


PROline prosonic flow 93 Division 1



 Ex documentation for the BA 076D and BA 077D operating instructions according to FACTORY MUTUAL standards

 Ex documentation for the BA 076D and BA 077D operating instructions according to CANADIAN STANDARDS ASSOCIATION



Endress + Hauser

The Power of Know How



PROline prosonic flow 93 Division 1

Ex documentation for the BA 076D and BA 077D operating instructions according to FACTORY MUTUAL standards



Example: **XP / I / 1 / ABCD**

Type of Protection

XP	Explosionproof
IS	Intrinsically Safe Apparatus
AIS	Associated Apparatus with Intrinsically Safe Connections
ANI	Nonincendive Field Wiring Circuit
PX, PY, PZ	Pressurized
APX, APY, APZ	Associated Pressurization Systems/Components
NI	Nonincendive
DIP	Dust-Ignitionproof
S	Special Protection

Class

I	Class I (Gas)
II	Class II (Dust)
III	Class III (Fibre)

Division

1	Division 1
2	Division 2

Group

FM / NEC	Gases, vapours and dusts (Examples)	Min. ignition temperature [μJ]
A	Acetylene, carbon disulfide (Class I)	0.02
B	Hydrogen, ethyl nitrate (Class I)	0.02
C	Ethylene, isoprene (Class I)	0.06
D	Acetone, ethane, benzene, ethanoic acid, gasolines, diesel oil, aircraft fuel, methane, heating oil, crude oil, hexane, ether (Class I)	0.18
E	Metallic powder (Class II)	
F	Coal dust (Class II)	
G	Mill dust (Class II) Textile fibres (Class III)	

Temperature Class

FM 3611	Maximum surface temperature	
T1	842 °F	450 °C
T2	572 °F	300 °C
T2A	536 °F	280 °C
T2B	500 °F	260 °C
T2C	446 °F	230 °C
T2D	419 °F	215 °C
T3	392 °F	200 °C
T3A	356 °F	180 °C
T3B	329 °F	165 °C
T3C	320 °F	160 °C
T4	275 °F	135 °C
T4A	248 °F	120 °C
T5	212 °F	100 °C
T6	185 °F	85 °C

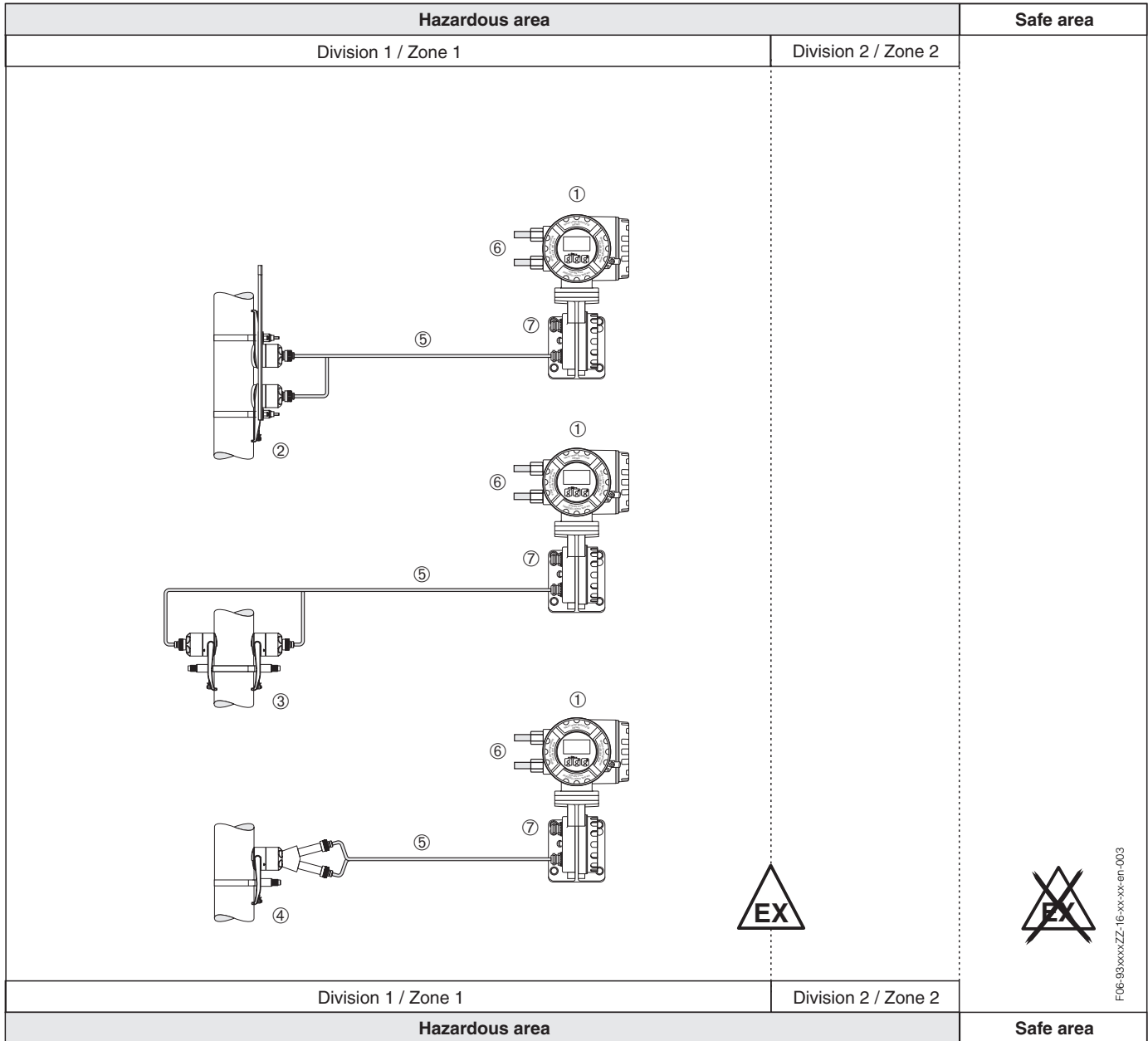
Factory Mutual



Endress + Hauser

The Power of Know How





F06-93xxxZZ-16-xx-xx-en-003

- | | |
|--|---|
| <p>① Ultrasonic transmitter Prosonic Flow 93 PROFIBUS-DP/-PA in:
XP-AIS-DIP / I,II,III / 1 / ABCDEFG / T6</p> <p>Explosionproof Enclosure</p> | <p>③ Sound velocity measuring sensors Prosonic Flow DDU 18 (Clamp On) in:
IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1
NEMA 6P</p> |
| <p>② Flow measuring sensors Prosonic Flow P (Clamp On) in:
IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1
NEMA 6P</p> <p>For ambient and fluid temperature ranges, and temperature class, see Page 3.</p> | <p>④ Wall thickness measuring sensor Prosonic Flow DDU 19 (Clamp On) in:
IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1
NEMA 4X</p> |
| <p>⑤ For safety reasons the max. cable length is 30 m.
For interconnection between transmitter and sensors only prefabricated Endress+Hauser cables shall be used.
Replace defective cables with new cables.</p> | |
| <p>Interconnection of components ① and ⑤ with sensors ②, ③ or ④ as loop concept.</p> | |
| <p>For number references ⑥ and ⑦ see on Page 8.</p> | |

Temperature tables

Prosonic Flow**PA*-A/B*****N***** and Sound velocity measuring sensors DDU 18-A***

at $T_a = 140\text{ }^\circ\text{F}$		Max. medium temperature [$^\circ\text{F}$] in					
		T6	T5	T4	T3	T2	T1
Sensors**PA*-A/B*****N*****	PVC cables	176	176	176	176	176	176
Sensors DDU 18-A***	PVC cables	176	176	176	176	176	176

The minimum medium temperature is $-40\text{ }^\circ\text{F}$

Prosonic Flow**PA*-E/F*****N***** and Sound velocity measuring sensors DDU 18-B***

at $T_a = 140\text{ }^\circ\text{F}$		Max. medium temperature [$^\circ\text{F}$] in					
		T6	T5	T4	T3	T2	T1
Sensors**PA*-E/F*****N*****	PTFE cables	176	203	266	338	338	338
Sensors DDU 18-B***	PTFE cables	176	203	266	338	338	338

The minimum medium temperature is $32\text{ }^\circ\text{F}$

Wall thickness measuring sensor DDU 19-A***

at $T_a = 140\text{ }^\circ\text{F}$		Max. medium temperature [$^\circ\text{F}$] in					
		T6	T5	T4	T3	T2	T1
Sensor DDU 19-A***	PVC or PTFE cables	176	176	176	176	176	176

The minimum medium temperature is $-4\text{ }^\circ\text{F}$

Transmitter Prosonic Flow 93 P**_*****

The Prosonic Flow 93 transmitter has a T6 temperature class rating when installed in the Explosionproof Enclosure for operation at ambient temperatures up to $T_a = 140\text{ }^\circ\text{F}$.

The maximum ambient temperature range is $-4\dots+140\text{ }^\circ\text{F}$.



Note:

At the specified medium temperatures, the equipment is not subjected to temperatures impermissible for the temperature class in question.

Approvals

No. / approval type	Description
J.I. 3010849 (See Page 5 for notes on special conditions)	for the electric flow measuring system Prosonic Flow 93 P PROFIBUS-DP/-PA Identification: see below

Transmitter Prosonic Flow 93 PROFIBUS-DP/-PA					
Prosonic Flow 93 P**-*****N****. <table border="1" style="display: inline-table; vertical-align: middle; margin-left: 10px;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="padding: 2px;">F = PROFIBUS-PA, EEx i FISCO</td> </tr> <tr> <td style="width: 20px; height: 20px;"></td> <td style="padding: 2px;">J = PROFIBUS-DP</td> </tr> </table>		F = PROFIBUS-PA, EEx i FISCO		J = PROFIBUS-DP	
	F = PROFIBUS-PA, EEx i FISCO				
	J = PROFIBUS-DP				
Prosonic Flow 93 P**-*****N****	XP-AIS-DIP / I,II,III / 1 / ABCDEFG / T6				
Flow measuring sensors					
Prosonic Flow P	IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1				
Sound velocity measuring sensors					
Prosonic Flow DDU 18	IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1				
Wall thickness measuring sensor					
Prosonic Flow DDU 19	IS-DIP / I,II,III / 1 / ABCDEFG / T6-T1				

Notified body

The Prosonic Flow measuring system was tested for approval by the following named entity:

FM: Factory Mutual Research

Special conditions



1. Control room equipment shall not use or generate more than 250 V rms.

Caution:

2. Use supply wires suitable for 41 °F above ambient temperature, but at least for 176 °F.
3. The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 3.
4. It is not permissible to connect the service adapter in explosive atmospheres.
5. Install per National Electrical Code. Install intrinsically safe circuits per NEC ANSI/NFPA 70 and ISA RP 12.6 respecting the explosionproof integrity of the enclosure.



Warning:

6. Substitution of components may impair intrinsic safety.
7. The flowmeter must be integrated into the potential equalisation system (see Fig. 2).

General warnings



- Installation, connection to the electricity supply, commissioning and maintenance of the devices must be carried out by qualified specialists trained to work on Ex-rated devices.
- Compliance with national regulations relating to the installation of devices in potentially explosive atmospheres is mandatory, if such regulations exist.
- Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply).
- The housing of the Ex-rated transmitter can be turned in 90° steps. Whereas the non-Ex version has a bayonet adapter, however, the Ex version has a thread. Recesses for centering the worm screw are provided to prevent inadvertent movement of the transmitter housing.
It is permissible to turn the transmitter housing through a maximum of 180° during operation (in either direction), without compromising explosion protection.
After turning the housing the worm screw must be tightened again.
- The screw cap has to be removed before the local display can be turned, and this must be done with the device de-energized (and after a delay of at least 10 minutes following shutdown of the power supply). Be sure that the device is closed properly, before connecting it to power again.

Electrical connections

Power supply connection

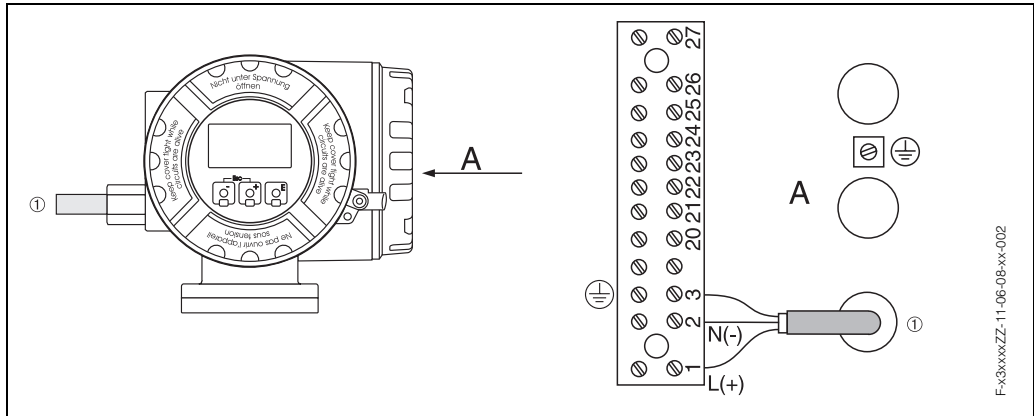


Fig. 1: ① = Power supply cable
A = View A

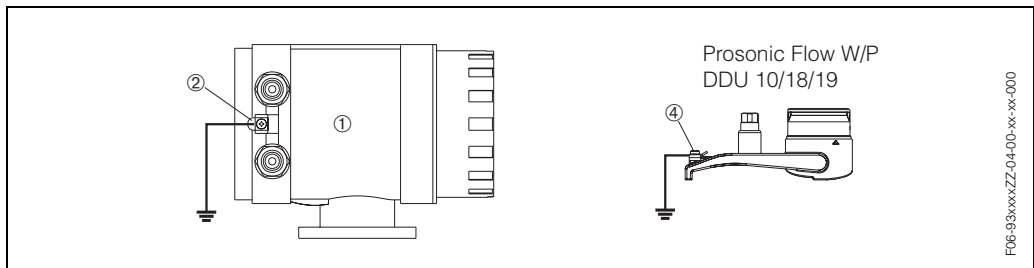


Fig. 2: Ground terminal for potential equalisation



Caution:

- The transmitter ① is to be securely connected to the potential equalization system using the screw terminal ② on the outside of the transmitter housing.
- The sensor holders are to be grounded using the external screw terminal ④. Alternatively, the sensor can be connected to the potential equalization system via the pipeline when a ground connection according to regulations can be assured.

The table below contains the values that are identical for all versions, irrespective of the type code.

Transmitter Prosonic Flow 93

Terminals	1	2	3
	L (+)	N (-)	
Designation	Power supply ①		Protective earth
Functional values	AC: U = 85...260 V or AC: U = 20...55 V or DC: U = 16...62 V Power consumption: 15 VA / 15 W		Caution: Follow ground network requirements for the facility
Intrinsically safe circuit	no		
U _m =	260 V AC		

Input/output circuit

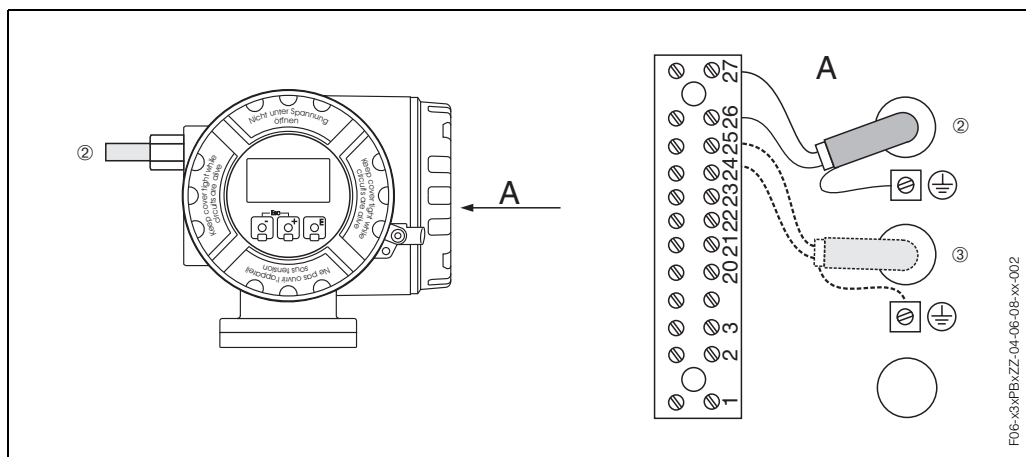


Fig. 3: ② = Bus cable (PROFIBUS-DP/-PA)
 ③ = Power supply cable for external termination (only by PROFIBUS-DP)
 A = View A



Note:

The table below contains the values which depend on the type code (type of device). Always remember to compare the type code in the table with the code on the nameplate of your device.

