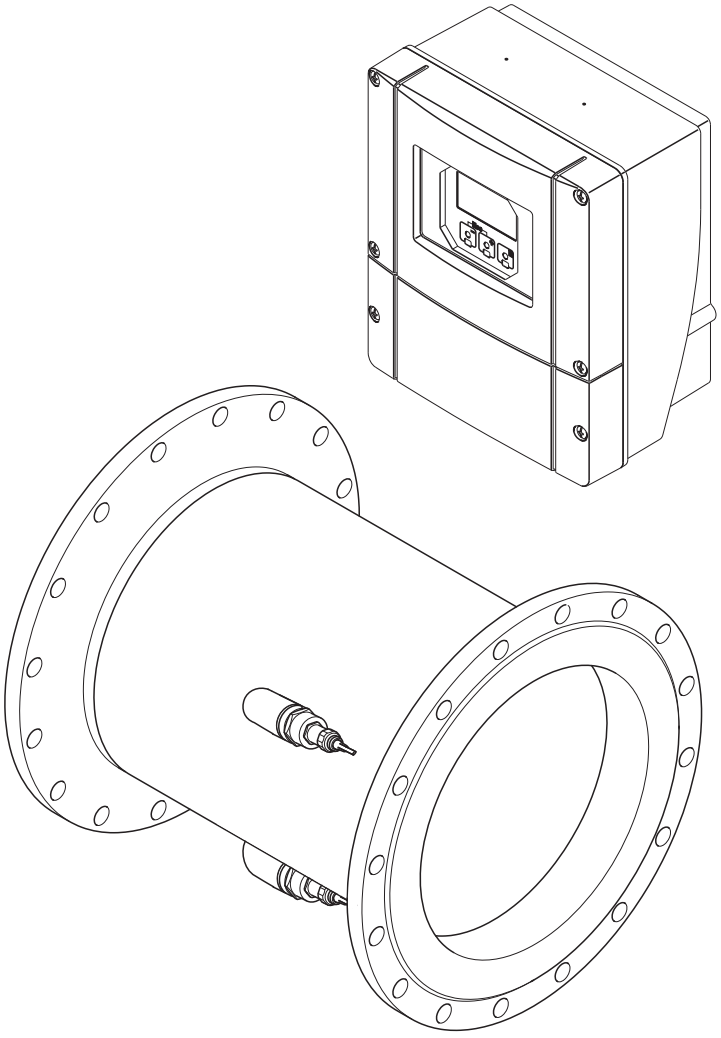
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Prosonic Flow 93C PROFIBUS DP/PA

Ultrasonic flow measuring system



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Valid as of version
PROFIBUS DP
V 3.06.XX (Device software)
PROFIBUS PA
V 3.06.XX (Device software)

Endress+Hauser

People for Process Automation

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1 Safety instructions

1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the flow rate of liquids in closed pipes.

Examples:
- Acids, alkalis, paints, oils
- Liquid gas
- Ultrapure water with low conductivity, water, wastewater

As well as measuring the volume flow, the sound velocity of the fluid is also always measured. Different fluids can be distinguished or the fluid quality can be monitored.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

1.2 Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator.
  The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- Endress+Hauser is willing to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning.
  However, small changes in temperature, concentration or the degree of contamination in the process can result in changes to the corrosion resistance properties. Therefore, Endress+Hauser cannot guarantee or accept liability for the corrosion resistance properties of wetted materials in a specific application.
  The user is responsible for choosing suitable wetted materials in the process.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, except in cases where special protective measures have been taken (e.g. galvanically isolated power supply SELV or PELV).
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this supplementary Ex documentation indicates the approval and inspection authority (e.g. Ⓔx Europe, FM USA, CSA Canada).
- The measuring system complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326, and NAMUR Recommendation NE 21 and NE 43.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to this Operating Instructions.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a duly completed "Declaration of Contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.

  ✎ Note!
  You will find a preprinted "Declaration of Contamination" form at the back of this manual.

- Enclose special handling instructions if necessary, for example a safety data sheet as per Regulation (EC) No 1907/2006 REACH.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

⚠ Warning!

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal or injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use".

⚠ Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

☝ Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

✎ Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Identification

2.1 Device designation

The "Prosonic Flow 93C Inline" flowmeter system consists of the following components:
- Prosonic Flow 93 transmitter
- Prosonic Flow C Inline measuring tube
- Prosonic Flow W sensors

2.1.1 Nameplate of the Prosonic Flow 93 transmitter

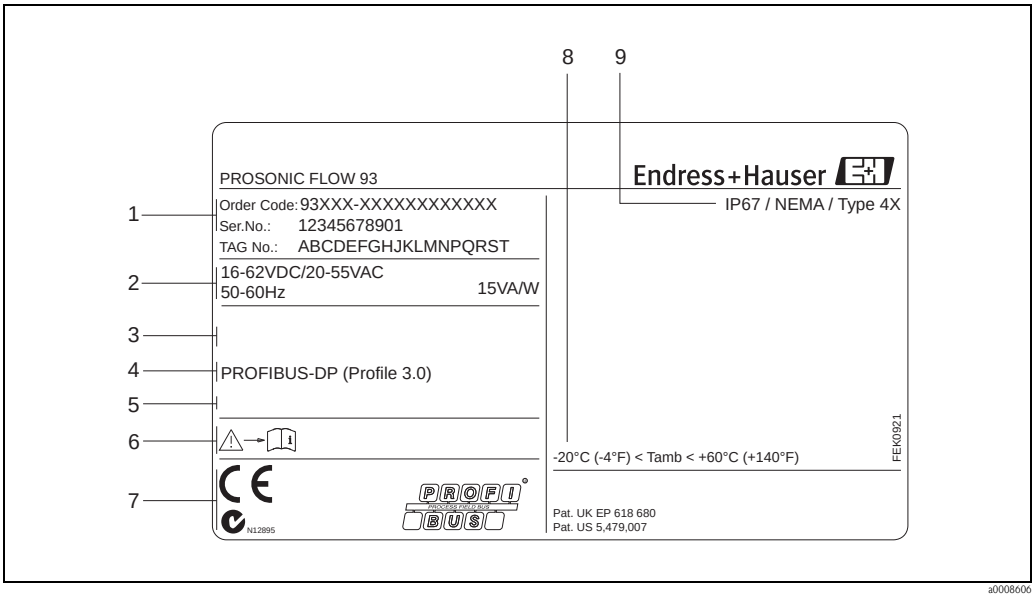


Fig. 1: Nameplate specifications for the "Prosonic Flow 93" transmitter (example)

1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply/frequency/power consumption
3 Additional functions and software
4 Available inputs and outputs
5 Reserved for information on special products
6 Please refer to operating instructions / documentation
7 Reserved for certificates, approvals and for additional information on device version
8 Ambient temperature range
9 Degree of protection

2.1.2 Nameplate of the Prosonic Flow C Inline measuring tube

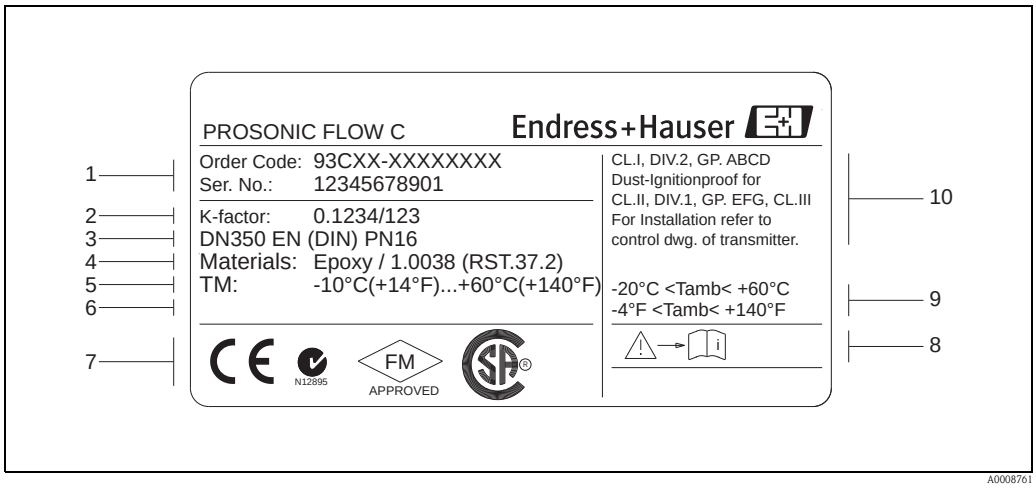


Fig. 2: Nameplate specifications for the "Prosonic Flow C Inline" measuring tube (example)

1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 K-factor of the measuring tube
3 Nominal diameter range
4 Lining material of the measuring tube
5 Max. medium temperature range
6 Reserved for information on special products
7 Reserved for certificates, approvals and for additional information on device version
8 Please refer to operating instructions / documentation
9 Permitted ambient temperature range
10 Data on explosion protection. Refer to the specific additional Ex documentation for detailed information. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

2.1.3 Nameplate of the Prosonic Flow W sensors

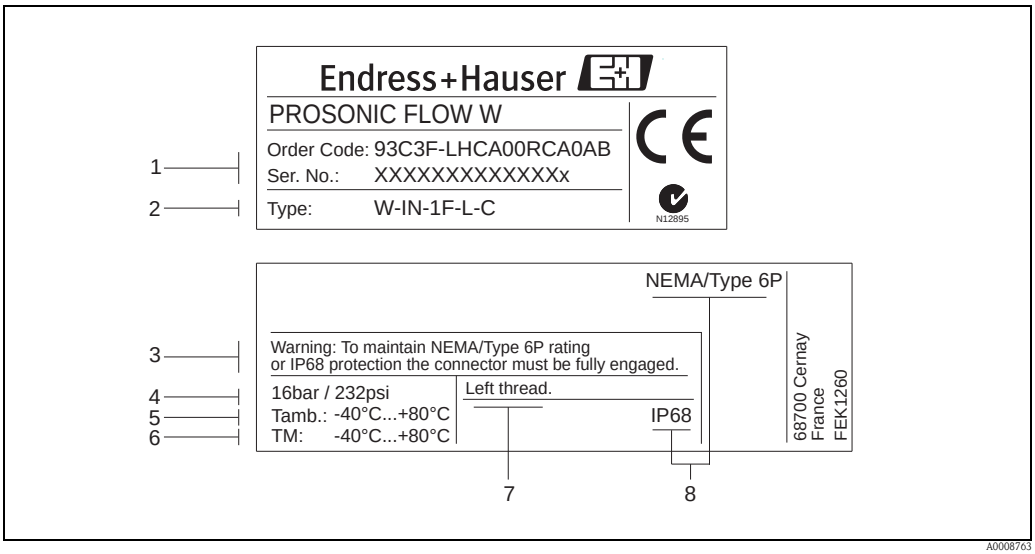


Fig. 3: Nameplate specifications for the "Prosonic Flow W" sensor (example)

1 Order code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Sensor type
3 Warning
4 Maximum nominal pressure
5 Ambient temperature range
6 Medium temperature range
7 Note indicating that the sensor holder and sensor nozzle are screwed together by a left thread
8 Degree of protection

2.1.4 Adhesive label for sensor channel identification on the measuring tube

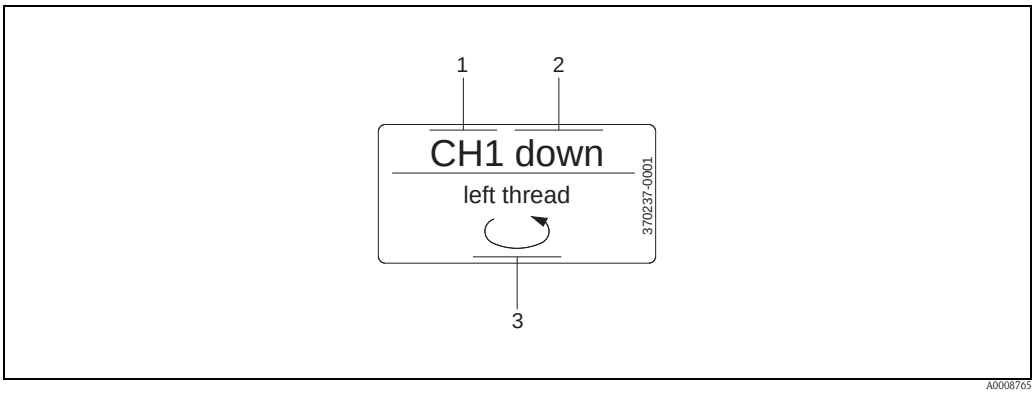


Fig. 4: Adhesive label for sensor channel identification on the measuring tube (example)

1 Channel name CH 1 to CH 4
2 Information on the flow direction (upstream or downstream)
3 Note indicating that the internal thread of the sensor nozzle has a left thread for safety reasons

2.1.5 Nameplate for the connections

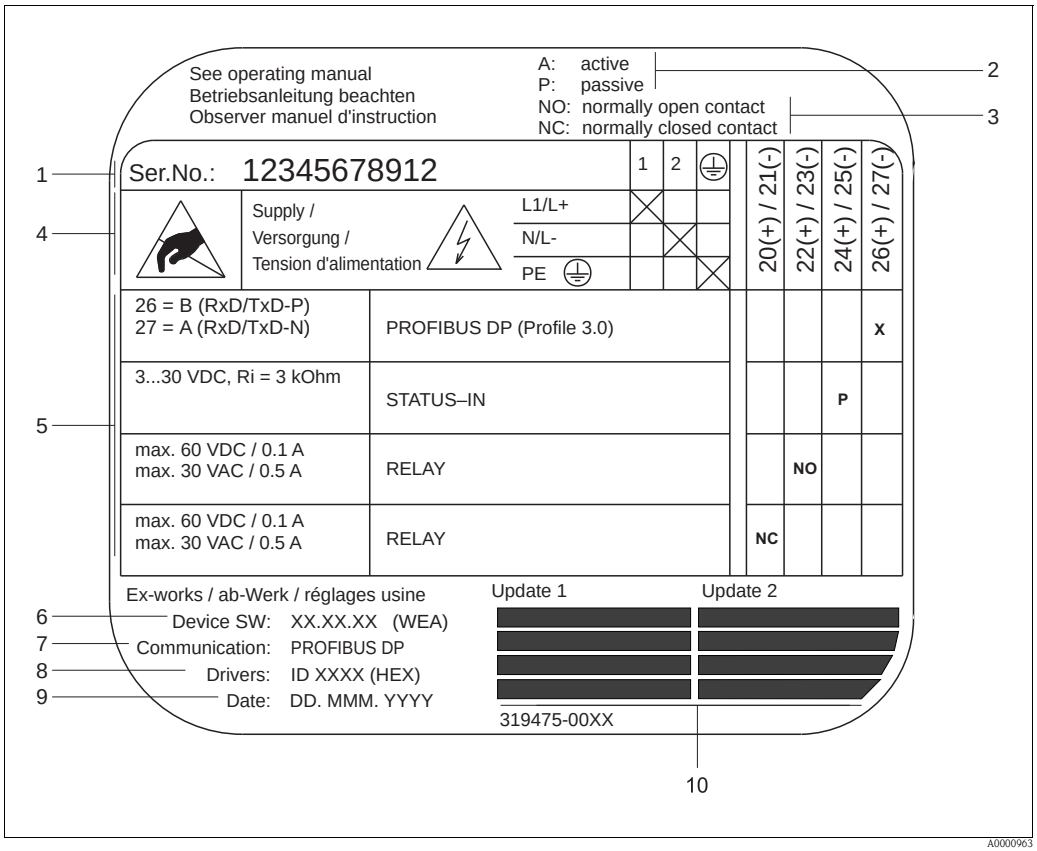


Fig. 5: Nameplate specifications for Proline transmitter (example)

1 Serial number
2 Possible configuration of the current input
3 Possible configuration of the relay contacts
4 Terminal assignment, cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
5 Signals present at the inputs and outputs, possible configuration and terminal assignment → 32
6 Version of device software currently installed (including language group)
7 Installed communication mode
8 PROFIBUS ID No.
9 Date of installation
10 Current updates to the information listed in Points 6 to 9

2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate.

The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use" and with the EMC requirements of IEC/EN 61326.

The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization).

The device thus meets all the requirements of the following specifications:
- Certified to PROFIBUS Specification Profile 3.0 version
  (Device certification number: provided upon request)
- The measuring device can also be operated with certified devices of other manufacturers (interoperability).

2.3 Registered trademarks

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, D

HistoROM™, T-DAT™, FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following points:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The devices must be transported in the container supplied when transporting them to the measuring point.

Caution!
Flanged devices should never be lifted at the sensor nozzle for transportation purposes. To transport, lift or insert the sensor into the pipe, only use the metal holders fitted on the flange.

3.1.3 Storage

Note the following points:
- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The storage temperature corresponds to the ambient temperature range (Page 120) of the transmitter, the sensors and the corresponding sensor cables.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 Installation conditions

3.2.1 Dimensions

All the dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document.

3.2.2 Mounting location

Correct flow measurement is possible only if the pipe is full.
It is preferable to install the sensors in a riser.

Note!
Entrained air or gas bubbles in the measuring tube can result in an increase in measuring errors.
For this reason, **avoid** the following mounting locations:
- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipe. Risk of partial pipe filling.

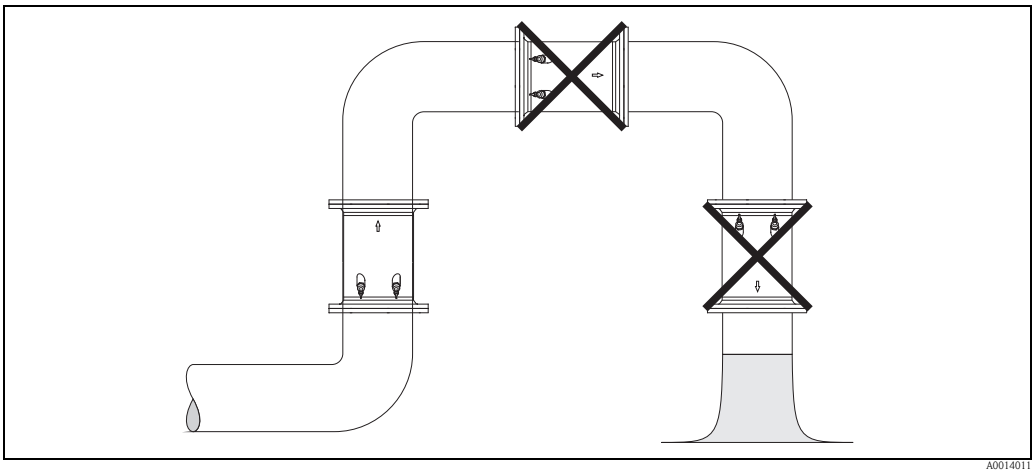


Fig. 6: Mounting location (side view)

Partially filled pipes

Partially filled pipes with a gradient necessitate a drain-type configuration.

Caution!
Risk of solids accumulating! Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.

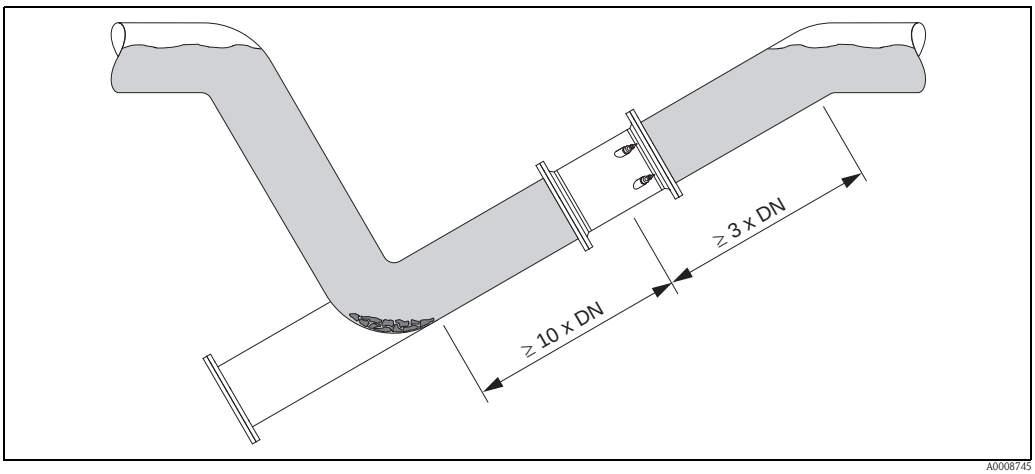


Fig. 7: Installation in partially filled pipe

3.2.3 Down pipes

Notwithstanding the foregoing, the installation suggested below permits installation in an open down pipe. Pipe restrictions or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the pipe from running empty while measurement is in progress.

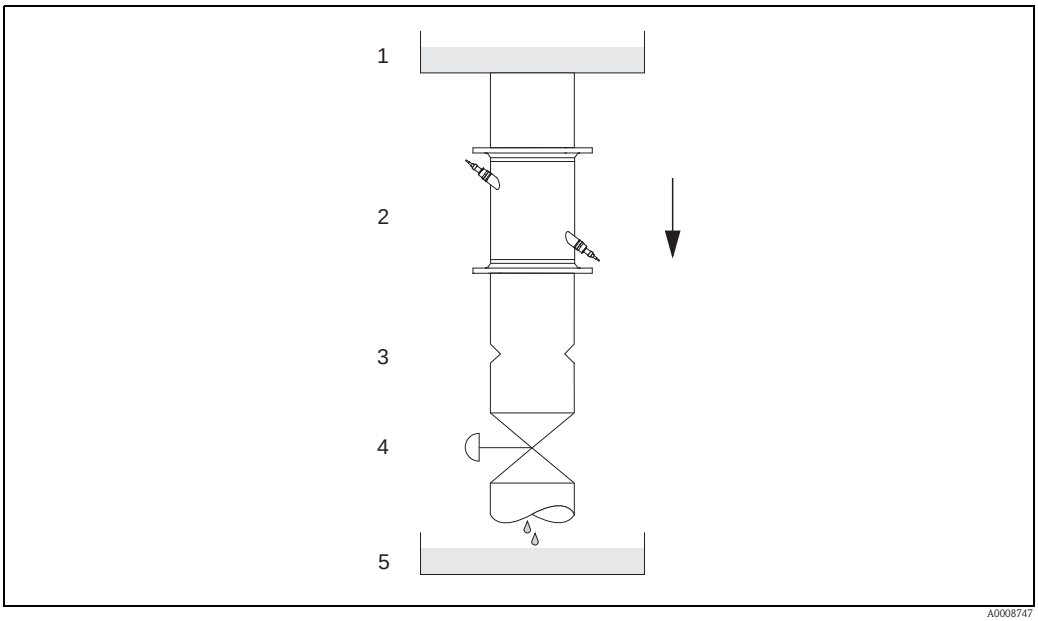


Fig. 8: Installation in a down pipe
1 = Supply tank, 2 = Measuring sensors, 3 = Orifice plate, pipe restriction, 4 = Valve, 5 = Filling tank

3.2.4 Orientation

Vertical

Recommended orientation with upward direction of flow (View A). With this orientation, entrained solids will sink and gases will rise away from the sensor when the fluid is stagnant. The piping can be completely drained and protected against solids buildup.

Horizontal

In the recommended installation range in a horizontal installation position (View B), gas and air collections at the pipe cover and problematic deposits at the bottom of the pipe have a smaller influence on measurement.

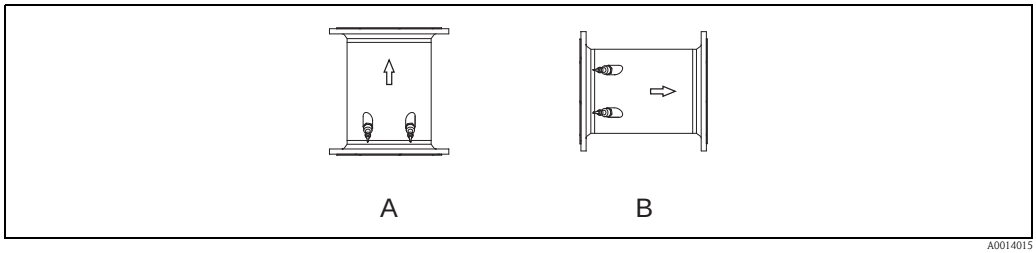


Fig. 9: Orientation (side view)
A Recommended orientation with upward direction of flow
B Recommended installation range with horizontal orientation

3.2.5 Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows, etc. The longest inlet and outlet run must be taken into consideration if two or more flow obstructions are present. The following inlet and outlet runs are recommended to comply with measuring accuracy specifications:

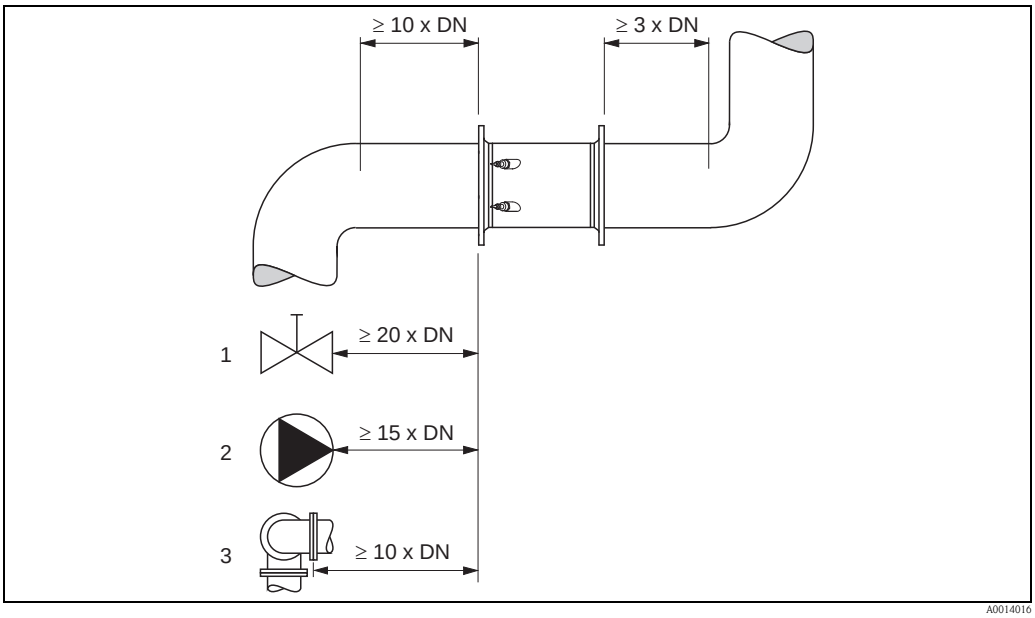


Fig. 10: Inlet and outlet runs (side view)

1 Valve (2/3 open)
2 Pump
3 Two pipe bends in different directions

3.2.6 Vibrations

Secure the piping and the sensor if vibration is severe.
Information on resistance to vibration and shock is provided on → Page 120

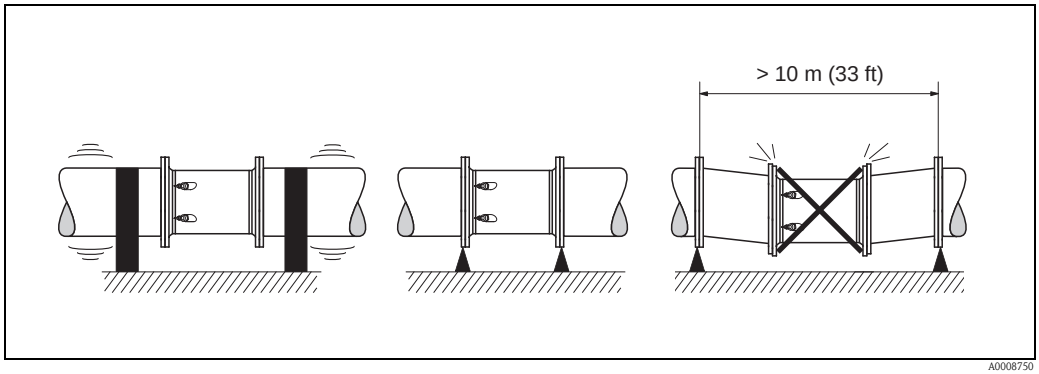


Fig. 11: Measures to prevent device vibrations

3.2.7 Foundations, supports

For all nominal diameter mount the sensor on a foundation of adequate load-beating strength.

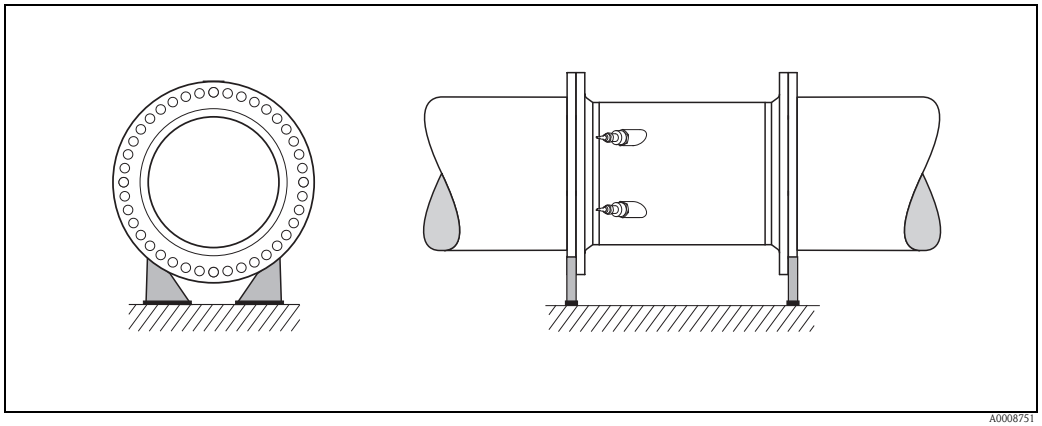


Fig. 12: Correct support for large nominal diameters

3.2.8 Adapters

The sensor can also be installed in a pipe with a larger nominal diameter using appropriate adapters in accordance with (E) DIN EN 545 (double-flange adapters). The resulting increase in flow velocity improves accuracy if the fluid flows very slowly.
The chart below can be used to determine the drop in pressure caused by reducers and expanders:

Caution!
The chart only applies to liquids with a viscosity similar to that of water.

1. Determine the diameter ratio d/D.
2. From the chart, determine the pressure loss as a function of the flow velocity (after the reduction) and the d/D ratio.

