XA00129D/06/EN/15.20
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2020-08-01

Safety Instructions

Proline Prosonic Flow 93

NEPSI: Zone 1, Zone 21

This document is an integral part of the following Operating Instructions:
- BA00070D, Proline Prosonic Flow 93 HART
- BA00076D, Proline Prosonic Flow 93 PROFIBUS DP/PA
- BA00078D, Proline Prosonic Flow 93 FOUNDATION Fieldbus

Contents

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Associated documentation

All documentation is available:
- On the CD-ROM supplied.
- Internet: www.endress.com/deviceviewer.
- Smart phone/Tablet: *Endress+Hauser Operations App*
- In the Download Area of the Endress+Hauser web site: www.endress.com → Download

Additional documentation:

Document type	Contents	Documentation code
Brochure	Explosion Protection	CP00021Z/11

Please note the documentation associated with the device.

General warnings

- For installation, use and maintenance of the flow meter, the instruction manual and the following standards shall be observed:
  - GB50257-2014 "Code for construction and acceptance of electric device for explosive atmospheres and fire hazard electrical equipment installation engineering"
  - GB3836.13-2013 "Explosive atmospheres - Part 13: Equipment repair, overhaul and reclamation"
  - GB3836.15-2017 "Explosive atmospheres - Part 15: Electrical installations design, selectionl and erection"
  - GB3836.16-2017 "Explosive atmospheres - Part 16: Electrical installations inspection and maintenance"
  - GB15577-2018: Safety regulations for dust explosion prevention and protection" (only if installed in dust hazardous areas)
- Any maintenance shall be done after power off or the area known to be non-hazardous.
- The flow meter shall not be modified in order to ensure the explosion protection performance of the equipment. Any change may impair safety.
- 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 all of the technical data of the device (see nameplate) is mandatory.
- Open the device only when it is de-energized (and after a delay of at least 10 minutes following shutdown of the power supply) or non-hazardous (classified) locations.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Opening the transmitter housing and the connection housing of the remote version is only permitted for a brief time. During this time, ensure that no dust or moisture enters the housing.
- To guarantee resistance to dust, the transmitter housing, the connection housing of the remote version and the cable entries must be tightly sealed.
- The suitability of the device in the event of simultaneous occurrence of gas-air and dust-air mixtures requires an additional assessment.

Special conditions

The device must be integrated into the potential equalization system. Potential must be equalized along the intrinsically safe sensor circuits. Further information is provided in the "Potential equalization" section → 7

The suffix "X" placed after the certificate number indicates that this product is subject to special conditions for safe use, that is:
- For information on the dimensions of the flameproof joints contact the manufacturer.
- The transmitter has been integrated into the potential equalisation system. Along the intrinsically safe sensor circuits potential equalisation must exist.

Installation instructions

- For terminals No. 20 to No. 27 of the transmitter, only devices with ratings $U_m \leq 260$ V and $I_m \leq 500$ mA are allowed to be connected (does not apply to intrinsically safe circuits).
- The measuring device must only be used in the permitted temperature class.
  The values of the individual temperature classes can be found in the temperature tables → 5.

  For Zone 21: The surface temperature of the measuring device must not exceed 2/3 of the ignition temperature of a dust cloud. The maximum surface temperature must maintain a safe distance of 75 °C to the smolder temperature of a dust layer of 5 mm.

  Example: Operation in temperature class T4 (135 °C) is, therefore, suitable for dust with an ignition temperature of 202.5 °C (1.5 · 135 °C or 135 °C = 2/3 of 202.5 °C) and a smolder temperature of 210 °C (135 °C + 75 °C).

- The following applies when connecting the transmitter with a connection compartment in Ex d: Only use separately certified cable and wire entries (Ex d IIC) which are suitable for operating temperatures up to 80 °C and for IP 66/67 according to GB/T 4208-2017. If using conduit entries, the associated sealing mechanisms must be mounted directly on the housing. Plastic sealing plugs act as transport protection and have to be replaced by suitable, individually approved installation material. The mounted metal thread extensions and dummy plugs are tested and certified as part of the housing for type of protection Ex d IIC. The thread extension or the dummy plug labeled as follows for identification purposes:
  – Md: M20 × 1.5
  – NPTd: NPT ½"
  – Gd: G ½"
- The following applies when connecting the transmitter with a connection compartment in Ex e: Only use separately certified cable and wire entries and sealing plugs (Ex e IIC), which are suitable for operating temperatures up to 80 °C and for IP 66/67 according to GB/T 4208-2017. The cables must be routed such that they are securely seated, and sufficient strain relief must be ensured. The mounted metal thread extensions and dummy plugs supplied are tested and certified as part of the housing for type of protection Ex e IIC. Plastic sealing plugs act as transport protection and have to be replaced by suitable, individually approved installation material. Supplied cable glands are separately certified and marked as components and meet device specification requirements.
- The cable entries and openings not used must be sealed tight with suitable components.
- The safety-related max. permitted cable length of the connecting cable is 30 meter. Use only cables supplied by Endress+Hauser. Damaged cables must be replaced by undamaged ones.
- Turning the local display:
  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).
- If Category "ia" intrinsically safe circuits of the measuring device are connected to certified intrinsically safe Category "ib" circuits with explosion group IIC or IIB ratings, the type of protection changes to Ex ib IIC or Ex ib IIB, as applicable. Intrinsically safe ib circuits are suitable for areas which require Zone 1 equipment.
- If the intrinsically safe communication circuits ("Output, Input" option: F, G, S, T; terminals 26/27 resp. 24/25) are fed into areas that require A20 or A21 apparatus, the connected apparatus must be tested and certified accordingly.