Transmitter Prosonic Flow 93*_*****F**

Terminals	20	21	22	23	24	25	26	27
	+	-	+	-	+	-	+	-
Designation							PROFIBUS-PA ②	
Functional values: U _B = operating voltage I _B = base current							U _{BUS} = 9...32 V DC I _{BUS} = 11 mA	
Intrinsically safe circuit							yes	
U _i =							30 V DC	
I _i =							500 mA	
P _i =							5.5 W	
L _i =							10 μH	
C _i =							5 nF	

Transmitter Prosonic Flow 93*_*****J**

Terminals	20	21	22	23	24	25	26	27
	+	-	+	-	+5 V	GND	+	-
Designation							PROFIBUS-DP ② (EN 50170 Volume 2, RS 485)	
Functional values: U _B = operating voltage							U = -7 to +12 V	
U _m =							260 V AC	
I _m =							500 mA	

Device fuse



Warning:

Use only fuses of the following types; the fuses are installed on the power supply board:

- Voltage 20...55 V AC / 16...62 V DC:
fuse 2.0 A slow-blow, breaking capacity 1500 A
(Schurter, 0001.2503 or Wickmann, Standard Type 181 2.0 A)
- Voltage 85...260 V AC:
fuse 0.8 A slow-blow, breaking capacity 1500 A
(Schurter, 0001.2507 or Wickmann, Standard Type 181 0.8 A)

Cable entries

For number reference see the figure on Page 2.

- ⑥ *Cable entries for the transmitter terminal compartment (XP version)
power supply / bus cable: (Prosonic Flow 93)
Choice of thread for cable entries, 1/2" NPT.*
- ⑦ *Cable entries for the transmitter terminal compartment
sensor cable connection:
A special cable gland allows you to insert both sensor cables (per channel) into
the connection compartment simultaneously.
Cable gland M20x1.5 for 2 x Ø 4 mm or threaded adapter 1/2" NPT, G 1/2".*

Make sure that the XP cable entries are secured to prevent working loose.

Cable specifications

The sensor cable connection between sensor and transmitter has an EEx i type of protection rating.

- The cables are available in lengths of 5 m (16 ft), 10 m (33 ft), 15 m (49 ft) and 30 m (98 ft).
- You can choose between PTFE and PVC cable materials.



Caution:
Use only the ready-to-use cables supplied by E+H with each sensor pair.

Connecting the sensor connecting cable



Warning:
Switch off the power supply before opening the connection compartment. 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.

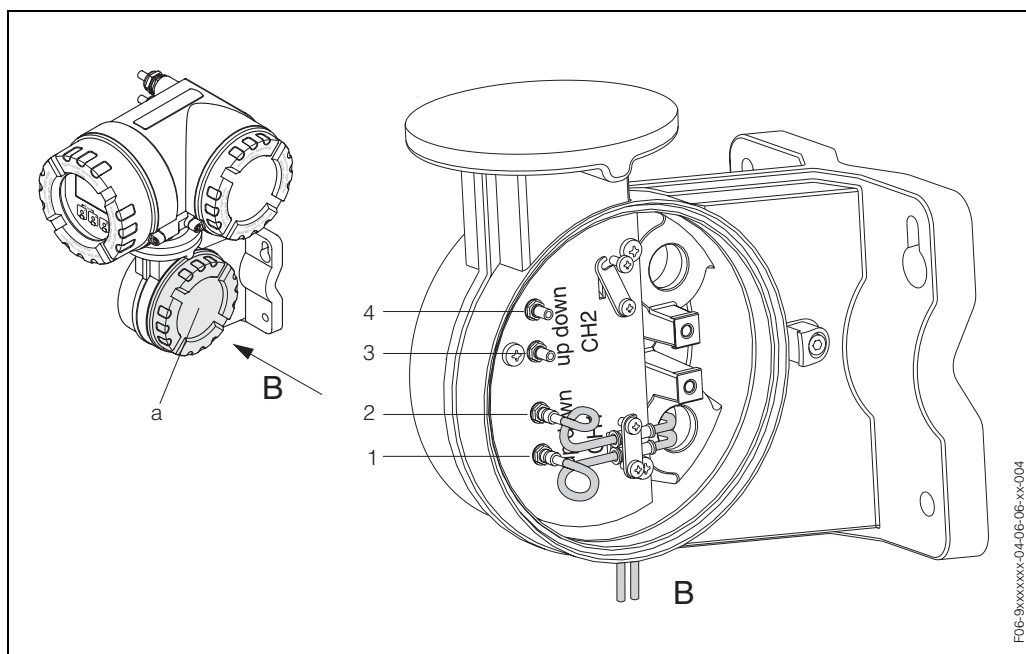


Fig. 4: Connecting the two possible measuring systems (one or two-channel)

- a = view B
- 1 = channel 1 upstream
- 2 = channel 1 downstream
- 3 = channel 2 upstream
- 4 = channel 2 downstream

Procedure:

1. Transmitter: remove cover (a, Fig. 4) from the connection compartment.
2. Remove blank cover for the cable entries for channel 1 and channel 2.
3. Remove special cable entry (supplied with sensors). Run both sensor connecting cables through the cover (b) of the cable gland and into the connection compartment.
4. Position the cable fixing sleeves (c) of the sensor cables exactly next each other (Detail C). Position the ground contact terminals (d) and screw them tight.

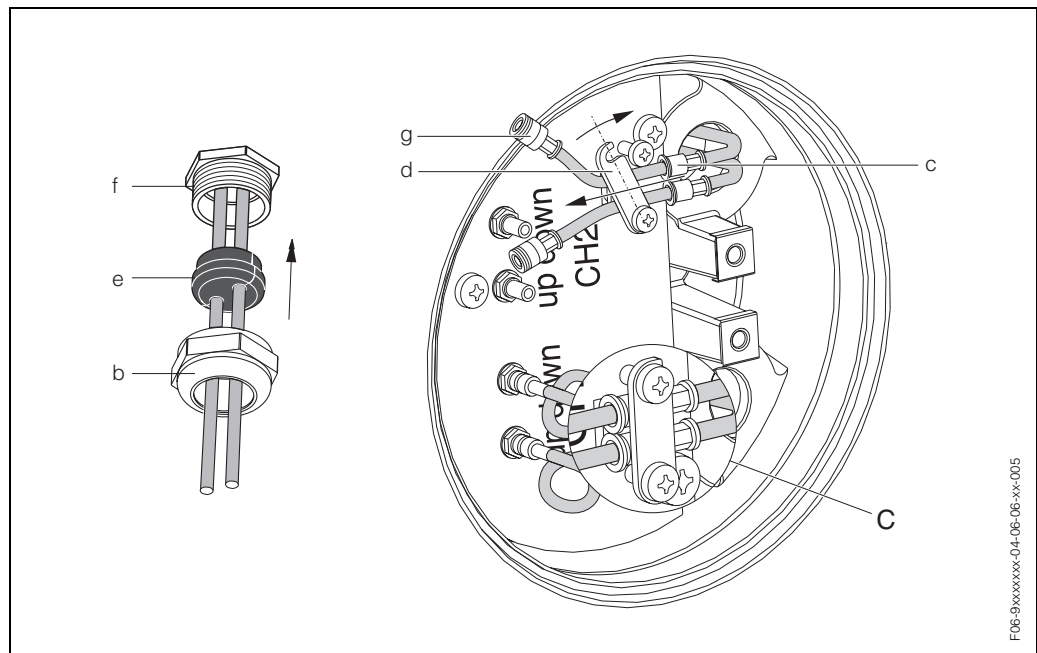


Fig. 5: Connecting the sensor connecting cable

5. Spread the rubber seal (e) along the side slit using a suitable tool (e.g. a large screwdriver) so that both sensor cables are clamped within. Push the rubber seal up into the cable gland bracket (f). Close the cover of the cable gland (b) so that it is tight.
6. Plug in the sensor cable connectors analogue to the arrangement in Fig. 4.
7. Transmitter: secure cover (a) on the connection compartment.

Removing and installing printed circuit boards

Field housing: removing and installing printed circuit boards (Fig. 6)



Warning:

- Danger of explosion! Danger of electrical shock! Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply).
- 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!

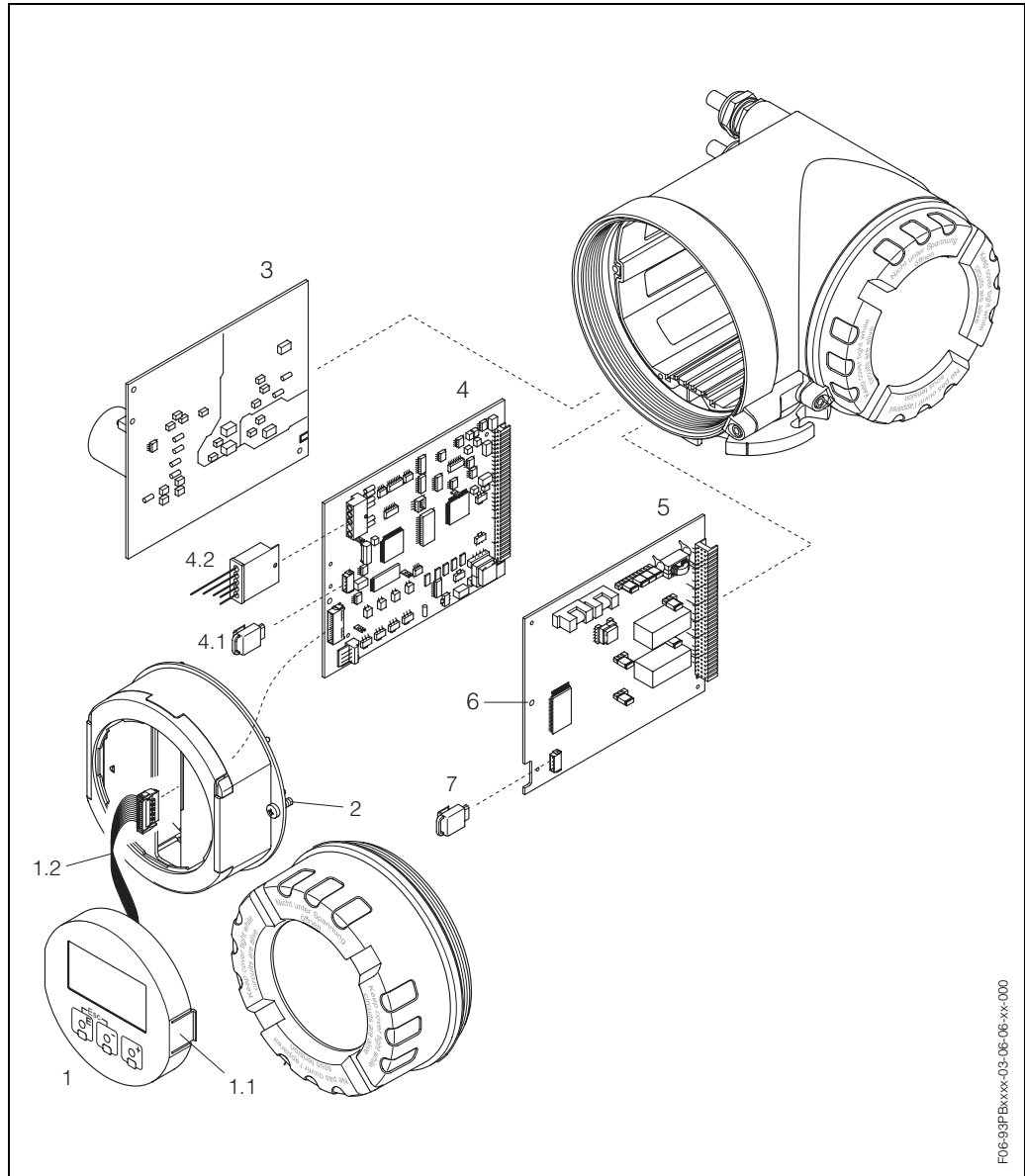
1. Remove the cover of the electronics compartment.
2. Remove the local display (1) as follows:
 - Press in the latches (1.1) at the side and remove the display module.
 - Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
3. Remove the screws and remove the cover (2) from the electronics compartment.
4. Remove power unit board and I/O board (3, 5):
Insert a thin pin into the hole (6) provided for the purpose and pull the board clear of its holder.
5. Remove amplifier board (4):
 - Disconnect the plug of the sensor signal cable (4.2) from the board.
 - Insert a thin pin into the hole (6) provided for the purpose and pull the board clear of its holder.
6. Installation is the reverse of the removal procedure.



Caution:

Use only original Endress+Hauser parts. Only replace printed circuit boards with identical ones.

7. If you cannot maintain the dielectric strength of the device during the work stages, carry out a test according to the manufacturer's specifications.