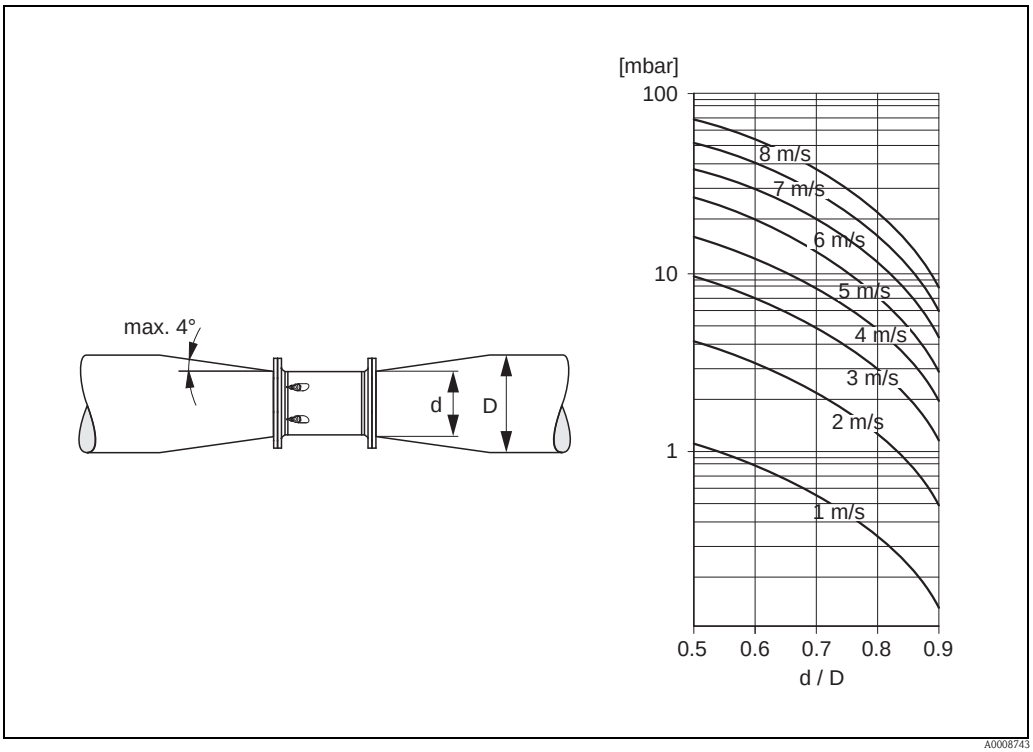


Fig. 13: Pressure loss caused by adapters (side view)

3.2.9 Nominal diameter and flow rate

The pipe diameter and the flow rate determine the nominal diameter of the sensor. Optimum flow velocity is between 2 and 3 m/s. The flow velocity (v) must also match the physical properties of the fluid:
v < 2 m/s: for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
v > 2 m/s: for fluids that tend to cause buildup, such as wastewater sludge etc.

Note!
If the flow velocity has to be increased, this can be achieved by reducing the nominal diameter of sensor (→ 17).

Flow characteristics of Prosonic Flow C (SI units)

Nominal diameter		Recommended flow rate	Factory setting
[mm]	[inch]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Creepage (v ~ 0.04 m/s)
300	12"	80 to 2700 m³/h	10 m³/h
350	14"	100 to 3300 m³/h	15 m³/h
400	16"	130 to 4400 m³/h	20 m³/h
450	18"	160 to 5600 m³/h	20 m³/h
500	20"	200 to 6900 m³/h	30 m³/h
600	24"	300 to 9900 m³/h	40 m³/h
700	28"	410 to 13600 m³/h	55 m³/h
–	30"	470 to 15900 m³/h	65 m³/h
800	32"	540 to 17900 m³/h	75 m³/h
900	36"	680 to 22500 m³/h	90 m³/h
1000	40"	850 to 25000 m³/h	115 m³/h
–	42"	950 to 27000 m³/h	125 m³/h
1200	48"	1250 to 30000 m³/h	160 m³/h
–	54"	1550 to 32000 m³/h	205 m³/h
1400	–	1650 to 35000 m³/h	220 m³/h
–	60"	1950 to 37000 m³/h	255 m³/h
1600	–	2200 to 40000 m³/h	285 m³/h
–	66"	2500 to 40000 m³/h	305 m³/h
1800	72"	2800 to 45000 m³/h	360 m³/h
2000	78"	3400 to 50000 m³/h	450 m³/h

Flow characteristics of Prosonic Flow C (US units)			
Nominal diameter		Recommended flow rate	Factory setting
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Creepage (v ~ 0.04 m/s)
12"	300	350 to 11900 gal/min	45 gal/min
14"	350	440 to 14500 gal/min	65 gal/min
16"	400	570 to 19400 gal/min	90 gal/min
18"	450	700 to 24700 gal/min	90 gal/min
20"	500	880 to 30400 gal/min	130 gal/min
24"	600	1320 to 43600 gal/min	175 gal/min
28"	700	1800 to 59900 gal/min	240 gal/min
30"	–	2070 to 70000 gal/min	275 gal/min
32"	800	2380 to 78800 gal/min	325 gal/min
36"	900	2990 to 99000 gal/min	400 gal/min
40"	1000	3740 to 110000 gal/min	500 gal/min
42"	–	4180 to 118900 gal/min	550 gal/min
48"	1200	5500 to 132100 gal/min	700 gal/min
54"	–	9.8 to 203 Mgal/d	1.3 Mgal/d
–	14000	10.5 to 222 Mgal/d	1.4 Mgal/d
60"	–	12.4 to 235 Mgal/d	1.6 Mgal/d
–	1600	13.9 to 254 Mgal/d	1.8 Mgal/d
66"	–	14.6 to 254 Mgal/d	1.9 Mgal/d
72"	1800	17.7 to 285 Mgal/d	2.3 Mgal/d
78"	2000	21.6 to 317 Mgal/d	2.9 Mgal/d

3.2.10 Length of connecting cable

Shielded cables are available in the following lengths:
5 m (16.4 ft), 10 m (32.8 ft), 15 m (49.2 ft) and 30 m (98.4 ft)

Caution!
Route the cables well clear of electrical machines and switching elements.

3.3 Installation

3.3.1 Installing the Prosonic Flow C measuring tube

Note!
The screws, nuts, seals etc. do not form part of the scope of supply and must be provided by the customer.

The sensor is mounted between the pipe flanges.

Caution!
Please pay attention to the required torques specified on this page and on the following pages.

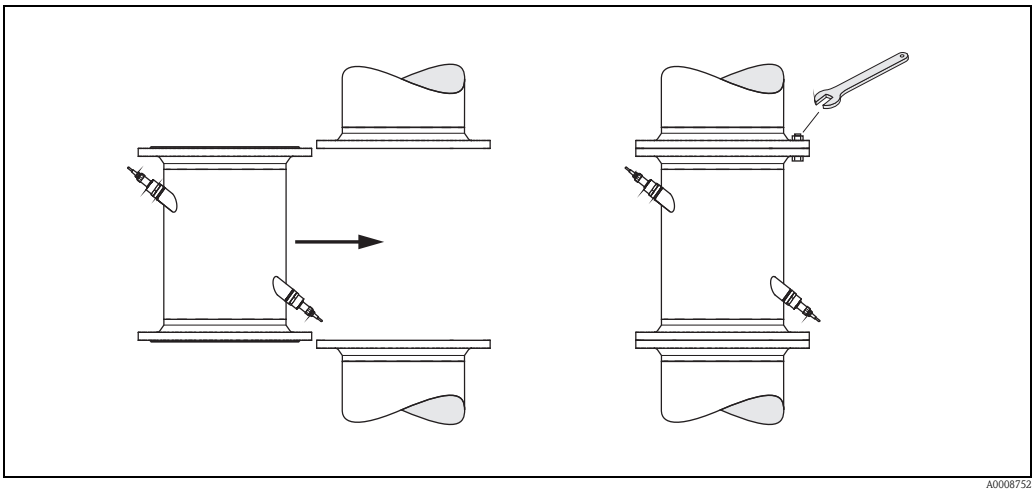


Fig. 14: Mounting the Prosonic Flow C measuring tube

Seals

- Only use seals of type "Compressed fiber with binder" according to EN (DIN) 1514 for (EN) DIN flanges.
- Attend to the guidelines of the seal manufacturer.
- Mounted seals should not project into the pipe cross-section.

Tightening torque

- The torques listed only apply to:
  – lubricated threads
  – pipes free from tensile stress.
- The torques listed for flanges according to (DIN) 1092 (→ 20) are only effective by using seals of type "Compressed fiber with binder" according to EN (DIN) 1514. Attend to the guidelines of the seal manufacturer.
- Always tighten threaded fasteners uniformly and in diagonally opposite sequence.
- Overtightened screws can deform the sealing surface or damage the seal.

DIN pressure rating

Prosonic Flow C				
Nominal diameter	DIN pressure rating	Screws	Max. tightening torque	
[mm]	[bar]		[Nm]	[lbf ft]
300	PN 10	12 × M 20	94	69
300	PN 16	12 × M 24	134	99
350	PN 10	16 × M 20	112	83
350	PN 16	16 × M 24	152	112
400	PN 10	16 × M 24	151	111
400	PN 16	16 × M 27	193	142
450	PN 10	20 × M 24	153	113
450	PN 16	20 × M 27	198	146
500	PN 10	20 × M 24	155	114
500	PN 16	20 × M 30	275	203
600	PN 10	20 × M 27	206	152
600	PN 16	20 × M 33	415	306
700	PN 10	24 × M 27	246	181
700	PN 16	24 × M 33	278	205
800	PN 10	24 × M 30	331	244
800	PN 16	24 × M 36	369	272
900	PN 10	28 × M 30	316	233
900	PN 16	28 × M 36	353	260
1000	PN 10	28 × M 33	402	297
1000	PN 16	28 × M 39	502	370
1200	PN 6	32 × M 30	319	235
1200	PN 10	32 × M 36	564	416
1200	PN 16	32 × M 45	701	517
1400	PN 6	36 × M 33	430	317
1400	PN 10	36 × M 39	654	482
1400	PN 16	36 × M 45	729	538
1600	PN 6	40 × M 33	440	325
1600	PN 10	40 × M 45	946	698
1600	PN 16	40 × M 52	1007	743
1800	PN 6	44 × M 36	547	403
1800	PN 10	44 × M 45	961	709
1800	PN 16	44 × M 52	1108	817
2000	PN 6	48 × M 39	629	464
2000	PN 10	48 × M 45	1047	772
2000	PN 16	48 × M 56	1324	977

AWWA pressure rating

Prosonic Flow C					
Nominal diameter		AWWA pressure rating	Screws	Max. tightening torque	
[mm]	[inch]			[Nm]	[lbf ft]
700	28"	Class D	28 × 1 1/4 "	247	182
–	30"	Class D	28 × 1 1/4 "	287	212
800	32"	Class D	28 × 1 1/4 "	394	291
900	36"	Class D	32 × 1 1/2 "	419	309
1000	40"	Class D	36 × 1 1/2 "	420	310
–	42"	Class D	36 × 1 1/2 "	528	389
1200	48"	Class D	44 × 1 1/2 "	552	407
–	54"	Class D	44 × 1 3/4 "	730	538
–	60"	Class D	52 × 1 3/4 "	758	559
–	66"	Class D	52 × 1 3/4 "	946	698
1800	72"	Class D	60 × 1 3/4 "	975	719
–	78"	Class D	64 × 2"	853	629

ANSI pressure rating

Prosonic Flow C					
Nominal diameter		ANSI pressure rating	Screws	Max. tightening torque	
[mm]	[inch]	[Ibs]		[Nm]	[lbf ft]
300	12"	Class 150	12 × 7/8 "	133	98
350	14"	Class 150	12 × 1 "	135	100
400	16"	Class 150	16 × 1"	128	94
–	18"	Class 150	16 × 1 1/8 "	204	150
500	20"	Class 150	20 × 1 1/8 "	183	135
600	24"	Class 150	20 × 1 1/4 "	268	198

3.3.2 Installing the wall-mount housing

There are various ways of installing the wall-mount housing:

- Direct wall mounting
- Panel mounting (with separate mounting kit, accessories) → 📄 23
- Pipe mounting (with separate mounting kit, accessories) → 📄 23

Caution!

- Make sure that the permitted operating temperature range (–20 to +60 °C (–4 to + °140 F), optionally –40 to +60 °C (–40 to +140 °F) is not exceeded at the mounting location. Install the device in a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Direct wall mounting

1. Drill the holes as shown in the diagram.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm (0.26 in)
   – Screw head: max. Ø 10.5 mm (0.41" in)
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

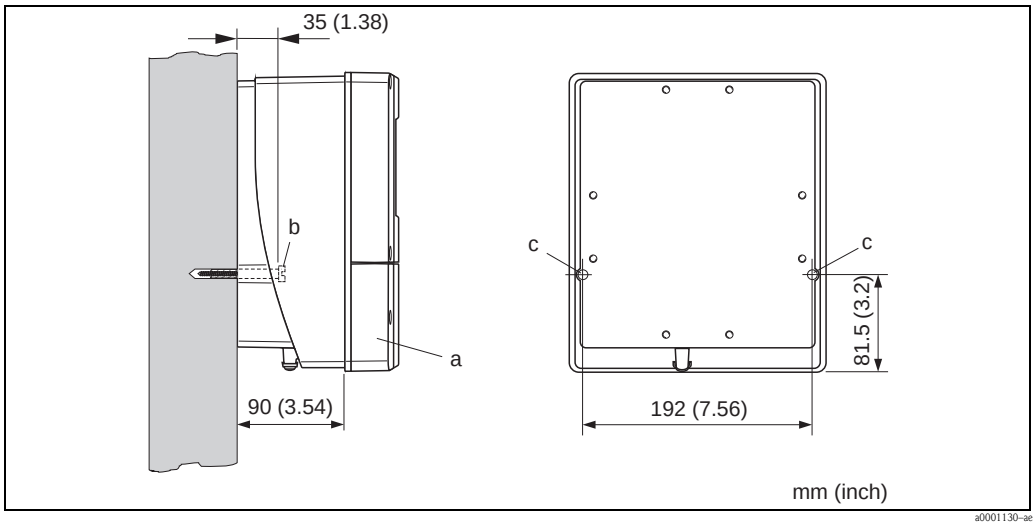


Fig. 15: Direct wall mounting

Panel mounting

1. Prepare the opening in the panel as shown in the diagram.
2. Slide the housing into the panel cutout from the front.
3. Screw the retainers onto the wall-mount housing.
4. Screw the threaded rods into the retainers and tighten until the housing is solidly seated on the panel wall. Tighten the counter nuts. No further support is necessary.

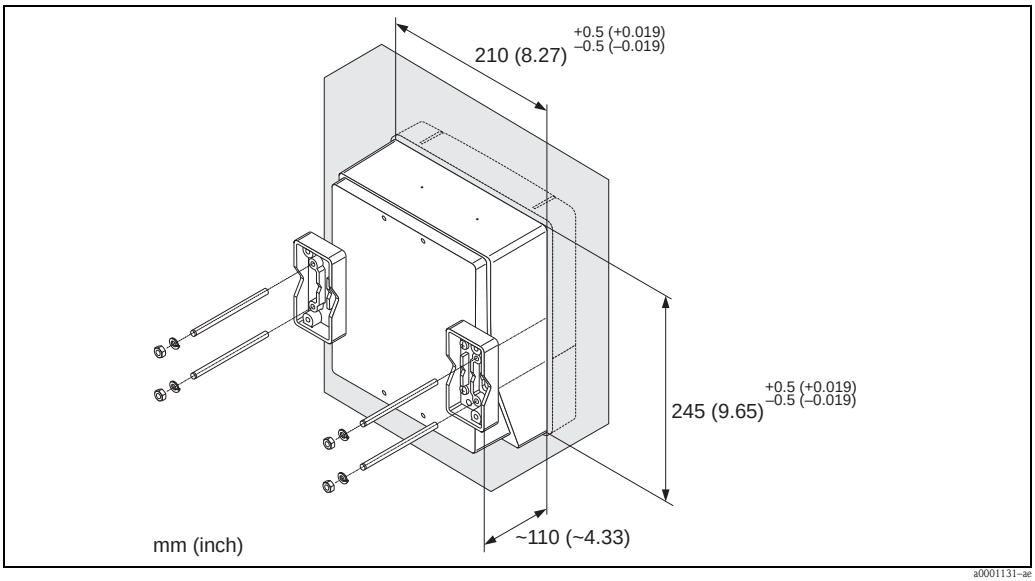


Fig. 16: Panel mounting (wall-mount housing)

Pipe mounting

The assembly should be performed as specified in the graphic.

Caution!
If the unit is mounted to a warm pipe, make sure that the housing temperature does not exceed the maximum permitted value of +60 °C (+140 °F).

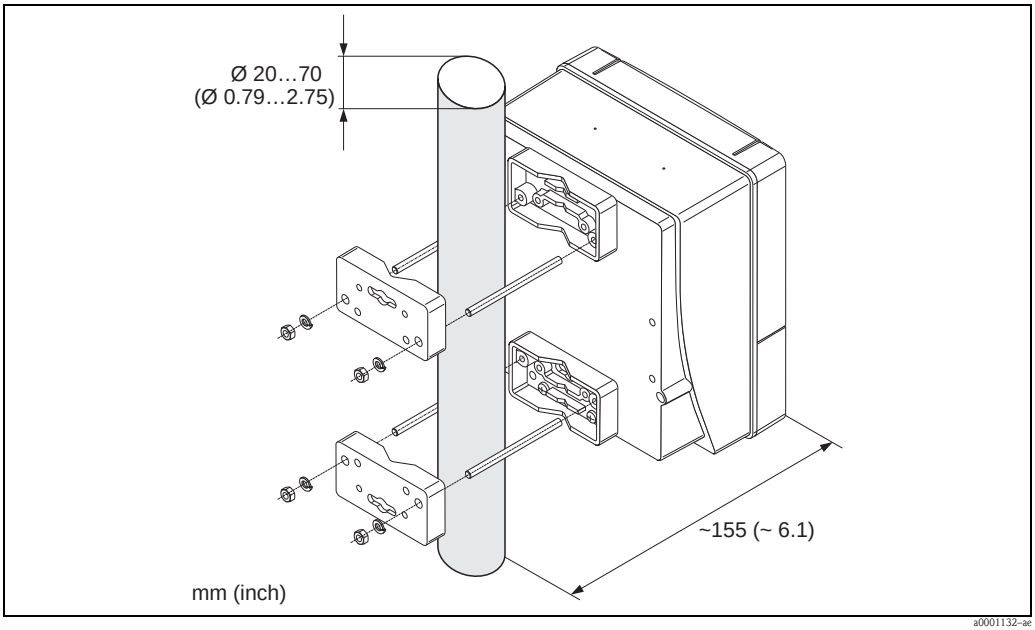


Fig. 17: Pipe mounting (wall-mount housing)

3.4 Post-installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	–
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?	→ 📄 5 ff.
Installation	Notes
Are the measuring point number and labeling correct (visual inspection)?	–
Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	→ 📄 14 ff.
Process environment / process conditions	Notes
Have the inlet and outlet runs been observed?	→ 📄 15
Is the measuring device protected against moisture and direct sunlight?	–
Is the measuring tube properly secured against vibration (fasteners, support)?	→ 📄 15

4 Wiring

Warning!
When connecting Ex-certified devices, please refer to the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

Note!
The device does not have an internal power switch. For this reason, assign the device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

4.1 PROFIBUS cable specifications

4.1.1 PROFIBUS DP cable specifications

Cable type

Two versions of the bus line are specified in IEC 61158. Cable type A can be used for all transmission rates up to 12 Mbit/s. Please refer to the table for the cable parameters:

Cable type A	
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Core cross-section	>0.34 mm², corresponds to AWG 22
Cable type	Twisted in pairs, 1 x 2, 2 x 2 or 1 x 4 wire
Loop-resistance	110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable section
Shielding	Copper braided shielding or braided shielding and foil shielding

Bus structure

Note the following points:
- The maximum line length (segment length) depends on the transmission rate.
  For cable type A, the maximum line length (segment length) is as follows:

Transmission rate	**Line length**	
[kBit/s]	**[m]**	**[ft]**
9.6 to 93.75	1200	4000
187.5	1000	3300
500	400	1300
1500	200	650
3000 to 12000	100	330

- A maximum of 32 users are permitted per segment.
- Each segment is terminated at either end with a terminating resistor.
- The bus length or the number of users can be increased by introducing a repeater.
- The first and last segment can comprise max. 31 devices.
  The segments between the repeaters can comprise max. 30 stations.
- The maximum distance between two bus users can be calculated as follows:
  (NO_REP + 1) x segment length

  Note!
  NO_REP = maximum number of repeaters that may be switched in series depending on the repeater in question.

Example

In accordance with manufacturer specifications, 9 repeaters can be switched in series when using a standard line. The maximum distance between two bus users at a transmission rate of 1.5 MBit/s can be calculated as follows:
(9 + 1) x 200 m (660 ft) = 2000 m (6600 ft).

Spurs

Note the following points:
- Length of spurs < 6.6 m (21.7 ft) (at max.1.5 MBit/s)
- No spurs should be used for transmission rates >1.5 MBit/s.
  The line between the connector and the bus driver is described as a spur. Experience has shown that you should proceed with caution when configuring spurs. For this reason, you cannot presume that the sum of all spurs at 1.5 MBit/s may be 6.6 m (21.7 ft).
  This is affected greatly by the arrangement of the field devices. Therefore, we recommend you do not use any spurs, if possible, at transmission rates >1.5 MBit/s.
- If you cannot avoid using spurs, then they may not include any bus terminators.

Bus termination

It is important to terminate the RS485 line correctly at the start and end of the bus segment since impedance mismatch results in reflections on the line which can cause faulty communication transmission → 53.

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.2 PROFIBUS PA cable specifications

Cable type

Twin-core cables are recommended for connecting the device to the fieldbus. Following IEC 61158-2 (MBP), four different cable types (A, B, C, D) can be used with the fieldbus, only two of which (cable types A and B) are shielded.

- Cable types A or B are particularly preferable for new installations. Only these types have cable shielding that guarantees adequate protection from electromagnetic interference and thus the most reliable data transfer. In the case of type B multi-pair cables, it is permissible to operate multiple fieldbuses with the same degree of protection on one cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

The electrical data of the fieldbus cable have not been specified but determine important characteristics of the design of the fieldbus, such as distances bridged, number of users, electromagnetic compatibility, etc.

	Type A	**Type B**
Cable structure	Twisted pair, shielded	One or more twisted pairs, fully shielded
Wire cross-section	0.8 mm² (AWG 18)	0.32 mm² (AWG 22)
Loop-resistance (DC)	44 Ω/km	112 Ω/km
Characteristic impedance at 31.25 kHz	100 Ω ± 20%	100 Ω ± 30%
Attenuation constant at 39 kHz	3 dB/km	5 dB/km
Capacitive asymmetry	2 nF/km	2 nF/km
Envelope delay distortion (7.9 to 39 kHz)	1.7 µs/km	*
Shield coverage	90%	*
Max. cable length (incl. spurs >1 m)	1900 m (6200 ft)	1200 m (4000 ft)

* Not specified

Suitable fieldbus cables from various manufacturers for non-hazardous areas are listed below:
- Siemens: 6XV1 830-5BH10
- Belden: 3076F
- Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Maximum overall cable length

The maximum network expansion depends on the type of protection and the cable specifications. The overall cable length combines the length of the main cable and the length of all spurs >1 m (>3.28 ft).

Note the following points:
- The maximum permissible overall cable length depends on the cable type used:

Type A	1900 m	6200 ft
Type B	1200 m	4000 ft

- If repeaters are used, the maximum permissible cable length is doubled.
  A maximum of three repeaters are permitted between user and master.

Maximum spur length

The line between the distribution box and field device is described as a spur.
In the case of non-Ex applications, the max. length of a spur depends on the number of spurs >1 m (>3.28 ft):

Number of spurs		1 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	[m]	120	90	60	30	1
	[ft]	393	295	196	98	3.28

Number of field devices

In systems that meet FISCO with EEx ia type of protection, the line length is limited to max. 1000 m (3300 ft). A maximum of 32 users per segment in non-Ex areas or a maximum of 10 users in an Ex-area (EEx ia IIC) is possible. The actual number of users must be determined during configuration.

Bus termination

The start and end of each fieldbus segment are always to be terminated with a bus terminator. With various junction boxes (non-Ex), the bus termination can be activated via a switch. If this is not the case, a separate bus terminator must be installed.

Note the following points:
- In the case of a branched bus segment, the device furthest from the segment coupler represents the end of the bus.
- If the fieldbus is extended with a repeater then the extension must also be terminated at both ends.

Further information

General information and further notes regarding the wiring are contained in BA034S/04: "Guidelines for planning and commissioning, PROFIBUS DP/PA, field communication."

4.1.3 Shielding and grounding

When planning the shielding and grounding for a fieldbus system, there are three important points to consider:

- Electromagnetic compatibility (EMC)
- Explosion protection
- Safety of the personnel

To ensure the optimum electromagnetic compatibility of systems, it is important that the system components and above all the cables, which connect the components, are shielded and that no portion of the system is unshielded. Ideally, the cable shields are connected to the normally metal housings of the connected field devices. Since these are generally connected to the protective earth, the shield of the bus cable is grounded many times. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.
This approach, which provides the best electromagnetic compatibility and personal safety, can be used without restriction in systems with good potential matching.
In the case of systems without potential matching, a power supply frequency (50 Hz) equalizing current can flow between two grounding points which, in unfavorable cases, e.g. when it exceeds the permissible shield current, may destroy the cable.
To suppress the low frequency equalizing currents on systems without potential equalization, it is therefore recommended to connect the cable shield directly to the building ground (or protective earth) at one end only and to use capacitive coupling to connect all other grounding points.

Caution!
The legal EMC requirements are fulfilled **only** when the cable shield is grounded on both sides!

4.2 Sensor/transmitter connecting cable

Warning!
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied.

Note!
To ensure correct measuring results, route the cable well clear of electrical machines and switching elements.

4.2.1 Connecting the Prosonic Flow W

Procedure → 31

1. Remove the cover (a) of the connection compartment.
2. Remove the dummy cover from the cable entry (b).
3. Route the two connecting cables (c) of channel 1 through the cable gland (d).
4. Route the two connecting cables of channel 1 through the cable entry (b) and into the connection compartment of the transmitter.
5. Place the cable retaining sleeves (e) of the two connecting cables at the ground contact terminals (f) (Detail B).
6. Twist down the ground contact terminals (f) so that the two cable retaining sleeves (e) are firmly seated.
7. Screw the ground contact terminals (f) tight.
8. Connect the connecting cable:
   – Channel 1 upstream = 1
   – Channel 1 downstream = 2
   – Channel 2 upstream = 3
   – Channel 3 downstream = 4
9. Spread the rubber seal (g) along the side slit with a suitable tool (e.g. a large screwdriver) and fix both connecting cables into place.
10. Push the rubber seal (g) up into the cable entry (b).
11. Tighten the cable gland (d).
12. Fit the cover (a) on the connection compartment and screw it on.

    Note!
    The connection compartment does not have to be assembled if the transmitter is wired (power supply and signal cable) directly afterwards.

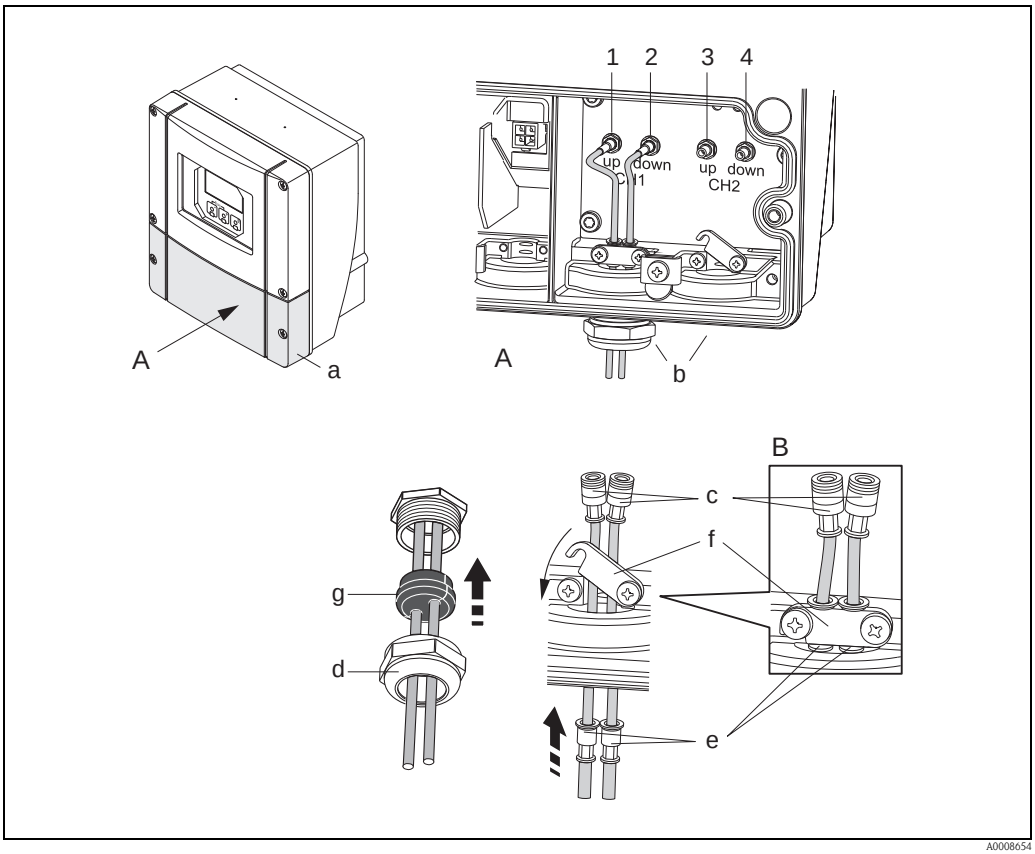


Fig. 18: Connecting the connecting cable for sensor/transmitter (with cable gland for two connecting cables per cable entry)

A View A
B Detail B

1 Sensor cable connector, channel 1 upstream
2 Sensor cable connector, channel 1 downstream
3 Sensor cable connector, channel 2 upstream
4 Sensor cable connector, channel 2 downstream

a Connection compartment cover
b Cable entries
c Connecting cables
d Cable gland
e Cable retaining sleeves
f Ground contact terminals
g Rubber seal

4.2.2 Cable specification for connecting cable

Only use the connecting cables supplied by Endress+Hauser.
The connecting cables are available in different lengths → 98 ff.

For the cable specifications, see → 119.

Operation in areas with strong electrical interference

The measuring system complies with the general safety requirements in accordance with EN 61010, the EMC requirements of IEC/EN 61326 "Emission as per Class A requirements" and NAMUR Recommendation NE 21.

