FXE4000 (COPA-XE/MAG-XE)

EN
English

Commissioning Instructions
Electromagnetic Flowmeter
FXE4000 (COPA-XE/MAG-XE)

HART FIELD COMMUNICATIONS PROTOCOL
PROFIBUS PROCESS FIELD BUS
Fieldbus Foundation

ABB

Electromagnetic Flowmeter
FXE4000 (COPA-XE/MAG-XE)

Commissioning Instructions - EN

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Contents

1 Safety

1.1 General Safety Information

The “Safety” chapter provides an overview of the safety aspects to be observed for the operation of the device.

The device is built based on state-of-the-art technology and is operationally safe. It was tested and left the factory in a proper state. The requirements in the manual as well as the documentation and certificates must be observed and followed in order to maintain this state for the period of operation.

The general safety requirements must be complied with completely during operation of the device. In addition to the general information, the individual chapters of the manual contain descriptions about processes or procedural instructions with specific safety information.

Only the observance of all safety information enables the optimal protection of personnel as well as the environment from hazards and the safe and trouble-free operation of the device.

1.2 Intended use

This device is intended for the following uses:

- To transmit fluid, pulpy or pasty substances with electrical conductivity.
- To measure the flowrate of the operating volume or mass flow units (at constant pressure / temperature), if a mass engeineering unit is selected.

The following items are included in the intended use:

- Read and follow the instructions in this manual.
- Observe the technical ratings; refer to the section “Technical limit values”.
- Use only allowed liquids for measurement; refer to the section “Allowed fluids”.

1.3 Improper use

The following uses of the device are prohibited:

- Operation as a flexible adapter in piping, e.g., to compensate for pipe offsets, pipe vibrations, pipe expansions, etc.
- Use as a climbing aid, e.g., for assembly purposes.
- Use as a support for external loads, e.g., as a support for pipes, etc.
- Material gain, e.g., by painting over the name plate or adding parts by welding / soldering.
- Material loss, e.g., by drilling the housing.

Repairs, alterations and enhancements or the installation of replacement parts is only permissible as far as described in the manual. Further actions must be verified with ABB Automation Products GmbH. Excluded from this are repairs performed by ABB-authorized specialist shops.

1.4 Technical limit values

The device is designed for use exclusively within the stated values on the name plate and within the technical limit values specified in the data sheets.

The following technical limit values must be observed:

- The permissible pressure (PS) in the permissible fluid temperature (TS) may not exceed the pressure-temperature ratings.
- The maximum operating temperature may not be exceeded.
- The permitted ambient temperature may not be exceeded.
- The housing protection class must be observed.
- The flowmeter primary may not be operated in the vicinity of powerful electromagnetic fields, e.g., motors, pumps, transformers, etc. A minimum spacing of approx. 100 cm should be maintained. For installation on or to steel parts (e.g., steel brackets), a minimum spacing of approx. 100 mm should be maintained (based on IEC801-2 and IECTC77B).

1.5 Allowed Fluids

When measuring fluids, the following points must be observed:

- Fluids may only be used if, based on state-of-the-art technology or the operating experience of the user, it is assured that chemical and physical properties of the components coming into contact with the fluids (signal electrodes, ground electrodes, liners and, possibly, process connections, protective plates or protective flanges) are not affected during the operating life.
- Fluids with unknown properties or abrasive agents may only be used if the operator can perform regular and suitable tests to ensure the safe condition of the device.
- Observe the information on the name plate.

1.6 Operator liability

- Before the use of corrosive and abrasive materials to be measured, the operator must clarify the resistance of all parts that come into contact with the materials to be measured. ABB will gladly support you with the selection, however, cannot accept any liability.
- The operators must strictly observe the applicable national regulations in their countries with regards to installation, function tests, repairs, and maintenance of electrical devices.

1.7 Personnel qualification

The installation, commissioning and maintenance of the device may only be carried out through trained specialist personell authorized by the plant operator. The specialist personnel must have read and understood the manual and comply with its instructions.

1.8 Installation safety information

Observe the following instructions:

- The flow direction must correspond to the direction indicated on the device, if labeled.
- Comply with the maximum torque for all flange bolts.
- Install the devices without mechanical tension (torsion, bending).
- Install flange and wafer units with coplanar counter flanges.
- Only install devices for the intended operating conditions and with suitable seals.
- Secure the flange bolts and nuts against pipeline vibrations.

1.9 Electrical installation safety information

The electrical connection may only be performed by authorized specialists according to the electrical plans.

Comply with electrical connection information in the manual. Otherwise, the electrical protection can be affected.

Ground the measurement system according to requirements.

1.10 Operating safety information

During operation with hot fluids, contact with the surface may result in burns.

Aggressive fluids may result in corrosion and abrasion of the liner or electrodes. As a result, pressurized fluids may escape prematurely.

Due to wear on the flange seal or process connection gaskets (e.g., aseptic threaded pipe connections, Tri-Clamp, etc.), a pressurized medium may escape.

When using internal flat gaskets, these can become embrittled through CIP/SIP processes.

1.11 Maintenance and inspection safety information

Warning – Risk to persons!

When the housing cover is open, EMC and protection against contact are suspended. There are electric circuits within the housing which pose a contact risk.
The auxiliary power must be switched off before opening the housing cover.

Warning – Risk to persons!

The inspection screw (for draining condensate fluid) for devices ≥ DN 450 can be under pressure. The medium which spurts out can cause severe injuries.
Depressurize pipes before opening the inspection screw.

Corrective maintenance work may only be performed by trained personnel.

- Depressurize the device and adjoining lines or containers before removing the device.
- Check whether hazardous materials are used as materials to be measured before opening the device. Residual amounts of hazardous material may still be present in the device and could escape when the device is opened.
- As far as provided in the scope of the operational responsibility, check the following items through a regular inspection:
  - the pressure-carrying walls / lining of the pressure device
  - the measurement-related function
  - the leak tightness
  - the wear (corrosion)

2 Transport

2.1 Inspection

Check the devices for possible damage that may have occurred from improper transport. Damages in transit must be recorded on the transport documents. All claims for damages must be claimed without delay against the shipper and before the installation.

2.2 General information on transport

Observe the following when transporting the device to the measurement site:

- The center of gravity may not be in the center of the device.
- The protective pates or dust caps mounted at the process connections of devices equipped with PTFE/PFA may only be removed before installation. To prevent possible leakage, make sure that the liner is not cut or damaged.
- Flanged units may not be lifted by the transmitter housing or terminal box.

2.3 Transport of flanged units smaller than DN 450

Warning – Danger of injuries due to slipping meter.
The center of gravity for the complete device may be higher than the lifting straps.
Make sure the device has not rotated or slipped unintentionally during transport. Support the meter laterally.

For transport of flanged units smaller than DN 450 use a lifting strap. Wrap the straps around both process connections when lifting the device. Avoid chains since these may damage the housing.

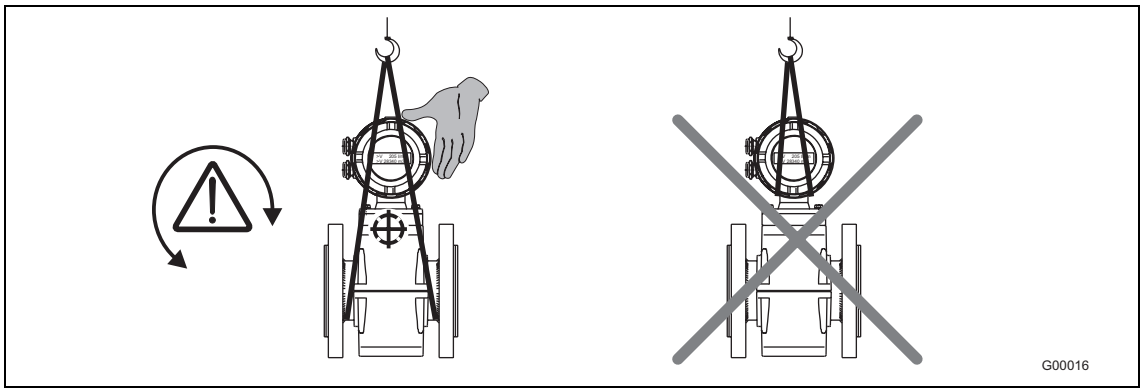


Fig. 1: Transport of flanged units smaller than DN 450

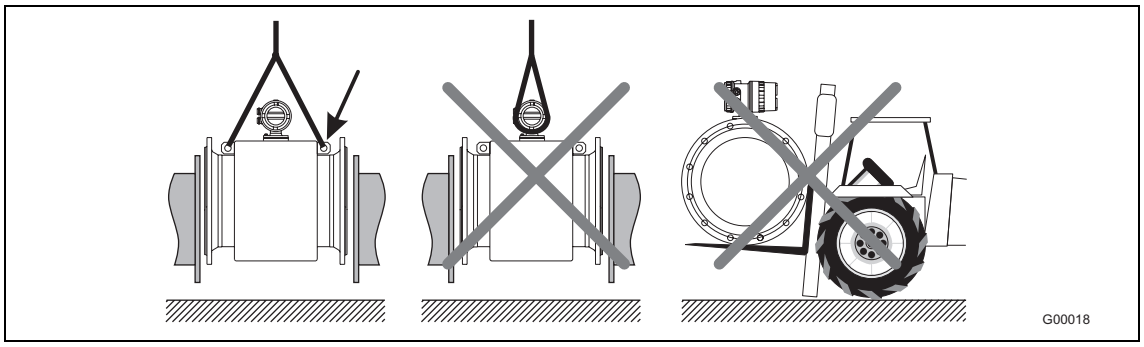


Fig. 2: Transport of flanged units larger than DN 400

3 Installation

3.1 Installation Requirements

The device measures the flowrate in both directions. The factory default is forward flow, as shown in Fig. 3.

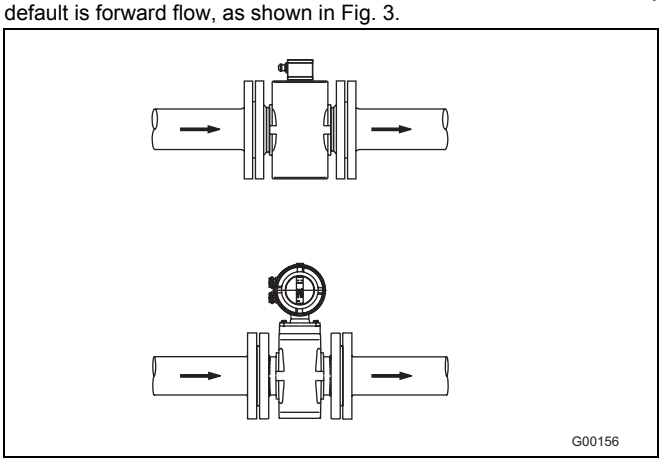


Fig. 3

The following items must be observed:

3.1.1 Electrode axis

Electrode axis (1) should be horizontal if at all possible or no more that 45° from horizontal.