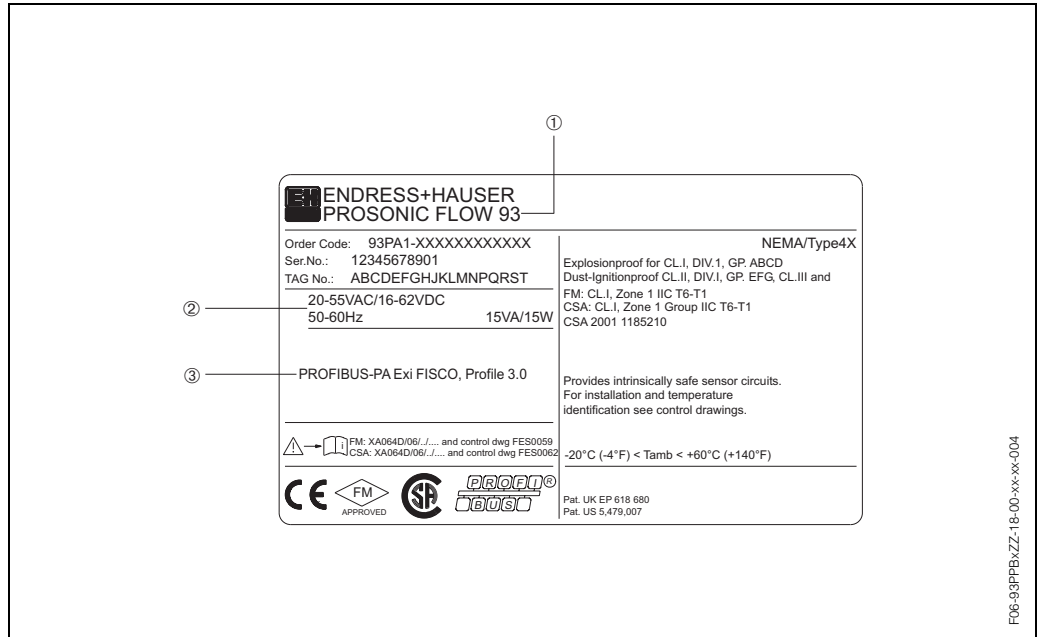


F06-93PB:xxx-03-06-06-xx-000

Fig. 6: Field housing: removing and installing printed circuit boards

- 1 Local display
- 1.1 Latch
- 1.2 Ribbon cable (display module)
- 2 Screws of electronics compartment cover
- 3 Power unit board
- 4 Amplifier board
- 4.1 T-DAT™ (transmitter data memory)
- 4.2 Unplug sensor signal cable
- 5 I/O board (type PROFIBUS-DP/-PA)
- 6 Aperture for installing/removing boards
- 7 F-Chip™ (function chip for optional software)

Exchanging electronics components

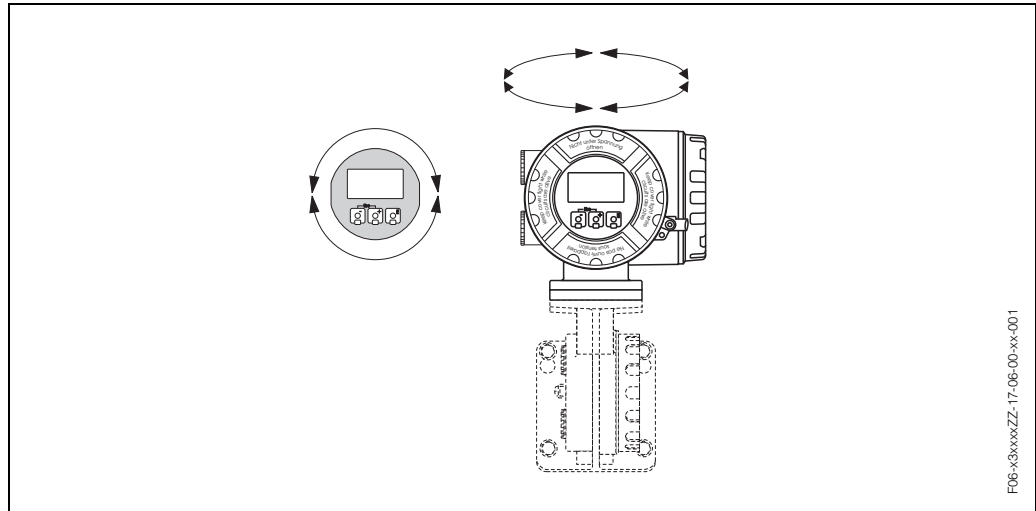


The following information on the nameplate must be compared for the information on the repairs set. Modules must not be exchanged unless this information is identical:

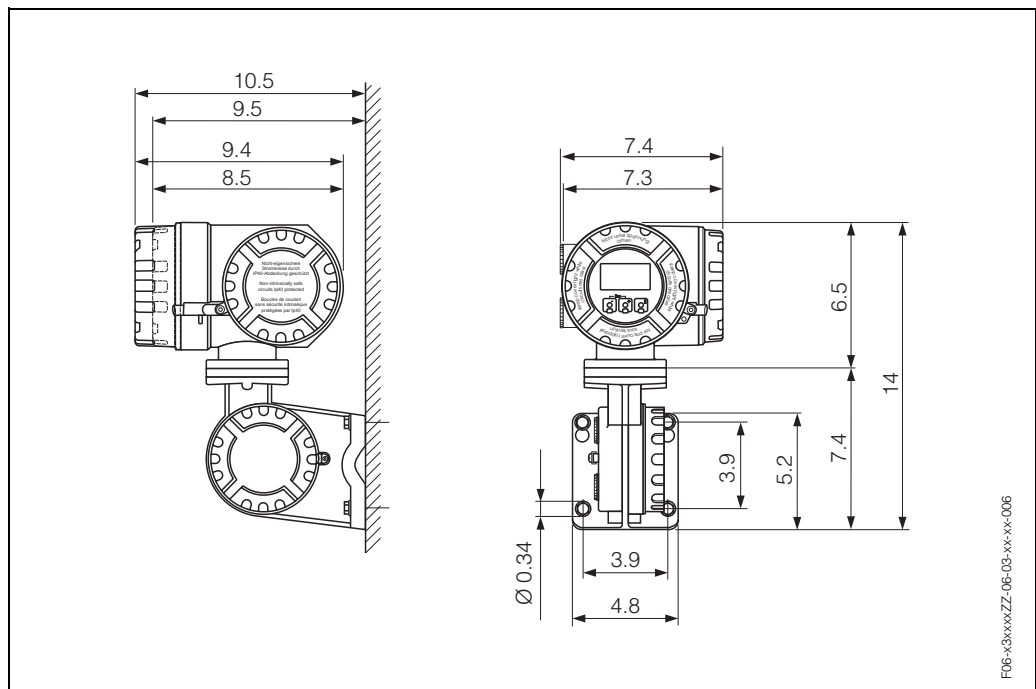
- Power unit board: ① and ②
- Amplifier board: ①
- I/O board: ③

Turning the transmitter housing and the local display

To obtain the optimum orientation of the display of the field housing, it is possible to turn the display or the head of the measuring transmitter housing up to 360°.



Dimensions Prosonic Flow 93 transmitter



Weight

Housing for transmitter:

- Wall-mounted housing: 13.3 lbs
- Field housing: 14.8 lbs

Measuring sensors:

- Flow measuring sensors P incl. mounting rail and tensioning bands: 6.2 lbs
- Sound velocity measuring sensors DDU 18 incl. tensioning bands: 5.3 lbs
- Wall thickness measuring sensor DDU 19 incl. tensioning band: 3.3 lbs

Explanation of the FISCO model (PROFIBUS-PA)

The German Federal Physical-Technical Institute (PTB) has developed the FISCO model which was published in Report PTB-W-53 "Examination on Intrinsic Safety for Field Bus Systems".

The FISCO model makes possible the interconnection of intrinsically safe apparatus and one intrinsically safe associated apparatus, without having to have separate certification for respective connections.

The criteria for the intrinsic safety of an interconnection (bus segment) is given under the following interrelationships:

1. To transmit power and data, the bus system uses the physical configuration defined by IEC 61158-2 (MBP). This is the case for PROFIBUS-PA and the H1 bus.
2. Only one active source is permitted on a bus segment (here the power repeater). All other components work as passive current sinks.
3. The basic current consumption of a field device is at least 10 mA.
4. U_i , I_i and P_i of the bus device $\geq U_o$, I_o and P_o of the associated equipment (bus power supply).
5. Each instrument must fulfill the following requirement: $C_i \leq 5$ nF, $L_i \leq 10$ μ H
6. The permissible line length for EEx ia IIC applications is 1000 m (3280 ft).
7. The permissible spur length for Ex applications is 30 m (98 ft) per spur.
8. The transmission line that is used must conform to the following cable parameters:
Resistor coating: $15 \Omega/\text{km} < R' < 150 \Omega/\text{km}$
Inductance coating: $0.4 \text{ mH}/\text{km} < L' < 1 \text{ mH}/\text{km}$
Capacitance coating: $80 \text{ nF}/\text{km} < C' < 200 \text{ nF}/\text{km}$ (including the shield)
9. The bus segment must be terminated on both ends of the line with a terminal bus resistor. A terminal resistor is integrated into the power repeater so that an external bus terminator is only required on the other end. According to the FISCO model the fieldbus terminator must conform to the following limits:
– $90 \Omega < R < 100 \Omega$
– $0 \mu\text{F} < C < 2.2 \mu\text{F}$



Note:

Cable parameters and length restrictions are respected (see Page 16)

Cable specifications

The sensor cable connection between sensor and transmitter has an IS type of protection rating.



Caution:
Use only the cable sets supplied by E+H.

Cable specifications for PROFIBUS-PA

	Cable type A (reference)	Cable type B
<i>Cable construction</i>	twisted pair, screened	one or more twisted pairs, common screening
<i>Core cross-section (nominal)</i>	0.8 mm ² / AWG 18	0.32 mm ² / AWG 22
<i>Loop resistance (direct current)</i>	44 Ω/km	112 Ω/km
<i>Impedance at 31.25 kHz</i>	100 Ω ±20%	100 Ω ±30%
<i>Attenuation constant at 39 kHz</i>	3 dB/km	5 dB/km
<i>Capacitive unsymmetry</i>	2 nF/km	2 nF/km
<i>Envelope delay distortion (7.9...39 kHz)</i>	1.7 μs/km	–
<i>Degree of voltage of shielding</i>	90%	–
<i>Max. bus segment length (incl. spur lines)</i>	1000 m (3280 ft)	1000 m (3280 ft)
<i>Specific inductance</i>	0.4...1.0 mH/km	
<i>Specific capacitance</i>	80...200 nF/km	
<i>Loop resistance</i>	15...150 Ω/km	
<i>Max. spur length</i>	≤30 m (98 ft)	

Cable specifications for PROFIBUS-DP

Two types of cable are specified for the bus in the EN 50 170 standard. Cable type A can be used for all transmission rates up to 12 Mbit/s. The cable parameters can be taken from the following table:

Cable Type A	
Characteristic impedance	135...165 Ω at a measurement frequency of 3...20 MHz
Cable capacitance	<30 pF/m
Wire size	>0.34 mm ² , equals AWG 22
Cable type	twisted pairs, 1 x 2, 2 x 2 or 1 x 4 conductors
Loop resistance	110 Ω/km
Signal attenuation	max. 9 dB over the entire length of the line segment
Shielding	Copper braided shield or braided shield and foil screen

When setting up the bus, observe the following points:

- The maximum cable length (segment length) of a PROFIBUS-DP system depends on the transmission rate. With PROFIBUS-RS 485 Cable Type A, this value is:

Transmission Rate [kBit/s]	9.6...93.75	187.5	500	1500	300...12000
Cable length [m]	1200	1000	400	200	100

- A maximum of 32 stations are permitted per segment.
- Each segment is terminated at both ends with a terminating resistor.
- The bus length or number of users can be increased by installing a repeater.
- The first and last segments can support a max. of 31 devices. The segments between repeaters can support a max. of 30 stations.
- The maximum distance achievable between two bus users is calculated as:
 $(\text{NUM_REP} + 1) \times \text{segment length}$
 NUM_REP = maximum number of repeaters, which can be placed in series, dependent on the respective repeater.

Example:

According to the manufacturer's information, a maximum of 9 repeaters may be placed in series on a standard line.

The maximum distance between two bus users at a transmission rate of 1.5 MBit/s is thus: $(9 + 1) \times 200 \text{ m} = 2000 \text{ m}$

Stubs (PROFIBUS-DP)

Note the following points:

- Total combined length of all stubs < 6.6 m (at a max. of 1.5 MBit/s)
- At transmission rates >1.5 MBit/s, stubs should not be used.

The line between the cable connector and the bus driver in the field device is called a stub. Our experience with the systems, indicates that you should be quite careful with the length of the stubs when planning your project. Therefore, we recommend that you do not attempt to utilise the full theoretical maximum total combined length of 6.6 m for all stubs at 1.5 MBit/s. The order of the respective field devices makes more of a difference in this case. We recommend that at transmission rates >1.5 MBit/s you avoid using stubs.

- If you must use stubs, do not install terminating resistors on them.

Shielding and grounding (PROFIBUS-DP/-PA)

When planning the shielding and grounding for a field bus 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 will be connected to the field devices' housings, which are usually metal. Since these housings are generally connected to the protective ground conductor, the shield of the bus cable will thus be grounded many times.

This approach, which provides the best electromagnetic compatibility, can be used without restriction in plants with good potential equalisation.

In the case of plants without potential equalisation, a mains frequency (50 Hz) equalising 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 equalising currents on systems lacking potential equalisation, it is therefore advisable to connect the cable shield directly to the building (or protective ground conductor) at only one end and to use capacitive coupling to connect it to all other grounding points.

Setting the terminators (only by PROFIBUS-DP)

Since mismatches in the impedance result in signal reflections on the line and can thus lead to communication errors, it is important to terminate the lines properly.



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 terminator switches are located on the I/O board.

- For baud rates of up to 1.5 MBaud, terminate the last transmitter on the bus by setting the terminator switch SW 1 to: ON – ON – ON – ON.
- If the device is to be operated at over 1.5 MBaud, you can tap the supply voltage for an external terminator from terminals 24 (GND) and 25 (+5 V) (this terminator must be approved for Division 1).

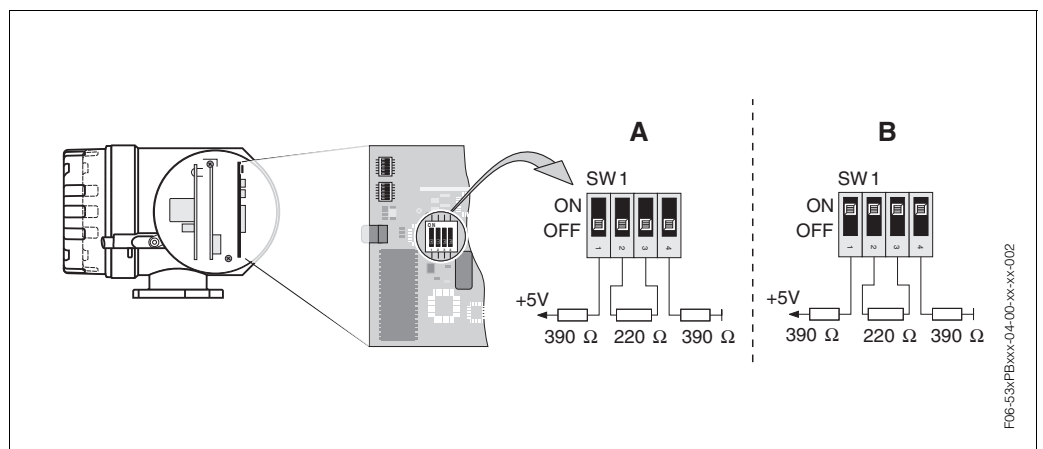


Fig. 7: Setting the terminators (PROFIBUS-DP)

A = Factory setting

B = Setting on the last transmitter

F06-53xPBxx-04-00-xx-xx-002

Potential equalisation with shielding grounded at both ends

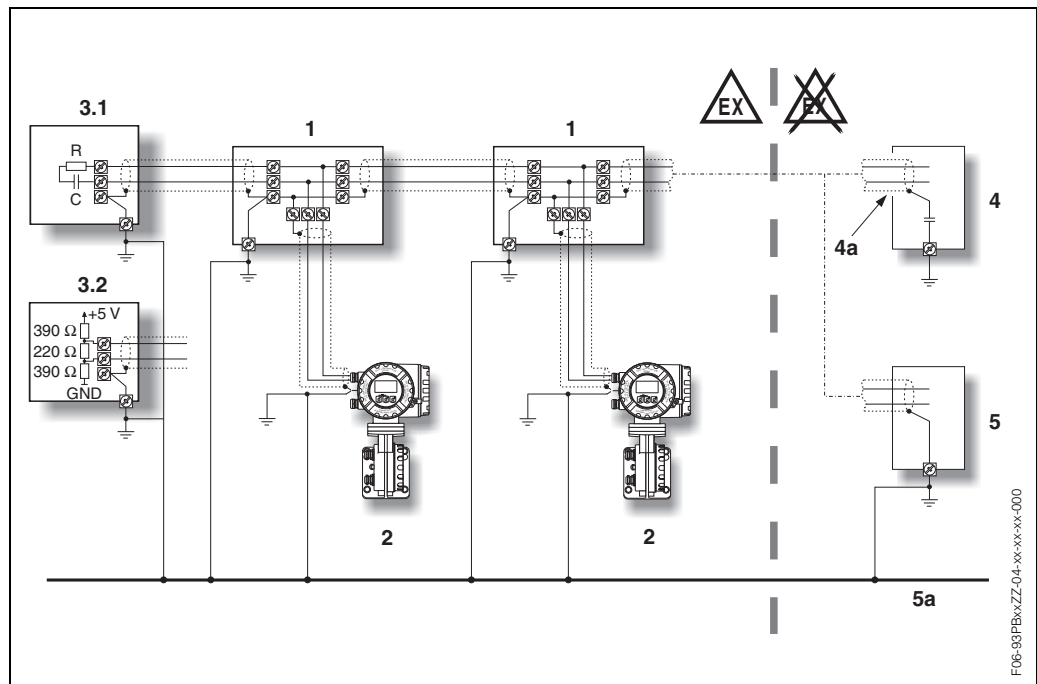


Fig. 8: Examples for connection of potential matching cables

- 1 = distributor/T-box
- 2 = Prosonic Flow 93 bus devices for hazardous area
- 3.1 = bus termination for PROFIBUS-PA: $R = 90...100 \Omega$ $C = 0...2.2 \mu F$
- 3.2 = bus termination for PROFIBUS-DP
- 4 = bus power supply or process control system variant 4a
- 4a = shielding connected via capacitor
- 5 = bus power supply or process control system variant 5a
- 5a = potential equalisation line led out

Variant 4/4a:

With capacitive grounding of the shielding in the safe area the potential equalisation line does not need to be led out of the safe area.