4.3 Connecting the measuring unit

4.3.1 Terminal assignment

Electrical values for:
- Inputs → 117
- Outputs → 117

PROFIBUS DP

Caution!
Only certain combinations of submodules (see Table) on the I/O board are permissible. The individual slots are marked and assigned to the following terminals in the connection compartment of the transmitter:
- "INPUT / OUTPUT 3" slot = terminals 22/23
- "INPUT / OUTPUT 4" slot = terminals 20/21

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–) Submodule on slot No. 4	**22 (+) / 23 (–) Submodule on slot No. 3**	**24 (+) / 25 (–) Fixed on I/O board**	**26 = B (RxD/TxD-P) 27 = A (RxD/TxD-N) Fixed on I/O board**
93***-**********J	-	-	+5V (power supply for ext. bus terminator)	PROFIBUS DP
93***-**********V	Relay output 2	Relay output 1	Status input	PROFIBUS DP
93***-**********P	Current output	Frequency output	Status input	PROFIBUS DP

PROFIBUS PA

Order version	Terminal No. (inputs/outputs)			
	20 (+) / 21 (–)	**22 (+) / 23 (–)**	**24 (+) / 25 (–)**	**26 = PA + [1] 27 = PA – [1]**
93***-**********H	-	-	-	PROFIBUS PA

[1] With integrated reverse polarity protection

4.3.2 Connecting the transmitter

Warning!
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

Procedure:
- PROFIBUS DP → 19 (→ 34)
- PROFIBUS PA → 20 (→ 35)

1. Unscrew the connection compartment cover (a) from the transmitter housing.
2. Feed the power supply cable (b), the fieldbus cable (d) and the power supply cable for external bus terminator (optional) or signal cable (g) through the appropriate cable entries.
3. Perform wiring in accordance with the respective terminal assignment and the associated wiring diagram.

   Caution!
   – Risk of damaging the fieldbus cable!
     Observe the information about shielding and grounding the fieldbus cable → 29.
   – We recommend that the fieldbus cable not be looped using conventional cable glands. If you later replace even just one measuring device, the bus communication will have to be interrupted.

   Note!
   – The terminals for connecting PROFIBUS PA (26/27) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if the cables are connected the wrong way round.
   – Cable cross-section: max. 2.5 mm² (0.0039 in², AWG 14)
   – Pay attention to the grounding concept of the plant.
4. Screw the cover of the connection compartment (a) back onto the transmitter housing.

4.3.3 PROFIBUS DP connection diagram

Permanent assignment board (order version 93*-**********J)**

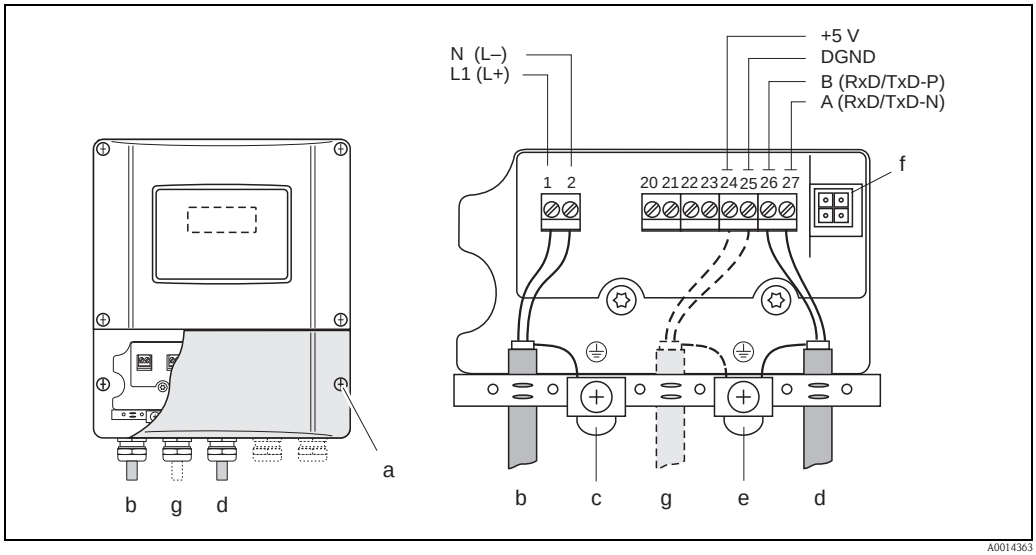


Fig. 19: Connecting the transmitter, cable cross-section: max. 2.5 mm² (AWG 14)

a Connection compartment cover
b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
c Ground terminal for protective ground
d Fieldbus cable:
Terminal No. 26: B (RxD/TxD-P)
Terminal No. 27: A (RxD/TxD-N)
e Ground terminal for fieldbus cable shield
Observe the following:
– the shielding and grounding of the fieldbus cable → 29
– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
g Power supply cable for external bus terminator (optional):
Terminal No. 24: +5 V
Terminal No. 25: DGND

Flexible assignment boards
(order version 93*-**********V and 93***-**********P)**

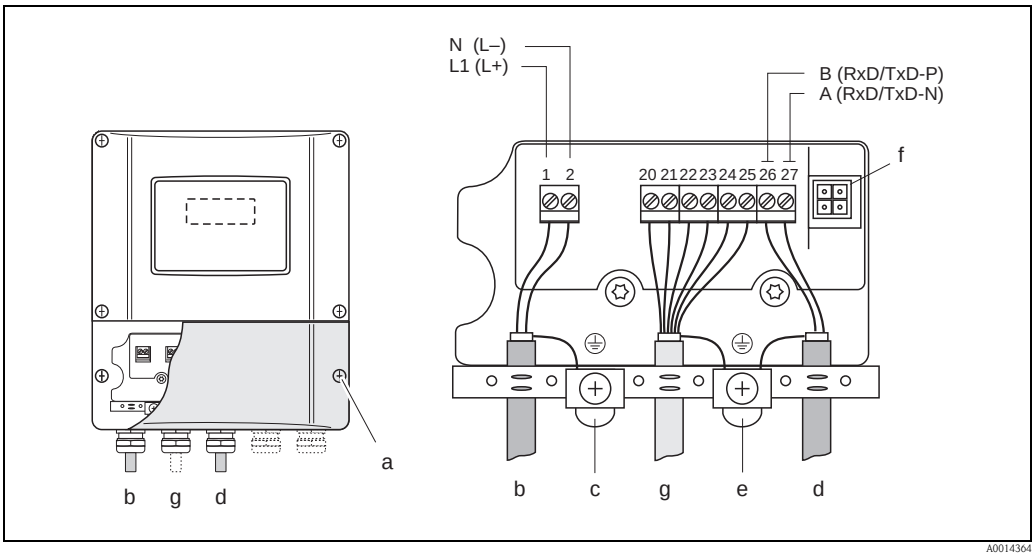


Fig. 20: Connecting the transmitter, cable cross-section: max. 2.5 mm² (AWG 14)

a Connection compartment cover
b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
c Ground terminal for protective ground
d Fieldbus cable:
Terminal No. 26: B (RxD/TxD-P)
Terminal No. 27: A (RxD/TxD-N)
e Ground terminal for signal cable shield
Observe the following:
– the shielding and grounding of the fieldbus cable → 29
– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
g Signal cable: see terminal assignment → 32

4.3.4 PROFIBUS PA connection diagram

Permanent assignment board (order version 93*-**********H)**

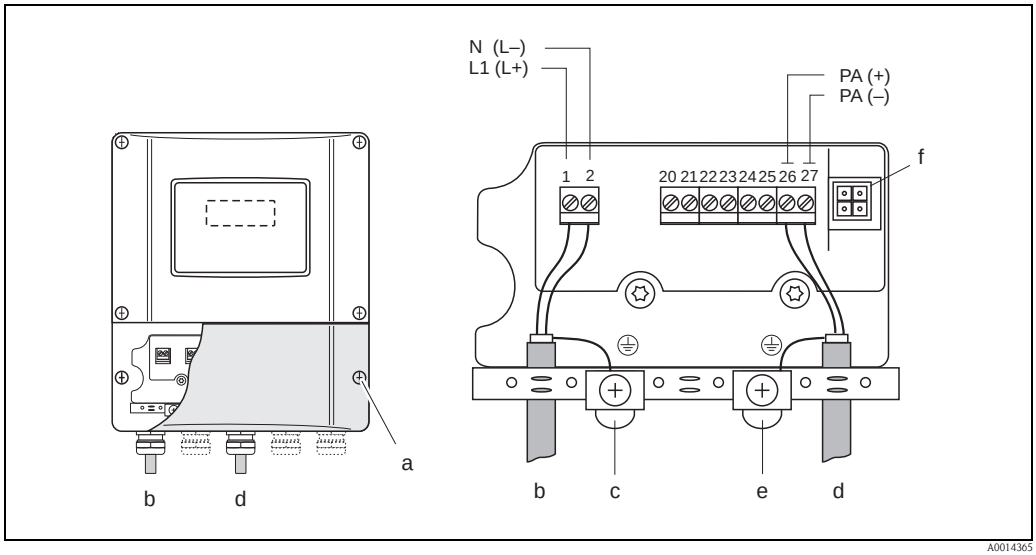


Fig. 21: Connecting the transmitter, cable cross-section: max. 2.5 mm² (AWG 14)

a Connection compartment cover
b Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
c Ground terminal for protective ground
d Fieldbus cable:
Terminal No. 26: PA + (with reverse polarity protection)
Terminal No. 27: PA – (with reverse polarity protection)
e Ground terminal for fieldbus cable shield
Observe the following:
– the shielding and grounding of the fieldbus cable → 29
– that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

Fieldbus connector

Note!
The connector can only be used for PROFIBUS PA devices.

The connection technology of PROFIBUS PA allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, distribution modules etc.

This connection technology using prefabricated distribution modules and plug-in connectors offers substantial advantages over conventional wiring:
- Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
- Installation and maintenance are significantly easier.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel distribution modules.

The device can therefore be supplied with the option of a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part → 98.

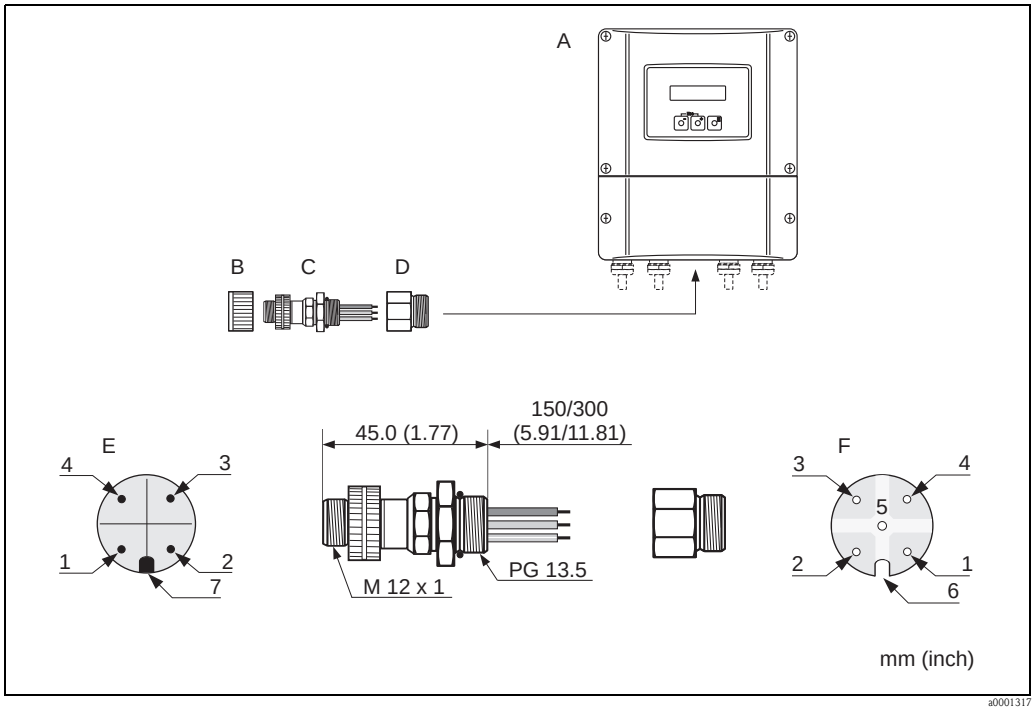


Fig. 22: Connectors for connecting to the PROFIBUS PA

A Wall-mount housing
B Protection cap for connector
C Fieldbus connector
D Adapter PG 13.5 / M 20.5
E Male connector at housing
F Female connector

Pin assignment / color codes:
1 Brown wire : PA + (terminal 26)
2 Not connected
3 Blue wire: PA – (terminal 27)
4 Black wire: ground (instructions for connection → 31)
5 Middle female connector not assigned
6 Positioning groove
7 Positioning key

Technical data (fieldbus connector):

Connection cross section	0.75 mm^2 (0.0012 in^2)
Connector thread	PG 13.5
Degree of protection	IP 67 in accordance with DIN 40 050 IEC 529
Contact surface	CuZnAu
Housing material	Cu Zn, surface Ni
Flammability	V - 2 in accordance with UL - 94
Operating temperature	–40 to +85 °C, (–40 to +185 °F)
Ambient temperature range	–40 to +150 °C, (–40 to +302 °F)
Nominal current per contact	3 A
Nominal voltage	125 to 150 V DC in accordance with the VDE Standard 01 10/ISO Group 10
Resistance to tracking	KC 600
Volume resistance	≤ 8 mΩ in accordance with IEC 512 Part 2
Insulation resistance	≤ 10^{12} Ω in accordance with IEC 512 Part 2

Shielding of the cable connection/T-box

Use cable glands with good EMC properties, with surrounding contact of the cable gland (iris spring). This requires small differences in potential, and possibly potential matching.
- Do not interrupt the shielding of the PA cable.
- Always keep the connection of the shielding as short as possible.

Ideally, cable glands with iris springs should be used for the connection of the shielding. The shield is placed on the T-box via the iris spring that is inside the cable gland. The shielding mesh is located under the iris spring. When the PG thread is screwed closed, the iris spring is pressed onto the shield, making a conductive connection between the shielding and the metal housing.

A junction box or connection is to be considered part of the shielding (Faraday cage). This is particularly true for offset boxes when these are connected to a PROFIBUS PA measuring device using a plug-in cable. In such a case, use a metallic plug in which the cable shielding is attached to the plug housing (such as prefabricated cables).

4.4 Degree of protection

4.4.1 Transmitter (wall-mount housing)

The transmitter fulfills all the requirements for IP 67.

Achtung!
Do not loosen the screws of the sensor housing, as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:
- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All the threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 31.
- Securely tighten the cable entries → 39.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

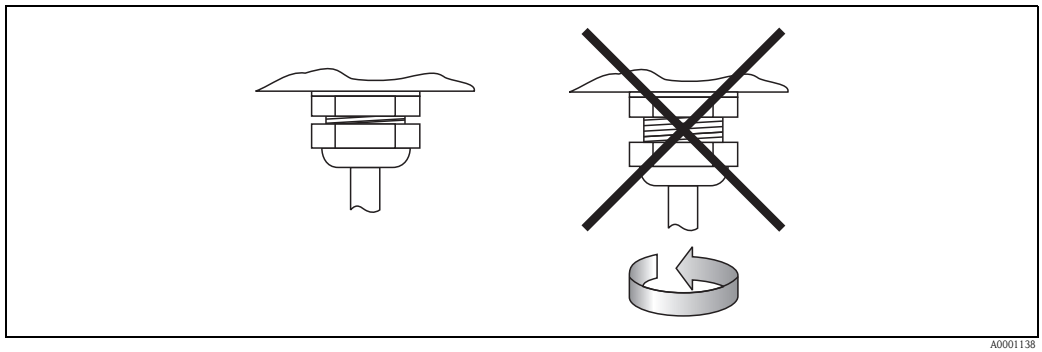


Fig. 23: Installation instructions for cable entries on the transmitter housing

4.4.2 Flowrate measuring sensors Prosonic Flow W

The flowrate measuring sensors W meet all the requirements of IP 68. Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 68 protection is maintained:

- Only use cables supplied by Endress+Hauser with the corresponding sensor connectors.
- The sensor connector seals (1), (2) must be clean, dry and undamaged when inserted in the seal groove. Replace the seals if necessary.
- Insert the cable connectors in such a way that they do not jam. Then tighten them as far as they can be tightened.

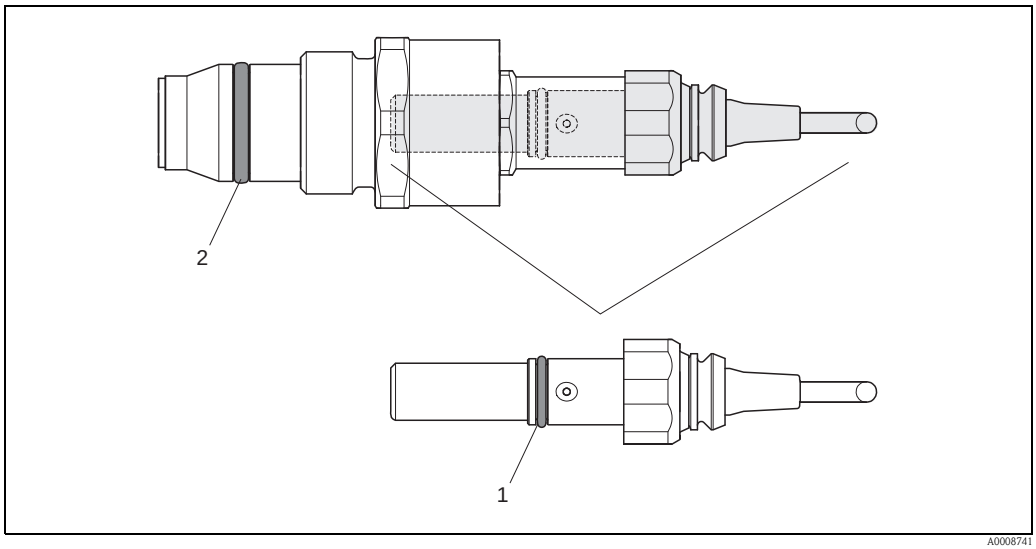


Fig. 24: Mounting instructions for sensor connectors with IP 68 protection

1 Sensor connector seal; degree of protection IP 68 relevant
2 Seal of sensor holder; prevents medium leaking out of the measuring tube

4.5 Post-connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	**Notes**
Are cables or the device damaged (visual inspection)?	–
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	85 to 260 V AC (45 to 65 Hz) 20 to 55 V AC (45 to 65 Hz) 16 to 62 V DC
Do the cables comply with the specifications?	PROFIBUS DP → 📄 25 PROFIBUS PA → 📄 27 Sensor cable → 📄 31
Do the cables have adequate strain relief?	–
Is the cable type route completely isolated? Without loops and crossovers?	–
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	–
Are all cable entries installed, firmly tightened and correctly sealed?	→ 📄 39
Are all the housing covers installed and tightened?	–
Electrical connection of PROFIBUS DP/PA	**Notes**
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	–
Has each fieldbus segment been terminated at both ends with a bus terminator?	PROFIBUS DP → 📄 25
Has the max. length of the fieldbus cable been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 📄 25 PROFIBUS PA → 📄 27
Has the max. length of the spurs been observed in accordance with the PROFIBUS specifications?	PROFIBUS DP → 📄 26 PROFIBUS PA → 📄 28
Is the fieldbus cable fully shielded and correctly grounded?	→ 📄 29

5 Operation

5.1 Quick operation guide

You have a number of options for configuring and commissioning the device:

1. **Local display (option)** → 📄 43
   The local display enables you to read all important variables directly at the measuring point, configure device-specific parameters in the field and perform commissioning.
2. **Operating programs** → 📄 49
   The configuration of profile and device-specific parameters is primarily done via the PROFIBUS interface. You can obtain special configuration and operating programs from various manufacturers for these purposes.
3. **Jumpers/miniature switches for hardware settings**
   – PROFIBUS DP → 📄 51
   – PROFIBUS PA → 📄 56
   You can make the following hardware settings using a jumper or miniature switches on the I/O board:
   - Address mode configuration (select software or hardware addressing)
   - Device bus address configuration (for hardware addressing)
   - Hardware write protection enabling/disabling

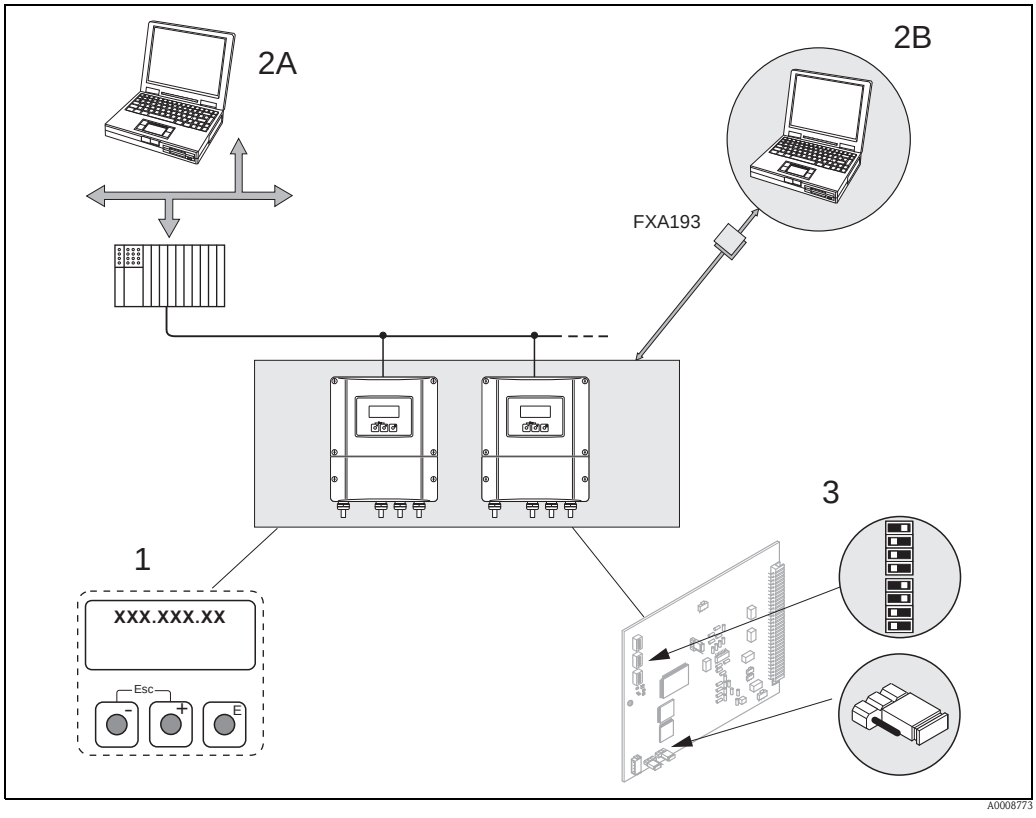


Fig. 25: Methods of operating PROFIBUS PA/DP

1 Local display for device operation in the field (option)
2A Configuration/operating programs (e.g. FieldCare) for operation via PROFIBUS DP/PA
2B Configuration/operating program for operation via the FXA193 service interface (e.g. FieldCare)
3 Jumper/miniature switches for hardware settings (write protection, device address, address mode)

5.2 Local display

5.2.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the "Quick Setup" or the function matrix.
The display consists of four lines; this is where measured values and/or status variables (direction of flow, empty pipe, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

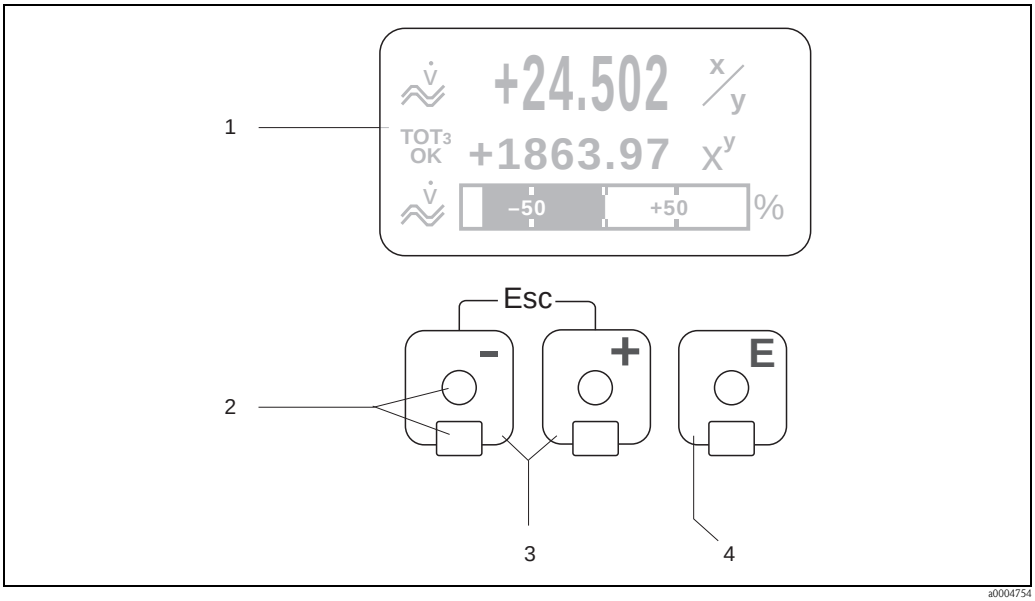


Fig. 26: Display and operating elements

1 Liquid crystal display
The backlit, four-line liquid-crystal display shows measured values, dialog texts, error messages and notice messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).
Display

2 Optical sensors for "Touch Control"

3 ⊞/⊟ keys
- *HOME position → Direct access to totalizer values and actual values of inputs/outputs*
- *Enter numerical values, select parameters*
- *Select different blocks, groups and function groups within the function matrix*

Press the ⊞⊟ keys simultaneously to trigger the following functions:
- *Exit the function matrix step by step → HOME position*
- Press and hold down the ⊞⊟ *keys for longer than 3 seconds → Return directly to HOME position*
- *Cancel data entry*

4 Ⓔ key
- *HOME position → Entry into the function matrix*
- *Save the numerical values you input or settings you change*

5.2.2 Display (operating mode)

The display area consists of three lines in all; this is where measured values are displayed, and/or status variables (direction of flow, bar graph, etc.). You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the "Description of Device Functions" manual).

Multiplex mode:
A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

Error messages:
Display and presentation of system/process errors → 48

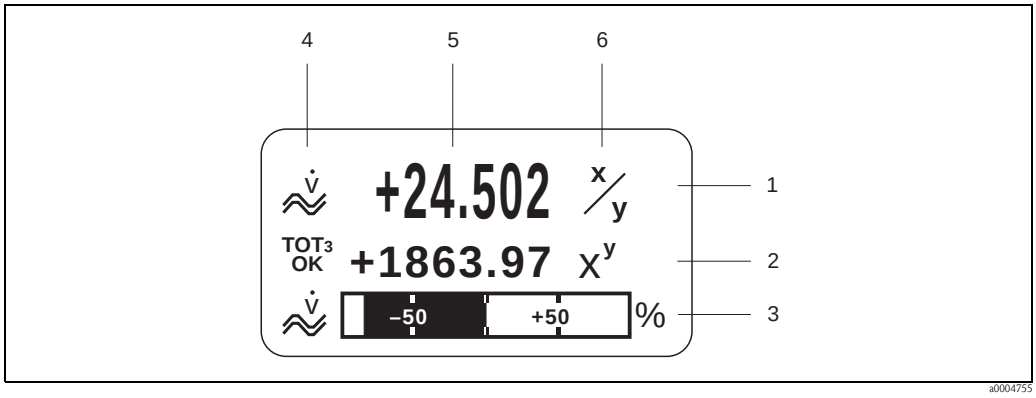


Fig. 27: Typical display for standard operating mode (HOME position)

1 Main line: shows the main measured values
2 Additional line: shows additional measured variables and status variables
3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph display
4 "Info icons" field: icons representing additional information on the measured values are shown in this field.
5 "Measured values" field: the current measured values appear in this field
6 "Unit of measure" field: the units of measure and time defined for the current measured values appear in this field

5.2.3 Additional display functions

From HOME position, use the ± keys to open an "Info Menu" containing the following information:
- Totalizers (including overflow)
- Actual values or states of the configured inputs/outputs
- Device TAG number (user-definable)

± → Scan of individual values within the Info Menu
E (Esc key) → Return to HOME position

5.2.4 Icons

The icons which appear in the field on the left make it easier to read and recognize measured variables, device status, and error messages.