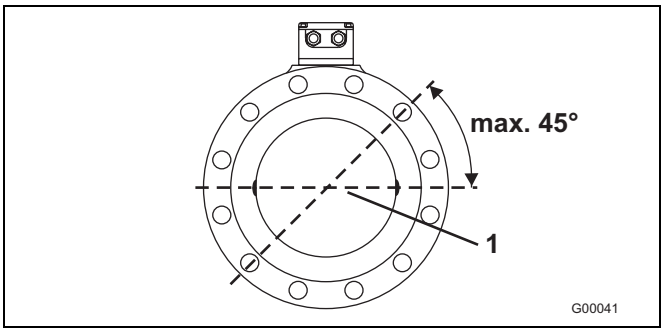


Fig. 4

3.1.2 In- and outlet pipe sections

Straight inlet section	Straight outlet section
≥ 3 x DN	≥ 2 x DN

DN = Flowmeter primary size

- Do not install fittings, manifolds, valves etc. directly in front of the meter tube (1).
- Butterfly valves must be installed so that the valve plate does not extend into the flowmeter primary.
- Valves or other turn-off components should be installed in the outlet pipe section (2).
- For compliance with the measuring accuracy, observe the inlet and outlet pipe sections.

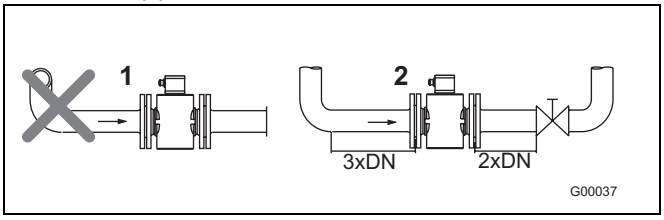


Fig. 5

3.1.3 Vertical connections

- Vertical installation for measurement of abrasive fluids, flow preferably from below to above.

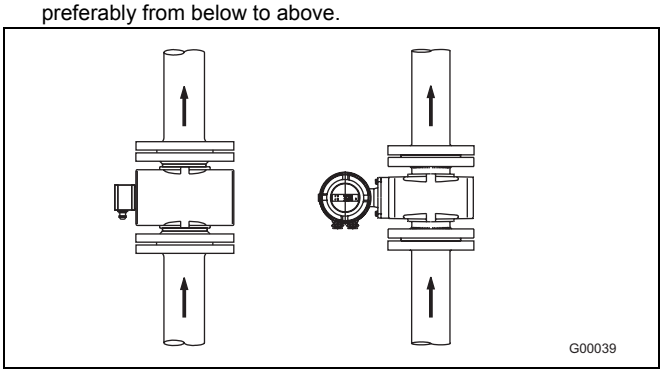


Fig. 6

3.1.4 Horizontal connections

- Meter tube must always be completely full.
- Provide for a slight incline of the connection for degassing.

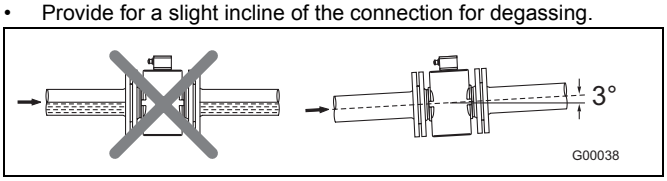


Fig. 7

3.1.5 Free inlet or outlet

- Do not install the flowmeter at the highest point or in the draining-off side of the pipeline, flowmeter runs empty, air bubbles can form (1).
- Provide for a siphon fluid intake for free inlets or outlets so that the pipeline is always full (2).

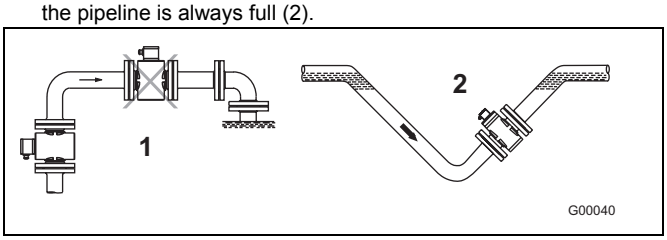


Fig. 8

3.1.6 Installation in the vicinity of pumps

- For flowmeter primaries which are to be installed in the vicinity of pumps or other vibration generating equip-ment, the utilization of mechanical snubbers is advantageous.

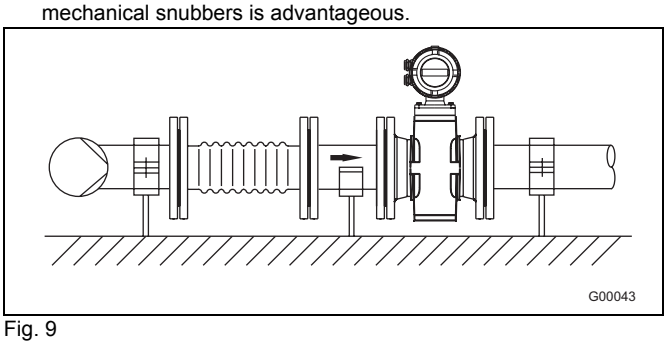


Fig. 9

3.2 Installation

3.2.1 Supports for meter sizes larger than DN 400

Warning - Potential damage to parts!

Improper support for the device may result in deformed housing and damage to internal magnet coils.
Place the supports at the edge of the housing (see arrows in the figure).

Devices with meter sizes larger than DN 400 must be mounted with support on a sufficiently strong foundation.

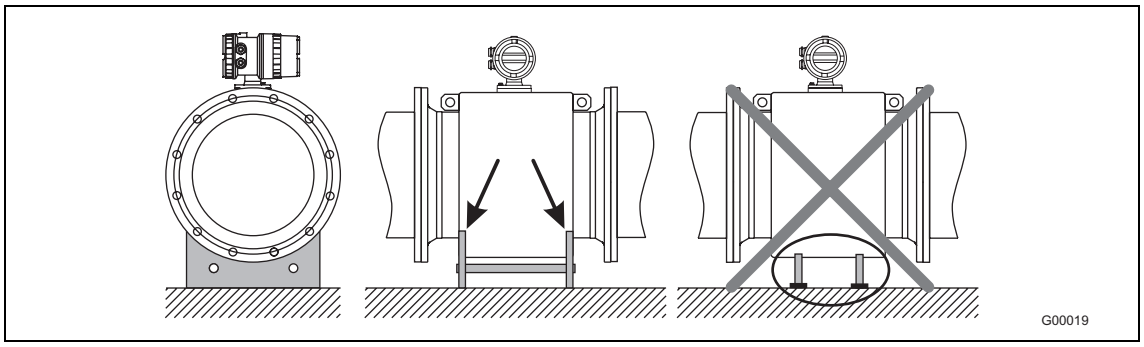


Fig. 10: Support for meter sizes larger than DN 400

3.2.2 General information on installation

The following points must be observed during installation:

- The measuring tube must be full at all times.
- The flow direction must correspond to the indicated direction, if labeled.
- You must comply with the maximum torque for all flange connections.
- Install the devices without mechanical tension (torsion, bending).
- Install flange and wafer units with coplanar counter flanges and use only appropriate gaskets.
- Use only gaskets made from a compatible material for the fluid and fluid temperatures.
- Gaskets must not extend into the flow area since possible turbulence could influence the device accuracy.
- The pipeline may not cause any unallowable forces or torques on the device.
- Do not remove the plugs in the cable connectors until you are ready to install the electrical cable.
- A separate transmitter (MAG-XE) must be installed at a largely vibration-free location.
- Do not expose the transmitter to direct sunlight. Provide appropriate sun protection as necessary.
- When selecting the installation site, make sure that moisture cannot penetrate the terminal housing or transmitter compartment.

Note

For additional information about installation conditions and mounting IDMs, refer to the data sheet for the device.

3.2.3 Mounting the measuring tube

The device can be installed at any location in a pipeline under consideration of the installation conditions.

Warning - Potential damage to device!

Use of graphite with the flange or process connection gaskets is prohibited. In some instances, an electrically conductive coating may form on the inside of the measuring tube. Vacuum shocks in the pipelines should be avoided to prevent damage to the liners (PTFE). Vacuum shocks can destroy the device.

1. Remove protective plates, if present, to the right and left of the measuring tube. To prevent possible leakage, make sure that the liner on the flange is not cut or damaged.
2. Position the measuring tube coplanar and centered between the pipes.
3. Install gaskets between the surfaces.

Note

For best results, make sure the flowmeter primary gaskets fit concentrically with the measuring tube.

4. Use the appropriate bolts for the flanges as per the section "Torque information".
5. Slightly grease the threaded nuts.
6. Tighten the nuts in a crosswise manner as shown in the figure. Observe the torque values specified under "Torques".

   First tighten the nuts to 50% of maximum torque, then to 80% and finally on the third time tighten to the maximum. Do not exceed the max. torque.