Use small capacitors (e.g. 1 nF, 1500 V dielectric strength, ceramic).

The total capacitance connected at the shielding may not exceed 10 nF.

Variant 5/5a:

Potential equalisation line is led out of the safe area.

Device identification

Prosonic Flow 93 PROFIBUS-DP/-PA transmitter and P sensor

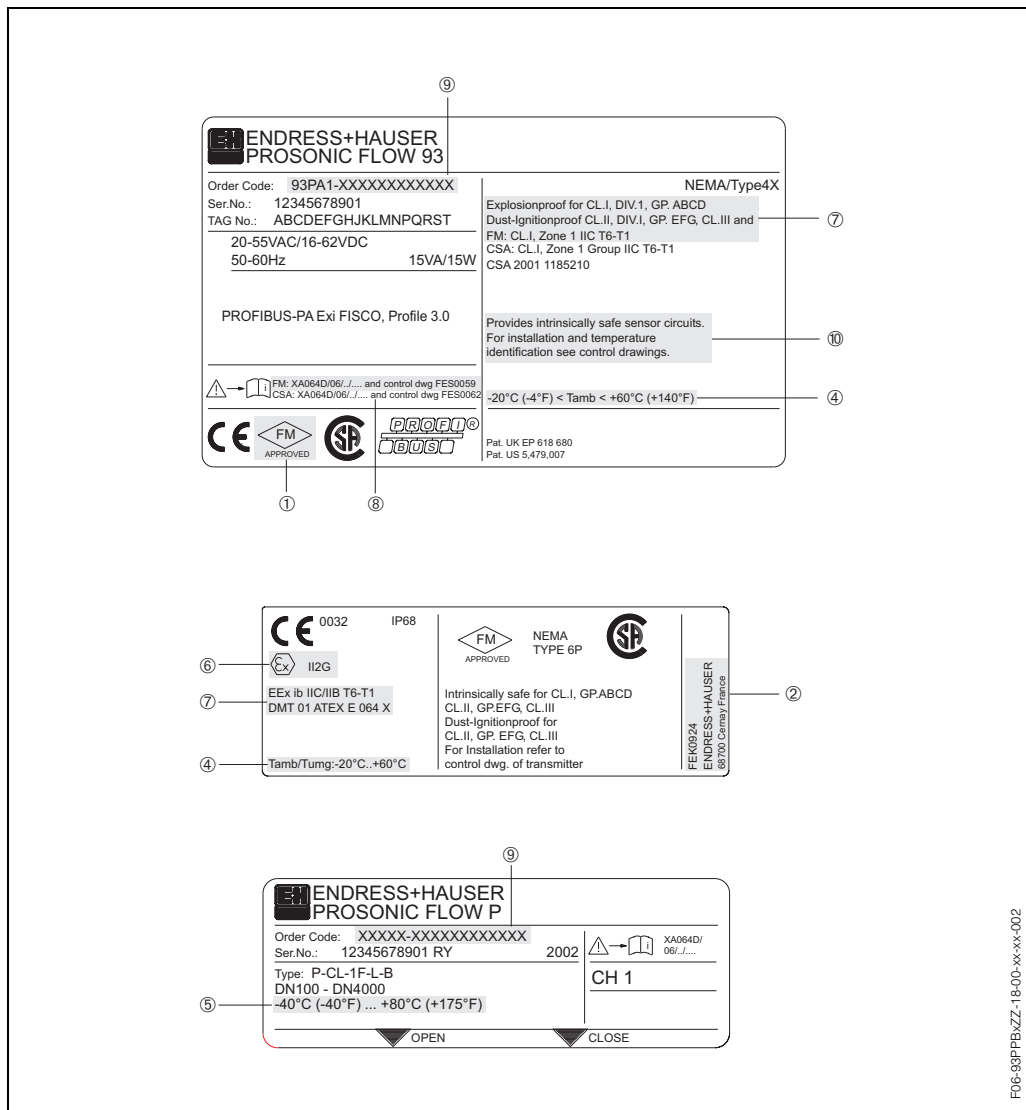


Fig. 9: Nameplate of transmitter and nameplate of sensor (example)

Key to nameplates (Figure 9)

No.	Meaning	No.	Meaning
①	Label of the notified body: Factory Mutual Research	⑥	Device group and device category to directive 94/9/EC
②	Place of manufacture	⑦	Type of protection and explosion group for the Prosonic Flow 93 PROFIBUS-DP/-PA transmitter
③	–	⑧	Applicable Ex documentation
④	Ambient temperature range	⑨	Type code
⑤	Maximum medium temperature	⑩	Warning

Control drawings

Endress+Hauser Reinach hereby declares that the product is in conformity with the requirements of the FACTORY MUTUAL standards.

Hazardous Locations

Class I Division 1 Groups ABCD or Class I Zone 1 Groups IIC and Class II Division 1 Groups EFG and Class III

Temperature table

Sensors	maximum medium temperature in °C									
	T6	T5	T4A	T4	T3C	T3B	T3A	T3	T2	T1
at Ta = 60°C										
Pros. Flow 9*PA* - A*****	80	80	80	80	80	80	80	80	80	80
Pros. Flow 9*PA* - B*****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU 10 - A****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU 10 - C****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU18-A***	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU19-A***	80	80	80	80	80	80	80	80	80	80
at Ta = 60°C										
Pros. Flow 9*PA* - E*****	80	95	115	130	155	160	170	170	170	170
Pros. Flow 9*PA* - F*****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU 10 - B****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU 10 - D****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU18-B***	80	95	115	130	155	160	170	170	170	170

Notes:

- Control room equipment shall not use or generate more than 250 V rms.
- Install per NEC ANSI/NFPA 70. Install all intrinsically safe I/O circuits per NEC and ISA RP 12.6 respecting the Explosionproof Integrity of the enclosure.
- Sensor circuits may be installed as intrinsically safe wiring per ISA RP 12.6 or in conduit in accordance with the NEC.
- Caution: Use supply wires suitable for 5 °C above ambient temperature, but at least for 80 °C / 176°F.
- Class II Group G: The surface temperature of the apparatus cannot exceed 165 °C / 329°F. The user must limit the process temperature for Group G to 160°C.
- Cable Type for all Sensors: Use only prefabricated Endress+Hauser Cable. For reasons of safety the maximum allowed cable length is 30 m per sensor.

Communication modules , I/O options

Communication options	Control Drawings
I/O option = F, H, J	see FES0059-0001 A
I/O option = G, K	see FES0059-0002 A
I/O option = S, T	see FES0059-0004 A

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

Keine Änderungen ohne vorherige Factory Mutual Genehmigung

Aenderungen:	A 04.03.02/MDI	F	G	H	I	J	K	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersteller: FES / ID 1102 FILE: M:\ZEICHNUNG\Fes0059\20304c.doc
<p>FM Control Drawing Class I Div. 1 Class I Zone 1</p> <p>PROSONIC FLOW 9 . P</p>								<p>Masstab</p> <p>Gezeichnet 09.03.01 UD</p> <p>Geprüft</p> <p>Ex-geprüft 04.03.02 MDI</p> <p>Gesehen</p>	
<p>Flowtec AG, Kaeggenstrasse 7, CH-4153 Reinach BL1, Postfach</p>								<p>FES0059 A</p>	

HAZARDOUS LOCATIONS

Cl. I Div. 1 Groups A,B,C,D
Cl. I Zone 1 Group IIC
Cl. I Div. 2 Group A,B,C,D
Cl. I Zone 2 Group IIC
Cl. II, III Div. 1 Group E,F,G

NON HAZARDOUS LOCATIONS

Notes:

Intrinsically safe signal output:

- Wire intrinsically safe circuits per ISA RP 12.6, or in conduit per NEC ANSI/NFPA 70.
- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.**
- Control room equipment may not use or generate more than 250 V rms.

Type: PROSONIC FLOW 9*.....F**
Terminals: 26 (+), 27 (-) (Profibus PA);
Passive intrinsically safe PROFIBUS PA circuit:
For connecting the intrinsically safe circuit (PROFIBUS PA) according to the FISCO-CONCEPT see FES 0059-0003.

Keine Änderungen ohne vorherige Factory Mutual Genehmigung

Nonintrinsically safe signal output:

- Install all intrinsically safe circuits per NEC ANSI/NFPA 70 and ISA RP 12.6 respecting the Explosionproof Integrity of the enclosure
- WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 1.**
- Control room equipment may not use or generate over 250 Vrms.

Type: PROSONIC FLOW 9*.....H**
Terminals 26 (+), 27 (-) (PROFIBUS PA)
V ≤ 32 V, I = 10 mA

Type: PROSONIC FLOW 9*.....J**
Terminals 24 (+), 25 (GND), 26 (DPA), 27 (DPB) (PROFIBUS DP)
Terminals: +5V, GND, DPA, DPB
V = 5 V, I = 100 mA

Aenderungen:	A 04.03.02/MDI	F	G	H	I	J	K	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersetzt durch: Ersteller: FES / ID 1102 FILE: M:\ZEICHNUNG\Fes0059\20304c.doc
<p>FM Control Drawing Class I. Div. 1 / Zone 1 PROSONIC FLOW 9* PROFIBUS PA / IS installation PROFIBUS PA / DP non-IS installation</p>								<p>Masstab</p> <p>Gezeichnet 09.03.01 UD</p> <p>Geprüft</p> <p>Ex-geprüft 04.03.02 MDI</p> <p>Gesehen</p>	
<p>Flowtec AG, Kaeggenstrasse 7, CH-4153 Reinach BL1, Postfach</p>								<p>FES0059-0001 A</p>	

FISCO CONCEPT
 The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specially examined in such combination. The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}), and the power (P_i or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_0 , V_{oc} or V_t), the current (I_0 , I_{sc} or I_t) and the power (P_0 or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 μ H respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The voltage U_0 (or V_{oc} or V_t) of the associated apparatus is limited to a range of 14V to 24V.d.c. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except a leakage current of 50 μ A for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameter in the following range:

Loop Resistance R' :	15...150 Ohm/km
Inductance per unit length L' :	0.4...1 mH/km
Capacitance per unit length C' :	80...200 nF

$C' = C'$ line/line + 0.5 C' line/screen, if both lines are floating, or
 $C' = C'$ line/line + C' line/screen, if the screen is connected to one line

Length of trunk cable: \leq 1000 m
 Length of spur cable: \leq 30 m
 Length of splice: \leq 1 m

At each end of the trunk cable an approved infallible line termination with following parameters is suitable:

$R = 90...100$ Ohm	$C = 0...2.2$ μ F
--------------------	-----------------------

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive apparatus connected to the bus segment is not limited due to I. S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of trunk and all spur cables), the inductance and the capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:
Intrinsically safe Class I, Div. 1, Groups A,B,C,D

- Approved associated apparatus must be installed in accordance with manufacturers instructions.
- FM approved associated apparatus must meet the following parameters:
 U_0 or V_{oc} or $V_t \leq U_i$ (V_{max}) and I_0 or I_{sc} or $I_t \leq I_i$ (I_{max}) and P_0 or $P_{max} \leq P_i$ (P_{max})
- The maximum non-hazardous area voltage must not exceed 250V
- The installation must be in accordance with the National Electrical Code NFPA 70, and ANSI/ISA-Rp 12.6. (except chapter 5).
- Multiple earthing of screen is allowed only, if high integrity equipotential system is realized between the points of bonding (see drawing No. FES 0014).
- Caution: Use only supply wires suitable for 5°C above surrounding temperature.
- Warning: Substitution of components may impair intrinsic safety.
- The polarity for connection PA+ (26) and PA- (27) is of no importance due to an internal rectifier.

HAZARDOUS (CLASSIFIED) LOCATION
 Class I, Division 1, Groups A,B,C,D
 Class II, Division 1, Groups E,F,G
 Class III, Division 1

NONHAZARDOUS LOCATION

PROS. FLOW 9***.....F/G
 Terminal 26 (+) Terminal 27(-)
 (FISCO-Model)

U_i (V_{max}) = 30 V	$C_i \leq 5$ nF
I_i (I_{max}) = 500 mA	$L_i \leq 10$ μ H
P_i (P_{max}) = 5.5 W	

Leakage current: ≤ 50 μ A
 Apparatus provides galvanic isolation up to 250V rms between fieldbus circuit and any other circuit
 Temperature Classification: **T6**
 Max. ambient Temperature: 60°C / 140°F

Any FM Approved Intrinsic Safe Apparatus suitable for FISCO Concept

Any FM Approved Termination with
 $R = 90...100$ Ω
 $C = 0...2.2$ μ F

Keine Änderungen ohne vorherige Factory Mutual Genehmigung

A	01.03.02/MDI	F	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersetzt durch: Erstellt: FES / ID 1102 File: MZEICHNG\Fes0059\020304c.doc
B		S		Gezeichnet: 09.03.01 UD
C		H		Geprüft: 04.03.02 MDI
D		J		Ex-geprüft: UD
E		K		Gesehen: UD

FM Control Drawing Class I, Div. 1/ Zone 1 PROSONIC FLOW 9* Intrinsically safe PROFIBUS PA FISCO-Concept

Massstab: Gezeichnet: 09.03.01 UD
 Geprüft: 04.03.02 MDI
 Gesehen: UD

FES0059-0003 A

Flowtec AG, Kaspernstrasse 7, CH-4153 Rainach BL 1, Postfach

HAZARDOUS (CLASSIFIED) LOCATION | **NON HAZARDOUS LOCATION**

Variation 1
 Field termination | T-Box | T-Box | Associated equipment
 Field device | Field device
 Intrinsic Safety Ground

Variation 2
 Field termination | T-Box | T-Box | Associated equipment
 Field device | Field device
 Intrinsic Safety Ground
 Shield isolated

Small capacitors (e.g. 1nF, 1500V, ceramic) to be used
 Capacitance connected to shield should not exceed 10nF in total.