Icon	Meaning	Icon	Meaning
S	System error	P	Process error
↯	Fault message (with effect on outputs)	!	Notice message (without effect on outputs)
 a0001188	Volume flow	 a0001206	Acyclic communication via PROFIBUS active (e.g. via the operating program "FieldCare")
← → (scrolling display)	Cyclic communication via PROFIBUS active, for example via PLC (Class 1 master)	 a0002322	Display value (module DISPLAY_VALUE) with status GOOD
 a0002321	Display value (module DISPLAY_VALUE) with status UNC = uncertain	 a0002320	Display value (module DISPLAY_VALUE) with status BAD
 a0002324	Output value OUT, Analog Input 1 to 6 (AI module) with status GOOD	 a0002325	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status GOOD
 a0002326	Output value OUT, Analog Input 1 to 6 (AI module) with status UNC = uncertain	 a0002327	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status UNC = uncertain
 a0002328	Output value OUT, Analog Input 1 to 6 (AI module) with status BAD	 a0002329	Output value OUT, Totalizer 1 to 3 (TOTAL module) with status BAD

5.3 Brief guide to the function matrix

Note!
- See the general notes → 47
- Function descriptions → see the "Description of Device Functions" manual"

1. HOME position → E → Entry into the function matrix
2. + / − → Select a block (e.g. USER INTERFACE) → E)
3. + / − → Select a group (e.g. CONTROL) → E
4. + / − → Select a function group (e.g. BASIC CONFIG.) → E
5. Select a function (e.g. LANGUAGE)
   Change parameter / enter numerical values:
   + / − → Select or enter enable code, parameters, numerical values
   E → Save your entries
6. Exit the function matrix:
   – Press and hold down Esc key (Esc) for longer than 3 seconds → HOME position
   – Repeatedly press Esc key (Esc) → Return step-by-step to HOME position

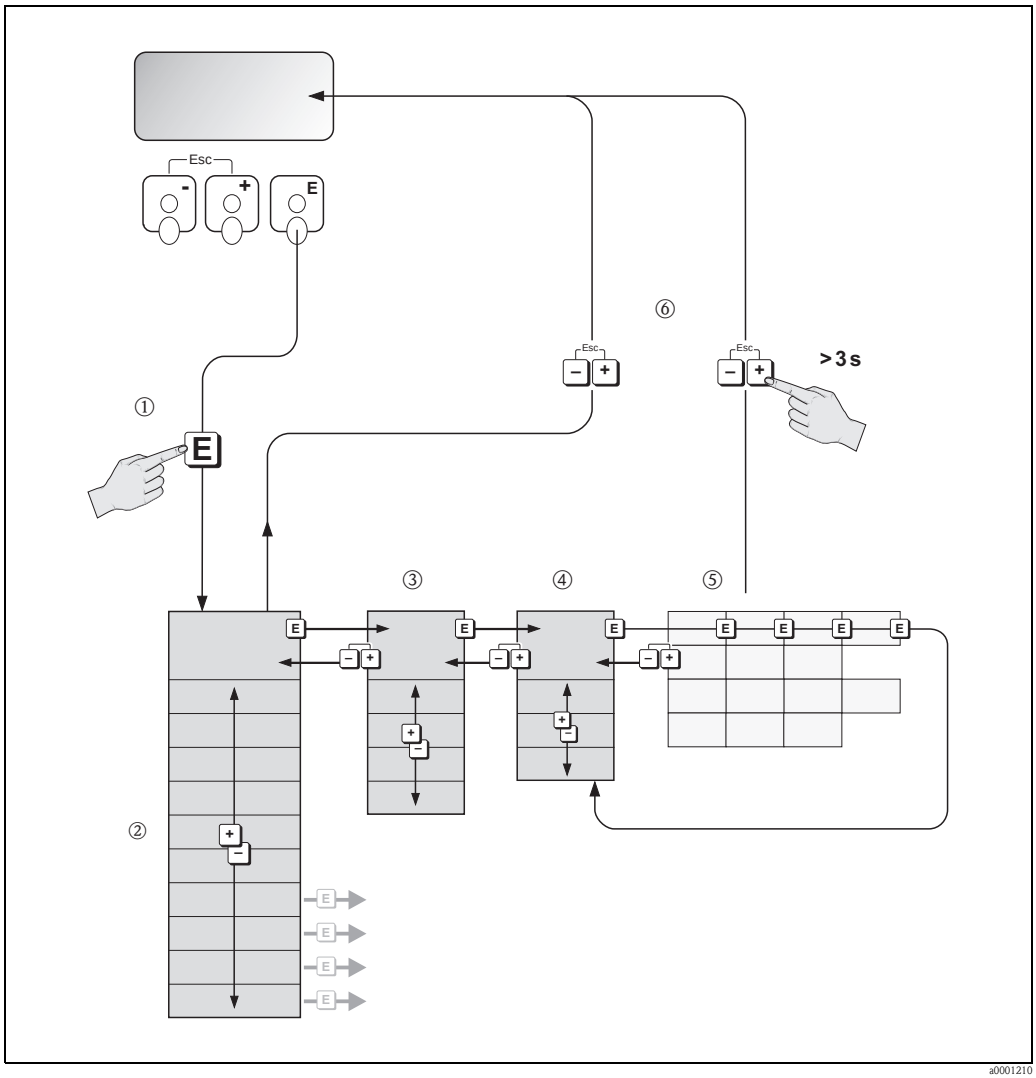


Fig. 28: Selecting functions and configuring parameters (function matrix)

5.3.1 General notes

The Quick Setup menu contains the default settings that are adequate for commissioning. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:
- You select functions as described → 📄 46.
  Each cell in the function matrix is identified by a numerical or letter code on the display.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press ⊞ to select "SURE [YES]" and press Ⓔ to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.
- Programming mode is disabled automatically if you do not press a key within 60 seconds following automatic return to the HOME position.

Caution!
All functions are described in detail, as is the function matrix itself, in the "Description of Device Functions" manual which is a separate part of these Operating Instructions.

Note!
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs or the fieldbus communication in the normal way.
- If the supply voltage fails all preset and parameterized values remain safely stored in the EEPROM.

5.3.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 93) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the ⊞ operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is entered as the private code, programming is always enabled.
- The Endress+Hauser service organization can be of assistance if you mislay your personal code.

Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy.
There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.

5.3.3 Disabling the programming mode

Programming mode is disabled if you do not press an operating element within 60 seconds following automatic return to the HOME position.
You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

5.4 Error messages

5.4.1 Type of error

Errors that occur during commissioning or measuring are displayed immediately. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:
- *System error:* this group includes all device errors, for example communication errors, hardware errors, etc. → 📄 102.
- *Process error:* This group includes all application errors, e.g. fluid not homogeneous, etc. → 📄 108.

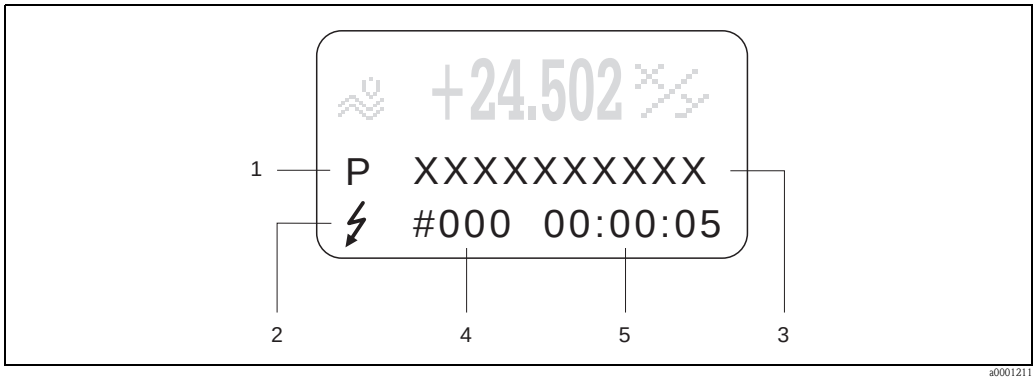


Fig. 29: Error messages on the display (example)

1 Error type: P = process error, S = system error
2 Error message type: ϟ = fault message, ! = notice message
3 Error designation
4 Error number
5 Duration of most recent error occurrence (hours:minutes:seconds)

5.4.2 Error message types

The measuring device always assigns system and process errors which occur to two types of error messages (**fault** or **notice messages**), resulting in different weightings. → 📄 100 ff.
Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)
- The error in question has no effect on the current measuring operation.
- Displayed as → Exclamation mark (!), type of error (S: system error, P: process error).
- Displaying the device status on PROFIBUS DP/PA → 📄 102.

Fault message (ϟ)
- The error in question interrupts or stops the current measuring operation.
- Displayed as → Lightning flash (ϟ), type of error (S: system error, P: process error).
- Displaying the device status on PROFIBUS DP/PA → 📄 102.

Note!
- Error conditions can be output via fieldbus communication.
- If an error message occurs, an upper or lower signal level for the breakdown information according to NAMUR NE 43 can be output via the current output.

5.5 Operating options

5.5.1 Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.

5.5.2 Operating program "SIMATIC PDM"

SIMATIC PDM is a standardized, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

5.5.3 Device description files for operating programs

The following table illustrates the suitable device description file for the operating program in question and then indicates where these can be obtained.

PROFIBUS DP

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
Device data PROFIBUS DP:		
Profile Version:	3.0	→ PROFILE VERSION function (6160)
Prosonic Flow 93 ID No.:	1531 (Hex)	→ DEVICE ID function (6162)
Profile ID No.:	9741 (Hex)	
GSD file information:	Extended Format	eh3x1531.gsd
Prosonic Flow 93 GSD file:	(recommended):	eh3_1531.gsd
	Standard Format:	
	Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file → 69 ff.	
Bitmaps:	EH_1531_d.bmp/.dib EH_1531_n.bmp/.dib EH_1531_s.bmp/.dib	
Profile GSD file:	PA039741.gsd	
Software release:	06.2010	

Operating program/device description:	Sources for obtaining device descriptions/program updates:
Prosonic Flow 93 GSD file	■ www.endress.com → Download ■ www.profibus.com ■ CD–ROM (Endress+Hauser order number: 56003894)
FieldCare/DTM	■ www.endress.com → Download ■ CD–ROM (Endress+Hauser order number: 56004088) ■ DVD (Endress+Hauser order number: 70100690)
SIMATIC PDM	■ www.endress.com → Download

Tester/simulator:	How to acquire:
Fieldcheck	■ Update via FieldCare with Flow Communication FXA193/291 DTM in Fieldflash module

Note!
The Fieldcheck tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.

PROFIBUS PA

Valid for device software:	3.06.XX	→ DEVICE SOFTWARE function (8100)
Device data PROFIBUS PA:		
Profile Version:	3.0	→ PROFILE VERSION function (6160)
Prosonic Flow 93 ID No.:	1530 (Hex)	→ DEVICE ID function (6162)
Profile ID No.:	9741 (Hex)	
GSD file information:	Extended Format	eh3x1530.gsd
Prosonic Flow 93 GSD file:	(recommended):	eh3_1530.gsd
	Standard Format:	
	Note! Before configuring the PROFIBUS network, read and follow the information for using the GSD file → 69 ff.	
Bitmaps:	EH_1530_d.bmp/.dib EH_1530_n.bmp/.dib EH_1530_s.bmp/.dib	
Profile GSD file:	PA039741.gsd	
Software release:	06.2010	

Operating program/device description:	Sources for obtaining device descriptions/program updates:
Prosonic Flow 93 GSD file	■ www.endress.com → Download ■ www.profibus.com ■ CD–ROM (Endress+Hauser order number: 56003894)
FieldCare/DTM	■ www.endress.com → Download ■ CD–ROM (Endress+Hauser order number: 56004088) ■ DVD (Endress+Hauser order number: 70100690)
SIMATIC PDM	■ www.endress.com → Download

Tester/simulator:	How to acquire:
Fieldcheck	■ Update via FieldCare with Flow Communication FXA193/291 DTM in Fieldflash module

Note!
The Fieldcheck tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.

5.6 PROFIBUS DP hardware settings

5.6.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When hardware write protection is switched on, it is **not** possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board.
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

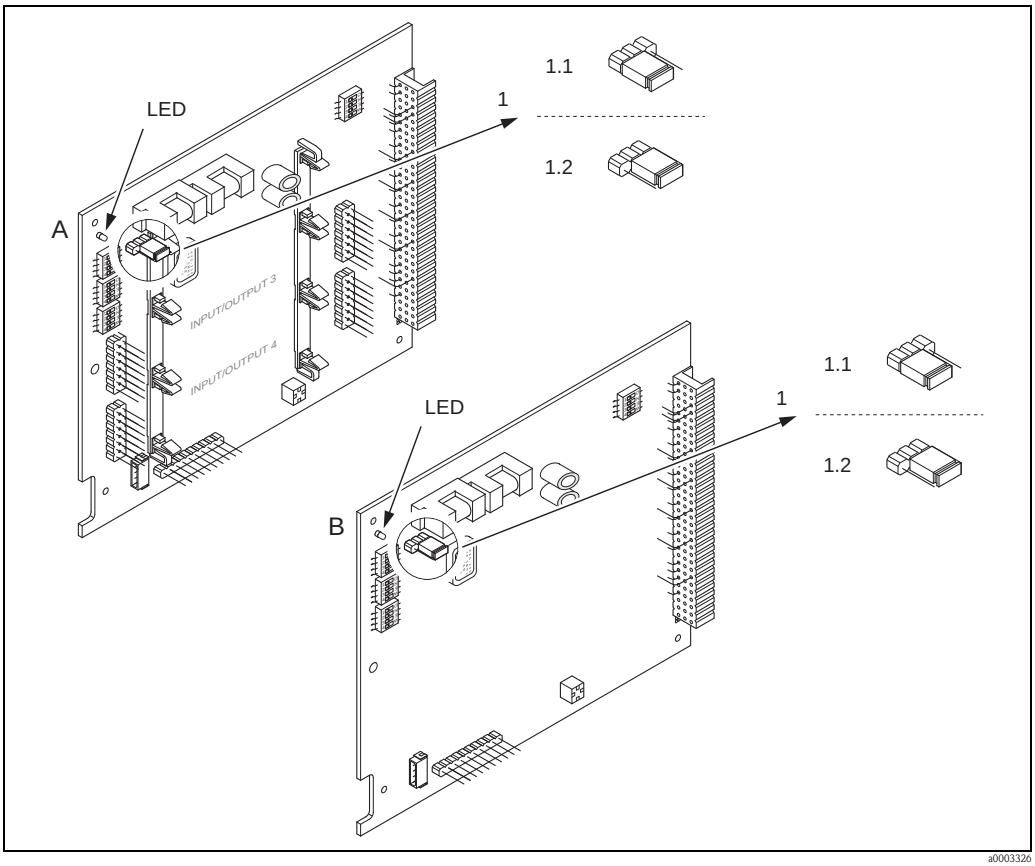


Fig. 30: Switching write protection on and off with the aid of a jumper on the I/O board

A Flexible assignment board
B Permanent assignment board

1 Jumper for switching write protection on and off
*1.1 Write protection switched on = it is **not** possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare")*
1.2 Write protection switched off (factory setting) = it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare")

LED Overview of LED states:
- *Lit continuously → Ready for operation*
- *Not lit → Not ready for operation*
- *Flashing → System or process error present → 100 ff.*

5.6.2 Configuring the device address

The address must always be configured for a PROFIBUS DP/PA device. Valid device addresses are in the range 1 to 126. Any address can only be allocated once in a PROFIBUS DP/PA network. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation/operating program

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches

⚠ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Loosen the Allen screw (3 mm) of the securing clamp.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (if present) by loosening the set screws of the display module.
4. Set the position of the miniature switches on the I/O board using a sharp pointed object.
5. Installation is the reverse of the removal procedure.

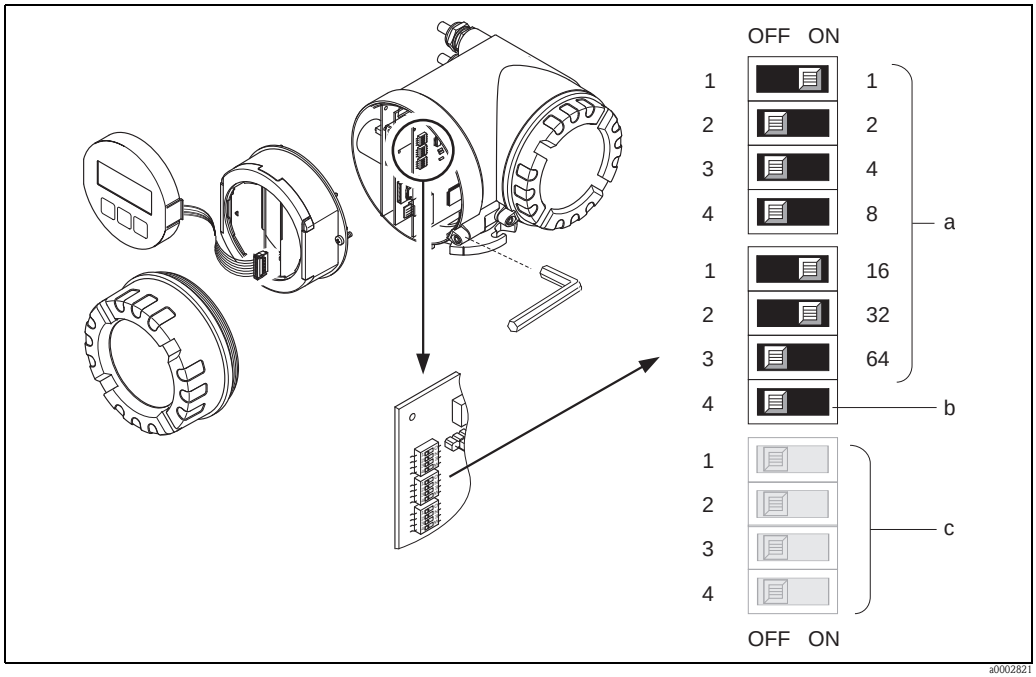


Fig. 31: Addressing with the aid of miniature switches on the I/O board

a Miniature switches for setting the device address (illustrated: 1 + 16 + 32 = device address 49)
b Miniature switches for the address mode (method of addressing):
OFF = software addressing via local operation/operating program (factory setting)
ON = hardware addressing via miniature switches
c Miniature switches not assigned

5.6.3 Configuring the terminating resistors

Note!
It is important to terminate the RS485 line correctly at the start and end of the bus segment since impedance mismatch results in reflections on the line which can cause faulty communication transmission.

Warning!
Risk of electric shock. Exposed components carry dangerous voltages.
Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

- For baudrates up to 1.5 MBaud, the termination is set via the terminating switch SW 1 for the last transmitter on the bus: ON – ON – ON – ON.
- Device is operated with a baud rate >1.5 MBaud: due to the capacitive load of the user and the resulting line reflection, make sure that an external bus terminator is used.
  In addition, the signal lines have to be shielded and grounded for flexible assignment boards → 📄 35.

The miniature switch for termination is located on the I/O board (see Figure):

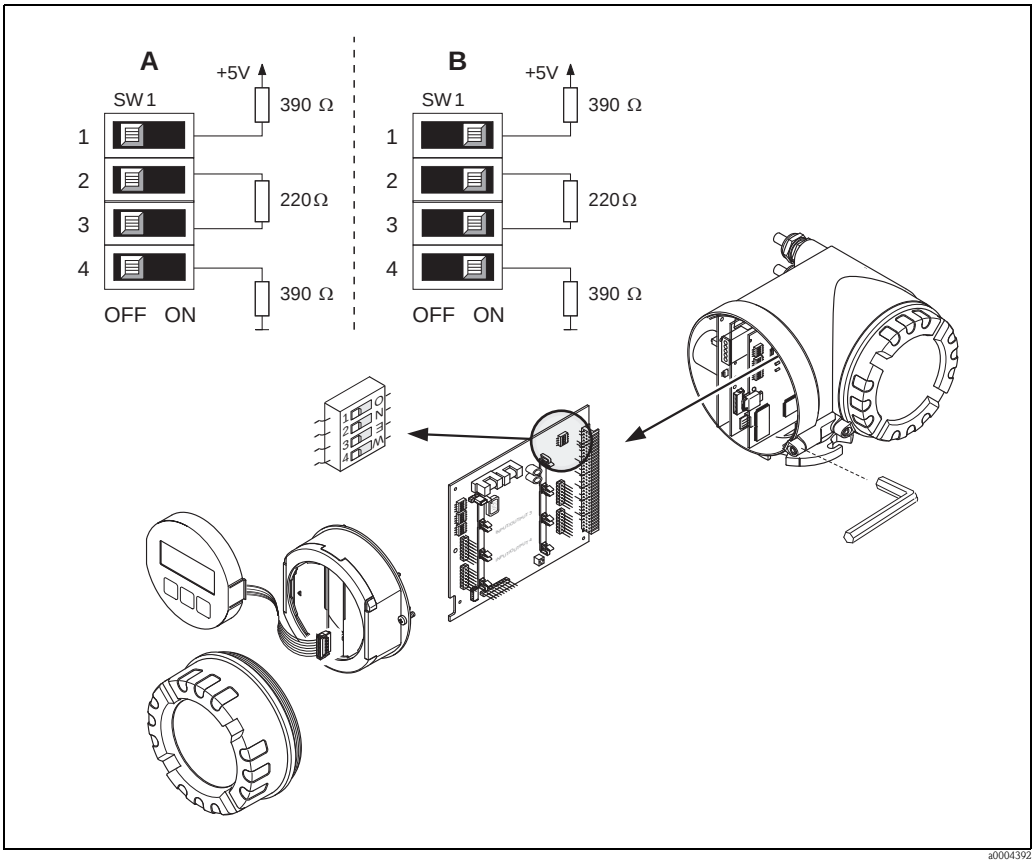


Fig. 32: Configuring the terminating resistors (for baud rates < 1.5 MBaud)

A = Factory setting
B = Setting at the last transmitter

Note!
It is generally recommended to use an external bus terminator since if a device that is terminated internally is defect, this can result in the failure of the entire segment.

5.6.4 Current output configuration

The current output is configured as "active" or "passive" via various jumpers on the current submodule.

Warning!
Risk of electric shock. Exposed components carry dangerous voltages.
Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board.
3. Set the position of the jumpers (see graphic).

Caution!
Risk of damaging the measuring devices! Set the jumpers exactly as shown in the graphic.
Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external device connected to it!

4. Installation of the I/O board is the reverse of the removal procedure.

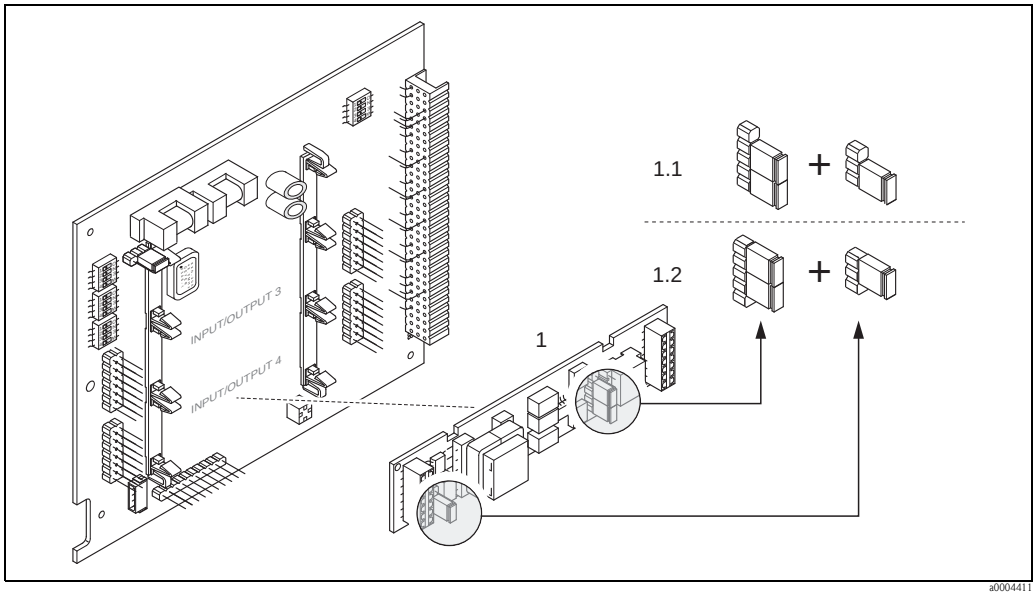


Fig. 33: Configuring the current output using the jumpers (I/O board)

1 Current output
1.1 Active current output (factory setting)
1.2 Passive current output

5.6.5 Relay output configuration

The relay contact can be configured as an NO or NC contact using two jumpers on the plug-in submodule. This configuration can be called up at any time in the ACT. STATUS RELAY (4740) function.

Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board.
3. Set the position of the jumpers (see graphic).

Caution!
If you change the setting, you must always change the position of **both** jumpers!
Note precisely the specified positions of the jumpers.

4. Installation of the I/O board is the reverse of the removal procedure.

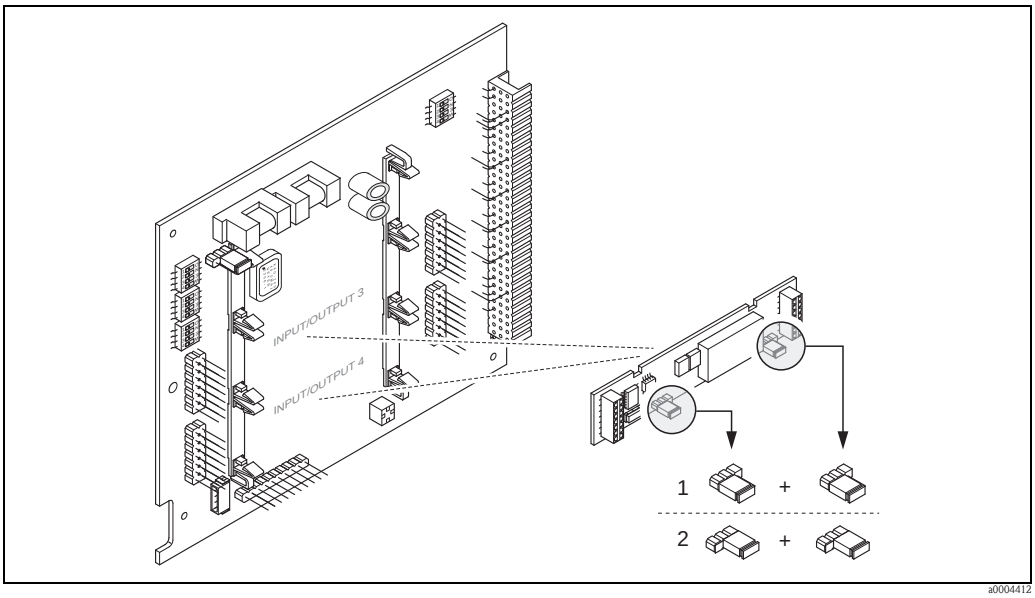


Fig. 34: Configuring the relay contacts (NC contact/NO contact) using the jumpers on the flexible assignment I/O board (submodule).

1 Configured as NO contact (factory setting for relay 1)
2 Configured as NC contact (factory setting for relay 2)

5.7 PROFIBUS PA hardware settings

5.7.1 Configuring the write protection

A jumper on the I/O board provides the means of switching hardware write protection on or off. When hardware write protection is switched on, it is **not** possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

⚠ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board.
3. Configure the hardware write protection accordingly with the aid of the jumpers (see Figure).
4. Installation is the reverse of the removal procedure.

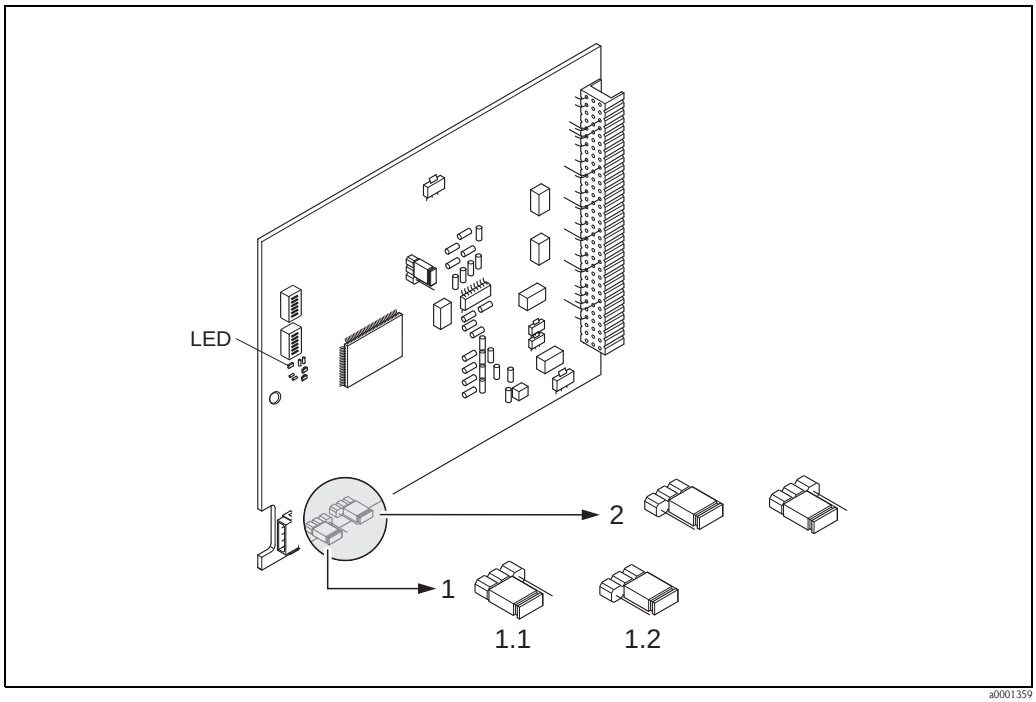


Fig. 35: Switching write protection on and off with the aid of a jumper on the I/O board

1 Jumper for switching write protection on and off
*1.1 Write protection switched on = it is **not** possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)*
1.2 Write protection switched off (factory setting) = it is possible to write to the device parameters via PROFIBUS (acyclic data transmission, e.g. via FieldCare)

2 Jumper without function

LED Overview of LED states:
- *Lit continuously → Ready for operation*
- *Not lit → Not ready for operation*
- *Flashing → System or process error present → 📄 100*

5.7.2 Configuring the device address

The address must always be configured for a PROFIBUS PA device. Valid device addresses are in the range 1 to 126. Any address can only be allocated once in a PROFIBUS network. If an address is not configured correctly, the device is not recognized by the master. All measuring devices are delivered from the factory with the address 126 and with software addressing.

Addressing via local operation/operating program

Addressing takes place in the FIELDBUS ADDRESS function (6101) → see the "Description of Device Functions" manual.

Addressing via miniature switches

⚠ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Loosen the screws and open the housing cover (a).
2. Loosen the screws securing the electronics module (b). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Remove the ribbon cable connector (c) of the display module.
4. Remove the cover (d) from the electronics compartment by loosening the screws.
5. Remove the I/O board (e):
   Insert a thin pin into the hole provided for the purpose and pull the board clear of its holder.
6. Set the position of the miniature switches on the I/O board using a sharp pointed object.
7. Installation is the reverse of the removal procedure.