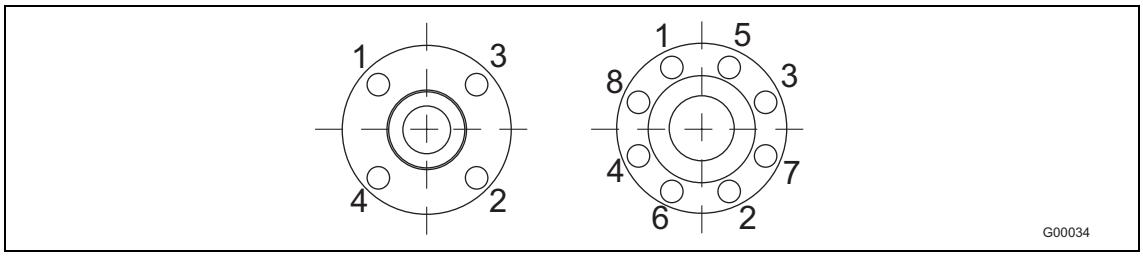


Fig. 11

3.2.4 Torque information

Nominal size DN		Nominal pressure	Screws	Flanged units Model DE41F, DE43F	Wafer Units	Variable process connections for models DE21 and DE23
mm	Inch	PN		Nm	Nm	Nm
3-8	⅜“	40	4 x M12	8	2,3	6,5
10	⅜“	40	4 x M12	8	7	6,5
15	½“	40	4 x M12	10	7	9
20	¾“	40	4 x M12	16	11	20
25	1“	40	4 x M12	21	15	32
32	1¼“	40	4 x M16	34	26	56
40	1½“	40	4 x M16	43	33	80
50	2“	40	4 x M16	56	46	30
65	2½“	40	8 x M16	39	30	42
80	3“	40	8 x M16	49	40	100
100	4“	16	8 x M16	47	67	125
125	5“	16	8 x M16	62		
150	6“	16	8 x M20	83		
200	8“	16	8 x M20	81		
250	10“	16	8 x M24	120		
300	12“	16	8 x M24	160		
350	14“	16	16 x M24	195		
400	16“	16	16 x M27	250		
500	20“	10	20 x M24	200		
600	24“	10	20 x M27	260		
700	28“	10	24 x M27	300		
800	32“	10	24 x M30	390		
900	36“	10	28 x M30	385		
1000	40“	10	28 x M33	480		

3.3 Ground

3.3.1 General information on ground connections

Observe the following items when grounding the device:

- Use the supplied green/yellow cable as a ground wire.
- Connect the ground screw for the flowmeter primary (on flange and transmitter housing) to the ground.
- The terminal box or COPA housing must also be grounded.
- For plastic pipes or pipes with insulating lining, the ground is provided by the grounding plate or grounding electrodes.
- When stray currents are present in the pipeline, install a grounding plate at the front and back of the flowmeter primary.
- For measurement-related reasons, the potentials in the ground and in the pipeline should be identical.
- An additional ground via the terminals is not required.

Note

If the flowmeter primary is installed in plastic pipeline, or in pipelines with an insulating lining, transient current may flow through the grounding electrode in special cases. In the long term, this may destroy the flowmeter primary, since the ground electrode will in turn degrade electrochemically. In these special cases, the connection to the ground must be performed using grounding plates.

3.3.2 Metal pipe with fixed flanges

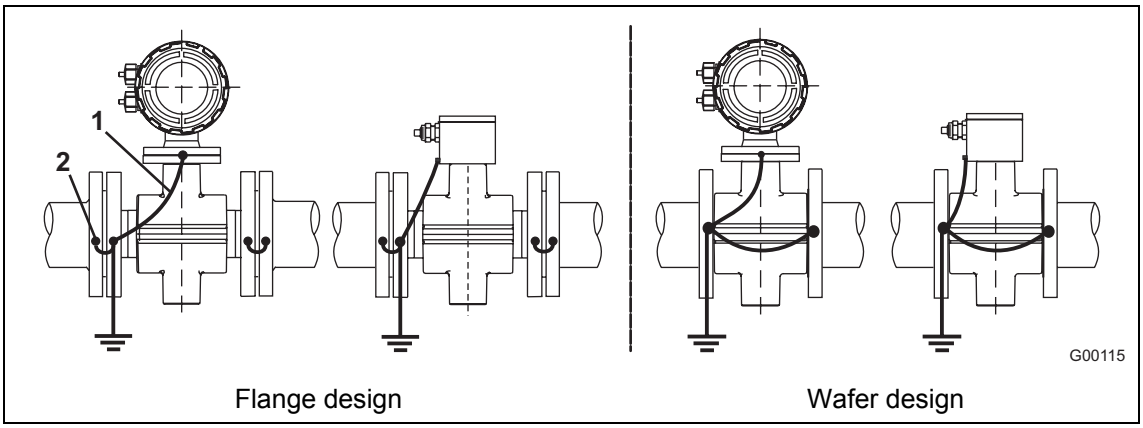


Fig. 12

3.3.3 Metal pipe with loose flanges

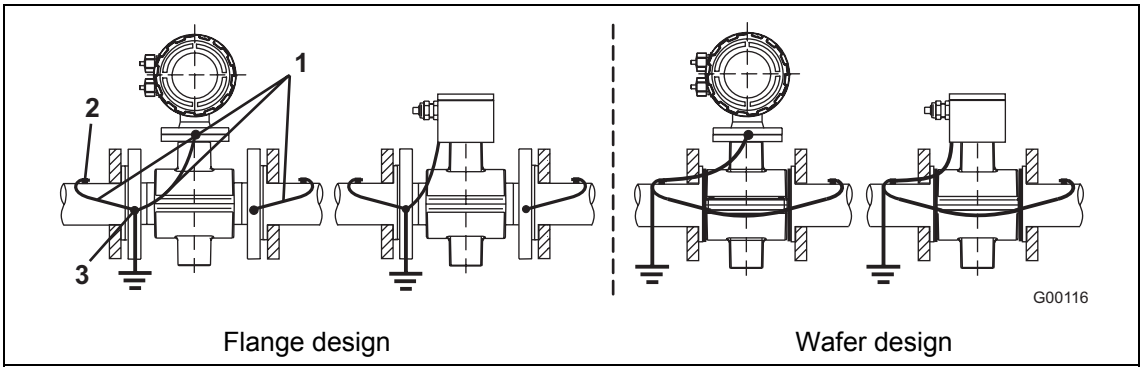


Fig. 13

3.3.4 Non-metallic pipes or pipes with insulating liner

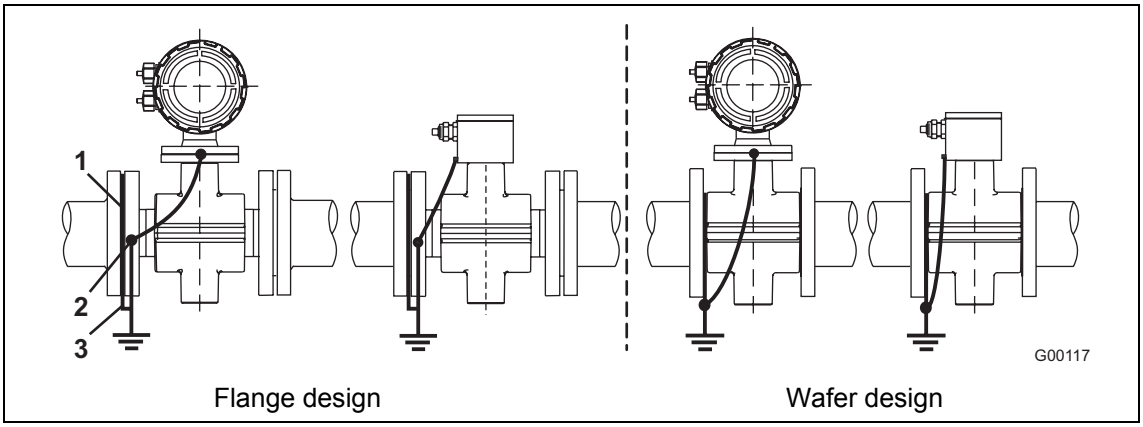


Fig. 14

3.3.5 Flowmeter primary in stainless steel design, model DE 21 and DE 23

Ground the stainless steel model as shown in the figure. The measuring agent is grounded via the adapter (1) and an additional ground is not required.

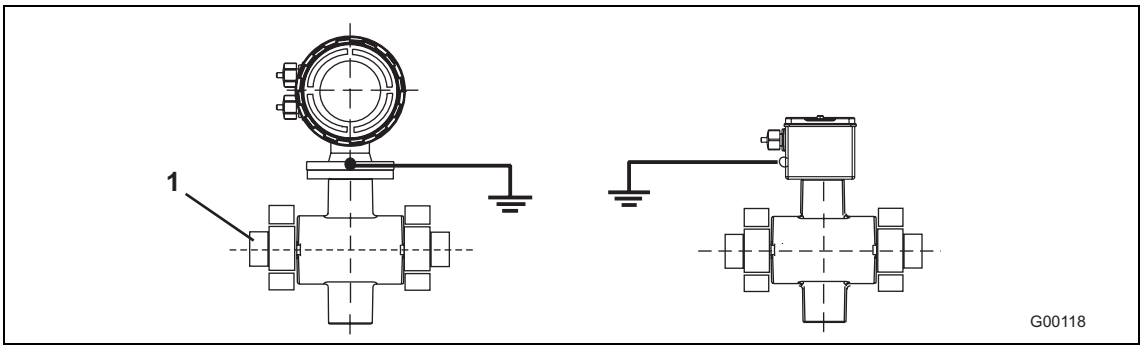


Fig. 15

3.3.6 Ground for units with hard or soft rubber liners

For devices with meter sizes DN125 and larger, the liner contains a conductive element. This element grounds the fluid.

3.3.7 Ground for devices with protective plates

The protective plates are used to protect the edges of the liner in the measuring tube, e.g., for abrasive fluids. In addition, they function as a grounding plate.

- For plastic or pipes with insulating lining, electrically connect the protective plate in the same manner as a grounding plate.

3.3.8 Ground with conductive PTFE grounding plate

For devices with a meter size between DN 10 … 150, grounding plates made of conductive PTFE are available. These are installed similar to conventional grounding plates.

3.4 Electrical connection

3.4.1 Preparing the signal and excitation current cable

Cut to length and terminate the cable as shown.

Note
Use wire end sleeves.

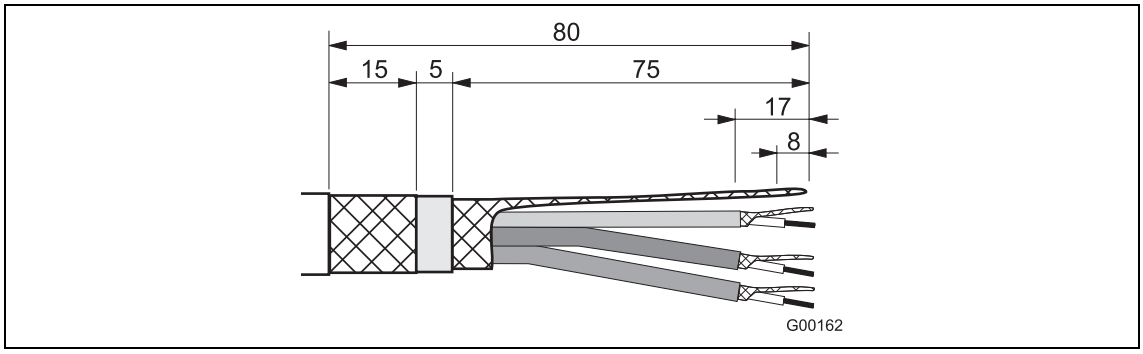


Fig. 16

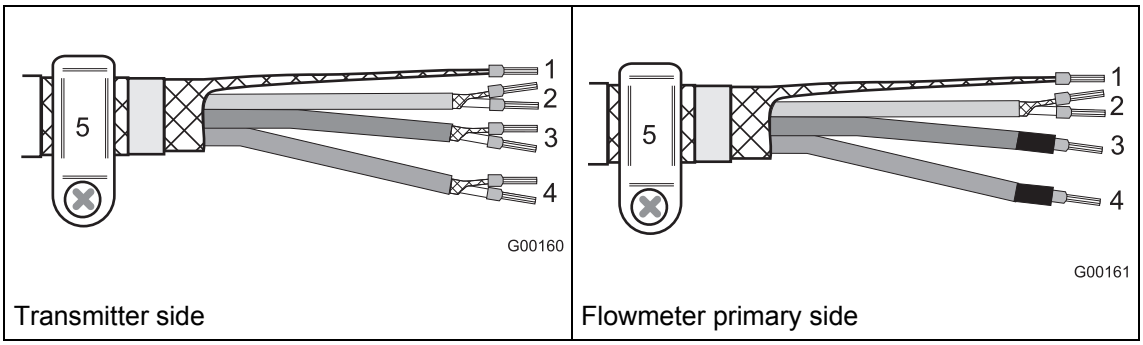


Fig. 17

1 Measurement potential, yellow
2 white
3 Electrode signal line, red
4 Electrode signal line, blue
5 SE clamp (shield)

Note
The shields may not touch (signal short circuit).