A	F	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersetzt durch: Erstellt für: File: 6162020304\WETTELUNG\FES0014\FES0014.FES.doc
B	S		Gezeichnet: 28.05.99 UD
C	H		Geprüft: 28.05.99 UD
D	J		Ex-geprüft: 28.05.99 UD
E	K		Gesehen: UD

Grounding of screen Variations

FES 0014-F00

Flowtec AG, Kaspernstrasse 7, CH-4153 Rainach BL 1, Postfach

**Supplementary
documentation**

TI 042D/06
TI 056D/06
TI 057D/06

USA

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

Canada

Endress+Hauser Ltd.
Burlington, Ontario
Tel. (905) 681 92 92
Fax. (905) 681 94 44

Instruments International

Endress+Hauser GmbH+Co.
Weil am Rhein
Germany
Tel. (07621) 975-02
Fax. (07621) 975 345



PROline prosonic flow 93 Division 1

**Ex documentation
for the BA 076D and BA 077D operating instructions
according to CANADIAN STANDARDS ASSOCIATION**



Example: **Class I, Division 1, Groups ABCD**

Canadian Standards Association

Class		
I	Class I (Gas)	
II	Class II (Dust)	
III	Class III (Fibre)	

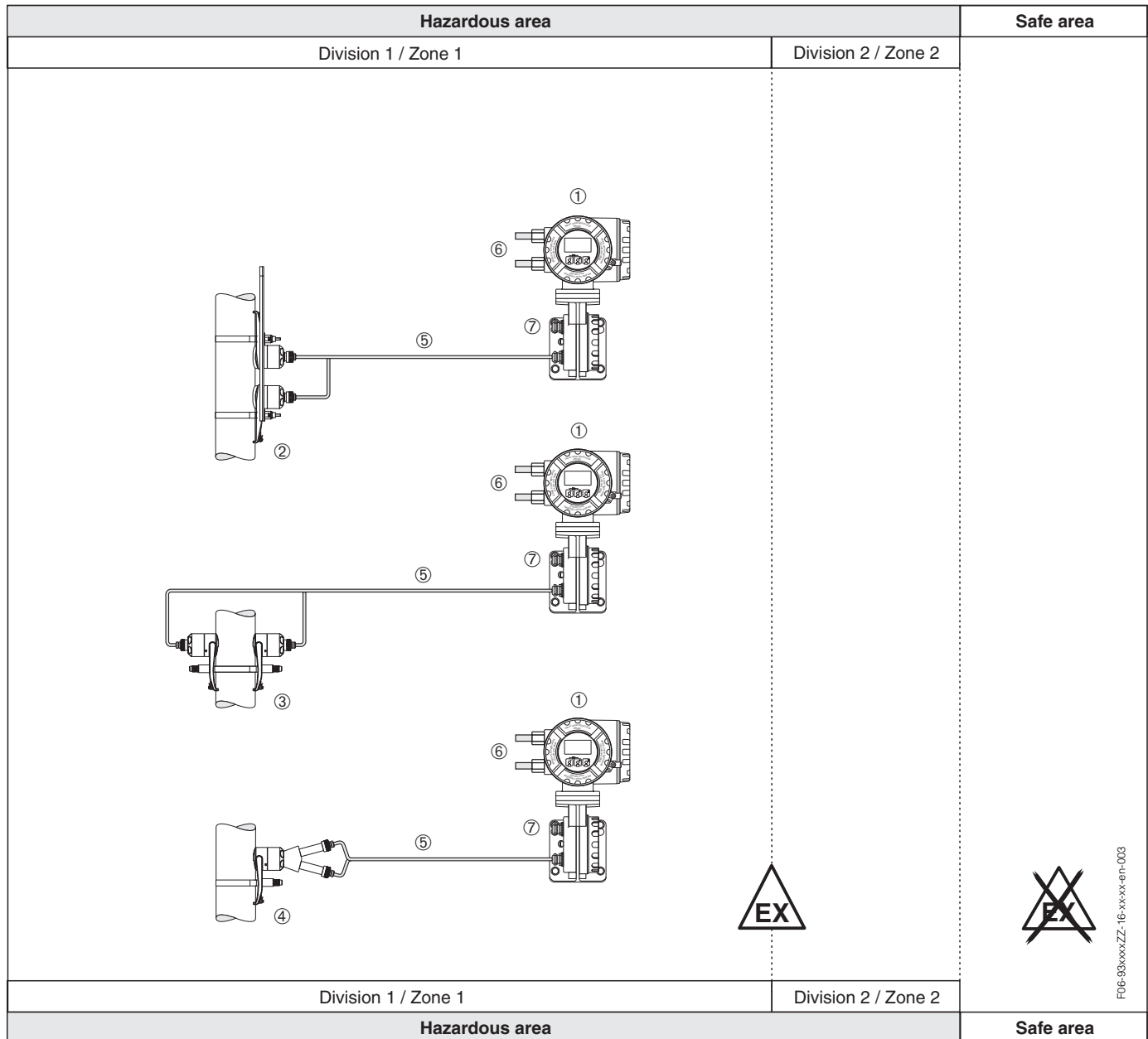
Division	
1	Division 1
2	Division 2

Group		
CSC / NEC	Gases, vapours and dusts (Examples)	Min. ignition temperature [μ J]
A	Acetylene, carbon disulfide (Class I)	0.02
B	Hydrogen, ethyl nitrate (Class I)	0.02
C	Ethylene, isoprene (Class I)	0.06
D	Acetone, ethane, benzene (Class I)	0.18
E	Metallic powder (Class II)	
F	Coal dust (Class II)	
G	Grain dust (Class II)	
	Textile fibres (Class III)	

Type of Protection	
	Explosionproof
	Intrinsically Safe Apparatus
	Associated Apparatus with Intrinsically Safe Connections
	Nonincendive Field Wiring Circuit
	Pressurized
	Associated Pressurization Systems/Components
	Nonincendive
	Dust-Ignitionproof
	Special Protection

Temperature Class		
CSA	Maximum surface temperature	
T1	450 °C	842 °F
T2	300 °C	572 °F
T2A	280 °C	536 °F
T2B	260 °C	500 °F
T2C	230 °C	446 °F
T2D	215 °C	419 °F
T3	200 °C	392 °F
T3A	180 °C	356 °F
T3B	165 °C	329 °F
T3C	160 °C	320 °F
T4	135 °C	275 °F
T4A	120 °C	248 °F
T5	100 °C	212 °F
T6	85 °C	185 °F





F06-93xxxxZZ-16-xx-xx-en-003

- | | |
|---|---|
| <p>① Ultrasonic transmitter Prosonic Flow 93 PROFIBUS-DP/-PA in:
Explosionproof for Class I, Div. 1, GP. ABCD
Dust-Ignitionproof Class II, Div. 1, GP. EFG, Class III</p> <p>Explosionproof Enclosure</p> <p>② Flow measuring sensors Prosonic Flow P (Clamp On) in:
Intrinsically safe for Class I, GP. ABCD
Class II, GP. EFG, Class III
Dust-Ignitionproof for Class II, GP. EFG, Class III
NEMA 6P</p> <p>For ambient and fluid temperature ranges,
and temperature class, see Page 3.</p> <p>Interconnection of components ① and ⑤ with sensors ②, ③ or ④ as loop concept.</p> <p>For number references ⑥ and ⑦ see on Page 8.</p> | <p>③ Sound velocity measuring sensors Prosonic Flow DDU 18 (Clamp On) in:
Intrinsically safe for Class I, GP. ABCD
Class II, GP. EFG; Class III
Dust-Ignitionproof for Class II, GP. EFG, Class III
NEMA 6P</p> <p>④ Wall thickness measuring sensor Prosonic Flow DDU 19 (Clamp On) in:
Intrinsically safe for Class I, GP. ABCD
Class II, GP. EFG, Class III
Dust-Ignitionproof for Class II, GP. EFG, Class III
NEMA 4X</p> <p>⑤ For safety reasons the max. cable length is 30 m.
For interconnection between transmitter and sensors only prefabricated Endress+Hauser cables shall be used.
Replace defective cables with new cables.</p> |
|---|---|

Temperature tables

Prosonic Flow**PA*-A/B*****N***** and Sound velocity measuring sensors DDU 18-A***

at $T_a = 60\text{ °C}$		Max. medium temperature [°C] in					
		T6	T5	T4	T3	T2	T1
Sensors**PA*-A/B*****N*****	PVC cables	80	80	80	80	80	80
Sensors DDU 18-A***	PVC cables	80	80	80	80	80	80

The minimum medium temperature is -40 °C

Prosonic Flow**PA*-E/F*****N***** and Sound velocity measuring sensors DDU 18-B***

at $T_a = 60\text{ °C}$		Max. medium temperature [°C] in					
		T6	T5	T4	T3	T2	T1
Sensors**PA*-E/F*****N*****	PTFE cables	80	95	130	170	170	170
Sensors DDU 18-B***	PTFE cables	80	95	130	170	170	170

The minimum medium temperature is 0 °C

Wall thickness measuring sensor DDU 19-A***

at $T_a = 60\text{ °C}$		Max. medium temperature [°C] in					
		T6	T5	T4	T3	T2	T1
Sensor DDU 19-A***	PVC or PTFE cables	80	80	80	80	80	80

The minimum medium temperature is -20 °C

Transmitter Prosonic Flow 93 P**_*****

The Prosonic Flow 93 transmitter has a T6 temperature class rating when installed in the Explosionproof Enclosure for operation at ambient temperatures up to $T_a = 60\text{ °C}$.

The maximum ambient temperature range is $-20\dots+60\text{ °C}$.



Note:

At the specified medium temperatures, the equipment is not subjected to temperatures impermissible for the temperature class in question.

Approvals

No. / approval type	Description
1185210 (See Page 5 for notes on special conditions)	for the electric flow measuring system Prosonic Flow 93 P PROFIBUS-DP/-PA Identification: see below

Transmitter Prosonic Flow 93 PROFIBUS-DP/-PA	
Prosonic Flow 93 P** - *****N**** T	F = PROFIBUS-PA, EEx i FISCO J = PROFIBUS-DP
Prosonic Flow 93 P** - *****N****	Explosionproof for Class I, Div. 1, GP. ABCD Dust-Ignitionproof Class II, Div. 1, GP. EFG, Class III
Flow measuring sensors	
Prosonic Flow P	Intrinsically safe for Class I, GP. ABCD Class II, GP. EFG, Class III Dust-Ignitionproof for Class II, GP. EFG, Class III
Sound velocity measuring sensors	
Prosonic Flow DDU 18	Intrinsically safe for Class I, GP. ABCD Class II, GP. EFG, Class III Dust-Ignitionproof for Class II, GP. EFG, Class III
Wall thickness measuring sensor	
Prosonic Flow DDU 19	Intrinsically safe for Class I, GP. ABCD Class II, GP. EFG, Class III Dust-Ignitionproof for Class II, GP. EFG, Class III

Notified body

The Prosonic Flow measuring system was tested for approval by the following named entity:

CSA: Canadian Standards Association

Special conditions



1. Control room equipment shall not use or generate more than 250 V rms

Caution:

2. Use supply wires suitable for 5 °C above ambient temperature, but at least for 80 °C.
3. The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 3.
4. It is not permissible to connect the service adapter in explosive atmospheres.
5. Install per Canadian Electrical Code. Install intrinsically safe circuits per CEC and ISA RP 12.6 respecting the explosionproof integrity of the enclosure.



Warning:

6. Substitution of components may impair intrinsic safety.
7. The flowmeter must be integrated into the potential equalisation system (see Fig. 2).

General warnings



- Installation, connection to the electricity supply, commissioning and maintenance of the devices must be carried out by qualified specialists trained to work on Ex-rated devices.
- Compliance with national regulations relating to the installation of devices in potentially explosive atmospheres is mandatory, if such regulations exist.
- Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply).
- The housing of the Ex-rated transmitter can be turned in 90° steps. Whereas the non-Ex version has a bayonet adapter, however, the Ex version has a thread. Recesses for centering the worm screw are provided to prevent inadvertent movement of the transmitter housing.
It is permissible to turn the transmitter housing through a maximum of 180° during operation (in either direction), without compromising explosion protection.
After turning the housing the worm screw must be tightened again.
- The screw cap has to be removed before the local display can be turned, and this must be done with the device de-energized (and after a delay of at least 10 minutes following shutdown of the power supply). Be sure that the device is closed properly, before connecting it to power again.

Electrical connections

Power supply connection

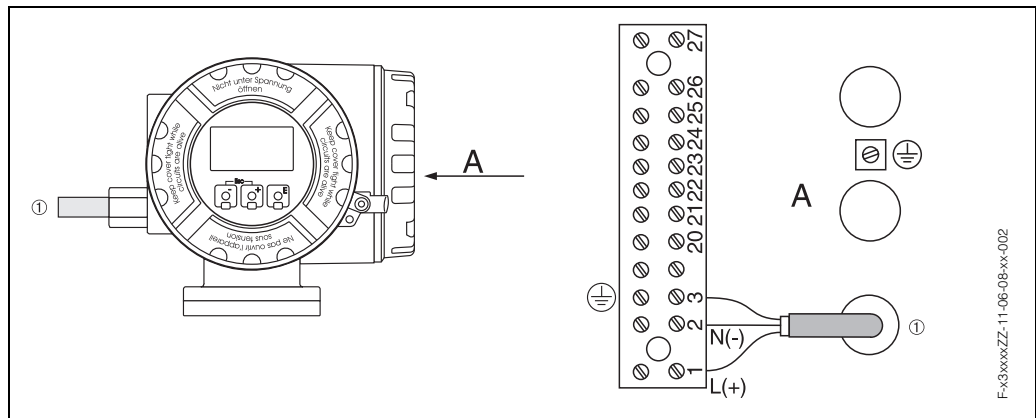


Fig. 1: ① = Power supply cable
A = View A

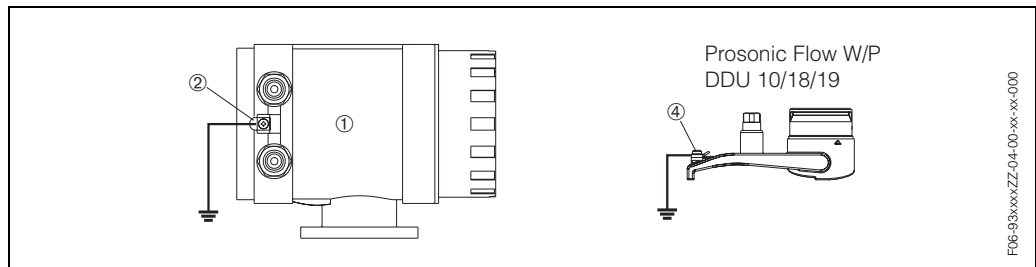


Fig. 2: Ground terminal for potential equalisation



Caution:

- The transmitter ① is to be securely connected to the potential equalization system using the screw terminal ② on the outside of the transmitter housing.
- The sensor holders are to be grounded using the external screw terminal ④. Alternatively, the sensor can be connected to the potential equalization system via the pipeline when a ground connection according to regulations can be assured.

The table below contains the values that are identical for all versions, irrespective of the type code.