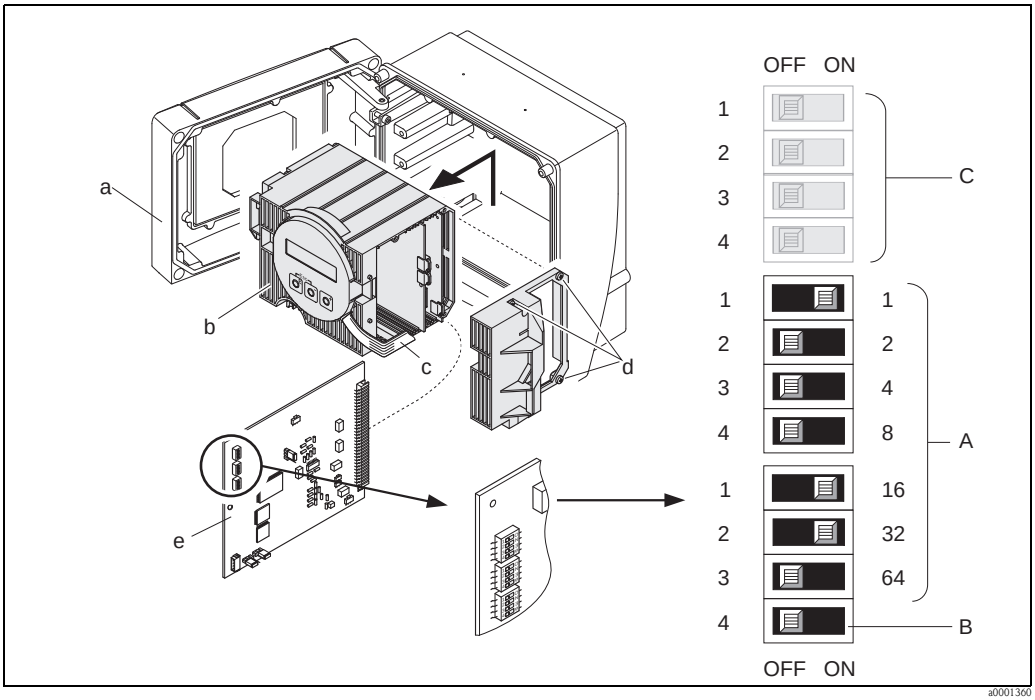


Fig. 36: Addressing with the aid of miniature switches on the I/O board

a Miniature switches for setting the device address (illustrated: 1 + 16 + 32 = device address 49)
b Miniature switches for the address mode (method of addressing)
– OFF = software addressing via local operation/operating program (factory setting)
– ON = hardware addressing via miniature switches
c Miniature switches not assigned

6 Commissioning

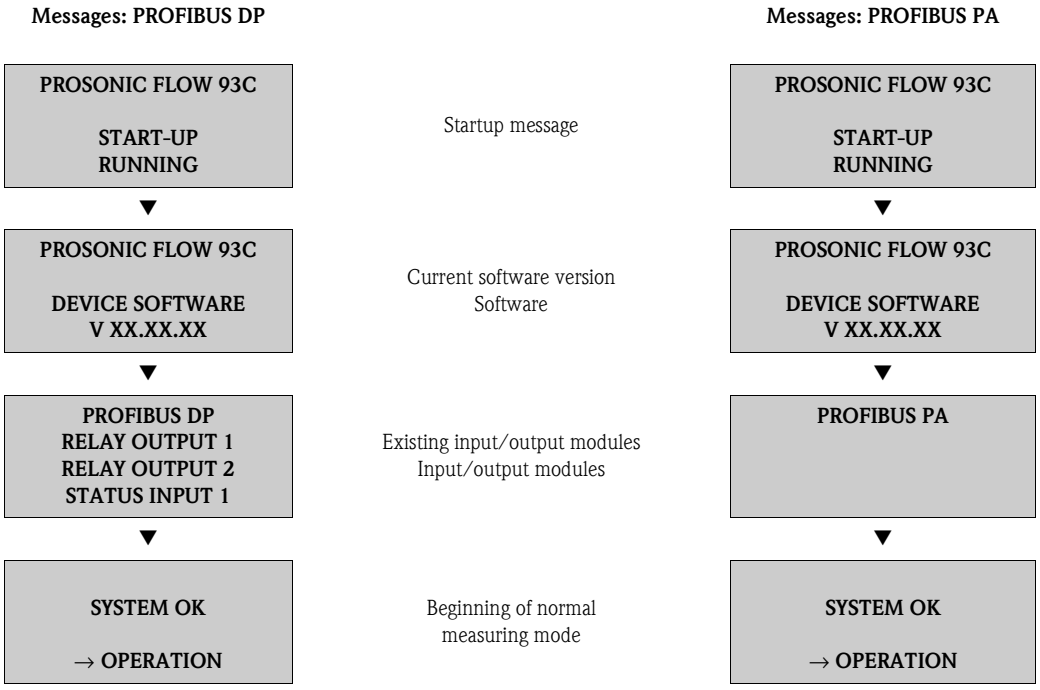
6.1 Function check

Make sure that the following function checks have been performed successfully before switching on the supply voltage for the measuring device:
- Checklist for "Post-installation check" → 📄 24
- Checklist for "Post-connection check" → 📄 41

Note!
When using PROFIBUS PA, please note the following:
- The PROFIBUS interface's technical data must be maintained in accordance with IEC 61158-2 (MBP).
- A normal multimeter can be used to check the bus voltage of 9 to 32 V and the current consumption of 11 mA at the device.

6.2 Switching on the measuring device

Once the function check has been performed successfully, the device is operational and can be switched on via the supply voltage. The device then performs internal test functions and the following messages are shown on the local display:



Normal measuring mode commences as soon as startup completes.
Various measured value and/or status variables appear on the display (HOME position).

Note!
If startup fails, an appropriate error message is displayed, depending on the cause.

6.3 Quick Setup

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the operating program, e.g. FieldCare.
If the measuring device is equipped with a local display, all the important device parameters for standard operation, as well as additional functions, can be configured quickly and easily by means of the following Quick Setup menus.

6.3.1 Quick Setup "Commissioning"

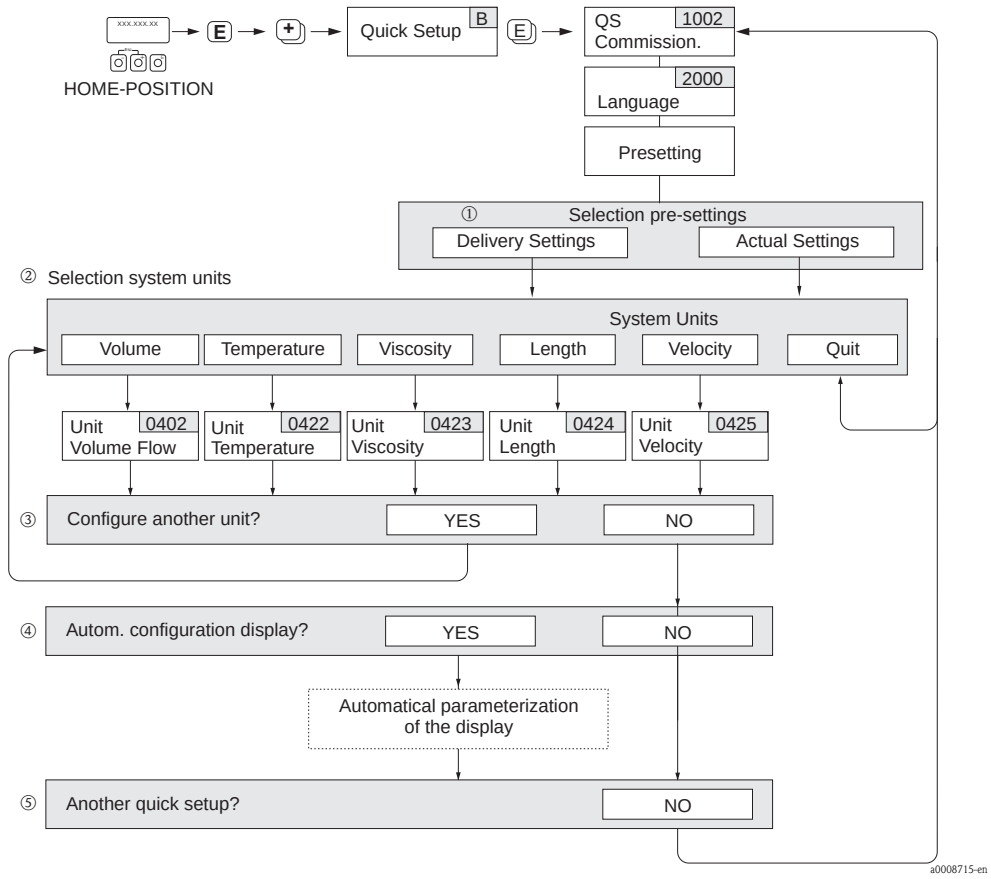


Fig. 37: Quick Setup "Commissioning"

Note!
- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ⊟+E key combination during parameter interrogation. The stored parameters remain valid.
- The "Commissioning" Quick Setup must be carried out before one of the Quick Setups explained below is run.

① The "DELIVERY SETTINGS" option sets every selected unit to the factory setting.
The "ACTUAL SETTINGS" accepts the units you configured beforehand.

② Only units not yet configured in the current Quick Setup are offered for selection in each cycle. The volume unit is derived from the volume flow unit.

③ The "YES" option remains visible until all the units have been configured.
"NO" is the only option displayed when no further units are available.

④ The "automatic parameterization of the display" option contains the following basic settings/factory settings

YES Main line = mass flow
Additional line = totalizer 1
Information line = operating/system condition

NO The existing (selected) settings remain.

⑤ The execution of other Quick Setups is described in the following sections.

6.3.2 Quick Setup "Communication"

To establish cyclic data transfer, various arrangements between the PROFIBUS master (Class 1) and the measuring device (slave) are required which have to be taken into consideration when configuring various functions. These functions can be configured quickly and easily by means of the "Communication" Quick Setup. The following table explains the parameter configuration options in more detail.

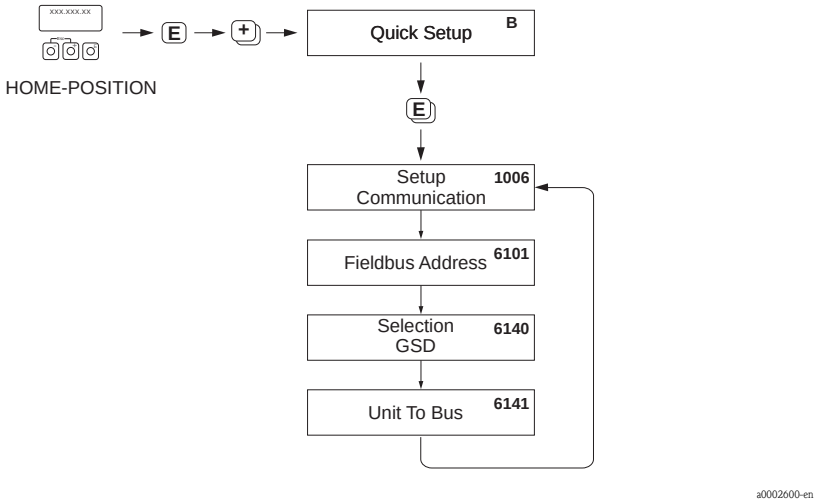


Fig. 38: Quick Setup communication

Quick Setup "Communication"		
HOME position → E → MEASURED VARIABLE (A) MEASURED VARIABLE → + → QUICK SETUP (B) QUICK SETUP → E → QUICK SETUP COMMUNICATION (1006)		
Function No.	Function name	Setting to be selected (+) (to next function with E)
1006	QUICK SETUP COMMUNICATION	YES → After E is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.
6101	FIELDBUS ADDRESS	Enter the device address (permitted address range: 1 to 126) **Factory setting:** 126
6140	SELECTION GSD	Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master. Options: MANUFACT. SPEC. → The measuring device is operated in the manufacturer-specific mode. PROFILE-GSD → The measuring device is operated in the PROFIBUS Profile mode. **Factory setting:** MANUFACT. SPEC. Note! For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 69 ff.

Quick Setup "Communication"		
6141	UNIT TO BUS	If this function is executed, the measured variables are transmitted cyclically to the PROFIBUS master (Class 1) with the system units set in the measuring device. **Options:** OFF SET UNITS (Transmission is started by pressing the E key) Caution! Activating this function can cause a sudden change of the measured variables transmitted to the PROFIBUS master (Class 1); this, in turn, can affect subsequent control routines.
		▼
Back to the HOME position: → Press and hold down the Esc keys for longer than three seconds or →Repeatedly press and release the Esc keys → Exit the function matrix step by step		

6.3.3 Data backup/transmission

Using the T-DAT SAVE/LOAD function, you can transfer data (device parameters and settings) between the T-DAT (exchangeable memory) and the EEPROM (device storage unit).

This is required in the following instances:
- Creating a backup: current data are transferred from an EEPROM to the T-DAT.
- Replacing a transmitter: current data are copied from an EEPROM to the T-DAT and then transferred to the EEPROM of the new transmitter.
- Duplicating data: current data are copied from an EEPROM to the T-DAT and then transferred to EEPROMs of identical measuring points.

Note!
For information on installing and removing the T-DAT → 110 ff.

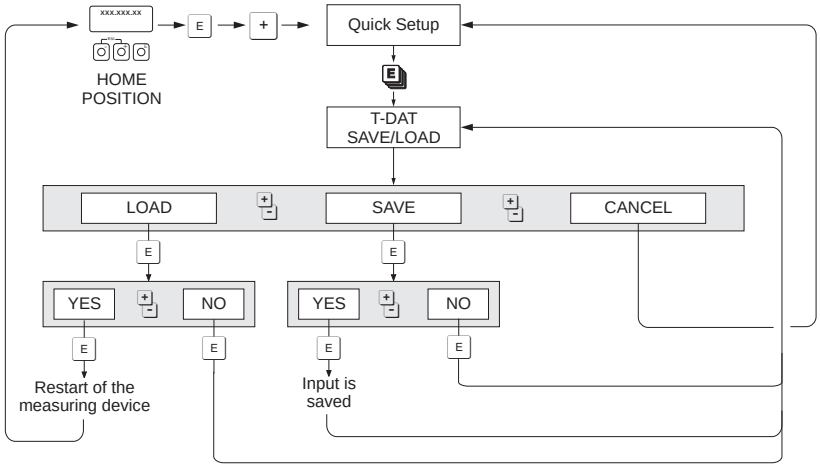


Fig. 39: Data backup/transmission with T-DAT SAVE/LOAD function

Information on the LOAD and SAVE options available:

LOAD: Data are transferred from the T-DAT to the EEPROM.

Note!
- Any settings already saved on the EEPROM are deleted.
- This option is only available if the T-DAT contains valid data.
- This option can only be executed if the software version of the T-DAT is the same or newer than that of the EEPROM. Otherwise, the error message "TRANSM. SW-DAT" appears after restarting and the LOAD function is then no longer available.

SAVE:
Data are transferred from the EEPROM to the T-DAT

6.4 Commissioning the PROFIBUS interface

Note!
- All functions required for commissioning are described in detail in the "Description of Device Functions" manual which is a separate part of these Operating Instructions.
- A code (factory setting: 93) must be entered to change device functions, numerical values or factory settings → 47.

6.4.1 PROFIBUS DP commissioning

The following steps must be carried out in the sequence specified:

1. **Check the hardware write protection:**
   The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

   Note!
   This check is not needed if operating via the local display.

   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION (610) → WRITE PROTECT (6102) → Display of one of the following options:
   – OFF (factory setting) = write access via PROFIBUS possible
   – ON = write access via PROFIBUS not possible

   Deactivate the write protection if necessary → 56.

2. **Enter the tag name (optional):**
   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → CONFIGURATION(610) → TAG NAME (6100)

3. **Configure the bus address:**
   Software addressing using the local display or an operating program:
   BASIC FUNCTION (G) → PROFIBUS DP (GBA)→ CONFIGURATION (610) → FIELDBUS ADDRESS (6101)

   Hardware addressing via miniature switches → 57.

4. **Select the system unit:**
   a. Determine the units by means of the system units group:
      MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) → UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT VOLUME FLOW (0402) / …
   b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:
      BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → UNIT TO BUS (6141)

   Note!
   - The configuration of the system units for the totalizer is described separately → see step 7
   - If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) → UNIT TO BUS (6141).

5. **Configuration of the Analog Input function blocks 1 to 8:**
The measuring device has eight Analog Input function blocks (AI modules) via which the various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The assignment of a measured variable to the Analog Input function block is shown below using the example of Analog Input function block 1 (AI module, slot 1).

Using the CHANNEL function (6123), you can determine the measured variable (e.g. AVERAGE VOLUME FLOW) to be cyclically transmitted to the PROFIBUS master (Class 1):

a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTIONBLOCKS (612) → BLOCK SELECTION (6120).

b. Select the option ANALOG INPUT 1.

c. Select the function CHANNEL (6123).

d. Select the option AVERAGE VOLUME FLOW.

Possible settings

Measured variable	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting AI function block 1)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 2)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 3)	571
AVERAGE VOLUME FLOW (factory setting AI function block 4)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 5)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 6)	571
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
✎ Note! If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1) → 🖹 75 ff.	

6. **Setting the measuring mode:**
In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601) → Selection of one of the following options:
– UNIDIRECTIONAL (factory setting) = only the positive flow portions
– BIDIRECTIONAL = the positive and negative flow components

7. **Configuration of totalizers 1 to 3:**
The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. mass flow) to be transmitted to the PROFIBUS master (Class 1) as a totalizer value:
  a. Select BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
  b. Select the option TOTALIZER 1.
  c. Go to the function CHANNEL (6133).
  d. Select the option AVERAGE VOLUME FLOW.

Possible settings → see following table.

- Enter the desired unit for the totalizer:
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
  BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
  TOTALIZER MODE (6137) → Selection of one of the following options:
  – BALANCE (factory setting): calculates the positive and negative flow portions
  – POSITIVE: calculates the positive flow portions
  – NEGATIVE: calculates the negative flow portions
  – HOLD VALUE: The totalizer remains at the last value

  ✎ Note!
  For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601).

Possible settings

Totalizer value/measured variable (channel 1 = active)	**ID for CHANNEL function**
AVERAGE VOLUME FLOW (factory setting totalizer 1 to 3)	567
AVERAGE SOUND VELOCITY	570
AVERAGE FLOW VELOCITY	571
OFF	0
✎ Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

8. **Select the operating mode:**
   Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (Class 1).

   BASIC FUNCTION (G) → PROFIBUS DP (GBA) → OPERATION (614) →
   SELECTION GSD (6140) → Options:
   – MANUFACT. SPEC. (factory setting): the complete device functionality is available.
   – PROFILE GSD: Prosonic Flow 93C is operated in the PROFIBUS Profile mode.

   ✎ Note!
   For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 🖹 69 ff.

9. **Configuration of cyclic data transmission in the PROFIBUS master**
   A detailed description of the system integration can be found on → 🖹 69.

6.4.2 PROFIBUS PA commissioning

The following steps must be carried out in the sequence specified:

1. **Check the hardware write protection:**
   The WRITE PROTECT (6102) parameter indicates whether it is possible to write to the device functions via PROFIBUS (acyclic data transmission, e.g. via the operating program "FieldCare").

   ✎ Note!
   This check is not needed if operating via the local display.

   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
   WRITE PROTECT (6102) → Display of one of the following options:
   – OFF (factory setting) = write access via PROFIBUS possible
   – ON = write access via PROFIBUS not possible

   Deactivate the write protection if necessary → 🖹 56.

2. **Enter the tag name (optional):**
   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION(610) →
   TAG NAME (6100)

3. **Configure the bus address:**
   Software addressing using the local display or an operating program:
   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → CONFIGURATION (610) →
   FIELDBUS ADDRESS (6101)

   Hardware addressing via miniature switches → 🖹 57.

4. **Select the system unit:**
   a. Determine the units by means of the system units group:
      MEASURED VARIABLES (A) → SYSTEM UNITS (ACA) → CONFIGURATION (040) →
      UNIT MASS FLOW (0400) / UNIT MASS (0401) / UNIT VOLUME FLOW (0402) / …
   b. In the function UNIT TO BUS (6141), select the option SET UNITS, so that the measured variables transmitted cyclically to the PROFIBUS master (Class 1) are transmitted with the system units set in the measuring device:
      BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) →
      UNIT TO BUS (6141)

   ✎ Note!
   - The configuration of the system units for the totalizer is described separately → see step 7
   - If the system unit of a measured variable is changed by means of the local operation or an operating program, this initially does not have any effect on the unit that is used to transmit the measured variable to the PROFIBUS master (Class 1). Changed system units of the measured variables are not transmitted to the PROFIBUS master (Class 1) until the SET UNITS option is activated in the function BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) → UNIT TO BUS (6141).

5. **Configuration of the Analog Input function blocks 1 to 8:**
The measuring device has eight Analog Input function blocks (AI modules) via which the various measured variables can be cyclically transmitted to the PROFIBUS master (Class 1). The assignment of a measured variable to the Analog Input function block is shown below using the example of Analog Input function block 1 (AI module, slot 1).

Using the CHANNEL function (6123), you can determine the measured variable (e.g. AVERAGE VOLUME FLOW) to be cyclically transmitted to the PROFIBUS master (Class 1):

a. Select BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTIONBLOCKS (612) → BLOCK SELECTION (6120).

b. Select the option ANALOG INPUT 1.

c. Select the function CHANNEL (6123).

d. Select the option AVERAGE VOLUME FLOW.

Possible settings

Measured variable	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting AI function block 1)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 2)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 3)	571
AVERAGE VOLUME FLOW (factory setting AI function block 4)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 5)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 6)	571
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
✎ Note! If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1) → 🖹 75 ff.	

6. **Setting the measuring mode:**
In the function MEASURING MODE (6601), select the flow portions to be measured by the measuring device.

BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601) → Selection of one of the following options:
– UNIDIRECTIONAL (factory setting) = only the positive flow portions
– BIDIRECTIONAL = the positive and negative flow components

7. **Configuration of totalizers 1 to 3:**
The measuring device has three totalizers. The following example describes the configuration of the totalizer using totalizer 1 as an example.

- Using the CHANNEL function (6133), you can determine the measured variable (e.g. mass flow) to be transmitted to the PROFIBUS master (Class 1) as a totalizer value:
  a. Select BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) → SELECT TOTALIZER (6130).
  b. Select the option TOTALIZER 1.
  c. Go to the function CHANNEL (6133).
  d. Select the option AVERAGE VOLUME FLOW.

Possible settings → see following table.

- Enter the desired unit for the totalizer:
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
  UNIT TOTALIZER (6134)
- Configure totalizer status (e.g. totalize):
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
  SET TOTALIZER (6135) → Select the option TOTALIZE
- Set the totalizer mode:
  BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
  TOTALIZER MODE (6137) → Selection of one of the following options:
  – BALANCE (factory setting): calculates the positive and negative flow portions
  – POSITIVE: calculates the positive flow portions
  – NEGATIVE: calculates the negative flow portions
  – HOLD VALUE: The totalizer remains at the last value

  ✎ Note!
  For the calculation of the positive and negative flow portions (BALANCE) or the negative flow portions (NEGATIVE) to be carried out correctly, the selection BIDIRECTIONAL must be active in the function BASIC FUNCTION (G) → SYSTEM PARAMETER (GLA) → CONFIGURATION (660) → MEASURING MODE (6601).

Possible settings

Totalizer value/measured variable (channel 1 = active)	**ID for CHANNEL function**
AVERAGE VOLUME FLOW (factory setting totalizer 1 to 3)	567
AVERAGE SOUND VELOCITY	570
AVERAGE FLOW VELOCITY	571
OFF	0
✎ Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

8. **Select the operating mode:**
   Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS master (Class 1).

   BASIC FUNCTION (G) → PROFIBUS PA (GCA) → OPERATION (614) →
   SELECTION GSD (6140) → Options:
   – MANUFACT. SPEC. (factory setting): the complete device functionality is available.
   – PROFILE GSD: Prosonic Flow 93C is operated in the PROFIBUS Profile mode.

   ✎ Note!
   For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode → 🖹 69 ff.

9. **Configuration of cyclic data transmission in the PROFIBUS master**
   A detailed description of the system integration can be found on → 🖹 69.

6.5 PROFIBUS DP/PA system integration

6.5.1 Device master file (GSD file)

For PROFIBUS network configuration, the device master file (GSD file) is needed for every bus user (PROFIBUS slave). The GSD file contains a description of the properties of a PROFIBUS device, such as supported data transmission rate and number of input and output data.
Before configuration takes place, a decision should be made as to which GSD file should be used to operate the measuring device in the PROFIBUS DP/PA master system.

The measuring device supports the following GSD files:
- Prosonic Flow 93C GSD file
  (manufacturer-specific GSD file, complete device functionality)
- PROFIBUS Profile GSD file:

Below you will find a detailed description of the GSD files supported.

Prosonic Flow 93C GSD file (manufacturer-specific GSD file, complete device functionality)

Use this GSD file to access the complete functionality of the measuring device. In this way, device-specific measured variables and functionalities are thus completely available in the PROFIBUS master system. An overview of the modules available (input and output data) is contained on the following pages:
PROFIBUS DP → 📄 72
PROFIBUS PA → 📄 83

GSD file with standard or extended format

The GSD file with either the standard or the extended format must be used depending on the configuration software used. When installing the GSD file, the GSD file with the extended format (EH3**x**15xx.gsd) should always be used first.
However, if the installation or the configuration of the measuring device fails with this format, then use the standard GSD (EH3_15xx.gsd). This differentiation is the result of different implementation of the GSD formats in the master systems. Note the specifications of the configuration software.

Name of the Prosonic Flow 93C GSD file

	ID No.	GSD file		Type file	Bitmaps
PROFIBUS DP	1531 (Hex)	Extended Format (recommended): Standard Format:	EH3x1531.gsd EH3_1531.gsd	EH_1531.200	EH_1531_d.bmp/.dib EH_1531_n.bmp/.dib EH_1531_s.bmp/.dib
PROFIBUS PA	1530 (Hex)	Extended Format (recommended): Standard Format:	EH3x1530.gsd EH3_1530.gsd	EH_1530.200	EH_1530_d.bmp/.dib EH_1530_n.bmp/.dib EH_1530_s.bmp/.dib

How to acquire

- Internet (Endress+Hauser) → www.endress.com → Download
- CD-ROM with all GSD files for Endress+Hauser devices → Order No.: 56003894

Contents of the download file from the Internet and the CD-ROM:

- All Endress+Hauser GSD files (standard and extended format)
- Endress+Hauser type files
- Endress+Hauser bitmap files
- Information on the devices

PROFIBUS Profile GSD file

The function scope of the profile GSD file is defined by the PROFIBUS Profile Specification 3.0. The function scope is restricted compared to the manufacturer-specific GSD file (complete device functionality). However, similar devices from different manufacturers can be interchanged with the profile GSD file without the need to reconfigure (interchangeability).

Profile GSD (multivariable) with ID number 9760 (hex): This GSD contains all the function blocks such as AI, DO, DI etc. Prosonic Flow does not support this GSD.

Note!
- Before configuration takes place, a decision should be made as to which GSD file should be used to operate the system.
- This setting can be changed via the local display or via a Class 2 master. For configuring via the local display, see Page 63.

Supported GSD files: → 📄 49

The Profibus User Organization (PNO) gives each device an identification number (ID No.). The name of the GSD file is derived from this number.
For Endress+Hauser, this ID No. starts with the manufacturer ID 15xx.
To clarify the assignment of the GSD files, the GSD names (apart from the Type files) at Endress+Hauser are as follows:

EH3_15xx	EH = Endress + Hauser 3 = Profile 3.0 _ = Standard ID 15xx = ID No.
EH3x15xx	EH = Endress + Hauser 3 = Profile 3.0 x = Extended ID 15xx = ID No.

Name of the PROFIBUS Profile GSD file

	ID No.	Profile GSD file
PROFIBUS DP	9741 (Hex)	PA139741.gsd
PROFIBUS PA	9741 (Hex)	PA139741.gsd

Source

Internet (GSD library of the PROFIBUS User Organization) → www.PROFIBUS.com

6.5.2 Selecting the GSD file in the measuring device

Depending on which GSD file is used in the PROFIBUS master system, the corresponding GSD file has to be configured in the device by means of the SELECTION GSD function.

BASIC FUNCTION (G) → PROFIBUS DP/PA (GBA/GCA) → OPERATION (614) → SELECTION GSD (6140)

Prosonic Flow 93C GSD file	→	Select: MANUFACT. SPEC. (factory setting)
Profile GSD file	→	Select: PROFILE-GSD

Example

Before configuration takes place, a decision should be made as to which GSD file should be used to configure the measuring device in the PROFIBUS master system. Below, the use of the manufacturer-specific GSD file (complete device functionality) is shown using **PROFIBUS PA** as an example:

Select the manufacturer-specific GSD file in the measuring device by means of the SELECTION GSD function.

BASIC FUNCTION (G)→ PROFIBUS PA (GCA) → OPERATION (614) → SELECTION GSD (6140)→ Select: MANUFACT. SPEC. (factory setting)

1. Before configuring the network, load the corresponding GSD file into the configuration system/master system.

   ✎ Note!
   When installing the GSD file, always first use the GSD file with the extended format (EH3x1530.gsd). However, if the installation or the configuration of the device fails with this format, then use the standard GSD (EH3_1530.gsd).

   Example for the configuration software Siemens STEP 7 of the Siemens PLC family S7–300/400:
   Use the GSD file with the extended format (EH3x1530.gsd). Copy the file to the subdirectory "…\siemens\step7\s7data\gsd". The GSD files also include bitmap files. These bitmap files are used to display the measuring points in image form. The bitmap files must be saved to the directory "…\siemens\step7\s7data\nsbmp".

   If you are using configuration software other than that referred to above, ask your PROFIBUS master system manufacturer which directory you should use.

2. The measuring device is a modular PROFIBUS slave, i.e. the desired module configuration (input and output data) must be performed in the next step. This can be done directly by means of the configuration software. A detailed description of the modules supported by the measuring device is provided on the pages indicated:
   PROFIBUS DP → 📄 72 ff.
   PROFIBUS PA → 📄 83 ff.

6.5.3 Maximum number of writes

If a nonvolatile device parameter is modified via the cyclic or acyclic data transmission, this change is saved in the EEPROM of the measuring device.
The number of writes to the EEPROM is technically restricted to a maximum of 1 million. Attention must be paid to this limit since, if exceeded, it results in data loss and measuring device failure. For this reason, avoid constantly writing nonvolatile device parameters via the PROFIBUS!

6.6 Cyclic data transmission PROFIBUS DP

Below is a description of the cyclic data transmission when using the Prosonic Flow 93C GSD file (complete device functionality).

6.6.1 Block model

The block model illustrated shows which input and output data Prosonic Flow 93C provides for cyclic data exchange via PROFIBUS DP.