Observe the following items when routing cables:

- The signal and excitation current cable carries a voltage signal of only a few millivolts and therefore must be routed the shortest distance possible. The maximum permissible signal cable length is 50 m.
- Avoid routing the cable in the vicinity of electrical equipment or switching elements that can create stray fields, switching pulses and induction. If this is not possible, run the signal/excitation current cable through a metal pipe and connect this to the ground.
- All leads must be shielded and connected to station ground.
- Do not run the signal cable over junction boxes or terminal blocks. A shielded excitation cable (white) is run parallel to the signal lines (red and blue). As a result, only one cable is required between the flowmeter primary and the transmitter.
- To shield against magnetic interspersion, the cable contains outer shielding that is attached to the SE clamp.
- Make sure during installation that the cable is provided with a water trap (1). For vertical installation, align the cable glands pointing downward.

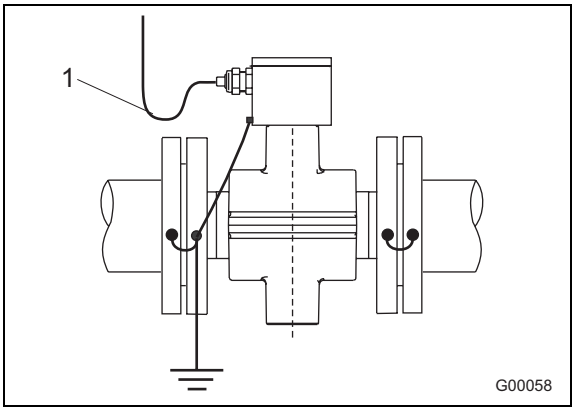


Fig. 18

3.4.2 Signal and excitation cable connection for model FXE4000 (MAG-XE)

The flowmeter primary is connected to the transmitter via the signal / excitation current cable (part no. D173D025U01). The coils of the flowmeter primary are supplied with a field voltage by the transmitter over terminals M1/M2. Connect the signal/excitation current cable to the flowmeter primary as shown in the figure.

1 red
2 blue
3 yellow
4 SE clamp
5 Signal cable
6 Ground connection
7 white

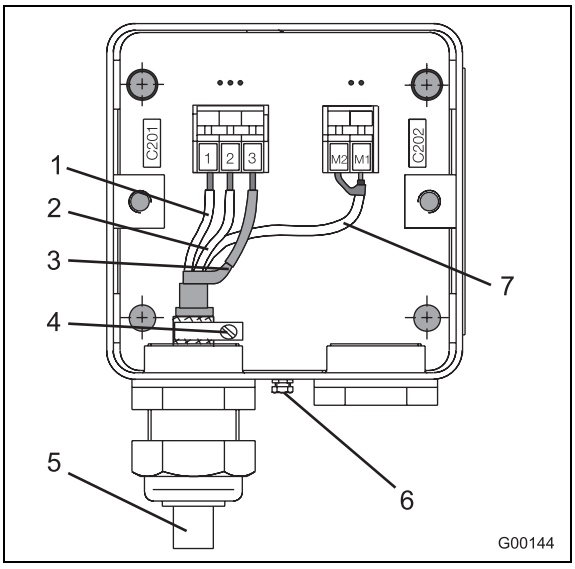


Fig. 19

Terminal designation	Connection
1 + 2	Wires for the measuring signal.
3	Internal lead (yellow), measurement potential.
M1 + M2	Connections for magnetic field excitation.
SE	Outer cable shield.

3.4.3 Connection for protection class IP68

For flowmeters primary with protection class IP 68, the maximum flooding height is 5 m. The supplied cable (part no. D173D025U01) fulfills all submersion requirements

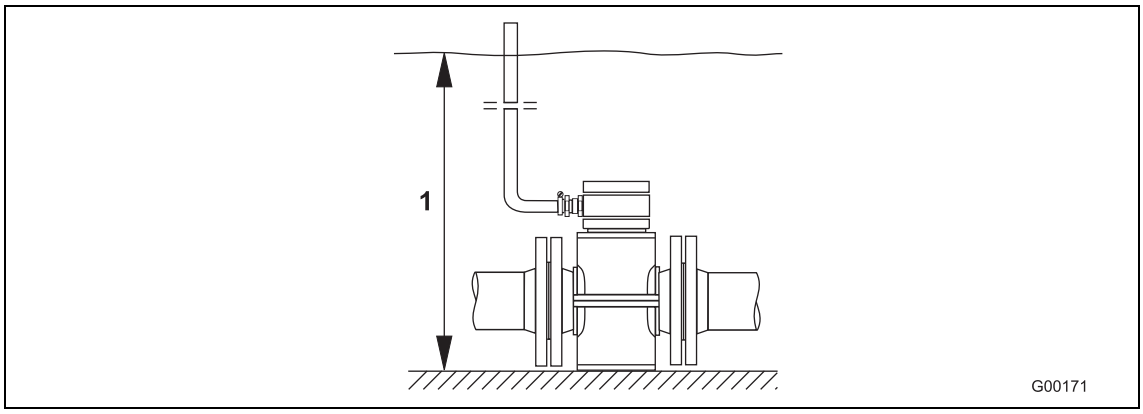


Fig. 20

1 Max. flooding height 5 m

3.4.3.1 Connection

1. Use the signal cable (part no. D173D025U01) to connect the flowmeter primary and the transmitter.
2. Connect the signal cable in the terminal box of the flowmeter primary.
3. Route the cable from the terminal box to over the maximum flooding height of 5 m.
4. Tighten the cable gland.
5. Carefully seal the terminal box. Make sure the gaskets for the cover are seated properly.

Caution - Potential damage to parts!

The jacket of the signal cable must not be damaged. Otherwise, the protection class IP 68 for the flowmeter primary cannot be ensured.

Note

As an option, the flowmeter primary can be ordered with signal cable already connected to the terminal box.

3.4.3.2 Potting the connection box

If the terminal box is to be potted on-site, a special potting compound can be ordered separately (order no. D141B038U01). Potting is only possible if the flowmeter primary is installed horizontally.

Observe the following instructions during work activity:

Warning - General hazards!

The sealing compound is toxic. Observe all relevant safety measures.
Risk notes: R20, R36/37/38, R42/43
Harmful by inhalation. Avoid direct skin contact. Irritating to eyes.
Safety advice: P4, S23-A, S24/25, S26, S37, S38
Wear suitable protective gloves and ensure sufficient ventilation.

Follow the instructions that are provided by the manufacturer prior to starting any preparations.

Preparation

- Complete the installation before beginning sealing activities in order avoids moisture penetration. Before starting, check all the connections for correct fitting and stability.
- Do not overfill the terminal box. Keep the potting compound away from the O-ring and the seal/groove (see below).
- Prevent the potting compound from penetrating a conduit if an NPT ½" thread is used.

Procedure

1. Remove the outer wrapper by cutting with scissors where indicated.
2. Remove the rubber end caps from the centre clip. Remove the clip.
3. Knead both components thoroughly until a uniformly blend is reached.
4. Cut open the bag at a corner.
5. Carefully fill the terminal box with potting compound until the connecting cable is covered.
6. Wait before closing the cover in order to allow the compound to dry, and to release any possible gas.
7. Ensure that the packaging material and the drying bag are disposed of in an environmentally sound manner.

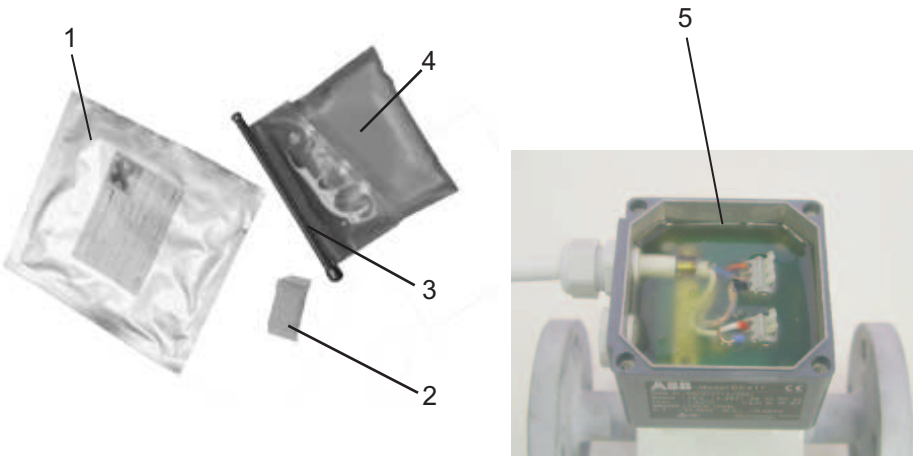


Fig. 21

1 Packaging bag
2 Drying bag
3 Clamp
4 Sealing compound
5 Filling height

3.4.4 Interconnection Diagrams

3.4.4.1 FXE4000 (COPA-XE), analog communication (incl. HART)

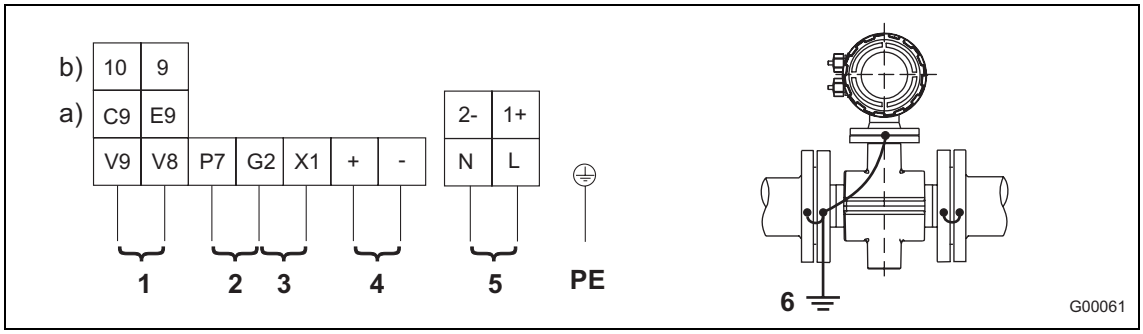


Fig. 22

1 **a) Scaled pulse output, passive:**

Pulse width adjustable from 0.1 to 2000 ms, terminals V8, V9, function E9, C9
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA

b) Scaled pulse output, active:

Pulse width adjustable from 0.1 to 2000 ms, terminals V8, V9, function 9, 10
20 mA < I ≤ 150 mA, f_{max} ≤ 4 Hz, pulse width ≤ 50 ms, pulse T_{16V} ≤ 25 ms; on/off ratio: 1:4 (T_{on} : T_{off}), f_{max} 5 kHz, 2 mA ≤ I ≤ 20 mA; 16 V ≤ U ≤ 30 V

2 **Contact output:**

Function selectable via software to system monitor, empty pipe, max.-min.-alarm or V/R contact output*, terminals G2, P7
Optocoupler specifications: f_{max} 5 kHz,
0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V;
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA

3 **Contact input:**

Function selectable via software as external zero return, external totalizer reset, external totalizer stop, terminals G2, X1
Optocoupler specifications: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

4 **Current output:**

Adjustable, terminals +/-, Current ≤ 600 Ω for 0/4 ... 20 mA,
Current ≤ 1200 Ω for 0/2 ... 10 mA, Current ≤ 2400 Ω for 0 ... 5 mA,
Option: HART-Protocol

5 **Supply Power:**

See name plate

6 **Functional ground**

*) The default factory setting is the “forward direction” signal.

3.4.4.2 FXE4000 (COPA-XE), digital communication

Valid for PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII

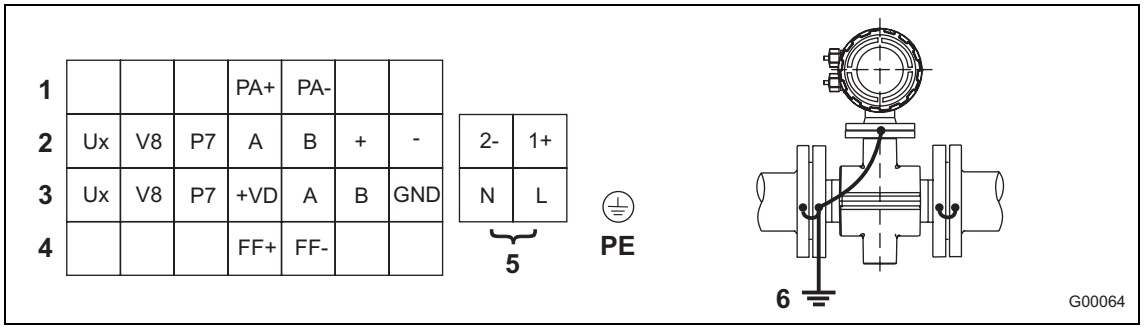


Fig. 23

1 **PROFIBUS PA:**

Terminals PA+, PA-: Connection for PROFIBUS PA according to IEC 61158-2 (Profile 3.0), U = 9 - 32 V, I = 13 mA (normal operation); 17 mA (fault condition / FDE)

2 **ASCII-Protocol (RS485):**

Terminals Ux, V8: Scaled pulse output, passive (Optocoupler), pulse width adjustable between 0.1 ms to 2000 ms,
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA
Terminals Ux, P7: Contact output, function selectable via software e.g. to system monitor, empty pipe, max. – min. –alarm or V/R contact output
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA
Terminals A, B: Serial data link RS485 for communication using ASCII-Protocol
Terminals +, -: Current output, terminals: +/-, current ≤ 600 Ω for 0/4 to 20 mA

3 **PROFIBUS DP:**

Like design 2 but terminals +VD, A, B, GND connection for PROFIBUS DP according to EN 50170

4 **FOUNDATION Fieldbus:**

Terminals FF+, FF-: Connection for FOUNDATION Fieldbus (H1) according to IEC 61158-2, U = 9 ... 32 V, I = 13 mA (normal operation); 17 mA (fault condition / FDE)

5 **Supply Power:**

See name plate

6 **Functional ground**

3.4.4.3 FXE4000 MAG-XE, analog communication (incl. HART)

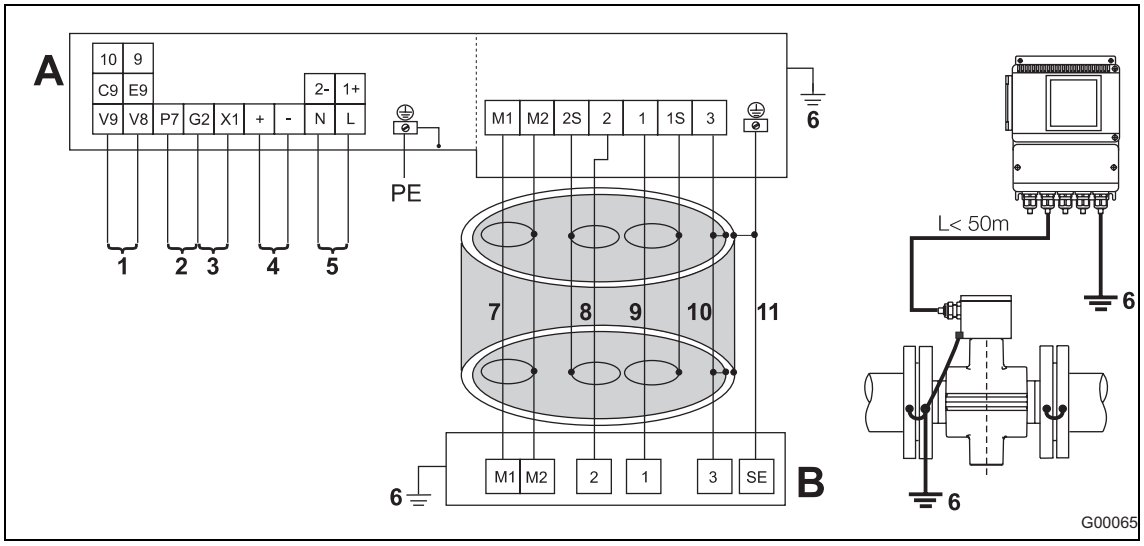


Fig. 24

1 **a) Scaled pulse output, passive:**

Pulse width adjustable from 0.1 to 2000 ms, terminals V8, V9, function E9, C9
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA

b) Scaled pulse output, active:

Pulse width adjustable from 0.1 to 2000 ms, terminals V8, V9, function 9, 10
20 mA < I ≤ 150 mA, f_{max} ≤ 4 Hz, pulse width ≤ 50 ms, pulse T_{16V} ≤ 25 ms; on/off ratio: 1:4 (T_{on} : T_{off}), f_{max} 5 kHz, 2 mA ≤ I ≤ 20 mA; 16 V ≤ U ≤ 30 V

2 **Contact output:**

Function selectable via software to system monitor, empty pipe, max.-min.-alarm or V/R contact output*, terminals G2, P7
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA

3 **Contact input:**

Function selectable via software as external zero return, external totalizer reset, external totalizer stop, terminals G2, X1
Optocoupler specifications: 16 V ≤ U ≤ 30 V, Ri = 2 kΩ

4 **Current output:**

Adjustable, terminals +/-, Current ≤ 600 Ω for 0/4 ... 20 mA,
Current ≤ 1200 Ω for 0/2 ... 10 mA, Current ≤ 2400 Ω for 0 ... 5 mA,
Option: HART-Protocol

5 **Supply Power:**

See name plate

6 **Functional ground**

7 **White**	9 **Red**	11 **Steel shielding**
8 **Blue**	10 **Yellow**	
A Converter	B Flowmeter primary	

*) The default factory setting is the “forward direction” signal.

3.4.4.4 FXE4000 (MAG-XE), digital communication

Valid for PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus, ASCII

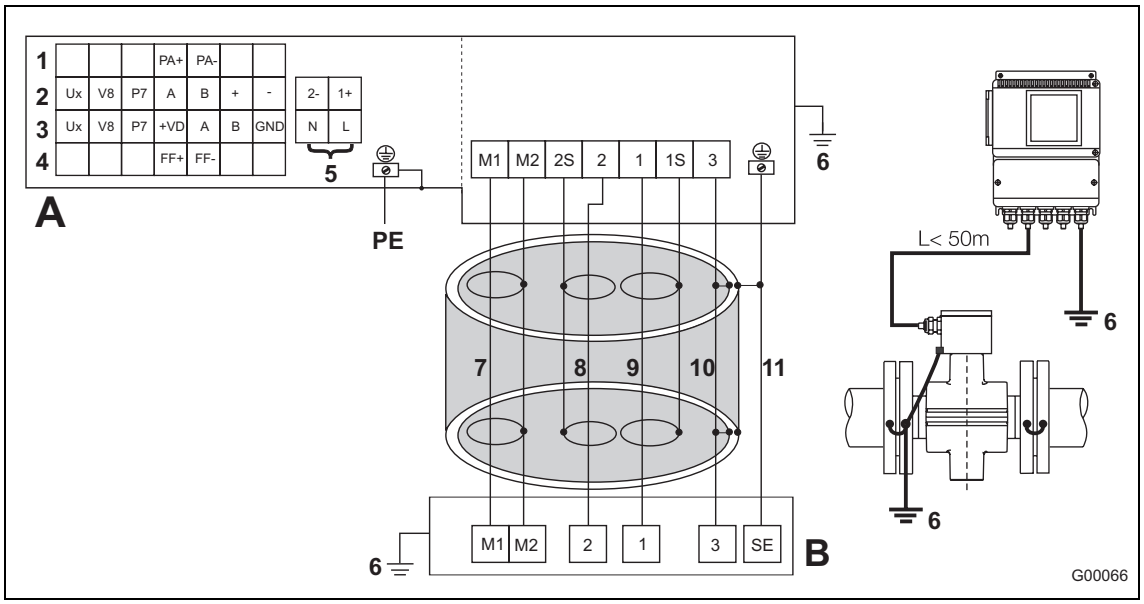


Fig. 25

1 **PROFIBUS PA:**

Terminals PA+, PA-: Connection for PROFIBUS PA according to IEC 61158-2 (Profile 3.0), U = 9 - 32 V, I = 13 mA (normal operation); 17 mA (fault condition / FDE)