Turning the transmitter housing

1. Unscrew the grub screw.
2. Rotate the transmitter housing cautiously clockwise until the end stop (end of the thread).
3. Rotate the transmitter housing counter-clockwise (max. 360°) in the wanted position.
4. Tighten the grub screw again.

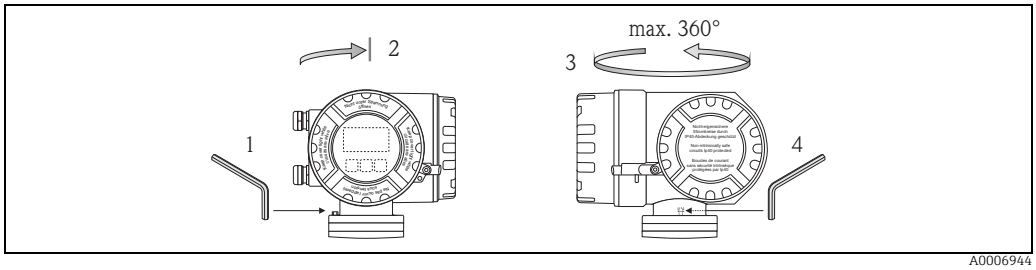

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Fig. 1: Turning the transmitter housing

Manufacturer's certificates

NEPSI certificate of conformity

Certificate number:

GYJ20.1116X

Affixing the certificate number certifies conformity with the standards (depending on the device version).

- GB3836.1-4-2010
- GB3836.20-2010
- GB12476.1-2013
- GB12476.4-2010
- GB12476-5-2013

Inspection body

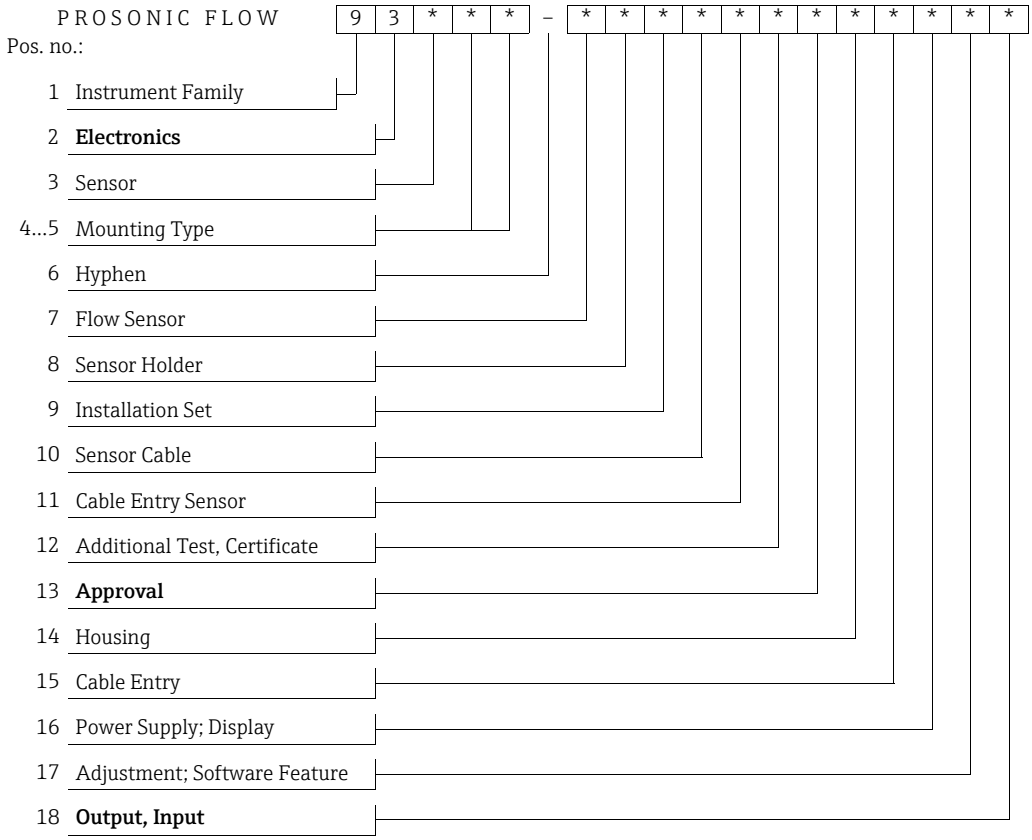
NEPSI, National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation

Description of measuring system

The measuring system consists of sensors and a transmitter. Transmitter and sensors are installed separately and connected to each other via connecting cables.

Type code

The type code describes the exact design and the equipment of the measuring system. It can be read on the nameplate of the transmitter and sensor and is structured as follows:



Electronics (Pos. no. 2 in type code)

*	Transmitter	Electronics/housing
3	Prosonic Flow 93	▪ Transmitter electronics in: [Ex ia] IIC/IIB ▪ Ex d housing in Ex d IIC or Ex d e IIC

Approval (Pos. no. 13 in type code)

*	Output, Input	Housing/Version	Approval
			Explosion Protection NEPSI
K	F, G, S, T (Ex ia)	Transmitter (Connection compartment Ex d)	Ex d [ia Gb] [ia Ga] IIC T6 Gb Ex tD [iaD 21] [iaD 20] A21 IP67 T85°C
		Sensor	Ex ib IIC T1~T6 Gb Ex ibD 21 T*
	A, B, C, D, H, J, K, L, M, P, V, W, 2, 4, 6 (not Ex ia)	Transmitter (Connection compartment Ex d)	Ex d [ia] IIC T6 Gb Ex tD [iaD 21] A21 IP67 T85°C
		Sensor	Ex ib IIC T1~T6 Gb Ex ibD 21 T*

S	F, G, S, T (Ex ia)	Transmitter (Connection compartment Ex e)	Ex d e [ia Gb]\[ia Ga] IIC T6 Gb Ex tD [iaD 21]\[iaD 20] A21 IP67 T85°C
		Sensor	Ex ib IIC T1~T6 Gb Ex ibD 21 T*
	A, B, C, D, H, J, K, L, M, P, V, W, 2, 4, 6 (not Ex ia)	Transmitter (Connection compartment Ex e)	Ex d e [ia] IIC T6 Gb Ex tD [iaD 21] A21 IP67 T85°C
		Sensor	Ex ib IIC T1~T6 Gb Ex ibD 21 T*

Output, Input (Pos. no. 18 in type code)

*	Type of protection
A, B, C, D, H, J, K, L, M, P, V, W, 2, 4, 6	non-intrinsically safe outputs and inputs
F, G, S, T	Ex ia

✎ Note!
A detailed explanation of these values, regarding the available outputs and inputs, as well as a description of the associated terminal assignments and connection data: → 🖹 10 onwards.

Temperature table (remote version)

Prosonic FlowPA*-1/2*****K/S*****

at T_a = 60 °C		Max. medium temperature [°C] in					
		T6 85 °C	T5 100 °C	T4 135 °C	T3 200 °C	T2 300 °C	T1 450 °C
SensorPA*-1*****K/S*****	TPE-V cables	80	95	100	100	100	100
SensorPA*-2*****K/S*****	TPE-V cables	80	95	130	150	150	150

The minimum medium temperature is −40 °C.

Prosonic FlowPA*-A/B*****K/S***** and Sound velocity measuring sensors DDU18-A*****

at T_a = 60 °C		Max. medium temperature [°C] in					
		T6 85 °C	T5 100 °C	T4 135 °C	T3 200 °C	T2 300 °C	T1 450 °C
SensorsPA*-A/B*****K/S*****	PVC cables	80	80	80	80	80	80
Sensors DDU18-A*	PVC cables	80	80	80	80	80	80

The minimum medium temperature is −40 °C.

Prosonic FlowPA*-E/F*****K/S***** and Sound velocity measuring sensors DDU18-B*****

at T_a = 60 °C		Max. medium temperature [°C] in					
		T6 85 °C	T5 100 °C	T4 135 °C	T3 200 °C	T2 300 °C	T1 450 °C
SensorsPA*-E/F*****K/S*****	PTFE cables	80	95	130	170	170	170
Sensors DDU18-B*	PTFE cables	80	95	130	170	170	170

The minimum medium temperature is 0 °C.