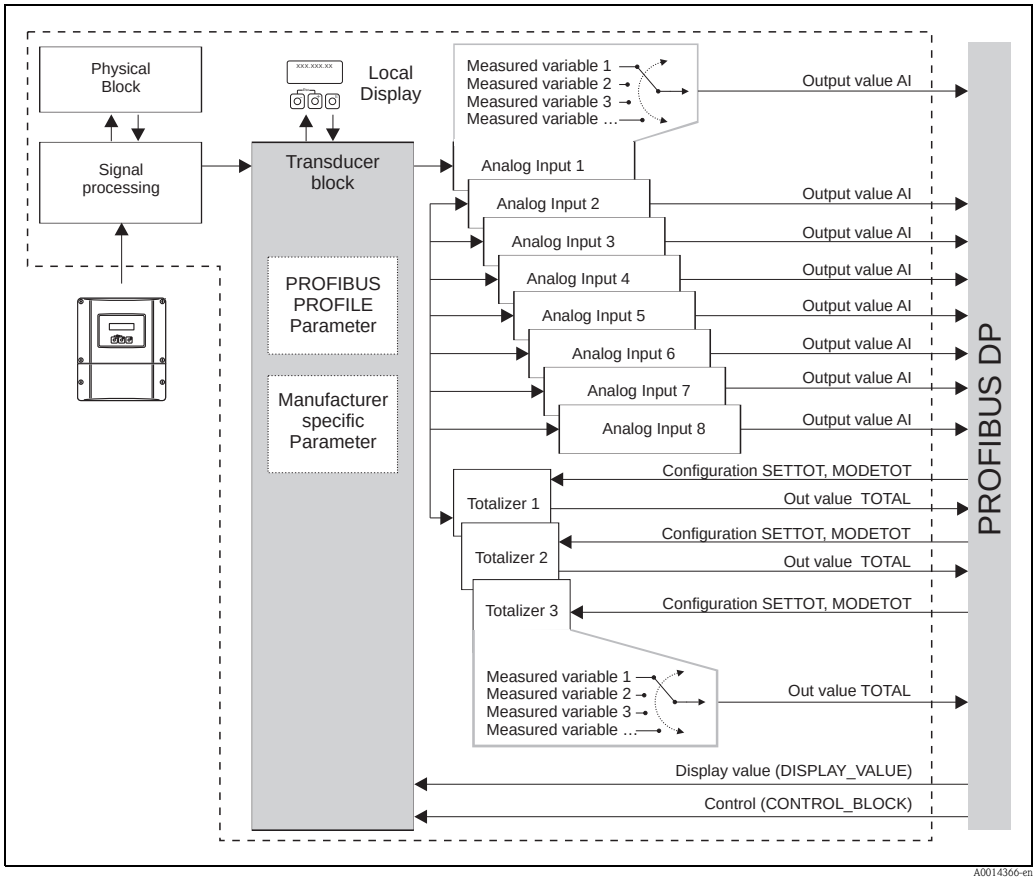


Fig. 40: Block model for Prosonic Flow 93C PROFIBUS DP Profile 3.0

6.6.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.
To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	**Analog Input function block 1** Output variable → average volume flow (factory setting)
2	AI	**Analog Input function block 2** Output variable → average sound velocity (factory setting)
3	AI	**Analog Input function block 3** Output variable → average flow velocity (factory setting)
4	AI	**Analog Input function block 4** Output variable → average volume flow (factory setting)
5	AI	**Analog Input function block 5** Output variable → average sound velocity (factory setting)
6	AI	**Analog Input function block 6** Output variable → average flow velocity (factory setting)
7	AI	**Analog Input function block 7** Output variable → average volume flow (factory setting)
8	AI	**Analog Input function block 8** Output variable → average sound velocity (factory setting)
9	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	**Totalizer function block 1** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
10		**Totalizer function block 2** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
11		**Totalizer function block 3** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	Default value for local display
13	CONTROL_BLOCK	Control of device functions

Note!

- The assignment of the measured variables for the Analog Input function blocks (1 to 8) and the Totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
  – By means of the local display
  – By means of an operating program (e.g. FieldCare)
  – By switching the supply voltage off and on again.

6.6.3 Description of the modules

AI module (Analog Input)

The corresponding measured variable, including the status, is cyclically transmitted to the PROFIBUS master (Class 1) by means of the AI module (slots 1 to 8). The measured variable is represented in the first four bytes in the form of floating point numbers in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable.
Further information on the device status → 📄 102.

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1).
The measured variables are assigned to the Analog Input function blocks 1 to 8 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) →
BLOCK SELECTION (6120): Selection of an Analog Input function block →
CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting AI function block 1)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 2)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 3)	571
AVERAGE VOLUME FLOW (factory setting AI function block 4)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 5)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 6)	571
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570
✎ Note! If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1) → 📄 75 ff.	

Factory setting:

Module	Analog Input function block	Measured variable	Unit	ID for CHANNEL function
AI (slot 1)	1	AVERAGE VOLUME FLOW	m³/h	567
AI (slot 2)	2	AVERAGE SOUND VELOCITY	m/s	570
AI (slot 3)	3	AVERAGE FLOW VELOCITY	m/s	571
AI (slot 4)	4	AVERAGE VOLUME FLOW	m³/h	567
AI (slot 5)	5	AVERAGE SOUND VELOCITY	m/s	570
AI (slot 6)	6	AVERAGE FLOW VELOCITY	m/s	571
AI (slot 7)	7	AVERAGE VOLUME FLOW	m³/h	567
AI (slot 8)	8	AVERAGE SOUND VELOCITY	m/s	570

Example:

You want to cyclically transmit the AVERAGE VOLUME FLOW to the PROFIBUS master (Class 1) by means of the Analog Input function block 1 (module AI, slot 1) and the AVERAGE SOUND VELOCITY by means of the Analog Input function block 2 (module AI, slot 2).

1. BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 1, then select CHANNEL (6123) = AVERAGE VOLUME FLOW
2. BASIC FUNCTION (G) → PROFIBUS DP (GBA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 2, then select CHANNEL (6123) = AVERAGE SOUND VELOCITY

TOTAL module

The measuring device has three Totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS master (Class 1) via the TOTAL module (slots 9 to 11). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.
Further information on the device status → 📄 102.

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
TOTALIZER selection (6130): Selection of a totalizer →
CHANNEL (6133): Selection of a measured variable

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting totalizer 1 to 3)	567
OFF	0
Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

Factory setting

Module	Totalizer function block	Totalizer value/measured variable	Unit	ID for CHANNEL function
TOTAL (slot 9)	1	AVERAGE VOLUME FLOW	m^3	567
TOTAL (slot 10)	2	AVERAGE VOLUME FLOW	m^3	567
TOTAL (slot 11)	3	AVERAGE VOLUME FLOW	m^3	567

Example:

You want to cyclically transmit the totalized volume flow as totalizer value 1 to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 7):

BASIC FUNCTION (G) → PROFIBUS DP (GBA) → TOTALIZER (613) →
select TOTALIZER (6130): Select TOTALIZER 1, then select CHANNEL (6133) = VOLUME FLOW

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 9 to 11) consists of the functions SETTOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.
The following control variables are supported:
- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset

Note!
After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function → 77.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 📄 75.

Data structure of the SETTOT_TOTAL module combination

Output data / Input data

SETTOT	TOTAL				
Byte 1	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control	Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 9 to 11) consists of the functions SETTOT, MODETOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT)
- The totalizer can be configured via the automation system (MODETOT)
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETOT_TOTAL module → 📄 76.

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.
The following settings are possible:
- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped

Note!
For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 📄 75.

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data / Input data

SETTOT	MODETOT	TOTAL				
Byte 1	Byte 2	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Control	Configuration	Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.
If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 10). Display value assignment to the main line, additional line or info line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Displayed value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol → 45.

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 11), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 1: Reserved 0 → 2: Positive zero return channel 1 ON 0 → 3: Positive zero return channel 1 OFF 0 → 4: Zero point adjustment channel 1 0 → 5: Reserved 0 → 6: Reserved 0 → 7: Reserved 0 → 8: Channel 1 operation UNIDIRECTIONAL 0 → 9: Channel 1 operation BIDIRECTIONAL 0 → 10 to 15: Reserved 0 → 16: Positive zero return channel 2 ON 0 → 17: Positive zero return channel 2 OFF 0 → 18: Zero point adjustment channel 2 0 → 19 to 21: Reserved 0 → 22: Channel 2 operation UNIDIRECTIONAL 0 → 22: Channel 2 operation BIDIRECTIONAL
✎ Note! The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.	

Example (change the output byte)

From		To	Result
0	→	2	Positive zero return for channel 1 is switched on.
2	→	0	No effect
0	→	3	Positive zero return for channel 1 is switched off.
3	→	2	No effect

Output data

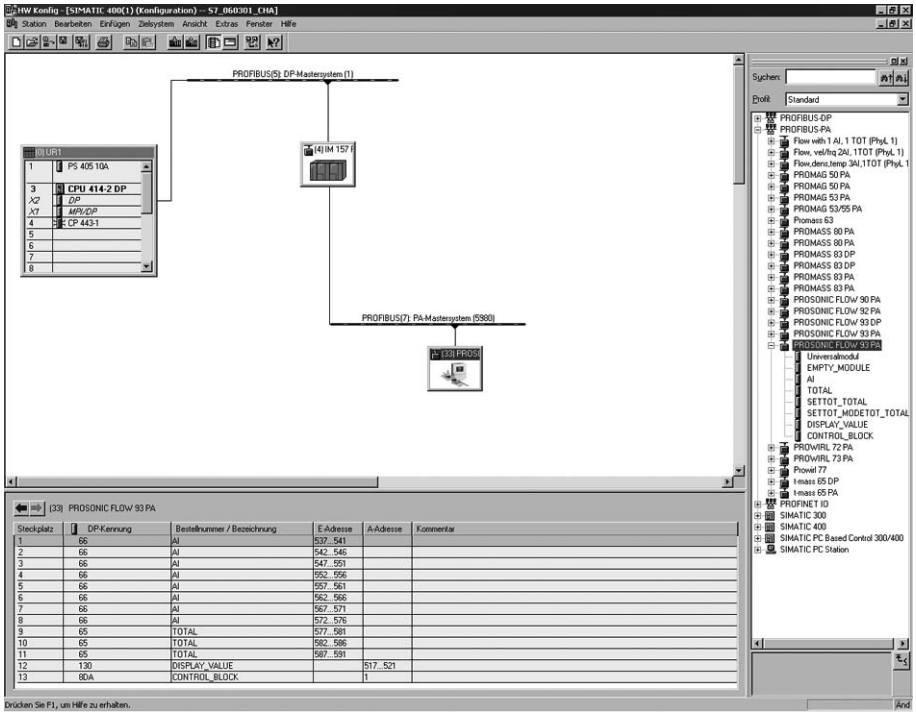
Byte 1
Control

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.
For a more detailed description, see → 73.

6.6.4 Configuration examples with Simatic S7 HW-Konfig

Example 1:



A0008802

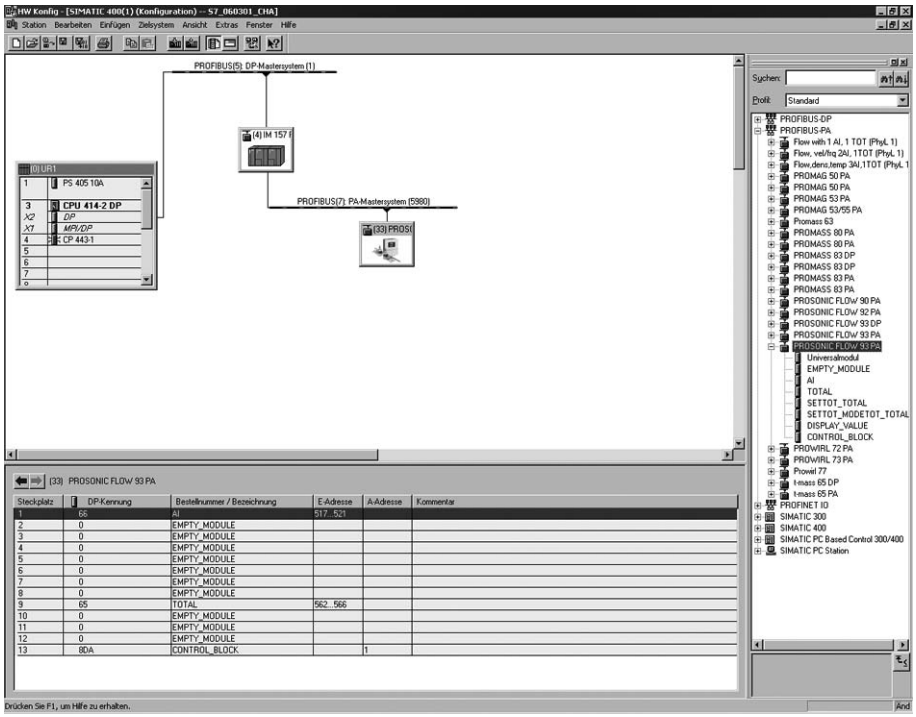
Fig. 41: Complete configuration using the Prosonic Flow 93C GSD file

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	AI	5	–	**Analog Input function block 2** Output variable → (factory setting)
3	AI	5	–	**Analog Input function block 3** Output variable → (factory setting)
4	AI	5	–	**Analog Input function block 4** Output variable → (factory setting)
5	AI	5	–	**Analog Input function block 5** Output variable → (factory setting)
6	AI	5	–	**Analog Input function block 6** Output variable → (factory setting)
7	AI	5	–	**Analog Input function block 7** Output variable → (factory setting)
8	AI	5	–	**Analog Input function block 8** Output variable → (factory setting)
9	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 1** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration

Slot sequence	Module	Byte length input data	Byte length output data	Description
10	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 2** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 3** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	–	5	Default value for local display
13	CONTROL_BLOCK	–	1	Control of device functions

Example 2:



A0008803

Fig. 42: In this configuration example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promass Flow 93C GSD file is used.

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 9) and the cyclic control of device functions CONTROL_BLOCK (slot 13) are activated. The mass flow (factory setting) is read out cyclically by the measuring device by means of the Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the mass flow (factory setting) by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	EMPTY_MODULE	–	–	Empty
3	EMPTY_MODULE	–	–	Empty
4	EMPTY_MODULE	–	–	Empty
5	EMPTY_MODULE	–	–	Empty
6	EMPTY_MODULE	–	–	Empty
7	EMPTY_MODULE	–	–	Empty
8	EMPTY_MODULE	–	–	Empty
9	TOTAL	5	–	**Totalizer function block 1** TOTAL → output variable = totalized (factory setting)
10	EMPTY_MODULE	–	–	Empty
11	EMPTY_MODULE	–	–	Empty
12	EMPTY_MODULE	–	–	Empty
13	CONTROL_BLOCK	–	1	Control of device functions

6.7 Cyclic data transmission PROFIBUS PA

Below is a description of the cyclic data transmission when using the Prosonic Flow 93C GSD file (complete device functionality).

6.7.1 Block model

The block model illustrated shows which input and output data Prosonic Flow 93C provides for cyclic data exchange via PROFIBUS PA.

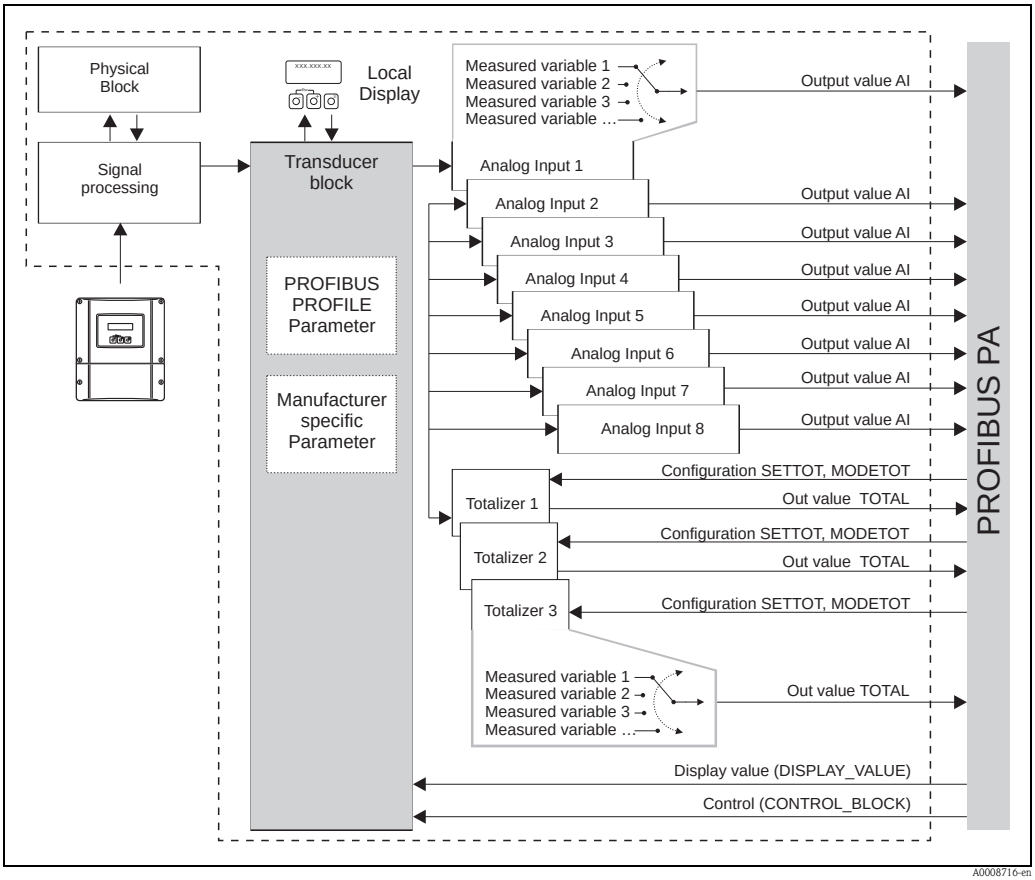


Fig. 43: Block model for Prosonic Flow 93C PROFIBUS PA Profile 3.0

6.7.2 Modules for cyclic data transmission

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules (input and output data) are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules (see following table). Gaps between configured modules have to be assigned the EMPTY_MODULE module.
To optimize the data throughput rate of the PROFIBUS network, it is recommended to only configure modules that are processed in the PROFIBUS master system.

It is essential to adhere to the following sequence/assignment when configuring the modules in the PROFIBUS master system:

Slot sequence	Module	Description
1	AI	**Analog Input function block 1** Output variable → average volume flow (factory setting)
2	AI	**Analog Input function block 2** Output variable → average sound velocity (factory setting)
3	AI	**Analog Input function block 3** Output variable → average flow velocity (factory setting)
4	AI	**Analog Input function block 4** Output variable → average volume flow (factory setting)
5	AI	**Analog Input function block 5** Output variable → average sound velocity (factory setting)
6	AI	**Analog Input function block 6** Output variable → average flow velocity (factory setting)
7	AI	**Analog Input function block 7** Output variable → average volume flow (factory setting)
8	AI	**Analog Input function block 8** Output variable → average sound velocity (factory setting)
9	TOTAL or SETTOT_TOTAL or SETTOT_MODETOT_TOTAL	**Totalizer function block 1** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
10		**Totalizer function block 2** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
11		**Totalizer function block 3** TOTAL → output variable = average volume flow SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	Default value for local display
13	CONTROL_BLOCK	Control of device functions

Note!

- The assignment of the measured variables for the Analog Input function blocks (1 to 8) and the Totalizer function blocks (1 to 3) can be changed by means of the CHANNEL function. A detailed description of the individual modules is contained in the following section.
- The device has to be reset once a new configuration has been loaded to the automation system. This can be effected as follows:
  – By means of the local display
  – By means of an operating program (e.g. FieldCare)
  – By switching the supply voltage off and on again.

6.7.3 Description of the modules

AI module (Analog Input)

The corresponding measured variable, including the status, is cyclically transmitted to the PROFIBUS master (Class 1) by means of the AI module (slots 1 to 8). The measured variable is represented in the first four bytes in the form of floating point numbers in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the measured variable.
Further information on the device status → 📄 102.

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
measured variable (IEEE 754 floating point number)				Status

Assignment of the measured variables to the AI module

The AI module can transmit different measured variables to the PROFIBUS master (Class 1).
The measured variables are assigned to the Analog Input function blocks 1 to 8 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the CHANNEL function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) →
BLOCK SELECTION (6120): Selection of an Analog Input function block →
CHANNEL (6123): Selection of a measured variable

Possible settings

Measured variable	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting AI function block 1)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 2)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 3)	571
AVERAGE VOLUME FLOW (factory setting AI function block 4)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 5)	570
AVERAGE FLOW VELOCITY (factory setting AI function block 6)	571
AVERAGE VOLUME FLOW (factory setting AI function block 7)	567
AVERAGE SOUND VELOCITY (factory setting AI function block 8)	570

✎ Note!
If, when performing the PROFIBUS network configuration, the AI module was integrated in slot 1 to 8, the measured variable selected in the CHANNEL function for the respective Analog Input function block 1 to 8 is transmitted cyclically to the PROFIBUS master (Class 1). → 📄 75 ff.

Factory setting:

Module	Analog Input function block	Measured variable	Unit	ID for CHANNEL function
AI (slot 1)	1	AVERAGE VOLUME FLOW	m^3/h	567
AI (slot 2)	2	AVERAGE SOUND VELOCITY	m/s	570
AI (slot 3)	3	AVERAGE FLOW VELOCITY	m/s	571
AI (slot 4)	4	AVERAGE VOLUME FLOW	m^3/h	567
AI (slot 5)	5	AVERAGE SOUND VELOCITY	m/s	570
AI (slot 6)	6	AVERAGE FLOW VELOCITY	m/s	571
AI (slot 7)	7	AVERAGE VOLUME FLOW	m^3/h	567
AI (slot 8)	8	AVERAGE SOUND VELOCITY	m/s	570

Example:

You want to cyclically transmit the AVERAGE VOLUME FLOW to the PROFIBUS master (Class 1) by means of the Analog Input function block 1 (module AI, slot 1) and the AVERAGE SOUND VELOCITY by means of the Analog Input function block 2 (module AI, slot 2).

1. BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 1, then select CHANNEL (6123) = AVERAGE VOLUME FLOW
2. BASIC FUNCTION (G) → PROFIBUS PA (GCA) → FUNCTION BLOCKS (612) → BLOCK SELECTION (6120): Select ANALOG INPUT 2, then select CHANNEL (6123) = AVERAGE SOUND VELOCITY

TOTAL module

The measuring device has three Totalizer function blocks. The totalizer values can be cyclically transmitted to the PROFIBUS master (Class 1) via the TOTAL module (slots 9 to 11). The totalizer value is represented in the first four bytes in the form of a floating point number in accordance with the IEEE 754 standard. The fifth byte contains standardized status information corresponding to the totalizer value.
Further information on the device status → 📄 102.

Input data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Totalizer value (IEEE 754 floating point number)				Status

Assignment of the measured variables to the TOTAL module

The TOTAL module can transmit different totalizer variables to the PROFIBUS master (Class 1). The measured variables are assigned to the Totalizer function blocks 1 to 3 by means of the local display or with the aid of an operating program (e.g. FieldCare) in the "CHANNEL" function:

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
Select TOTALIZER (6130): Selection of a totalizer →
CHANNEL (6133): Selection of measured variable

Possible settings

Totalizer value/measured variable (channel 1 = active)	ID for CHANNEL function
AVERAGE VOLUME FLOW (factory setting totalizer 1 to 3)	567
OFF	0
Note! If, when performing the PROFIBUS network configuration, the module or the function TOTAL was integrated in slot 9, 10 or 11, the measured variable selected in the CHANNEL function for the totalizers 1 to 3 is transmitted cyclically to the PROFIBUS master (Class 1).	

Factory setting

Module	Totalizer function block	Totalizer value/measured variable	Unit	ID for CHANNEL function
TOTAL (slot 9)	1	AVERAGE VOLUME FLOW	m^3	567
TOTAL (slot 10)	2	AVERAGE VOLUME FLOW	m^3	567
TOTAL (slot 11)	3	AVERAGE VOLUME FLOW	m^3	567

Example:

You want to cyclically transmit the totalized volume flow as totalizer value 1 to the PROFIBUS master (Class 1) by means of the TOTAL module (slot 7):

BASIC FUNCTION (G) → PROFIBUS PA (GCA) → TOTALIZER (613) →
select TOTALIZER (6130): Select TOTALIZER 1, then select CHANNEL (6133) = VOLUME FLOW

SETTOT_TOTAL module

The module combination SETTOT_TOTAL (slots 9 to 11) consists of the functions SETTOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

In the SETTOT function, the totalizer can be controlled via control variables.
The following control variables are supported:
- 0 = Totalize (factory setting)
- 1 = Reset totalizer (the totalizer value is reset to 0)
- 2 = Accept totalizer preset

Note!
After the totalizer value has been reset to 0 or set to the preset value, the totalizing continues automatically. The control variable does not have to be changed to 0 again to restart totalizing. Stopping totalizing is controlled in the SETTOT_MODETOT_TOTAL module via the MODETOT function → 77.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 📄 75.

Data structure of the SETTOT_TOTAL module combination

Output data	Input data				
SETTOT	**TOTAL**				
Byte 1	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**
Control	Totalizer value (IEEE 754 floating point number)				Status

SETTOT_MODETOT_TOTAL module

The module combination SETTOT_MODETOT_TOTAL (slots 9 to 11) consists of the functions SETTOT, MODETOT and TOTAL.
With this module combination:
- The totalizer can be controlled via the automation system (SETTOT).
- The totalizer can be configured via the automation system (MODETOT).
- The totalizer value is transmitted including the status (TOTAL)

SETTOT function

For a description of the SETTOT function, refer to SETOT_TOTAL module → 📄 76.

MODETOT function

In the MODETOT function, the totalizer can be configured via control variables.
The following settings are possible:
- 0 = Balance (factory setting), calculates the positive and negative flow portions
- 1 = calculates the positive flow portions
- 2 = calculates the negative flow portions
- 3 = Totalizing is stopped

Note!
For the calculation of the positive and negative flow portions (control variable 0) or the negative flow portions only (control variable 2) to be carried out correctly, the option BIDIRECTIONAL must be active in the MEASURING MODE (6601) function.

TOTAL function

For a description of the TOTAL function, refer to TOTAL module → 📄 75.

Data structure of the SETTOT_MODETOT_TOTAL module combination

Output data		Input data				
SETTOT	**MODETOT**	**TOTAL**				
Byte 1	**Byte 2**	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**
Control	Configuration	Totalizer value (IEEE 754 floating point number)				Status

Example of using the SETTOT_MODETOT_TOTAL module

If the SETTOT function is set to 1 (= reset the totalizer), the value for the aggregated total is reset to 0.
If the aggregated total of the totalizer should constantly retain the value 0, the MODETOT function must first be set to 3 (= totalizing is stopped) and then the SETTOT function must be set to 1 (= reset the totalizer).

DISPLAY_VALUE module

Any value (IEEE 754 floating point number), including status, can be cyclically transmitted via the PROFIBUS master (Class 1) directly to the local display using the DISPLAY_VALUE module (slot 10). Display value assignment to the main line, additional line or info line can be configured via the local display itself or an operating program (e.g. FieldCare).

Output data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Displayed value (IEEE 754 floating point number)				Status

Status

The measuring device interprets the status in accordance with PROFIBUS Profile Specification Version 3.0. The statuses OK, BAD and UNCERTAIN are indicated on the local display by a corresponding symbol. → 45

CONTROL_BLOCK module

By means of the CONTROL_BLOCK module (slot 11), the measuring device is able to process device-specific control variables from the PROFIBUS master (Class 1) in cyclic data transmission (e.g. switching on positive zero return).

Supported control variables of the CONTROL_BLOCK module

The following device-specific control variables can be activated by changing the output byte from 0 → x:

Module	Control variables
CONTROL_BLOCK	0 → 1: Reserved 0 → 2: Positive zero return channel 1 ON 0 → 3: Positive zero return channel 1 OFF 0 → 4: Zero point adjustment channel 1 0 → 5: Reserved 0 → 6: Reserved 0 → 7: Reserved 0 → 8: Channel 1 operation UNIDIRECTIONAL 0 → 9: Channel 1 operation BIDIRECTIONAL 0 → 10 to 15: Reserved 0 → 16: Positive zero return channel 2 ON 0 → 17: Positive zero return channel 2 OFF 0 → 18: Zero point adjustment channel 2 0 → 19 to 21: Reserved 0 → 22: Channel 2 operation UNIDIRECTIONAL 0 → 22: Channel 2 operation BIDIRECTIONAL
✎ Note! The control (e.g. switching on positive zero return) is executed by cyclic data transmission if the output byte switches from "0" to the bit pattern in question. The output byte must always switch from "0". A switchback to "0" does not have any effect.	

Example (change the output byte)

From		To	Result
0	→	2	Positive zero return for channel 1 is switched on.
2	→	0	No effect
0	→	3	Positive zero return for channel 1 is switched off.
3	→	2	No effect

Output data

Byte 1
Control

EMPTY_MODULE module

The measuring device is a so-called modular PROFIBUS slave. In contrast to a compact slave, the structure of a modular slave is variable – it consists of several individual modules. In the GSD file, the individual modules are described with their individual properties. The modules are permanently assigned to the slots, i.e. the sequence or arrangement of the modules must be observed when configuring the modules. Gaps between configured modules have to be assigned the EMPTY_MODULE module.
For a more detailed description, see → 🖹 73.

6.7.4 Configuration examples with Simatic S7 HW-Konfig

Example 1:

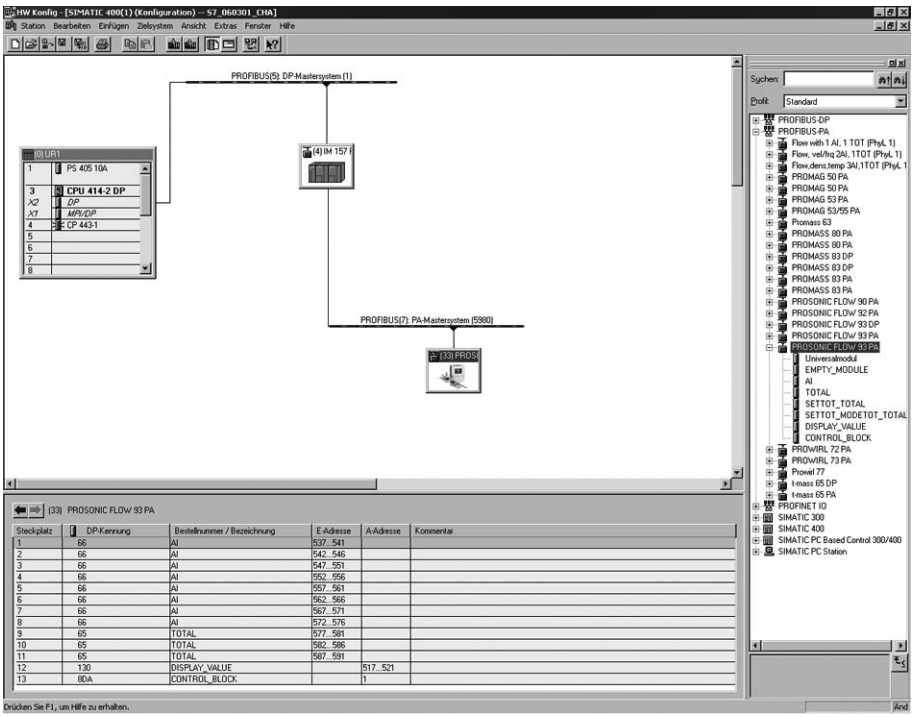


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Fig. 44: Complete configuration using the Prosonic Flow 93C GSD file

It is essential to adhere to the following sequence when configuring the modules in the PROFIBUS master (Class 1):

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	AI	5	–	**Analog Input function block 2** Output variable → (factory setting)
3	AI	5	–	**Analog Input function block 3** Output variable → (factory setting)
4	AI	5	–	**Analog Input function block 4** Output variable → (factory setting)
5	AI	5	–	**Analog Input function block 5** Output variable → (factory setting)
6	AI	5	–	**Analog Input function block 6** Output variable → (factory setting)
7	AI	5	–	**Analog Input function block 7** Output variable → (factory setting)
8	AI	5	–	**Analog Input function block 8** Output variable → (factory setting)
9	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 1** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration

Slot sequence	Module	Byte length input data	Byte length output data	Description
10	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 2** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
11	SETTOT_MODETOT_TOTAL	5	2	**Totalizer function block 3** TOTAL → output variable = totalized (factory setting) SETTOT→ totalizer control MODETOT → totalizer configuration
12	DISPLAY_VALUE	–	5	Default value for local display
13	CONTROL_BLOCK	–	1	Control of device functions

Example 2:

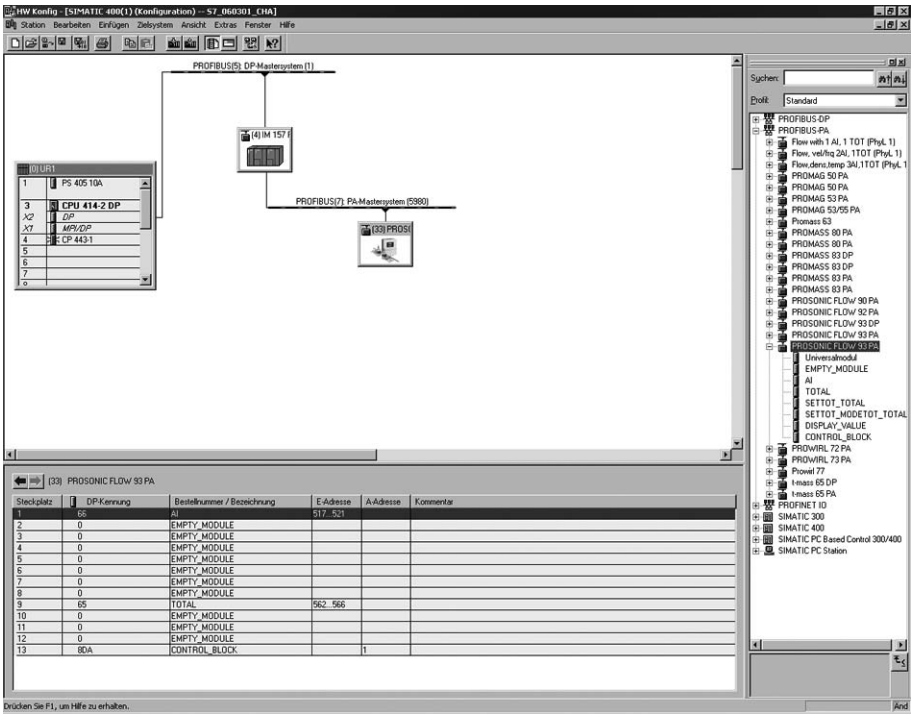

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Fig. 45: In this configuration example, modules that are not needed are replaced by the module EMPTY_MODULE. The Promass Flow 93C GSD file is used.