Transmitter Prosonic Flow 93

Terminals	1	2	3
	L (+)	N (-)	
Designation	Power supply ①		Protective earth
Functional values	AC: U = 85...260 V or AC: U = 20...55 V or DC: U = 16...62 V Power consumption: 15 VA / 15 W		Caution: Follow ground network requirements for the facility
Intrinsically safe circuit	no		
U _m =	260 V AC		

Input/output circuit

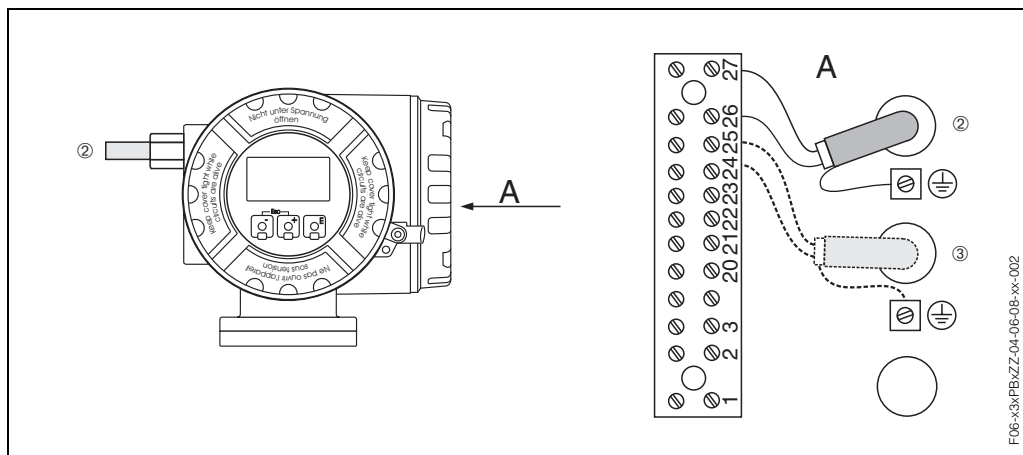


Fig. 3: ② = Bus cable (PROFIBUS-DP/-PA)
 ③ = Power supply cable for external termination (only by PROFIBUS-DP)
 A = View A



Note:

The table below contains the values which depend on the type code (type of device). Always remember to compare the type code in the table with the code on the nameplate of your device.

Transmitter Prosonic Flow 93*_*****F**

Terminals	20	21	22	23	24	25	26	27
	+	-	+	-	+	-	+	-
Designation							PROFIBUS-PA ②	
Functional values: U _B = operating voltage I _B = base current							U _{BUS} = 9...32 V DC I _{BUS} = 11 mA	
Intrinsically safe circuit							yes	
U _i =							30 V DC	
I _i =							500 mA	
P _i =							5.5 W	
L _i =							10 μH	
C _i =							5 nF	

Transmitter Prosonic Flow 93*_*****J**

Terminals	20	21	22	23	24	25	26	27
	+	-	+	-	+5 V	GND	+	-
Designation							PROFIBUS-DP ② (EN 50170 Volume 2, RS 485)	
Functional values: U _B = operating voltage							U = -7 to +12 V	
U _m =							260 V AC	
I _m =							500 mA	

Device fuse



Warning:

Use only fuses of the following types; the fuses are installed on the power supply board:

- Voltage 20...55 V AC / 16...62 V DC:
fuse 2.0 A slow-blow, breaking capacity 1500 A
(Schurter, 0001.2503 or Wickmann, Standard Type 181 2.0 A)
- Voltage 85...260 V AC:
fuse 0.8 A slow-blow, breaking capacity 1500 A
(Schurter, 0001.2507 or Wickmann, Standard Type 181 0.8 A)

Cable entries

For number reference see the figure on Page 2.

- ⑥ *Cable entries for the transmitter terminal compartment (XP version)
power supply / bus cable: (Prosonic Flow 93)
Choice of thread for cable entries, 1/2" NPT.*
- ⑦ *Cable entries for the transmitter terminal compartment
sensor cable connection:
A special cable gland allows you to insert both sensor cables (per channel) into
the connection compartment simultaneously.
Cable gland M20x1.5 for 2 x Ø 4 mm or threaded adapter 1/2" NPT, G 1/2".*

Make sure that the XP cable entries are secured to prevent working loose.

Cable specifications

The sensor cable connection between sensor and transmitter has an EEx i type of protection rating.

- The cables are available in lengths of 5 m, 10 m, 15 m and 30 m.
- You can choose between PTFE and PVC cable materials.



Caution:
Use only the ready-to-use cables supplied by E+H with each sensor pair.

Connecting the sensor connecting cable



Warning:
Switch off the power supply before opening the connection compartment. 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.

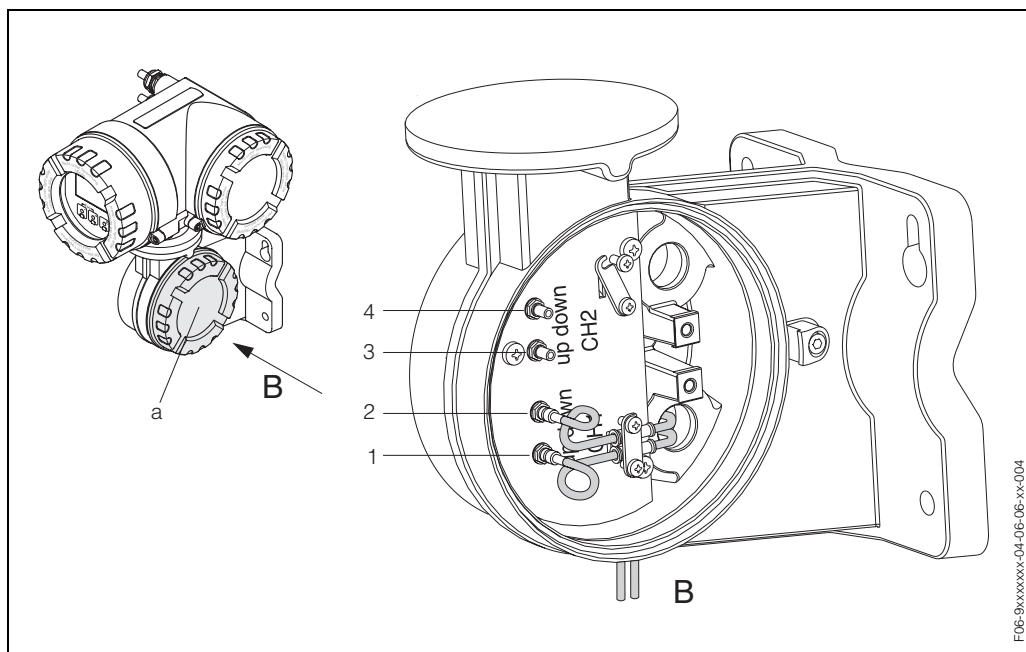


Fig. 4: Connecting the two possible measuring systems (one or two-channel)

- a = view B
- 1 = channel 1 upstream
- 2 = channel 1 downstream
- 3 = channel 2 upstream
- 4 = channel 2 downstream

Procedure:

1. Transmitter: remove cover (a, Fig. 4) from the connection compartment.
2. Remove blank cover for the cable entries for channel 1 and channel 2.
3. Remove special cable entry (supplied with sensors). Run both sensor connecting cables through the cover (b) of the cable gland and into the connection compartment.
4. Position the cable fixing sleeves (c) of the sensor cables exactly next each other (Detail C). Position the ground contact terminals (d) and screw them tight.

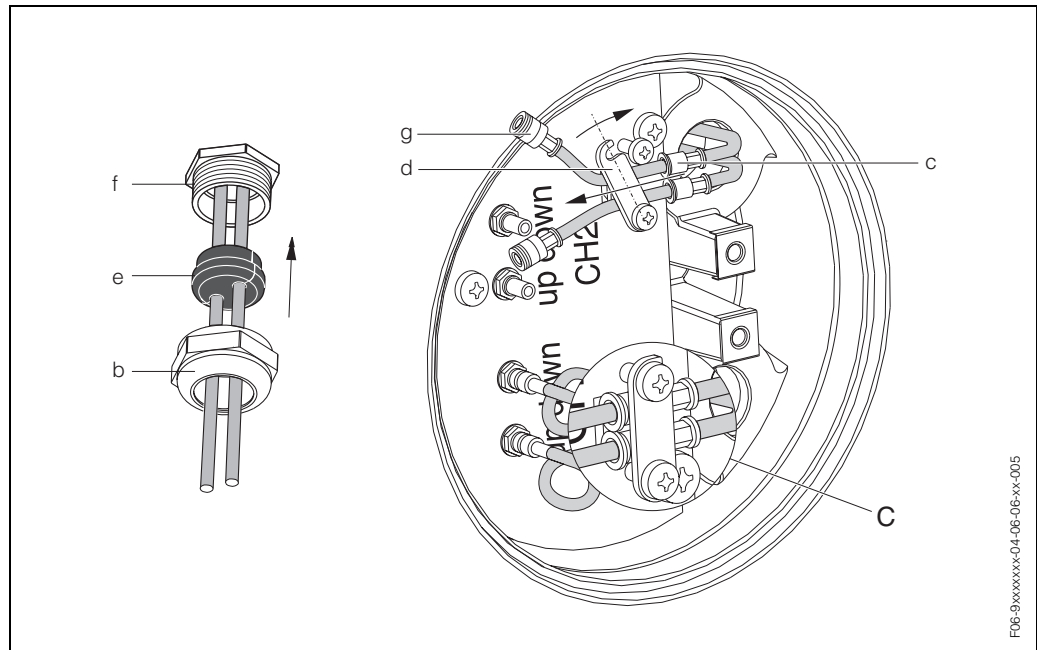


Fig. 5: Connecting the sensor connecting cable

5. Spread the rubber seal (e) along the side slit using a suitable tool (e.g. a large screwdriver) so that both sensor cables are clamped within. Push the rubber seal up into the cable gland bracket (f). Close the cover of the cable gland (b) so that it is tight.
6. Plug in the sensor cable connectors analogue to the arrangement in Fig. 4.
7. Transmitter: secure cover (a) on the connection compartment.

Removing and installing printed circuit boards

Field housing: removing and installing printed circuit boards (Fig. 6)



Warning:

- Danger of explosion! Danger of electrical shock. Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply).
- 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!

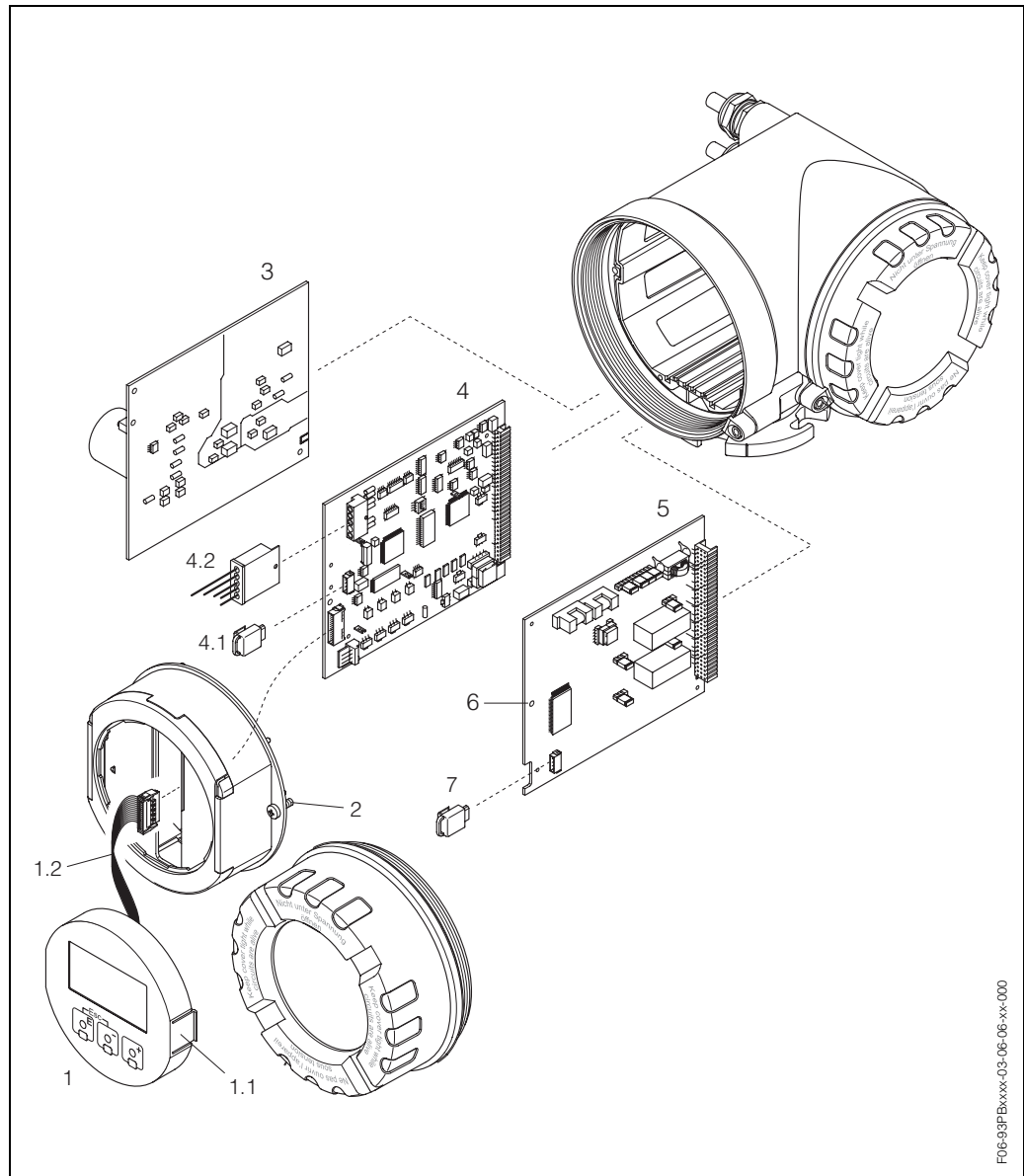
1. Remove the cover of the electronics compartment.
2. Remove the local display (1) as follows:
 - Press in the latches (1.1) at the side and remove the display module.
 - Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
3. Remove the screws and remove the cover (2) from the electronics compartment.
4. Remove power unit board and I/O board (3, 5):
Insert a thin pin into the hole (6) provided for the purpose and pull the board clear of its holder.
5. Remove amplifier board (4):
 - Disconnect the plug of the sensor signal cable (4.2) from the board.
 - Insert a thin pin into the hole (6) provided for the purpose and pull the board clear of its holder.
6. Installation is the reverse of the removal procedure.



Caution:

Use only original Endress+Hauser parts. Only replace printed circuit boards with identical ones.

7. If you cannot maintain the dielectric strength of the device during the work stages, carry out a test according to the manufacturer's specifications.