2 **ASCII-Protocol (RS485):**

Terminals Ux, V8: Scaled pulse output, passive (optocoupler), Pulse width adjustable between 0.1 ms to 2000 ms,
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA
Terminals Ux, P7: Contact output, function selectable via software e.g. to system monitor, empty pipe, max. – min. –alarm or V/R contact output
Optocoupler specifications: f_{max} 5 kHz, 0 V ≤ U_{CEL} ≤ 2 V, 16 V ≤ U_{CEH} ≤ 30 V,
0 mA ≤ I_{CEH} ≤ 0.2 mA, 2 mA ≤ I_{CEL} ≤ 220 mA
Terminals A, B: Serial data link RS485 for communication using ASCII-Protocol
Terminals +, -: Current output, terminals: +/-, current ≤ 600 Ω for 0/4 to 20 mA

3 **PROFIBUS DP:**

Like design 2 but terminals +VD, A, B, GND connection for PROFIBUS DP according to EN 50170

4 **FOUNDATION Fieldbus:**

Terminals FF+, FF-: Connection for FOUNDATION Fieldbus (H1) according to IEC 61158-2, U = 9 ... 32 V, I = 13 mA (normal operation); 17 mA (fault condition / FDE)

5 **Supply Power:**

See name plate

6 **Functional ground**

7 **White**	9 **Red**	11 **Steel shielding**
8 **Blue**	10 **Yellow**	
A Converter	B Flowmeter primary	

4 Startup Operation

4.1 Preliminary checks prior to start-up

The following points must be checked before commissioning:

- The auxiliary power must be switched off.
- The auxiliary power must match the specifications started on the name plate.

Note

The connections for the auxiliary power can be found under the cover (1) in the connection area.

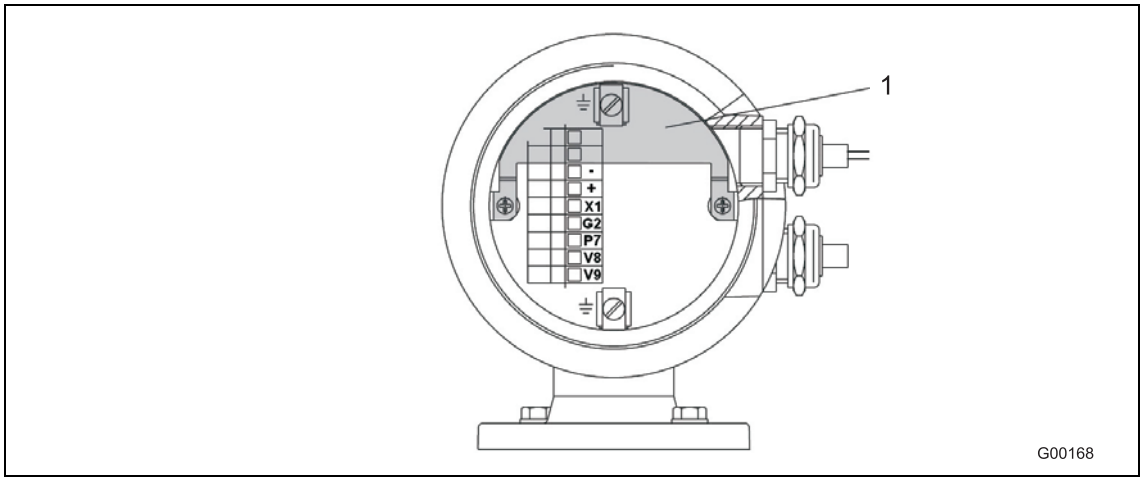


Fig. 26

1 Cover

- The pin assignment must correspond to the connection diagram.
- The unit must be grounded properly.
- The temperature limits must be observed.
- The EEPROM (1) must be plugged on the display board in the transmitter. The EEPROM is labeled with an order number and an end number. The end number can be found on the name plate of the corresponding flowmeter primary. These numbers must be identical.

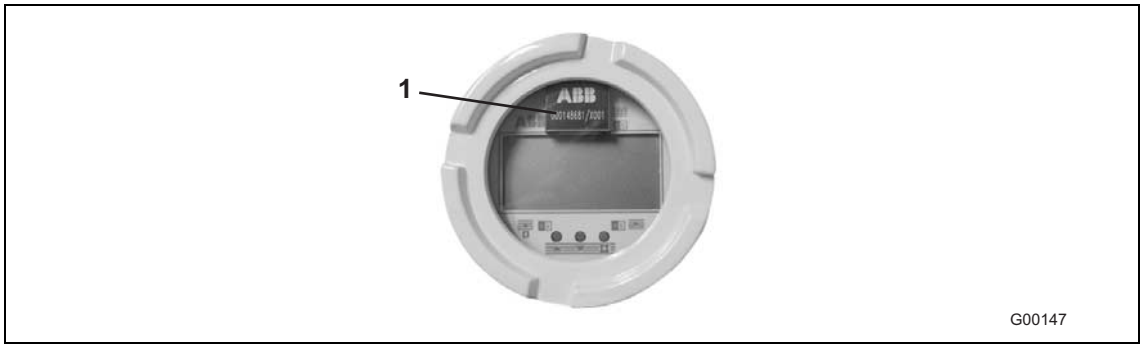


Fig. 27

1 EEPROM

- The flowmeter primary must be installed at a largely vibration-free location.
- The flowmeter primary and the converter must be assigned properly for the model FXE4000 (MAG-XE). The flowmeters primary have an end number of X1, X2, etc., on the name plate. The transmitters have the end numbers Y1, Y2, etc. End numbers X1 and Y1 are considered a unit.
- Pulse output setting.

  The pulse output can be operated as active output (24 VDC pulse) or as passive output (optocoupler). Settings for the pulse output are shown in the following figure.

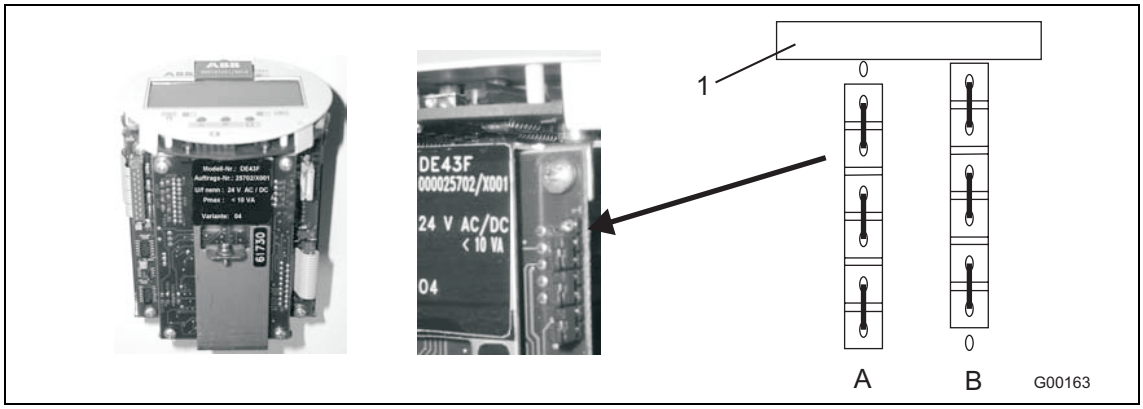


Fig. 28 Setting the pulse output using jumpers

A Pulse passive

B Pulse active

1 Display board

4.2 Commissioning the unit

4.2.1 Switching on auxiliary power

After switching on the auxiliary power, the flowmeter data in the external EEPROM is compared with the data saved internally. If the data is not identical, the transmitter uploads data from the external EEPROM automatically. Once completed, the message “Primary data are loaded” is displayed. The measuring equipment is now ready for operation.

The display shows the current flowrate.

4.2.2 Device configuration

The parameter setting can be done prior shipment in accordance to customer specifications upon request. If no customer information is available, the device is delivered with factory settings.

On-site configuration requires only a few parameter settings. For information on settings, refer to the chapter "Parameterization". A short overview of the menu structure can be found in the section "Parameter overview".

The following parameters should be checked or set before start-up:

1. **Flow range** (menu items “Range” and “Unit”).

   The device is set to the largest flow range, unless other customer information is available. The ideal flow range is approximately 2-3 m/s. First set the engineering unit of the flow range (e.g., m3/h or l/s) under menu item “Unit”, and then set the flow range end value under “Range”. The smallest and largest possible flow range end values are shown in the following table.

Note

The flow range end value is fixed for custody transfer devices.

Nominal size	Flow range end value	
	minimum (0.5 m/s)	maximum (10 m/s)
3	0.2 l/min	4 l/min
4	0,4 l/min	8 l/min
6	1,0 l/min	20 l/min
8	1,5 l/min	30 l/min
10	2,25 l/min	45 l/min
15	5 l/min	100 l/min
20	7,5 l/min	150 l/min
25	10 l/min	200 l/min
32	20 l/min	400 l/min
40	30 l/min	600 l/min
50	3 m^3/h	60 m^3/h
65	6 m^3/h	120 m^3/h
80	9 m^3/h	180 m^3/h
100	12 m^3/h	240 m^3/h

Nominal size	Flow range end value	
	minimum (0.5 m/s)	maximum (10 m/s)
125	21 m^3/h	420 m^3/h
150	30 m^3/h	600 m^3/h
200	54 m^3/h	1080 m^3/h
250	90 m^3/h	1800 m^3/h
300	120 m^3/h	2400 m^3/h
350	165 m^3/h	3300 m^3/h
400	225 m^3/h	4500 m^3/h
450	300 m^3/h	6000 m^3/h
500	330 m^3/h	6600 m^3/h
600	480 m^3/h	6900 m^3/h
700	660 m^3/h	13200 m^3/h
800	900 m^3/h	18000 m^3/h
900	1200 m^3/h	24000 m^3/h
1000	1350 m^3/h	27000 m^3/h

2. **Current output** (menu item “Current output”)

   Select the desired current range (0 … 20 mA or 4 … 20 mA)

3. For devices with a fieldbus, the bus address must be set (menu item “Data Link”).

4. **Pulse output** (menu items “Pulse factor” and “Unit”).