With this configuration, the Analog Input function block 1 (slot 1), the totalizer value TOTAL (slot 9) and the cyclic control of device functions CONTROL_BLOCK (slot 13) are activated. The mass flow (factory setting) is read out cyclically by the measuring device by means of the Analog Input function block 1. The totalizer is configured "without configuration". In other words, in this example it only returns the totalizer value for the mass flow (factory setting) by means of the TOTAL module and cannot be controlled by the PROFIBUS master (Class 1).

Slot sequence	Module	Byte length input data	Byte length output data	Description
1	AI	5	–	**Analog Input function block 1** Output variable → (factory setting)
2	EMPTY_MODULE	–	–	Empty
3	EMPTY_MODULE	–	–	Empty
4	EMPTY_MODULE	–	–	Empty
5	EMPTY_MODULE	–	–	Empty
6	EMPTY_MODULE	–	–	Empty
7	EMPTY_MODULE	–	–	Empty
8	EMPTY_MODULE	–	–	Empty
9	TOTAL	5	–	**Totalizer function block 1** TOTAL → output variable = totalized (factory setting)
10	EMPTY_MODULE	–	–	Empty
11	EMPTY_MODULE	–	–	Empty
12	EMPTY_MODULE	–	–	Empty
13	CONTROL_BLOCK	–	1	Control of device functions

6.8 Acyclic data transmission PROFIBUS DP/PA

Acyclic data transmission is used to transmit parameters during commissioning or maintenance, or to display additional measured variables that are not included in cyclic data traffic. Thus parameters for identification, control or adjustment in the various blocks (Physical Block, Transducer Block, function block) can be changed while the device is in the process of cyclic data transmission with a PLC.

The measuring device supports the two basic types of acyclic data transmission:
- MS2AC communication with 2 available SAPs
- MS1AC communication

6.8.1 Master class 2 acyclic (MS2AC)

MS2AC is acyclic data transmission between a field device and a Class 2 master (e.g. FieldCare, Siemens PDM etc. → 49). During this process, the master opens a communication channel via an SAP (Service Access Point) to access the device.
All parameters to be exchanged with a device via PROFIBUS must be made known to a Class 2 master. This assignment to each individual parameter takes place either in a device description (DD), a DTM (Device Type Manager), or inside a software component in the master via slot and index addressing.

When using MS2AC communication, note the following:
- As described above, a Class 2 master accesses a device via special SAPs.
  Therefore, the number of Class 2 masters that can communicate with a device simultaneously is limited to the number of SAPs available for this data transmission.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into account when programming the control system used.

6.8.2 Master class 1 acyclic (MS1AC)

In MS1AC, a cyclic master, that is already reading the cyclic data from the device or writing to the device opens the communication channel via the SAP 0x33 (special Service Access Point for MS1AC) and can then read or write a parameter acyclically like a Class 2 master via the slot and the index (if supported).
When using MS1AC communication, note the following:
- Currently, few PROFIBUS masters on the market support this data transmission.
- MS1AC is not supported by all PROFIBUS devices.
- In the user program, note that constant writing of parameters (for example, at every cycle of the program) can drastically reduce the service life of a device. Acyclically written parameters are written to voltage-resistant memory modules (EEPROM, Flash etc.). These memory modules are designed for a limited number of write operations. In normal operation without MS1AC (during parameter configuration), the number of write operations does not even come close to this number. If programming is incorrect, this maximum number can be reached quickly, drastically reducing a device's service life.

  ✎ Note!
  The memory module of the measuring device is designed for one million writes.

6.9 Adjustment

All measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate.
Calibration takes place under reference operating conditions → 119 ff.
Consequently, the zero point adjustment is generally **not** necessary!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

Preconditions for a zero point adjustment
Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that have no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – Standard operation → Valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → Valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → Valve 1 closed / valve 2 open

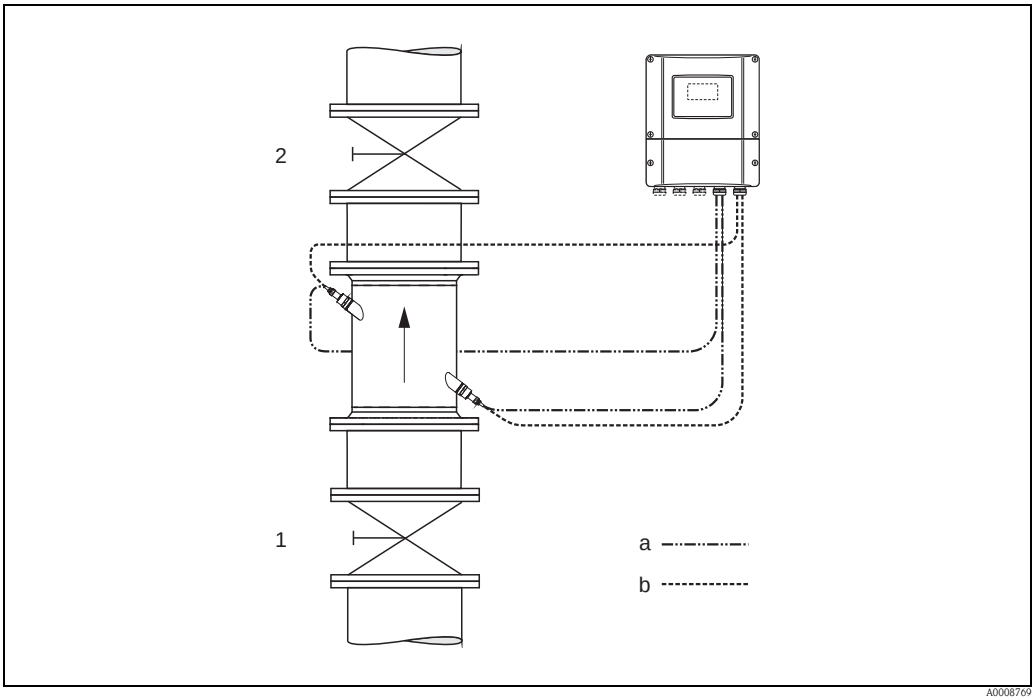

Fig. 46: Zero point adjustment and shutoff valves

1 Shutoff valve upstream of Prosonic Flow C
2 Shutoff valve downstream of Prosonic Flow C
a Sensor cable for channel 1
b Sensor cable for channel 2

Caution!
- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your Endress+Hauser service center.
- You can view the currently valid zero point value using the ZERO POINT function (see the "Description of Device Functions" manual).

Performing a zero point adjustment
Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that have no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  – Standard operation → Valves 1 and 2 open
  – Zero point adjustment *with* pump pressure → Valve 1 open / valve 2 closed
  – Zero point adjustment *without* pump pressure → Valve 1 closed / valve 2 open

1. Operate the system until normal operating conditions resume.
2. Stop the flow (v = 0 m/s).
3. Check the shutoff valves for leaks.
4. Check that operating pressure is correct.
5. Using the local display or an operating program, select the ZEROPOINT ADJUSTMENT function in the function matrix:
   BASIC FUNCTION (G) → PROCESS PARAMETER (GIA) → ADJUSTMENT (648) → ZERO POINT ADJUST (6480).
6. When you press ⊞ or ⊟ you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code (factory setting = 93).
7. Now use ⊞ or ⊟ to select START and confirm with Ⓔ. Acknowledge the security prompt with YES and confirm again with Ⓔ. Zero point adjustment is now started.
   – The message "ZEROPOINT ADJUST RUNNING" appears on the display for 30 to 60 seconds while adjustment is in progress.
   – If the flow in the pipe exceeds 0.1 m/s (0.3 ft/s), the following error message appears on the display: ZERO ADJUST NOT POSSIBLE.
   – When the zero point adjustment is completed, the "ZERO ADJUST" function reappears on the display.
8. Back to the HOME position:
   – Press and hold down the Esc keys (⊟ + ⊞) for longer than three seconds or
   – Repeatedly press and release the Esc keys (⊟ + ⊞).

6.10 Memory (HistoROM)

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. By plugging and unplugging such modules, device configurations can be duplicated onto other measuring devices to cite just one example.

6.10.1 HistoROM/T-DAT (transmitter-DAT)

The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.
Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= manual save function). Please refer to Page 62for a description of the related function (T-DAT SAVE/LOAD) and the exact procedure for managing data.

7 Maintenance

No special maintenance work is required.

7.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser representative can provide detailed information on the order codes in question.

Device-specific accessories

Accessory	Description	Order code
Wall-mount housing, transmitter Prosonic Flow 93	Transmitter for replacement or for stock. Use the order code to define the following specifications: ■ Approvals ■ Degree of protection/version ■ Cable entry ■ Display / power supply / operation ■ Software ■ Outputs / inputs	Two-channel version: 93XXX - XX2XX********
Conversion kit, inputs/outputs	Conversion kit with appropriate plug-in point modules for converting the current input/output configuration to a new version.	DK9UI - **

Measuring principle-specific accessories

Accessory	Description	Order code
Mounting kit for aluminum field housing	Mounting kit for wall-mount housing. Suitable for: ■ Wall mounting ■ Pipe mounting ■ Panel mounting	DK9WM - A
93C Flow sensor set	Type C Sensors ■ (DN 300 to 2000 (11.8 to 78.7") ■ –10 to 60 °C (14 to 140 °F) ■ NEMA IP68	DK9WS - L*
Conduit adapter for connecting cable	Prosonic Flow 93C (DN 50 to 4000 / 2 to 160") ■ Conduit adapter incl. cable entry M20 × 1.5 ■ Conduit adapter incl. cable entry ½" NPT ■ Conduit adapter incl. cable entry G ½"	DK9CB - BD1 DK9CB - BD2 DK9CB - BD3
Connecting cable	5 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 10 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 15 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F) 30 m sensor cable, PVC, –20 to +70 °C (–4 to +158 °F)	DK9SS - BDA DK9SS - BDB DK9SS - BDC DK9SS - BDD

Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters. The Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.	DXA80 - *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
FXA193	Service interface from the measuring device to the PC for operation via FieldCare.	FXA193 – *
Communication cable	Communication cable for connecting the Prosonic Flow 93C transmitter to the FXA193 service interface.	DK9ZT – A

9 Troubleshooting

9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

Check the display	
No display visible and no output signals present.	1. Check the supply voltage → Terminals 1, 2 2. Check device fuse → 📄 115 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V 3. Meter electronics defective → Order spare part → 📄 110
No display visible, but output signals are present.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → 📄 110 ff. 2. Display module defective → Order spare part → 📄 110 3. Meter electronics defective → Order spare part → 📄 110
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the ⊟ keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
▼	
Error messages on display	
Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows: – Type of error: **S** = system error, **P** = process error – Error message type: ϟ = fault message, **!** = notice message – **MEDIUM INHOM.** = error designation (e.g. fluid is not homogeneous) – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – **#702** = error number ☝ Caution! ■ Also refer to the information on → 📄 48 ■ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice messages only.	
System error (device error) has occurred → 📄 102	
Process error (application error) has occurred → 📄 108	
▼	
Faulty connection to control system	
No connection can be made between the control system and the device. Check the following points:	
Supply voltage Transmitter	Check the supply voltage → Terminals 1/2
Device fuse	Check device fuse → 📄 115 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V
Fieldbus connection	PROFIBUS PA: Check data line Terminal 26 = PA + Terminal 27 = PA – PROFIBUS DP: Check data line Terminal 26 = B (RxD/TxD-P) Terminal 27 = A (RxD/TxD-N)
Fieldbus connector (only for PROFIBUS PA)	■ Check pin assignment/wiring → 📄 24 ■ Check connection between connector/fieldbus port. Is the coupling ring tightened correctly?

Fieldbus voltage (only for PROFIBUS PA)	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 to 32 V DC
Network structure	Check permissible fieldbus length and number of spurs → 📄 25
Faulty connection to control system	
Basic current (only for PROFIBUS PA)	Is there a basic current of min. 11 mA?
Bus address	Check bus address: make sure there are no double assignments
Bus termination (Termination)	Has the PROFIBUS network been terminated correctly? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in communication.
Power consumption, permitted feed current (only for PROFIBUS PA)	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all bus users) must not exceed the max. permissible feed current of the bus power supply.
▼	
System or process error messages	
System or process errors which occur during commissioning or operation can be displayed via the local display or an operating program (e.g. FieldCare) in the ACTUAL SYSTEM CONDITION function.	
▼	
Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 📄 108

9.2 System error messages

Serious system errors are **always** recognized by the instrument as "Fault message" and are shown as a lightning flash (ϟ) on the display! Fault messages immediately affect the outputs. Simulations and positive zero return, on the other hand, are classed and displayed as "Notice messages".

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a flowmeter to Endress+Hauser → 🖹 6.
Always enclose a duly completed "Declaration of Contamination" form. A copy of the form can be found at the end of these Operating Instructions!

Note!
See the information on → 🖹 48.

9.2.1 Displaying the device status on PROFIBUS DP/PA

Display in the operating program (acyclic data transmission)

The device status can be queried using an operating program (e.g. FieldCare):
Function block SUPERVISION → SYSTEM → OPERATION → ACTUAL SYSTEM CONDITION

Display in the PROFIBUS master system (cyclic data transmission)

If the AI or TOTAL modules are configured for cyclic data transmission, the device status is coded in accordance with PROFIBUS Profile Specification 3.0 and transmitted with the measured value to the PROFIBUS master (Class 1) by means of the quality byte (byte 5). The quality byte is split into the "quality status", "quality substatus" and "limits" segments.

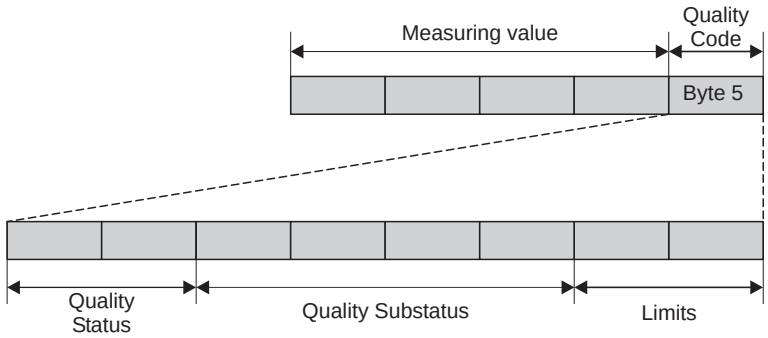

Fig. 47: Structure of the quality byte

The content of the quality byte depends on the failsafe mode error behavior configured in the corresponding Analog Input function block. Depending on which failsafe mode has been set in the FAILSAFE_TYPE function, the following status information is transmitted to the PROFIBUS master (Class 1) via the quality byte:

- For FAILSAFE_TYPE → FSAFE VALUE:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x48 0x49 0x4A	UNCERTAIN	Substitute set	OK Low High

■ For FAILSAFE_TYPE → LAST GOOD (factory setting):

If a valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x44 0x45 0x46	UNCERTAIN	Last usable value	OK Low High

If no valid output value was available before the failure:

Quality code (HEX)	Quality status	Quality substatus	Limits
0x4C 0x4D 0x4E	UNCERTAIN	Initial Value	OK Low High

■ For FAILSAFE_TYPE → WRONG VALUE:
For status information, see the table in the following section.

Note!
The FAILSAFE_TYPE function can be configured in the corresponding Analog Input function block 1 to 8 or Totalizer function block 1 to 3 by means of an operating program (e.g. FieldCare).

9.2.2 List of system error messages

No.	Device status message (local display)	PROFIBUS measured value status: Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits	Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part → 🖹 110 ff.)
Depicted on the local display: S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without any effect on the outputs)							
001	S: CRITICAL FAILURE ϟ: # 001	0x0F	BAD	Device Failure	Constant	ROM / RAM failure	*Cause*: ROM/RAM error. Error when accessing the program memory (ROM) or random access memory (RAM) of the processor. *Remedy:* Replace the amplifier board.
011	S: AMP HW EEPROM ϟ: # 011	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM failure	*Cause:* Amplifier with faulty EEPROM *Remedy:* Replace the amplifier board.
012	S: AMP SW-EEPROM ϟ: # 012	0x0F	BAD	Device Failure	Constant	Amplifier EEPROM data inconsistent	*Cause* Amplifier with faulty EEPROM *Remedy* Replace the amplifier board.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part → 🖹 110 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
041	S: TRANSM. HW-DAT ϟ: # 041	0x0F	BAD	Device Failure	Constant	T-DAT failure	*Cause*: 1. T-DAT is not plugged into the amplifier board correctly (or is missing). 2. T-DAT is defective. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board. 2. Replace the T-DAT if it is defective. Check that the new, replacement DAT is compatible with the measuring electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the T-DAT into the amplifier board.
042	S: TRANSM. SW-DAT ϟ: # 042	0x0F	BAD	Device Failure	Constant	T-DAT data inconsistent	
082	S: SENS. DOWN CH1 ϟ: # 082	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH1	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected. Change the sensor type specified: *Access:* BASIC FUNCTION → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
083	S: SENS. DOWN CH2 ϟ: # 083	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH2	
085	S: SENSOR UP CH1 ϟ: # 085	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH1	*Cause:* System error. Connection between sensor channel 1/2 and transmitter interrupted. *Remedy:* – Check the cable connection between the sensor and the transmitter. – Check that the sensor connector is fully screwed in. – The sensor may be defective. – Incorrect sensor connected. Change the sensor type specified: *Access:* BASIC FUNCTION → SENSOR DATA → SENSOR PARAMETER → SENSOR TYPE
086	S: SENSOR UP CH2 ϟ: # 086	0x13	BAD	Sensor Failure	Constant	Interruption between sensor and transmitter CH2	

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part → 🖹 110 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
121	S: A / C COMPATIB. !: # 121	0x0F	BAD	Device Failure	Constant	Amplifier and I/O board only partially compatible	*Cause:* Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). ✎ Note! ■ This message is only listed in the error history. ■ Nothing is displayed on the display. *Remedy:* Module with lower software version has either to be updated by FieldCare with the required software version or the module has to be replaced.
205	S: LOAD T-DAT !: # 205	0x0F	BAD	Device Failure	Constant	Save to T-DAT failed	*Cause:* Data backup (download) to T-DAT failed, or error when accessing (uploading) the calibration values stored in the T-DAT. *Remedy:* 1. Check whether the T-DAT is correctly plugged into the amplifier board. Using the spare part set number, check whether the new, replacement DAT is compatible with the existing measuring electronics. 2. Replace the T-DAT if it is defective. Check that the new, replacement DAT is compatible with the measuring electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the T-DAT into the amplifier board.
206	S: SAVE T-DAT !: # 206	0x0F	BAD	Device Failure	Constant	Restore from T-DAT failed	
261	S: COMMUNICAT. I/O ϟ: # 261	0x18 0x19 0x1A	BAD	No Communication	O.K. Low High	Communication failure	*Cause:* Communication error. No data reception between amplifier and I/O board or faulty internal data transfer. *Remedy:* Check whether the electronics boards are correctly inserted in their holders
392	S: SIGNAL LOW CH1 ϟ: # 392	0x0F	BAD	Device Failure	Constant	Attenuation of acoustic measurement section too high	*Cause:* System error. Attenuation of acoustic measurement section too high. *Remedy:* – Check to see if the coupling fluid must be renewed. – It is possible that the fluid indicates too much attenuation. – It is possible that the pipe indicates too much attenuation. – Check the sensor spacing (Installation dimensions). – Reduce the number of traverses if possible.
393	S: SIGNAL LOW CH1 ϟ: # 393						

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part → 🖹 110 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
469	S: PIPE DATA CH1 ϟ: # 469	0x0F	BAD	Device Failure	Constant	Pipe data ? CH1	*Cause:* The internal diameter is negative. *Remedy:* In the "PIPE DATA" function group, check the values of the functions "OUTER DIAMETER" and "WALL THICKNESS" or "LINING THICKNESS".
470	S: PIPE DATA CH2 ϟ: # 470					Pipe data ? CH2	
492	S: S. V. RANGE CH1 ϟ: # 492	0x03	BAD	Non specific (uncertain status)	Constant	Sound velocity in CH1 outside the range	*Cause:* Process error. The sound velocity in channel 1 or channel 2 is outside the search range of the transmitter. *Remedy:* – Check the installation dimensions. – If possible, check the sound velocity of the liquid or check the specialist literature. If the current sound velocity is outside the defined search range, the corresponding parameters must be changed in the LIQUID DATA function group. More detailed information on this is provided in the "Description of Device Functions, Prosonic Flow 93" manual (BA 077D) under the SOUND VELOCITY LIQUID (6542) function (local display)
493	S: S. V. RANGE CH2 ϟ: # 493					Sound velocity in CH2 outside the range	
495	S: INTERFERENCE CH1 ϟ: # 495	0x43	UNCERTAIN	Non specific (uncertain status)	Constant	Interference CH 1	*Cause:* The wave transmitted in the pipe may superimpose the useful signal. We recommend you alter the sensor configuration in the event of this error message. ☝ Caution! The sensor configuration **must** be changed if the measuring device indicates zero flow or low flow. *Remedy:* In the SENSOR CONFIGURATION function, change the number of traverses from 2 or 4 to 1 or 3 and mount the sensors accordingly.
496	S: INTERFERENCE CH2 ϟ: # 496					Interference CH 2	
501	S: SW.-UPDATE ACT. !: # 501	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	New amplifier software loaded	*Cause:* New amplifier or communication software version is loaded. Currently no other functions are possible. *Remedy:* Wait until process is finished. The device will restart automatically.
502	S: UP-/DOWNLO. ACT. !: # 502					Upload/download of device data active	*Cause:* Uploading or downloading the device data via operating program. Currently no other functions are possible. *Remedy:* Wait until process is finished.

No.	Device status message (local display)	PROFIBUS measured value status				Extended diagnostic message in the PROFIBUS master	Cause/remedy (spare part → 🖹 110 ff.)
		Quality code (HEX) Measured value status	Quality status	Quality substatus	Limits		
602	S: POS.0-RET. CH1 !: # 602	0x53	UNCERTAIN	Sensor conversion not accurate (measured value from sensor not accurate)	Constant	Positive zero return active CH1	*Cause:* System error Positive zero return channel 1 or channel 2 is active. *Remedy:* Switch off positive zero return. *Access:* BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POS. ZERO RETURN (→ OFF)
603	S: POS.0-RET. CH2 !: # 603					Positive zero return active CH2	
604	S: POS.0-RET. CH1&2 !: # 604	0x53	UNCERTAIN	Sensor conversion not accurate (measured value from sensor not accurate)	Constant	Positive zero return active CH1&2	*Cause:* System error Positive zero return channel 1 and channel 2 are active. *Remedy:* Switch off positive zero return. *Access:* BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → POS. ZERO RETURN (→ OFF)
691	S: SIM. FAILSAFE. !: # 691	0x48 0x49 0x4A	UNCERTAIN	Substitute set (Substitute set of failsafe status)	O.K. Low High	Simulation failsafe active	*Cause:* Simulation of response to error is active. *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
694	S: SIM. MEASUR. CH1 !: # 694	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Simulation of measuring CH1 active	*Cause:* System error Simulation of the volume flow for channel 1 or 2 active *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. MEASURAND (→ OFF)
695	S: SIM. MEASUR. CH2 !: # 695					Simulation of measuring CH2 active	
696	S: SIM.FAILSAFE CH1 !: # 696	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Simulation failsafe act. CH1	*Cause:* System error Simulation of the failsafe mode for channel 1 or 2 active *Remedy:* Switch off simulation: *Access:* SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
697	S: SIM.FAILSAFE CH2 !: # 697					Simulation failsafe act. CH2	
698	S: DEV. TEST ACT. !: # 698	0x60 0x61 0x62	UNCERTAIN	Simulated Value (manually specified value)	O.K. Low High	Device test via Fieldcheck active	*Cause:* The measuring device is being checked on site via the test and simulation device.

9.3 Process error messages

Note!
See the information on → 48.

9.3.1 Displaying the device status on PROFIBUS DP/PA

Further information → 102

9.3.2 List of process error messages

No.	Device status message (local display)	PROFIBUS measured value status: Quality code (HEX) Measured value status	PROFIBUS measured value status: Quality status	PROFIBUS measured value status: Quality substatus	PROFIBUS measured value status: Limits	Extended diagnostic message in the PROFIBUS master	Cause/remedy
P = Process error ϟ = Fault message (*with* an effect on the outputs) ! = Notice message (*without* any effect on the outputs)							
743	P: 0-ADJ. FAIL CH1 ϟ: # 800	0x40	UNCER-TAIN	Non specific (uncertain status)	No limits	Zeropoint adjustment is not possible	*Cause:* The measuring device is being checked on site via the test and simulation device. *Remedy:* Make sure that zero point adjustment is carried out at "zero flow" only (v = 0 m/s) → 95.
744	P: DENS. DEV. LIMIT ϟ: # 801	0x40 0x41 0x42	UNCER-TAIN	Non specific (uncertain status)	O.K. Low High	Density outside the limit	

9.4 Process errors without messages

Symptoms	Rectification
Note! You may have to change or correct certain settings of the function matrix in order to rectify faults. The functions outlined below are described in detail in the "Description of Device Functions" manual.	
Measured value reading fluctuates even though flow is steady.	1. Check the fluid for presence of gas bubbles. 2. Increase the following values: – Analog Input function block → RISING TIME – BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → FLOW DAMPING 3. Increase the value for display damping: HOME → USER INTERFACE → CONTROL → BASIC CONFIG. → DISPLAY DAMPING
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check the fluid for presence of gas bubbles. 2. Enter a value for the low flow cutoff or increase this value: BASIC FUNCTION → PROCESS PARAMETER → CONFIGURATION → ON-VALUE LF CUTOFF
The fault cannot be rectified or some other fault not described above has occurred. In these instances, please contact your Endress+Hauser service organization.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organization to have a service technician sent out, please be ready with the following information: ■ Brief description of the fault ■ Nameplate specifications: order code and serial number → 7 **Return devices to Endress+Hauser** You can return a measuring device to Endress+Hauser for repair or calibration. Always enclose the duly completed "Declaration of Contamination" form with the flowmeter. You will find a preprinted blank of this form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective→ Order spare part → 110 ff.

9.5 Response of outputs to errors

Note!
The failsafe mode of the current, pulse and frequency outputs can be customized by means of various functions in the function matrix. More detailed information on this is provided in the "Description of Device Functions" manual.

You can use positive zero return to reset the signals of the current, pulse and frequency outputs to their fallback value, or reset measured value transmission via fieldbus to "0", for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions. This function has priority over all other device functions; simulations are suppressed, for example.

Failsafe mode of outputs		
	Process/system error present	Positive zero return activated
Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the outputs. See the information on Page 48 ff.		
Current output	MIN. CURRENT Depending on the option selected in the CURRENT SPAN function (see "Description of Device Functions" manual), the current output is set to the value of the lower signal on alarm level. MAX. CURRENT Depending on the option selected in the CURRENT SPAN function (see "Description of Device Functions" manual), the current output is set to the value of the upper signal on alarm level. HOLD VALUE Measured value displayed is based on the last measured value saved before the error occurred. ACTUAL VALUE Measured value displayed is based on the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow".
Pulse output	FALLBACK VALUE Signal output → No pulses HOLD VALUE The last valid measured value (before the error occurred) is output. ACTUAL VALUE The fault is ignored, i.e. the measured value is output as normal on the basis of the current flow measurement.	Output signal corresponds to "zero flow".
Frequency output	FALLBACK VALUE Signal output → 0 Hz FAILSAFE LEVEL Output of the frequency specified in the FAILSAFE VALUE function. HOLD VALUE The last valid measured value (before the error occurred) is output. ACTUAL VALUE The fault is ignored, i.e. the measured value is output as normal on the basis of the current flow measurement.	Output signal corresponds to "zero flow".
Relay output	In the event of a fault or power supply failure: Relay → deenergized The "Description of Device Functions" manual contains detailed information on relay switching response for various configurations such as error message, flow direction, limit value, etc.	No effect on the relay output
PROFIBUS	→ 102	–

9.6 Spare parts

The previous sections contain a detailed troubleshooting guide → 100 ff.
The measuring device, more over, provides additional support in the form of continuous self-diagnosis and error messages.
Troubleshooting can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate → 7.