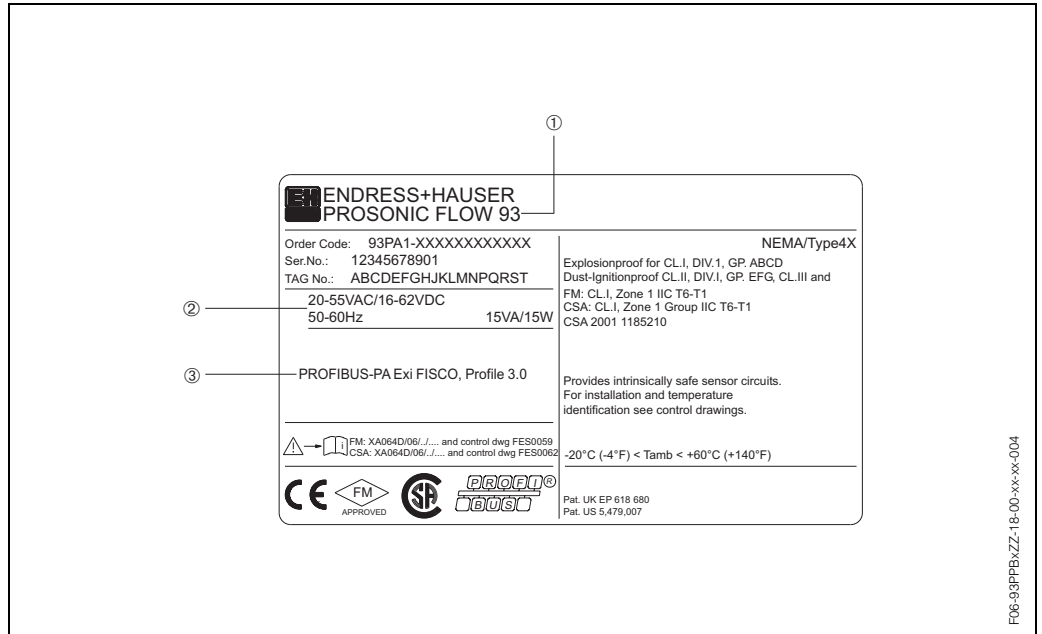


F06-93PB:xxx-03-06-06-xx-000

Fig. 6: Field housing: removing and installing printed circuit boards

- 1 Local display
- 1.1 Latch
- 1.2 Ribbon cable (display module)
- 2 Screws of electronics compartment cover
- 3 Power unit board
- 4 Amplifier board
- 4.1 T-DAT™ (transmitter data memory)
- 4.2 Unplug sensor signal cable
- 5 I/O board (type PROFIBUS-DP/-PA)
- 6 Aperture for installing/removing boards
- 7 F-Chip™ (function chip for optional software)

Exchanging electronics components



The following information on the nameplate must be compared for the information on the repairs set. Modules must not be exchanged unless this information is identical:

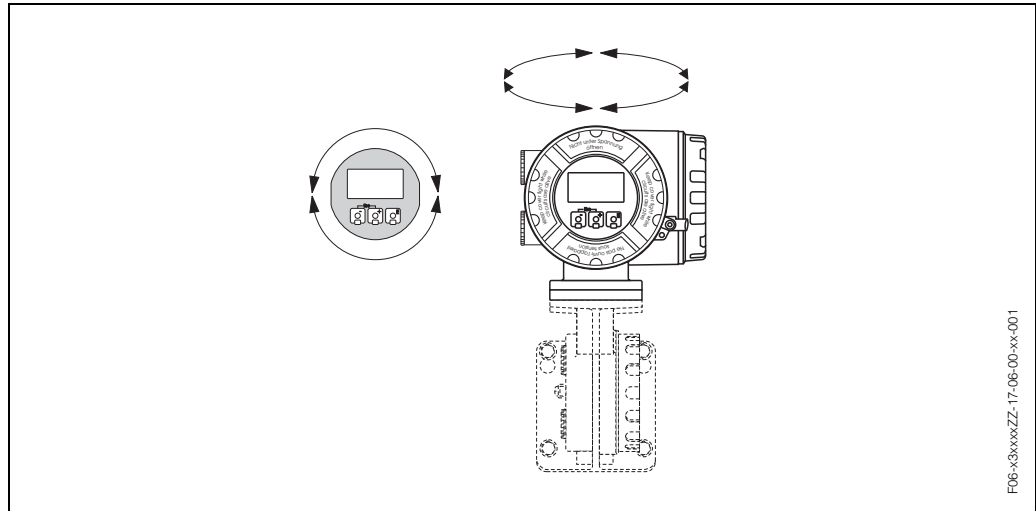
Power unit board: ① and ②

Amplifier board: ①

I/O board: ③

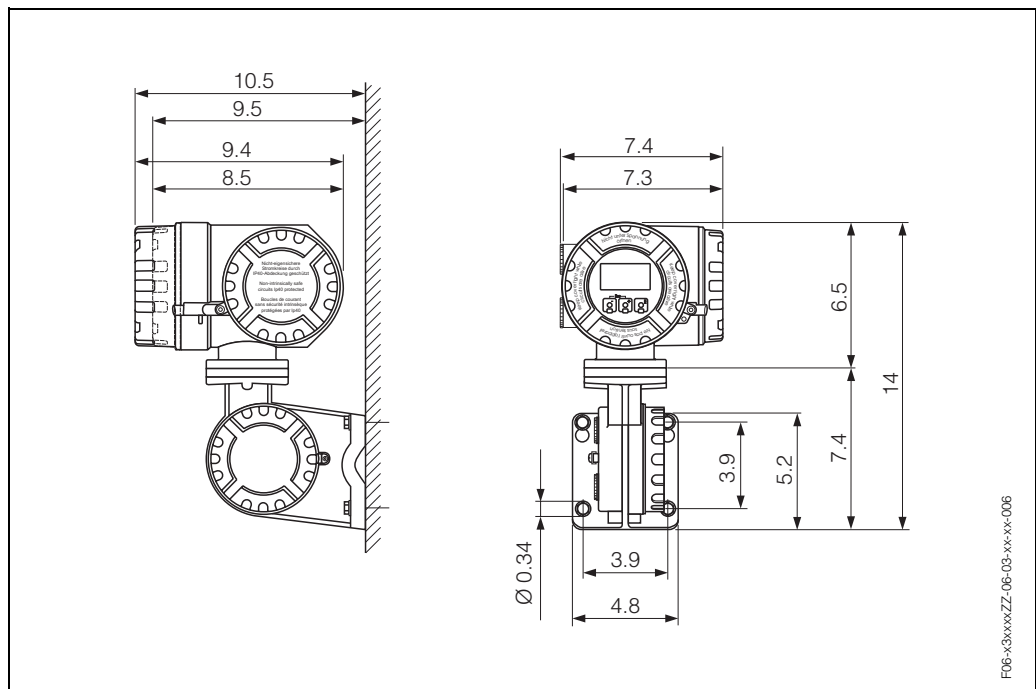
Turning the transmitter housing and the local display

To obtain the optimum orientation of the display of the field housing, it is possible to turn the display or the head of the measuring transmitter housing up to 360°.



F06-x3xxxxZZ-17-06-00-xx-001

Dimensions Prosonic Flow 93 transmitter



F06-x3xxxxZZ-06-03-xx-xx-006

Weight

Housing for transmitter:

- Wall-mounted housing: 6.0 kg
- Field housing: 6.7 kg

Measuring sensors:

- Flow measuring sensors P incl. mounting rail and tensioning bands: 2.8 kg
- Sound velocity measuring sensors DDU 18 incl. tensioning bands: 2.4 kg
- Wall thickness measuring sensor DDU 19 incl. tensioning band: 1.5 kg

Explanation of the FISCO model (PROFIBUS-PA)

The German Federal Physical-Technical Institute (PTB) has developed the FISCO model which was published in Report PTB-W-53 "Examination on Intrinsic Safety for Field Bus Systems".

The FISCO model makes possible the interconnection of intrinsically safe apparatus and one intrinsically safe associated apparatus, without having to have separate certification for respective connections.

The criteria for the intrinsic safety of an interconnection (bus segment) is given under the following interrelationships:

1. To transmit power and data, the bus system uses the physical configuration defined by IEC 61158-2 (MBP). This is the case for PROFIBUS-PA and the H1 bus.
2. Only one active source is permitted on a bus segment (here the power repeater). All other components work as passive current sinks.
3. The basic current consumption of a field device is at least 10 mA.
4. U_i , I_i and P_i of the bus device $\geq U_o$, I_o and P_o of the associated equipment (bus power supply).
5. Each instrument must fulfill the following requirement: $C_i \leq 5$ nF, $L_i \leq 10$ μ H
6. The permissible line length for EEx ia IIC applications is 1000 m.
7. The permissible spur length for Ex applications is 30 m per spur.
8. The transmission line that is used must conform to the following cable parameters:
Resistor coating: $15 \Omega/\text{km} < R' < 150 \Omega/\text{km}$
Inductance coating: $0.4 \text{ mH}/\text{km} < L' < 1 \text{ mH}/\text{km}$
Capacitance coating: $80 \text{ nF}/\text{km} < C' < 200 \text{ nF}/\text{km}$ (including the shield)
9. The bus segment must be terminated on both ends of the line with a terminal bus resistor. A terminal resistor is integrated into the power repeater so that an external bus terminator is only required on the other end. According to the FISCO model the fieldbus terminator must conform to the following limits:
– $90 \Omega < R < 100 \Omega$
– $0 \mu\text{F} < C < 2.2 \mu\text{F}$



Note:

Cable parameters and length restrictions are respected (see Page 16)

Cable specifications

The sensor cable connection between sensor and transmitter has an IS type of protection rating.



Caution:
Use only the cable sets supplied by E+H.

Cable specifications for PROFIBUS-PA

	Cable type A (reference)	Cable type B
<i>Cable construction</i>	twisted pair, screened	one or more twisted pairs, common screening
<i>Core cross-section (nominal)</i>	0.8 mm ² / AWG 18	0.32 mm ² / AWG 22
<i>Loop resistance (direct current)</i>	44 Ω/km	112 Ω/km
<i>Impedance at 31.25 kHz</i>	100 Ω ±20%	100 Ω ±30%
<i>Attenuation constant at 39 kHz</i>	3 dB/km	5 dB/km
<i>Capacitive unsymmetry</i>	2 nF/km	2 nF/km
<i>Envelope delay distortion (7.9...39 kHz)</i>	1.7 μs/km	–
<i>Degree of voltage of shielding</i>	90%	–
<i>Max. bus segment length (incl. spur lines)</i>	1000 m	1000 m
<i>Specific inductance</i>	0.4...1.0 mH/km	
<i>Specific capacitance</i>	80...200 nF/km	
<i>Loop resistance</i>	15...150 Ω/km	
<i>Max. spur length</i>	≤30 m	

Cable specifications for PROFIBUS-DP

Two types of cable are specified for the bus in the EN 50 170 standard. Cable type A can be used for all transmission rates up to 12 Mbit/s. The cable parameters can be taken from the following table:

Cable Type A	
Characteristic impedance	135...165 Ω at a measurement frequency of 3...20 MHz
Cable capacitance	<30 pF/m
Wire size	>0.34 mm ² , equals AWG 22
Cable type	twisted pairs, 1 x 2, 2 x 2 or 1 x 4 conductors
Loop resistance	110 Ω/km
Signal attenuation	max. 9 dB over the entire length of the line segment
Shielding	Copper braided shield or braided shield and foil screen

When setting up the bus, observe the following points:

- The maximum cable length (segment length) of a PROFIBUS-DP system depends on the transmission rate. With PROFIBUS-RS 485 Cable Type A, this value is:

Transmission Rate [kBit/s]	9.6...93.75	187.5	500	1500	300...12000
Cable length [m]	1200	1000	400	200	100

- A maximum of 32 stations are permitted per segment.
- Each segment is terminated at both ends with a terminating resistor.
- The bus length or number of users can be increased by installing a repeater.
- The first and last segments can support a max. of 31 devices. The segments between repeaters can support a max. of 30 stations.
- The maximum distance achievable between two bus users is calculated as:
 (NUM_REP + 1) x segment length
 NUM_REP = maximum number of repeaters, which can be placed in series, dependent on the respective repeater.

Example:

According to the manufacturer's information, a maximum of 9 repeaters may be placed in series on a standard line.

The maximum distance between two bus users at a transmission rate of 1.5 MBit/s is thus: (9 + 1) x 200 m = 2000 m

Stubs (PROFIBUS-DP)

Note the following points:

- Total combined length of all stubs < 6.6 m (at a max. of 1.5 MBit/s)
- At transmission rates >1.5 MBit/s, stubs should not be used.

The line between the cable connector and the bus driver in the field device is called a stub. Our experience with the systems, indicates that you should be quite careful with the length of the stubs when planning your project. Therefore, we recommend that you do not attempt to utilise the full theoretical maximum total combined length of 6.6 m for all stubs at 1.5 MBit/s. The order of the respective field devices makes more of a difference in this case. We recommend that at transmission rates >1.5 MBit/s you avoid using stubs.

- If you must use stubs, do not install terminating resistors on them.

Shielding and grounding (PROFIBUS-DP/-PA)

When planning the shielding and grounding for a field bus 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 will be connected to the field devices' housings, which are usually metal. Since these housings are generally connected to the protective ground conductor, the shield of the bus cable will thus be grounded many times.

This approach, which provides the best electromagnetic compatibility, can be used without restriction in plants with good potential equalisation.

In the case of plants without potential equalisation, a mains frequency (50 Hz) equalising 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 equalising currents on systems lacking potential equalisation, it is therefore advisable to connect the cable shield directly to the building (or protective ground conductor) at only one end and to use capacitive coupling to connect it to all other grounding points.

Setting the terminators (only by PROFIBUS-DP)

Since mismatches in the impedance result in signal reflections on the line and can thus lead to communication errors, it is important to terminate the lines properly.



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 terminator switches are located on the I/O board.

- For baud rates of up to 1.5 Mbaud, terminate the last transmitter on the bus by setting the terminator switch SW 1 to: ON – ON – ON – ON.
- If the device is to be operated at over 1.5 Mbaud, you can tap the supply voltage for an external terminator from terminals 24 (GND) and 25 (+5 V) (this terminator must be approved for Division 1).

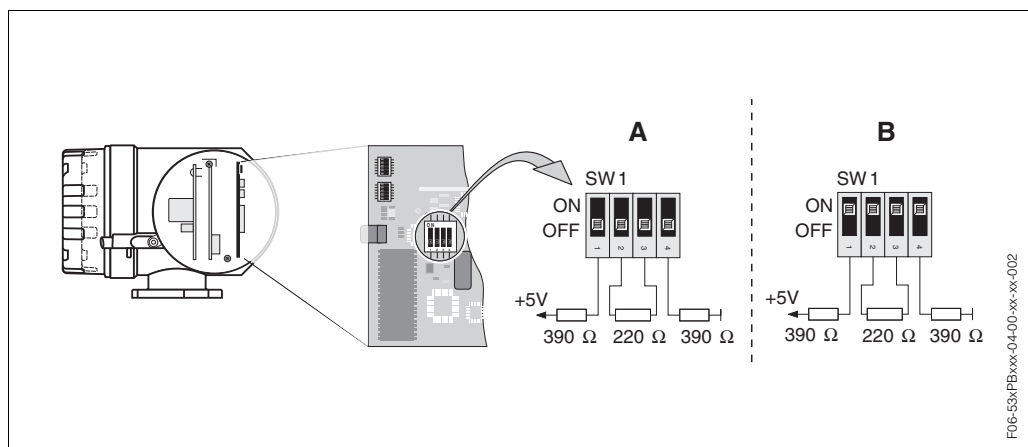


Fig. 7: Setting the terminators (PROFIBUS-DP)

A = Factory setting
B = Setting on the last transmitter

F06-53x/PBxx-04-00-xx-xx-002

Potential equalisation with shielding grounded at both ends

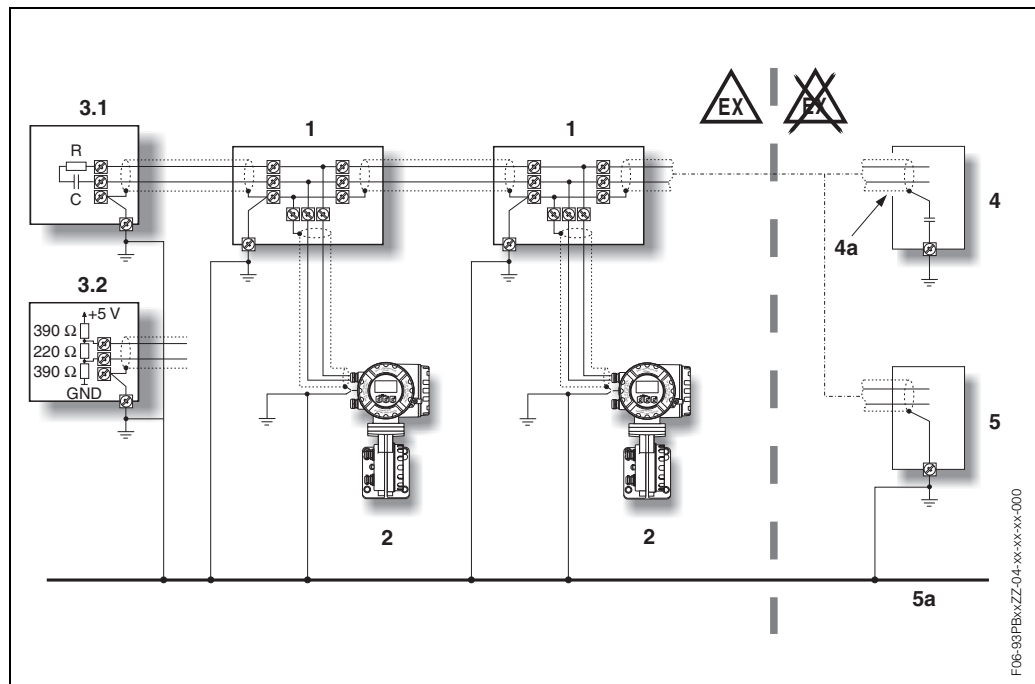


Fig. 8: Examples for connection of potential matching cables

- 1 = distributor/T-box
- 2 = Prosonic Flow 93 bus devices for hazardous area
- 3.1 = bus termination for PROFIBUS-PA: $R = 90...100 \Omega$ $C = 0...2.2 \mu F$
- 3.2 = bus termination for PROFIBUS-DP
- 4 = bus power supply or process control system variant 4a
- 4a = shielding connected via capacitor
- 5 = bus power supply or process control system variant 5a
- 5a = potential equalisation line led out

Variant 4/4a:

With capacitive grounding of the shielding in the safe area the potential equalisation line does not need to be led out of the safe area.