   To set the number of pulses per volume flow unit, a unit for the totalizer (e.g., m^3 or l) must be selected under “Unit”. Afterward the number of pulses has to be entered in the menu item “Pulse factor”.

5 **Pulse width** (menu item “Pulse width”)

   The pulse width at terminals V8 and V9 can be set between 0.1 ms and 2,000 ms.

6 **System zero adjustment** (menu item “System zero adjustment”)

   The fluid in the flowmeter primary must be at absolute zero. The flowmeter primary must be full. Select the menu “System zero adjustment”. Next press ENTER. Use the STEP key to call up “automatic” and select ENTER to start the adjustment. During the automatic adjustment, the flowmeter primary counts from 255 to 0 in the second display line. The system zero point adjustment is completed when the counter reaches zero. The adjustment lasts approx. 20 seconds.

7 **Detector empty pipe**

(menu item “Detector e. pipe”), for devices with meter size DN10 and larger

The measuring tube for the flowmeter primary must be full. Select the menu “Detector e. pipe”. Next press ENTER. Use the STEP key to call up “Adjust detector e. pipe” and select ENTER to start the adjustment. A number is displayed. Use the STEP or DATA key to change to the value 2000 ± 25 Hz. To accept this value, press ENTER.

Now empty the pipeline. The adjustment value displayed must rise above the value set in the “Threshold” menu. This ensures the empty pipe detector is adjusted.

Note

When configuration is complete, all data must be saved. To do so, call up the menu item “Save data to ext. EEPROM” and select ENTER.

5 Parameterization

5.1 Data entry

Use the keys (3) to enter data when housing is open. If closed, use the magnet stick (6) and the magnet sensors. The stick is held over the appropriate NS symbol.

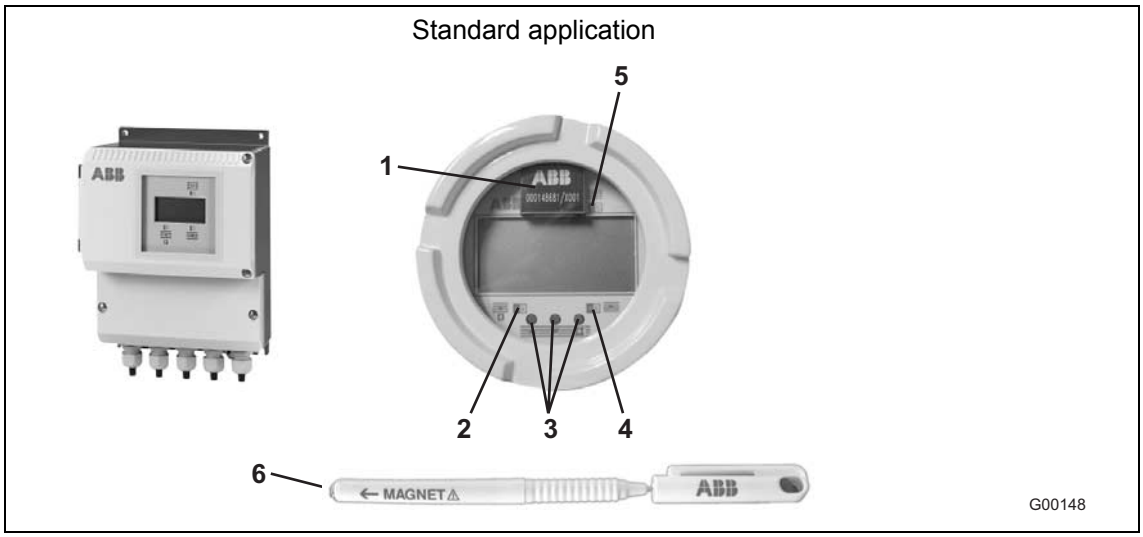


Fig. 29

1 Plug-in EEPROM
2 Magnet sensor DATA/ENTER
3 Operator keys
4 Magnet sensor STEP
5 Magnet sensor C/CE
6 Magnet

When entering data, the transmitter remains online, i.e., current and pulse outputs show the current operating mode. The functions of the individual keys are explained in the following:

C/CE — Toggle between operating mode and menu.

STEP ↓ — The STEP key is one of two arrow keys. Use STEP to scroll forward through the menu. All the desired parameters can be called up.

DATA ↑ — The DATA key is one of two arrow keys. Use DATA to scroll backward through the menu. All the desired parameters can be called up.

ENTER — The ENTER function requires that both arrow keys, STEP and DATA, be pressed simultaneously. ENTER has the following functions:

- Turn on/off Program protection.
- Access the parameter to be changed and set the new, selected or default parameter.

The ENTER function is only active for 10 seconds. If no entries are made during this period, the old value is displayed on the transmitter.

ENTER function for magnet stick operation

The ENTER function is initiated when the DATA/ENTER sensor is activated for more than 3 seconds. The display flashes to indicate that the function is active.

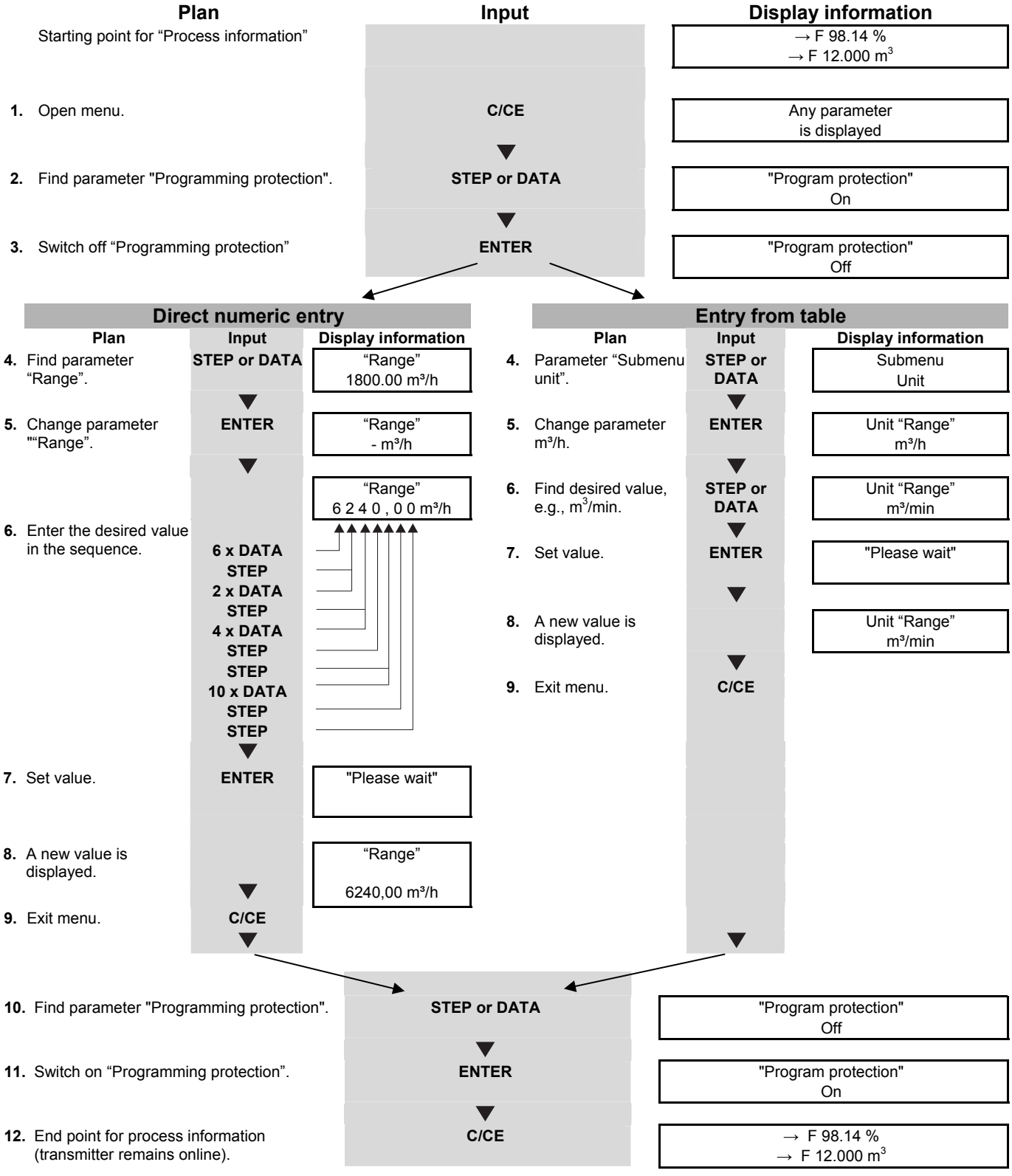
There are two different methods of entering data:

- Numeric entry
- Entry from specified table

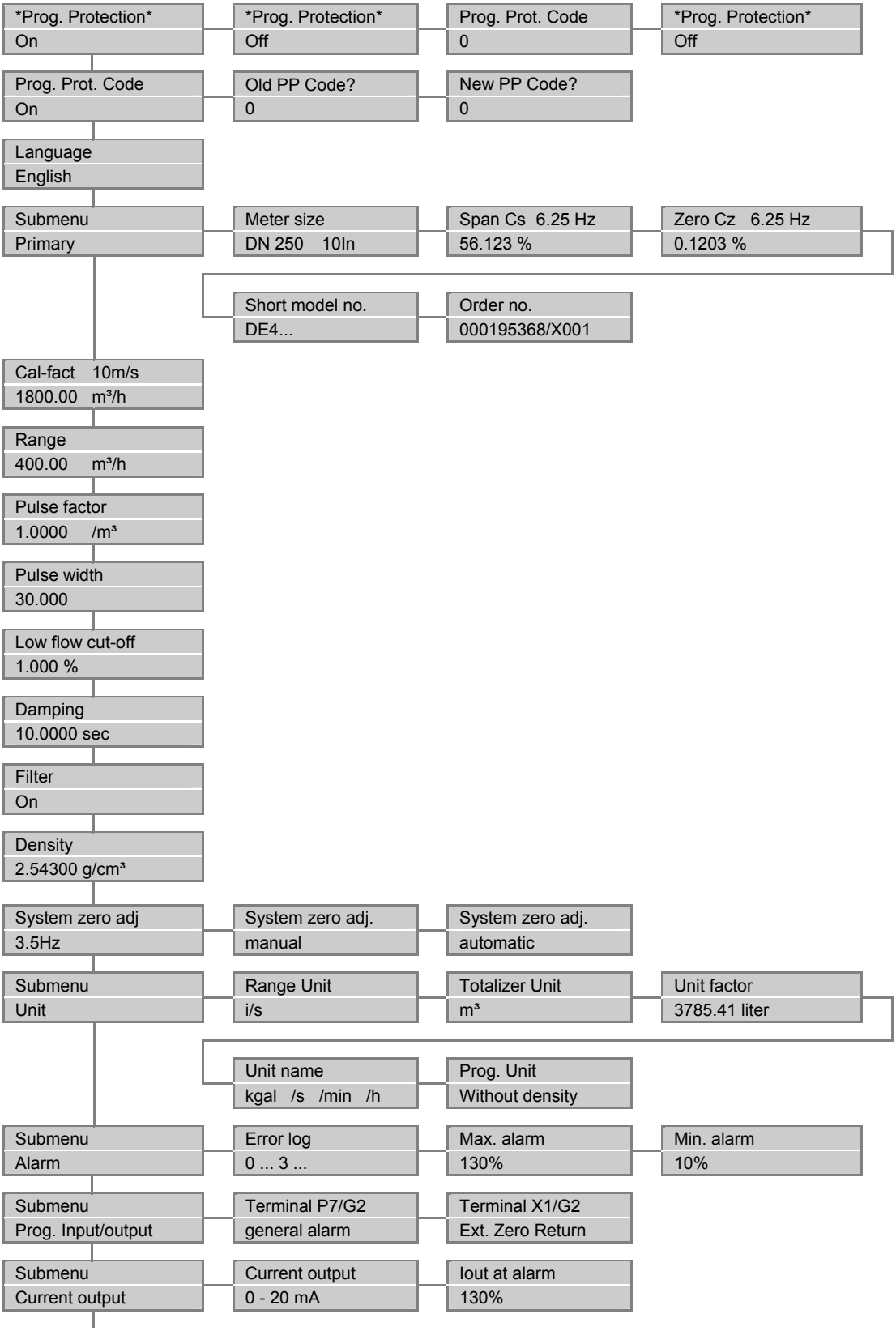
Note

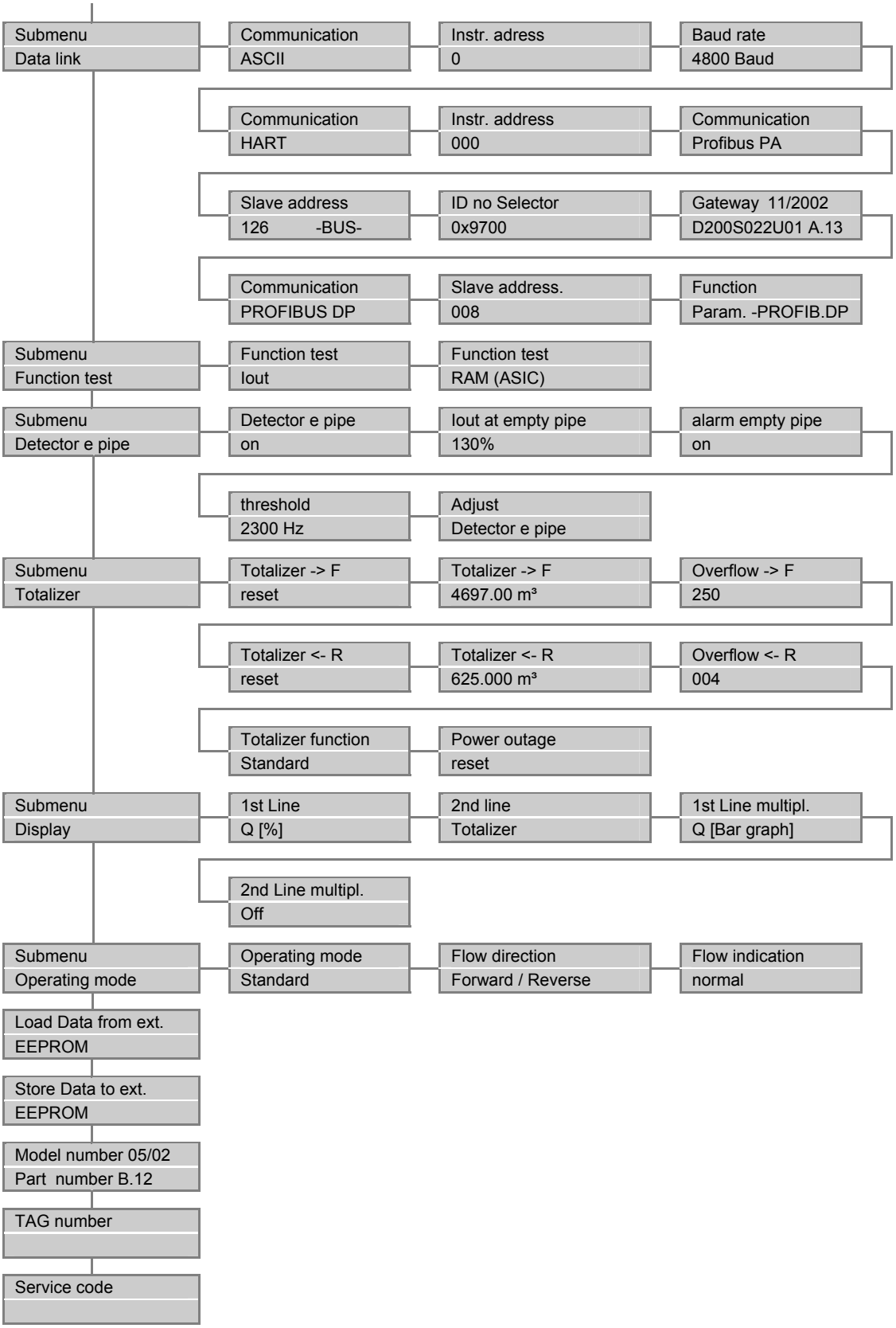
When entering data, the values are checked for plausibility and, if necessary, rejected with an appropriate message.

5.2 Entering data in “short form”



5.3 Parameter overview in “short form”





Note

For information about menu navigation for the device, refer to the the “Parameterization” section of the operating instructions.

6 Error messages

The following list of error messages provides explanations of the error codes shown in the display. When entering information, the error codes 0 to 9, A, B, C do not appear.

Error code	System errors	Error removal
0	Pipeline not filled.	Open shut-off devices; fill pipeline; adjust Detector empty pipe cut-off
1	A/D converter	Reduce flowrate, throttle shut-off device.
2	Positive or negative reference too small	Check connection board and transmitter.
3	Flowrate greater than 130%	Reduce flowrate, change flow range.
4	External zero return activated	Zero return activated by pump or field contact.
5	RAM defective 1. Error 5 appears in the display: second error 5 appears in Error log only	Program must be reinitialized. Contact ABB Service department. Information: Corrupted data in RAM, computer automatically resets and uploads data from EEPROM.
7	Positive reference is too large	Check signal cables and magnetic field excitation.
8	Negative reference is too large	Check signal cables and magnetic field excitation.
6	Error > V	Reset forward totalizer or preset new values in totalizer.
	Error totalizer < R	Reset reverse totalizer or preset new values in totalizer.
	Error totalizer	Forward/reverse or difference totalizer is defective Reset forward/reverse totalizer
9	Excitation frequency is incorrect	Check line frequency for supply power 50/60 Hz or for AC/DC auxiliary power error in the digital signal board.
A	MAX alarm limit value	Reduce flowrate.
B	MIN alarm limit value	Increase flowrate.
C	Flowmeter primary data invalid	The data for the flowmeter primary in the external EEPROM is invalid. Compare data in the submenu “Flowmeter primary” with data listed on the name plate. If the values match, use “Store primary” to reset the error message. If the values are not identical, the flowmeter primary data must first be reentered and must then be completed with "Store primary". Contact ABB Service.
10	Entry > 1.00 Range DN > 10 m/s	Reduce flow .
11	Entry > 0.05 Range DN > 0.5 m/s	Increase flow range.
16	Entry > 10% low flow cut-off	Decrease input value.
17	Entry < 0% low flow cut-off	Increase input value.
20	Entry ≥ 100 s Damping	Decrease input value.
21	Entry < 0.5 s damping	Increase entry value (as a function of the excitation frequency).
22	Entry > 99 device address	Decrease input value.
38	Entry > 1000 pulse/unit	Decrease input value.
39	Entry < 0.001 pulse/unit	Increase input value.

Error code	System errors	Error removal
40	Max. pulse frequency exceeded, scaled pulse output, pulse factor (5 kHz)	Reduce pulse factor.
41	Min. pulse frequency below limit < 0.00016 Hz	Increase pulse factor.
42	Entry > 2000 ms pulse width	Decrease input value.
43	Entry < 0.1 ms pulse width	Increase input value.
44	Entry > 5.0 g/cm^3 density	Decrease input value.
45	Entry < 0.01 g/cm^3 density	Increase input value.
46	Input too large	Reduce pulse width entry value.
54	Zero flowmeter primary > 50 Hz	Check the ground and ground signals. Adjustment can be made if the flowmeter primary is filled with fluid and the flowrate is zero.
56	Entry > 3000 threshold Detector empty pipe	Reduce entry value, check “Detector empty pipe” adjustment.
74/76	Entry > 130% MAX – or MIN alarm	Decrease input value.
91	Data in internal EEPROM invalid	Data in internal EEPROM invalid, for corrective measures, see Error code 5.
92	Data in ext. EEPROM incorrect	Data (e.g., R, damping) in external EEPROM is invalid, access possible. Occurs when function “Store data in ext. EEPROM” was not called. Use the function "Store data to ext. EEPROM” to clear the error message.
93	Ext. EEPROM is incorrect or not installed	No access possible, component defective. If the component is not installed, the current ext. EEPROM that belongs to the flowmeter must be plugged in above the display.
94	Ver. ext. EEPROM incorrect	The database has not been updated to the present software version. Use the function "Load data from ext. EEPROM” to automatically update the external data. Use the function "Store data to ext. EEPROM” to clear the error message.
95	External flowmeter primary data incorrect	See error code C.
96	Ver. EEPROM incorrect	Database version in the EEPROM is different from the installed software. Clear the error by selecting "Update".
97	Flowmeter primary incorrect	The data for the flowmeter primary in the internal EEPROM is invalid. Clear the error by selecting "Load primary". (see error code C)
98	Ver. EEPROM is incorrect or not installed	No access possible, components defective. If the component is not installed, the current EEPROM that belongs to the flowmeter must be plugged in.
99	Input too large Entry is too small.	Reduce input value. Increase input value.

7 Appendix

7.1 Additional documents

- Operating Instructions (D184B132U02)
- Data Sheet (D184S075U02)

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