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (screws, etc.)
- Mounting instructions
- Packaging

9.6.1 PROFIBUS DP

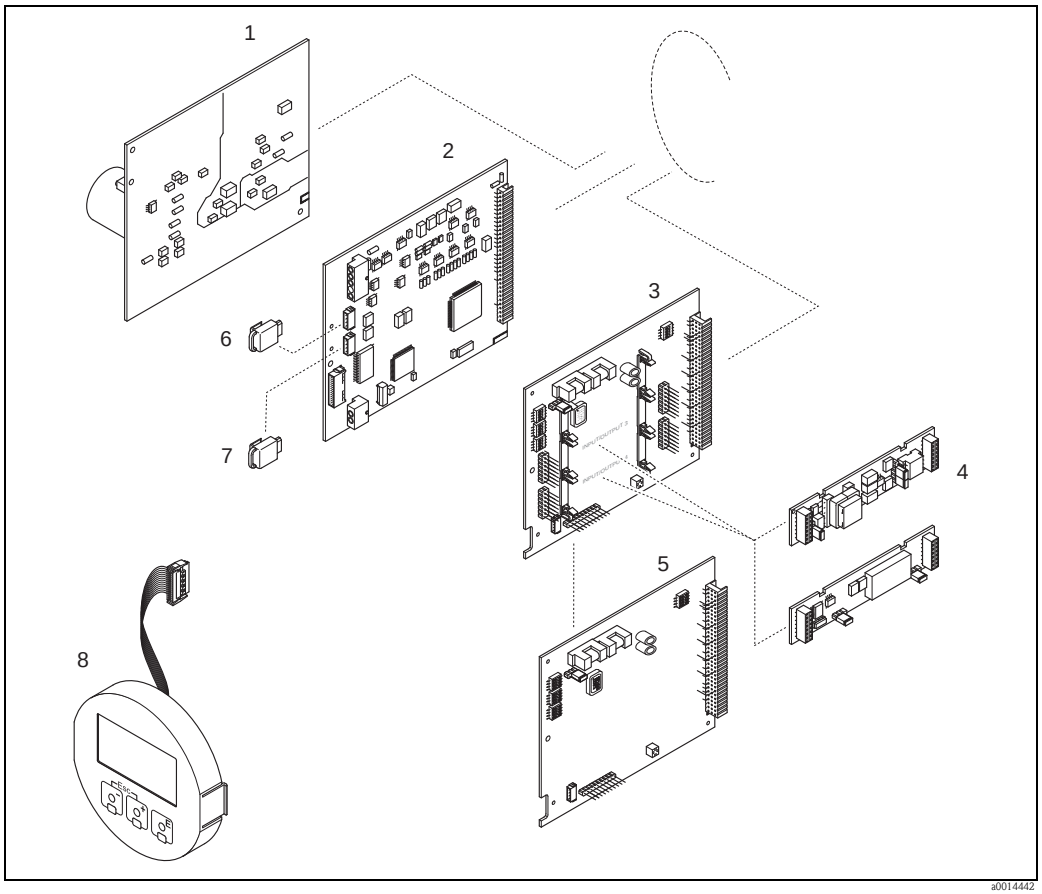

Fig. 48: Spare parts for PROFIBUS DP transmitters (field and wall-mount housing)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3 I/O board (COM module), flexible
4 Pluggable input/output submodules; ordering structure
5 I/O board (COM module), permanent assignment
6 S-DAT (sensor data storage device)
7 T-DAT (transmitter data storage device)
8 Display module

9.6.2 PROFIBUS PA

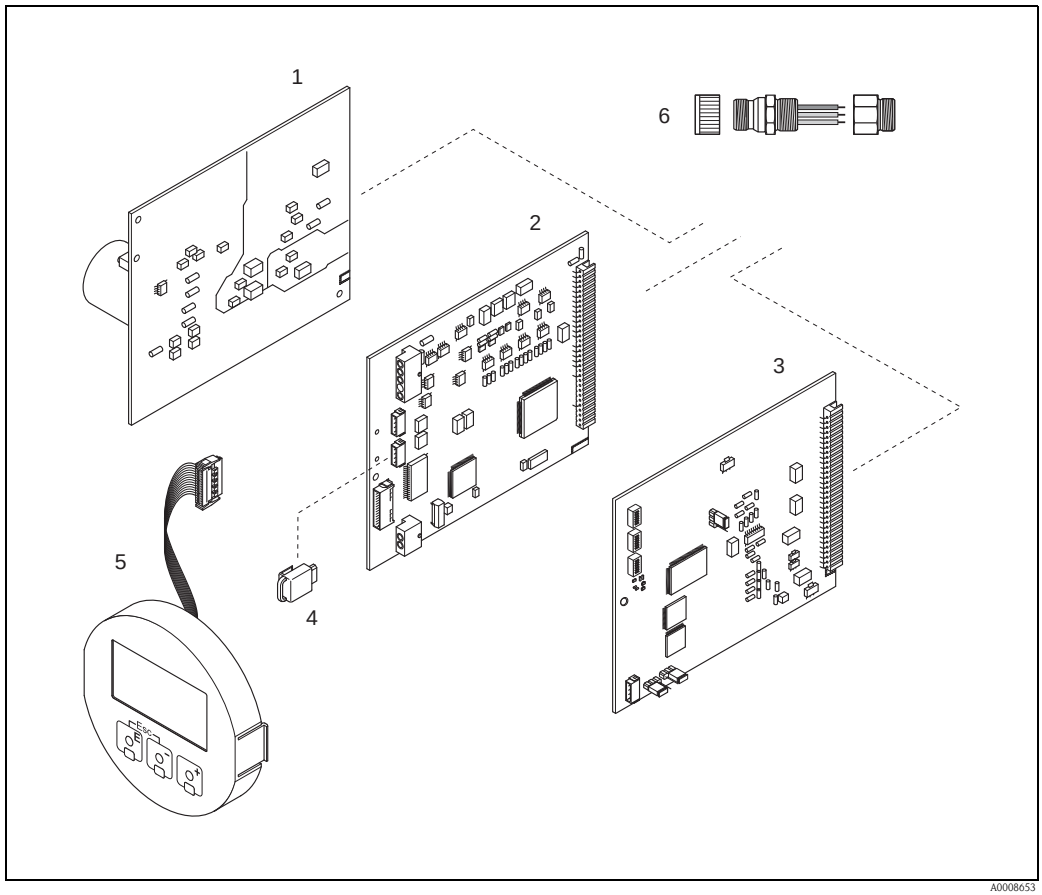

Fig. 49: Spare parts for PROFIBUS PA transmitters (field and wall-mount housing)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3 I/O board (COM module), permanent assignment
4 T-DAT (transmitter data storage device)
5 Display module
6 Fieldbus connector consisting of protection cap, connector, adapter PG 13.5/M20.5 (only for PROFIBUS PA, Order No. 50098037)

9.6.3 Installing and removing electronics boards

Warning!
- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface, purposely built for electrostatically sensitive devices.
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.

Caution!
Use only original Endress+Hauser parts.

Installing and removing printed circuit boards → Fig. 50:

1. Loosen the screws and open the housing cover (1).
2. Loosen the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Disconnect the following cable connectors from amplifier board (7):
   – Signal cable connector (7.1)
   – Plug of exciting current cable (7.2):
     Gently disconnect the plug, i.e. without moving it back and forward.
   – Ribbon cable plug (3) of the display module
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Remove the boards (6, 7, 8):
   Insert a thin pin into the hole provided (5) for the purpose and pull the board clear of its holder.
6. Remove submodules (8.2) (optional):
   No tools are required for removing the submodules (outputs) from the I/O board. Installation is also a no-tools operation.

   Caution!
   Only certain combinations of submodules on the I/O board are permissible → 32.
   The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

   "INPUT / OUTPUT 3" slot = terminals 22/23
   "INPUT / OUTPUT 4" slot = terminals 20/21
7. Installation is the reverse of the removal procedure.

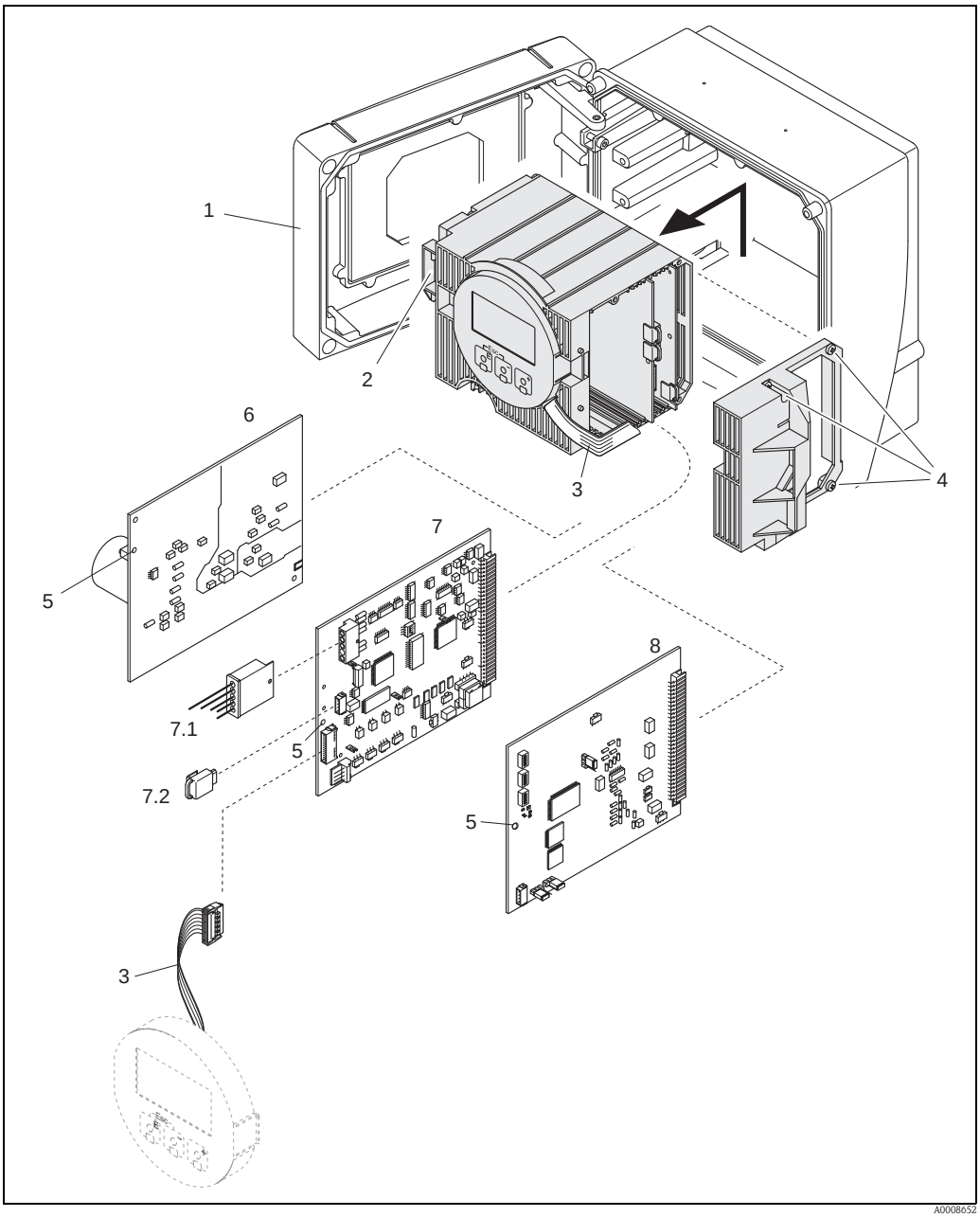

Fig. 50: Wall-mount housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Screws of electronics compartment cover
5 Aperture for installing/removing boards
6 Power unit board
7 Amplifier board
7.1 Sensor signal cable
7.2 T-DAT (transmitter data storage device)
8 I/O board

9.6.4 Installing and removing the W sensors

The active part of the flowrate measuring sensor W can be replaced without interrupting the process.

1. Unscrew the sensor connector (1) from the sensor neck (2) and pull it out.
2. Unscrew the sensor neck (2) from the sensor holder (5). Note that you must reckon with a certain amount of resistance.

Note!
When performing these assembly and disassembly tasks, hold the sensor holder (5) in place with a wrench (AF 36)! For safety reasons, the sensor holder (5) and the sensor nozzle (6) are screwed together by a left thread.

1. Pull out the sensor neck.
2. Pull the sensor element (4) out of the sensor holder (5) and replace it with a new one.
3. Check whether the O–ring (3) is intact and replace it with a new one if necessary.
4. Installation is the reverse of the removal procedure.

Warning!
Risk of accidents! During operation, do not unscrew the sensor holder (5) from the sensor nozzle (6) of the Prosonic Flow C measuring tube as to do so may cause medium to leak!

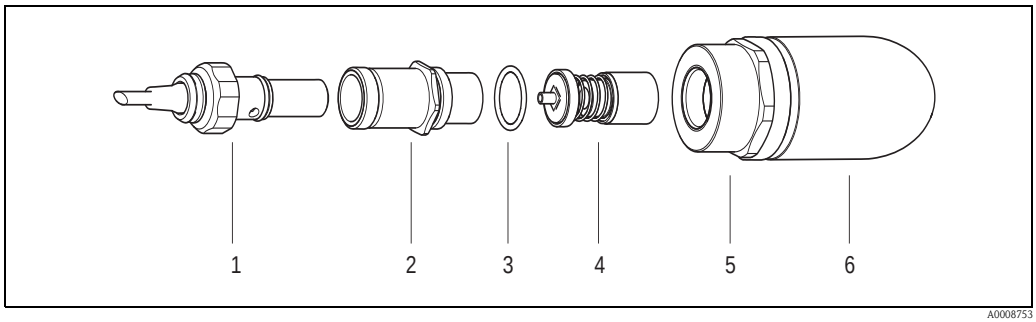

Fig. 51: Flow measuring sensor W: installation/removal

1 Sensor connector
2 Sensor neck
3 O-ring
4 Sensor element
5 Sensor holder
6 Sensor support in measuring pipe Prosonic Flow C

9.6.5 Replacing the device fuse

Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power unit board → Fig. 52.
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board.
3. Remove cap (1) and replace the device fuse (2).
   Only use the following fuse type:
   – Power supply 20 to 55 V AC / 16 to 62 V DC → 2.0 A slow-blow / 250 V; 5.2 × 20 mm
   – Power supply 85 to 260 V AC → 0.8 A slow-blow / 250 V; 5.2 × 20 mm
   – Ex-rated devices → see the Ex documentation
4. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser parts.

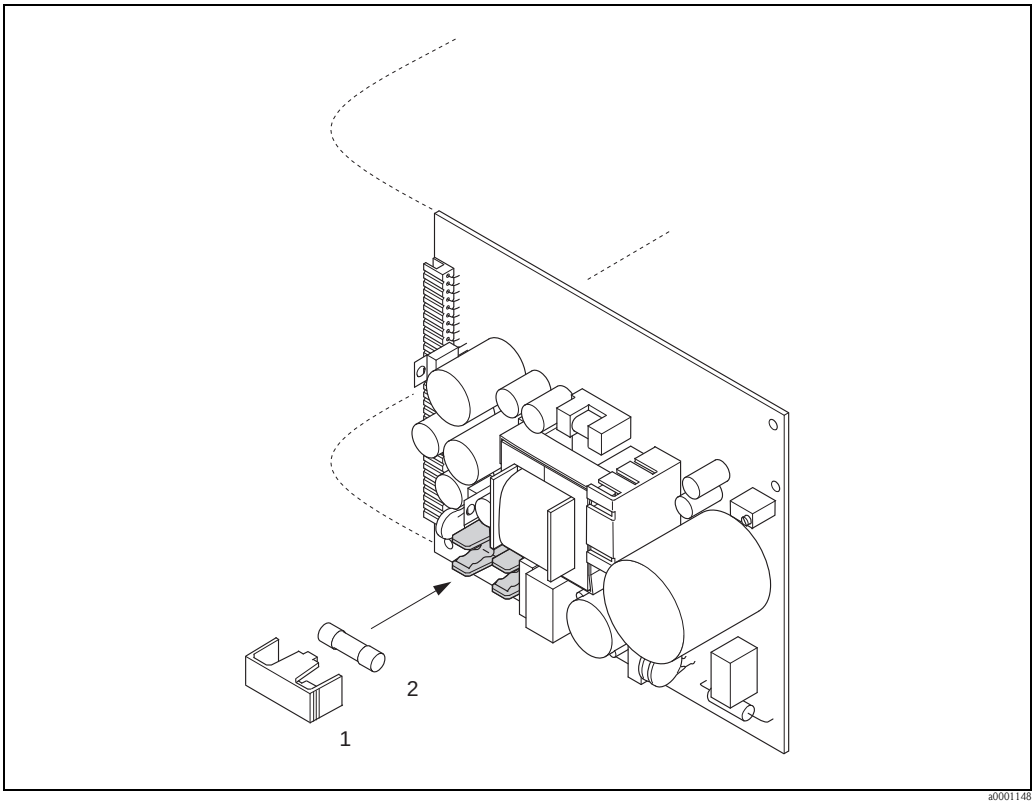

Fig. 52: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse

9.7 Return

→ 📄 6

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Date	Software version	Changes to software	Operating Instructions
06.2010	PROFIBUS DP 3.06.XX	Introduction of a new PROFIBUS DP I/O board	BA00089D/06/en/13.10 71121240
12.2007	PROFIBUS PA 3.05.XX	Introduction of a new PROFIBUS PA I/O board	BA089D/06/en/12.07 71066296
12.2006	PROFIBUS DP	PROFIBUS DP I/O board phased out	
12.2002	Amplifier: 1.05.00 Communication module: 2.02.00	Original software – Profibus Profile version 3.0 – Function blocks: – Measured variable: Average volume flow Average sound velocity Average flow velocity Compatible with: – Fieldtool – Commuwin II (version 2.07.02 and higher) – PROFIBUS DP/PA Profile Version 3.0	BA089D/06/en/0103 50104331

10 Technical data

10.1 Quick technical data guide

10.1.1 Applications

- Measuring the flow rate of liquids in closed piping systems.
- Applications in measuring, control and regulation technology for monitoring processes.

10.1.2 Function and system design

Measuring principle	Prosonic Flow operates on the principle of transit time difference.
Measuring system	The measuring system consists of a transmitter and sensors. *Transmitter:* ■ Prosonic Flow 93C Inline PROFIBUS DP/PA *Measuring tube Prosonic Flow C with measuring sensors Prosonic Flow W:* ■ Prosonic Flow C (for water and wastewater applications) for nominal diameters DN 300 to 2000 (12" to 78")

10.1.3 Input

Measured variable	Flow velocity (transit time difference proportional to flow velocity)
Measuring range	Typically v = 0 to 10 m/s (0 to 33 ft/s)
Operable flow range	Over 150 : 1
Input signal	*Status input (auxiliary input):* U = 3 to 30 V DC, R_i = 3 kΩ, galvanically isolated. Switch level: ±3 to ±30 VDC, independent of polarity

10.1.4 Output

Output signal	*PROFIBUS DP interface:* ■ PROFIBUS DP in accordance with IEC 61158, galvanically isolated ■ Profile Version 3.0 ■ Data transmission rate: 9.6 kBaud to 12 MBaud ■ Automatic data transmission rate recognition ■ Signal coding: NRZ code ■ Bus address can be configured via miniature switches, via the local display (optional) or operating program

PROFIBUS PA interface:

- PROFIBUS PA in accordance with IEC 61158 (MBP), galvanically isolated
- Profile Version 3.0
- Data transmission rate: 31.25 kBaud
- Current consumption: 11 mA
- Permitted supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Signal coding: Manchester II
- Bus address can be configured via miniature switches, via the local display (optional) or operating program

Current output

Active/passive selectable, galvanically isolated, time constant selectable (0.05 to 100 s), Full scale value adjustable, temperature coefficient typ. 0.005% o.f.s./°C, resolution: 0.5 µA

- Active: 0/4 to 20 mA, $R_L < 700\ \Omega$
- Passive: 4 to 20 mA; supply voltage V_S 18 to 30 V DC; $R_i \geq 150\ \Omega$

Pulse/frequency output:

Active/passive selectable, galvanically isolated

- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), $R_L > 100\ \Omega$
- Passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2 to 10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

Signal on alarm

PROFIBUS DP/PA

Status and alarm messages in accordance with PROFIBUS Profile Version 3.0

Current output:

Failsafe mode selectable (for example NAMUR recommendation NE 43)

Pulse/frequency output:

Failsafe mode selectable

Relay output:

De-energized by fault or power supply failure

10.1.5 Power supply

Electrical connections

→ 📄 25 ff.

Supply voltage

85 to 260 V AC, 45 to 65 Hz
20 to 55 V AC, 45 to 65 Hz
16 to 62 V DC

Measuring sensors are powered by the transmitter.

Cable entry

Power supply and signal cables (inputs/outputs):
- Cable entry M20 × 1.5 (8 to 12 mm, 0.31 to 0.47 in)
- Cable gland for cables with Ø 6 to 12 mm (Ø 0.24 to 0.47 in)
- Thread for cable entries, ½" NPT, G ½"

Sensor cable connection (→ 🔲 18 on → 📄 31):
A special cable gland makes it possible to guide both sensor cables (per channel) into the connection compartment at the same time
- Threaded adapter 1/2" NPT, G 1/2"
- Thread for cable entries, ½" NPT, G ½"

Cable specifications

Only use the connecting cables supplied by Endress+Hauser.

Different versions of the connecting cables are available → 📄 98 ff.

Prosonic Flow W

- Cable material made of PVC (standard) or PTFE (for higher temperatures)
- Cable length: 5 to 60 m (16.4 to 196.8 ft)

✎ Note!
To ensure correct measuring results, route the connecting cable well clear of electrical machines and switching elements.

Power consumption

AC: < 18 VA (incl. sensor)
DC: < 10 W (incl. sensor)

Switch-on current:
- max. 13.5 A (< 50 ms) at 24 V DC
- max. 3 A (< 5 ms) at 260 V AC

Power supply failure

Lasting min. 1 power cycle:
EEPROM and T-DAT save measuring system data if the power supply fails

Potential equalization

For potential equalization, no special measures are necessary. With regard to devices suitable for potentially explosive atmospheres, please refer to the information in the Ex-specific supplementary documentation.

10.1.6 Performance characteristics

Reference operating conditions

- Fluid temperature: +20 to +30 °C
- Ambient temperature: +22 °C ± 2 K
- Warm-up period: 30 minutes
- Sensors and transmitter are grounded.
- The measuring sensors are correctly installed.

Maximum measured error

For flow velocities of > 0.3m/s (1 ft/s) and a Reynolds number of > 10000, the system accuracy is:

Nominal diameter	Guaranteed error limits of the device	Report
DN 300 to 2000 (12 to 80")	±0.5 % o.r. ± 3 mm/s	Factory measurement report

o.r. = of reading

Note!
The Prosonic Flow 93 C Inline sensor is also available without factory flow calibration.
The error limits without calibration are ±1.5 % o.r. ± 3 mm/s

Repeatability

±0.3 % for flow velocities > 0.3 m/s (1 ft/s)

10.1.7 Operating conditions: installation

Installation instructions

Any orientation (vertical, horizontal)
Restrictions and other installation instructions → 13 ff.

Inlet and outlet run

Version → 15

Length of connecting cable

Shielded cables are available in the following lengths:
5 m (16.4 ft), 10 m (32.8 ft), 15 m (49.2 ft) and 30 m (98.4 ft)
Route the cables well clear of electrical machines and switching elements.

10.1.8 Operating conditions: environment

Ambient temperature range

- Prosonic Flow 93 transmitter:
  –20 to +60 °C (–4 to +140 °F)
- Measuring tube Prosonic Flow C with measuring sensors Prosonic Flow W:
  –10 to +80 °C (+14 to +176 °F)
- PVC sensor cable:
  –20 to +70 °C (–4 to +158 °F)

Note!
- Install the transmitter in a shady location.
  Avoid direct sunlight, particularly in warm climatic regions.
- At ambient temperatures below –20 °C (–4 °F) the readability of the display may be impaired.
- In the case of heated pipes, or pipes with cold fluids, it is permitted to completely insulate the measuring tube with the mounted ultrasonic sensors.

Storage temperature

The storage temperature corresponds to the ambient temperature range of the transmitter, the measuring tube, the sensors and the corresponding sensor cable → 120.

Degree of protection

- Prosonic Flow 93C transmitter:
  IP 67 (NEMA 4X)
- Prosonic Flow W flow sensors:
  IP 68 (NEMA 6P)

Shock resistance

Following IEC 68–2–31

Electromagnetic compatibility (EMC)

In accordance with IEC/EN 61326 and NAMUR Recommendation NE 21

10.1.9 Operating conditions: process

Medium temperature range	Measuring tube Prosonic Flow C with measuring sensors Prosonic Flow W: –10 to +80 °C (+14 to +176 °F)  Note! Drinking Water Approval: 0 to +60 °C (+32 to +140 °F)
Limiting medium pressure range (nominal pressure)	Perfect measurement requires that the static fluid pressure is higher than vapor pressure. The maximum nominal pressure is PN 16 (16 bar / 232 psi).
Pressure loss	There is no pressure loss. Pressure loss occurs if adapters are used upstream and downstream of the device. The corresponding values can be taken from the chart → 16.

10.1.10 Mechanical construction

Design / dimensions	The dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document on the device in question. This can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided on → 117.

Weight (SI units)

Transmitter wall-mount housing: 6.0 kg

Nominal diameter		Measuring pipe incl. sensors				
[mm]	[inch]	DIN PN 6	DIN PN 10	DIN PN 16	ANSI Class 150	AWWA Class D
300	12"	–	41.8	59.6	77.2	–
350	14"	–	54.7	70.1	111.2	–
400	16"	–	66.4	90.3	139.6	–
–	18"	–	–	–	162.7	–
500	20"	–	96.8	145.9	197.8	–
600	24"	–	120.4	196.6	287.9	–
700	28"	–	183.6	251.3	–	229.9
–	30"	–	–	–	–	265.1
800	32"	–	245.0	327.0	–	323.9
900	36"	–	313.7	456.3	–	455.6
1000	40"	–	379.0	587.3	–	552.6
–	42"	–	–	–	–	626.1
1200	48"	434.6	678.6	941.7	–	894.7
–	54"	–	–	–	–	1280.2
1400	–	569.2	907.6	1267.6	–	–
–	60"	–	–	–	–	1584.5
1600	–	818.7	1381.4	2012.0	–	–
–	66"	–	–	–	–	2268.0
1800	72"	993.5	1726.7	2608.2	–	2707.0
2000	78"	1508.2	2393.6	3601.3	–	3073.9

Weight information valid for standard pressure ratings and without packaging material.
All weight information in [kg]

Weight (US units)

Transmitter wall-mount housing: 13.2 lbs

Nominal diameter		Measuring pipe incl. sensors				
[mm]	[inch]	DIN PN 6	DIN PN 10	DIN PN 16	ANSI Class 150	AWWA Class D
300	12"	–	92	131	170	–
350	14"	–	121	155	245	–
400	16"	–	146	199	308	–
–	18"	–	–	–	359	–
500	20"	–	213	322	436	–
600	24"	–	265	434	635	–
700	28"	–	405	554	–	507
–	30"	–	–	–	–	585
800	32"	–	540	721	–	714
900	36"	–	692	1006	–	1005
1000	40"	–	836	1295	–	1218
–	42"	–	–	–	–	1381
1200	48"	958	1496	2076	–	1973
–	54"	–	–	–	–	2823
1400	–	1255	2001	2795	–	–
–	60"	–	–	–	–	3494
1600	–	1805	3046	4436	–	–
–	66"	–	–	–	–	5001
1800	72"	2191	3807	5751	–	5969
2000	78"	3326	5278	7941	–	6778

Weight information valid for standard pressure ratings and without packaging material.
All weight information in [lbs]

Materials

Housing of transmitter 93 (wall-mount housing):

Powder-coated die-cast aluminum

Standard names of materials:	DIN 17660	UNS
Prosonic Flow C measuring tube	ST 37.2 (carbon steel)	
Standard sensor cable – Cable connector (nickel-plated brass) – Cable sheath	 2.0401 PVC	 C38500 PVC
	DIN 17440	AISI
Sensor housing W	1.4404	316L
Weld-in parts for W sensors	1.4404	316L

10.1.11 Human interface

Display elements	■ Liquid crystal display: illuminated, four lines each with 16 characters ■ Custom configuration for presenting different measured values and status variables ■ 3 totalizers ■ At ambient temperatures below –20 °C (–4 °F) the readability of the display may be impaired.
Operating elements	■ Local operation with three optical sensor keys (⊟/⊞/E) ■ Application-specific Quick Setup menus for straightforward commissioning
Language groups	Language groups available for operation in different countries: ■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese ■ Eastern Europe/Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech. ■ South and Eastern Asia (SEA): English, Japanese, Indonesian ■ China (CN): English, Chinese Note! You can change the language group via the operating program "FieldCare".
Remote operation	Operation via PROFIBUS DP or PROFIBUS PA

10.1.12 Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-Tick mark	The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	Information on the currently available Ex-rated versions (ATEX, FM, CSA, etc.) can be supplied by your Endress+Hauser Sales Center on request. All information relevant to explosion protection is available in separate documents that you can order as necessary.
PROFIBUS DP/PA certification	The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications: ■ Certified in accordance with PROFIBUS Profile Version 3.0 (device certification number: available on request) ■ The measuring device can also be operated with certified devices of other manufacturers (interoperability).

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010–1
  Safety requirements for electrical equipment for measurement, control and laboratory use
- IEC/EN 61326
  "Emission in accordance with Class A requirements".
  Electromagnetic compatibility (EMC requirements).
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

10.1.13 Ordering information

The Endress+Hauser service organization can provide detailed ordering information and information on the order codes on request.

10.1.14 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor → 98.

10.1.15 Documentation

- Flow measurement (FA005)
- Technical Information for Prosonic Flow 93C (TI108D)
- Description of Device Functions for Prosonic Flow 93C PROFIBUS DP/PA (BA090D)
- Ex supplementary documentation (Control–Drawing) for FM, CSA

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System /** *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*

Temperature / *Temperatur*_____ [°F] _____ [°C]
Pressure / *Druck* _____ [psi] _____ [Pa]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits-schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

_____

Address / *Adresse*

_____

_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

_____ (place, date / *Ort, Datum*)

_____ Name, dept./*Abt.* (please print / *bitte Druckschrift*)

_____ Signature / *Unterschrift*

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People for Process Automation

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