Use small capacitors (e.g. 1 nF, 1500 V dielectric strength, ceramic).

The total capacitance connected at the shielding may not exceed 10 nF.

Variant 5/5a:

Potential equalisation line is led out of the safe area.

Device identification

Prosonic Flow 93 PROFIBUS-DP/-PA transmitter and P sensor

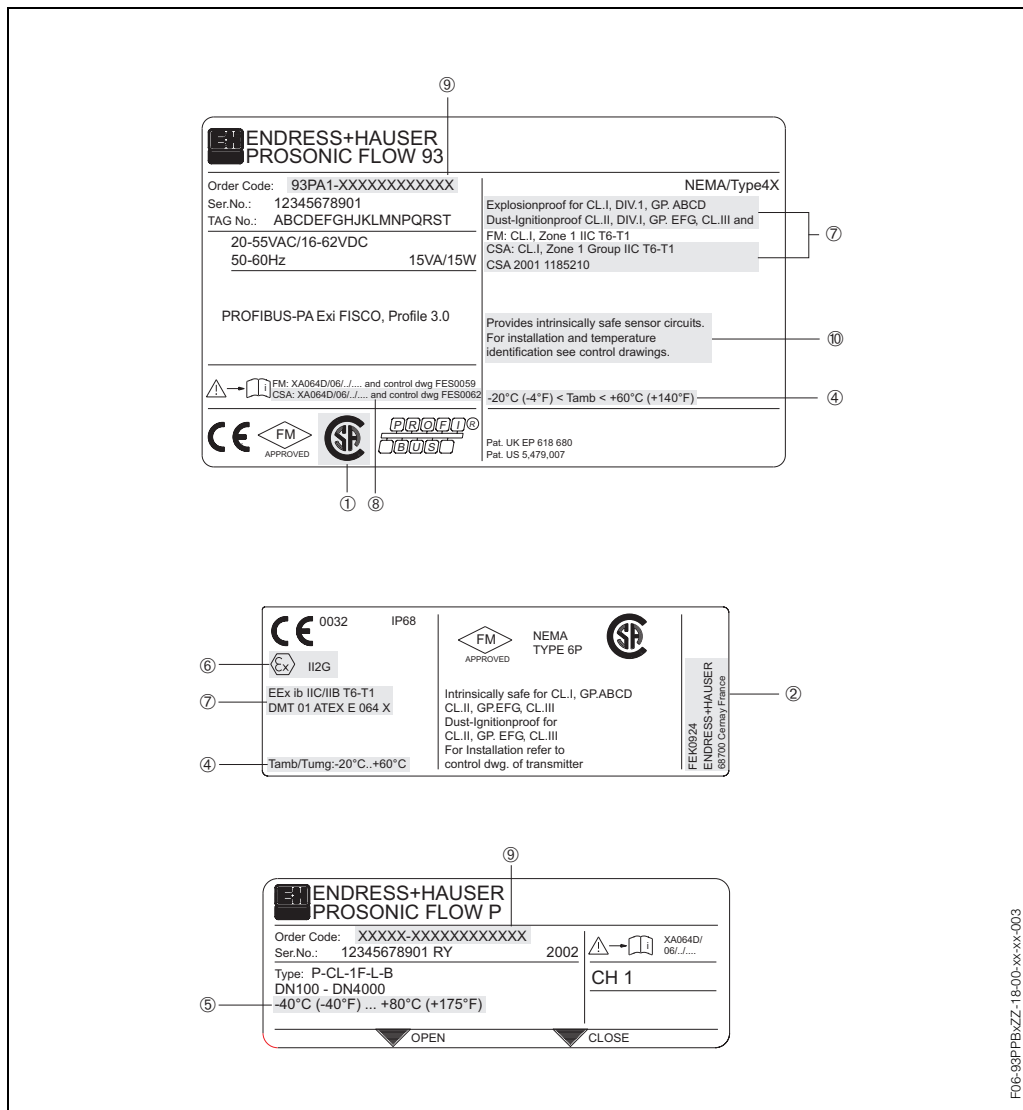


Fig. 9: Nameplate of transmitter and nameplate of sensor (example)

Key to nameplates (Figure 9)

No.	Meaning	No.	Meaning
①	Label of the notified body: Factory Mutual Research	⑥	Device group and device category to directive 94/9/EC
②	Place of manufacture	⑦	Type of protection and explosion group for the Prosonic Flow 93 PROFIBUS-DP/-PA transmitter
③	–	⑧	Applicable Ex documentation
④	Ambient temperature range	⑨	Type code
⑤	Maximum medium temperature	⑩	Warning

Control drawings

Endress+Hauser Reinach hereby declares that the product is in conformity with the requirements of the CADADIAN STANDARDS ASSOCIATION.

Hazardous Locations

Class I Division 1 Groups ABCD or Class I Zone 1 Groups IIC and Class II Division 1 Groups EFG and Class III

Transmitter
PROline Prosonic Flow 9*P**.....N****

Sensors
Prosonic Flow P
Prosonic Flow DDU10
Prosonic Flow DDU18
Prosonic Flow DDU19

Temperature table

Sensors	maximum medium temperature in °C									
	T6	T5	T4A	T4	T3C	T3B	T3A	T3	T2	T1
at Ta = 60°C										
Pros. Flow 9*PA* - A*****	80	80	80	80	80	80	80	80	80	80
Pros. Flow 9*PA* - B*****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU 10 - A****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU 10 - C****	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU18-A***	80	80	80	80	80	80	80	80	80	80
Prosonic Flow DDU19-A***	80	80	80	80	80	80	80	80	80	80
at Ta = 60°C										
Pros. Flow 9*PA* - E*****	80	95	115	130	155	160	170	170	170	170
Pros. Flow 9*PA* - F*****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU 10 - B****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU 10 - D****	80	95	115	130	155	160	170	170	170	170
Prosonic Flow DDU18-B***	80	95	115	130	155	160	170	170	170	170

Communication modules , I/O options

Communication options	Control Drawings
I/O option = F, H, J	see FES0062-0001 A
I/O option = G, K	see FES0062-0002 A
I/O option = S, T	see FES0062-0004 A

WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

Notes:

- Control room equipment shall not use or generate more than 250 V rms.
- Wire per Canadian Electrical Code. Wire all intrinsically safe I/O circuits per CEC respecting the Explosionsproof Integrity of the enclosure.
- Sensor circuits may be installed as intrinsically safe wiring or in conduit per CEC.
- Caution: Use supply wires suitable for 5 °C above ambient temperature, but at least for 80 °C / 176°F.
- Class II Group G: The surface temperature of the apparatus cannot exceed 165 °C / 329°F. The user must limit the process temperature for Group G to 160°C.
- Cable Type for all Sensors: Use only prefabricated Endress+Hauser Cable. For reasons of safety, the maximum allowed cable length is 30 m per sensor.

Änderungen: A 05.04.02/MDI B C D E	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersteller: FES / ID 1100 FILE: M:\ZEICHNUNG\FES0062\010310c.doc
CSA Control Drawing Class I, Div. 1 Class I Zone 1 PROSONIC FLOW 9.		Massstab Gezeichnet 10.03.01 UID Geprüft Ex-geprüft 05.04.02 MDI Gesehen
Flowtec AG, Kaegenstrasse 7, CH-4153 Reinach BL1, Postfach		FES0062 A

HAZARDOUS LOCATIONS

Cl. I Div. 1 Groups A,B,C,D
Cl. I Zone 1 Group IIC
Cl. I Div. 2 Group A,B,C,D
Cl. I Zone 2 Group IIC
Cl. II, III Div. 1 Group E,F,G

NON HAZARDOUS LOCATIONS

Notes:

Intrinsically safe signal output:

- Wire all intrinsically safe circuits per Canadian Electrical Code respecting the Explosionsproof integrity of the enclosure
- WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.**
- Control room equipment may not use or generate more than 250 V rms.

Type: PROSONIC FLOW 9*.....F**
Terminals: 26 (+), 27 (-) (Profibus PA):
 Passive intrinsically safe PROFIBUS PA circuit:
 For connecting the intrinsically safe circuit (PROFIBUS PA) according to the FISCO-CONCEPT see FES0062-0003

Nonintrinsically safe signal output:

- Transmitter circuit wiring in conduit in accordance with Canadian Electrical Code.
- WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 1.**
- Control room equipment may not use or generate over 250 Vrms.

Type: PROSONIC FLOW 9*.....H**
Terminals 26 (+), 27 (-) (PROFIBUS PA)
 V ≤ 32 V, I = 10 mA

Type: PROSONIC 9*.....J**
Terminals 24 (+5V), 25 (GND), 26 (DPA), 27 (DPB) (PROFIBUS DP)
 Terminals: +5V, GND, DPA, DPB
 V = 5 V, I = 100 mA

Änderungen: A 05.04.02/MDI B C D E	Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.	Ersetzt durch: Ersteller: FES / ID 1100 FILE: M:\ZEICHNUNG\FES0062\010310c.doc
CSA Control Drawing Class I, Div. 1 / Zone 1 PROSONIC FLOW 9. PROFIBUS PA / IS installation PROFIBUS PA / DP non-IS installation		Massstab Gezeichnet 10.03.01 UID Geprüft Ex-geprüft 05.04.02 MDI Gesehen
Flowtec AG, Kaegenstrasse 7, CH-4153 Reinach BL1, Postfach		FES0062-0001 A

FISCO CONCEPT
 The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specially examined in such combination. The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}), and the power (P_i or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o or V_{oc}), the current (I_o or I_{sc}) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 μ H respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system. The voltage U_o or V_{oc} of the associated apparatus is limited to a range of 14V to 24Vd.c. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except a leakage current of 50 μ A for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameter in the following range:

Loop Resistance R' : 15...150 Ohm/km
 Inductance per unit length L' : 0.4...1 mH/km
 Capacitance per unit length C' : 80...200 nF

$C' = C'$ line/line + 0.5 C' line/screen, if both lines are floating, or
 $C' = C'$ line/line + C' line/screen, if the screen is connected to one line

Length of trunk cable: ≤ 1000 m
 Length of spur cable: ≤ 30 m
 Length of splice: ≤ 1 m

At each end of the trunk cable an approved infallible line termination with following parameters is suitable:
 $R = 90...100$ Ohm $C = 0...2.2$ μ F

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive apparatus connected to the bus segment is not limited due to I. S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of trunk and all spur cables), the inductance and the capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:
 Intrinsically safe Class I, Div. 1, Groups A,B,C,D

- Approved associated apparatus must be installed in accordance with manufacturers instructions.
- CSA approved associated apparatus must meet the following parameters:
 U_o or $V_{oc} \leq U_i$ (V_{max}) and I_o or $I_{sc} \leq I_i$ (I_{max}) and P_o or $P_{max} \leq P_i$ (P_{max})
- The maximum non-hazardous area voltage must not exceed 250V
- Wire all intrinsically safe circuits per Canadian Electrical Code respecting the Explosionsproof Integrity of the enclosure
- Multiple earthing of screen is allowed only, if high integrity equipotential system is realized between the points of bonding (see drawing No. FES 0014).
- Caution: Use only supply wires suitable for 5°C above surrounding temperature.
- Warning: Substitution of components may impair intrinsic safety.
- The polarity for connection PA+ (26) and PA- (27) is of no importance due to an internal rectifier.

HAZARDOUS (CLASSIFIED) LOCATION
 Class I, Division 1, Groups A,B,C,D
 Class II, Division 1, Groups E,F,G
 Class III, Division 1

NONHAZARDOUS LOCATION

PROSONIC FLOW 9***.....F/G

Any CSA Approved Associated Apparatus suitable for FISCO concept

Any CSA Approved Intrinsic Safe Apparatus suitable for FISCO Concept

Any CSA Approved Termination with $R = 90...100\Omega$ $C = 0...2.2\mu F$

PROS. FLOW 9***.....F/G
 Terminal 26(+) Terminal 27 (-)
 (FISCO-Model)
 U_i (V_{max}) = 30 V
 I_i (I_{max}) = 500 mA
 P_i (P_{max}) = 5.5 W
 Leakage current: $\leq 50\mu A$
 Apparatus provides galvanic isolation up to 250V rms between fieldbus circuit and any other circuit
 Temperature Classification: T6
 Max. ambient Temperature: 60°C / 140°F

$C_i \leq 5$ nF
 $L_i \leq 10$ μ H

Table with 5 rows (A-E) and 3 columns (1-3) for changes.

Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.

Ersatz für: Ersteller: FES / ID 1100 File: M:\ZEICHNUNG\FES0062\010310c.doc

CSA Control Drawing Cl. I, Div. 1 / Zone 1 PROSONIC FLOW 9. Intrinsically safe PROFIBUS PA FISCO-Concept

Massstab: Gezeichnet: 10.03.01 UD Geprüft: Ex-geprüft: 05.04.02 MDI Gesehen:

FES0062-0003 A

Flowtec AG, Kappenstrasse 7, CH-4153 Reinach BL1, Postfach

HAZARDOUS (CLASSIFIED) LOCATION | **NON HAZARDOUS LOCATION**

Field termination | T-Box | T-Box | Associated equipment

Intrinsic Safety Ground

Variation 1

HAZARDOUS (CLASSIFIED) LOCATION | **NON HAZARDOUS LOCATION**

Field termination | T-Box | T-Box | Associated equipment

Intrinsic Safety Ground

Shield isolated

Variation 2

Small capacitors (e.g. 1nF, 1500V, ceramic) to be used
 Capacitance connected to shield should not exceed 10nF in total.

Table with 5 rows (A-E) and 3 columns (1-3) for changes.

Alle gesetzlichen Urheberrechte vorbehalten. Diese Zeichnung darf ohne unsere Genehmigung weder vervielfältigt werden noch dritten Personen und Konkurrenzfirmen zugänglich gemacht werden.

Ersatz für: File: I:\FES0014\TABELLUNG\FES0014_010310c.doc

Grounding of screen Variations

Massstab: Gezeichnet: 28.05.99 UD Geprüft: 28.05.99 UD Ex-geprüft: 28.05.99 UD Gesehen:

FES 0014-F00

Flowtec AG, Kappenstrasse 7, CH-4153 Reinach BL1, Postfach

**Supplementary
documentation**

TI 042D/06
TI 056D/06
TI 057D/06

USA

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

Canada

Endress+Hauser Ltd.
Burlington, Ontario
Tel. (905) 681 92 92
Fax. (905) 681 94 44

Instruments International

Endress+Hauser GmbH+Co.
Weil am Rhein
Germany
Tel. (07621) 975-02
Fax. (07621) 975 345