Wall thickness measuring sensor DDU19-A***

at T_a = 60 °C		Max. medium temperature [°C] in					
		T6 85 °C	T5 100 °C	T4 135 °C	T3 200 °C	T2 300 °C	T1 450 °C
Sensor DDU19-A*	PVC or PTFE cables	80	80	80	80	80	80

The minimum medium temperature is −20 °C.

Transmitter Prosonic Flow 93 P-******H*****

The Prosonic Flow 93 transmitter has a T6 temperature class rating when installed in the Ex d housing for operation at ambient temperatures up to T_a = 60 °C. The maximum ambient temperature range is −20…+60 °C.

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

Gas and dust explosion protection

1. Determine the temperature class for gas in relation to the ambient T_a and medium temperature T_M.
2. Determine the maximum surface temperature for dust in relation to the max. ambient temperature T_a and max. medium temperature T_M.

Example:
Device: Prosonic Flow 93 PA*-E****B…
Max. ambient temperature: T_a = 60 °C
Max. medium temperature: T_M = 78 °C

		T_a	T6 (85 °C)	T5 (100 °C)	T4 (135 °C)	T3 (200 °C)	T2 (300 °C)	T1 (450 °C)
Prosonic Flow 93PA*-A/B*****B/D*****	PVC-Kabel[1]	~~+60 °C~~	80	80	80	80	80	80
DDU 18-A	PVC-Kabel	+60 °C	80	80	80	80	80	80

T_a max = 60 °C
T_M = 78 °C (≤ 80 °C)

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Fig. 2: Procedure for calculating the max. surface temperature

1. In the associated temperature table, the selection of the measuring device (Prosonic Flow 93P) and the ambient temperature T_a (60 °C) determine the line in which the max. medium temperature can be found.
2. The max. medium temperature T_M (78 °C), which is smaller or equal to the max. fluid temperature of a cell, determines the column, or temperature class, for gas (78 °C ≤ 80 °C → T6).
3. The maximum temperature of the calculated temperature class corresponds to the maximum surface temperature (T6 → 85 °C = maximum surface temperature for dust).

Design of measuring system

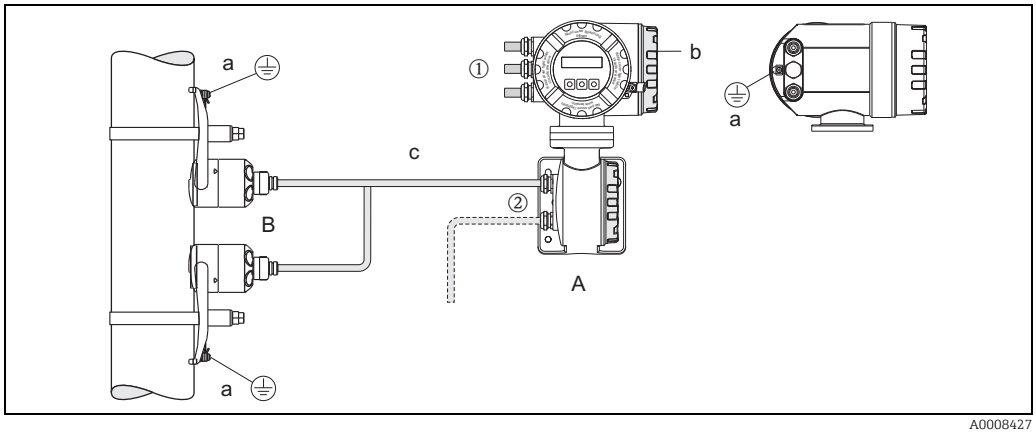

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Fig. 3: Design of the measuring system (remote version)

A Transmitter housing with connection housing
B Sensors

a Screw terminal for connecting to the potential equalization
b Connection compartment cover
c Connecting cable remote version
① and ② see following section "Cable entries"

Cable entries

- ① for connection compartment (Ex d version): power supply cable and cable of the communication circuit → Choice of thread for cable entries M20 × 1.5, ½" NPT or G ½".

  Make sure that the Ex d cable glands/entries are secured to prevent working loose and that the seals are installed immediately adjacent to the housing.
- ① for connection compartment (Ex e version): power supply cable and cable of the communication circuit → Choice of cable gland M20 × 1.5 or thread for cable entries ½" NPT or G ½".
  The cables must be installed such that they are fixed in place. Adequate strain relief must be ensured.
- ② for remote version connecting cable:
  → Choice of cable gland M20 × 1.5 or thread for cable entries ½" NPT or G ½"

⚠ Warning!
The leak-tight of the cable glands and cable entries is to ensure.

Cable specification

You can find information about the cable specification in the associated Operating Instructions.

Potential equalization

The transmitter (remote version) is to be securely connected to the potential equalization system using the screw terminal on the outside of the transmitter housing.

✎ Note!
- Further information about potential equalization, shielding and grounding can be found in the associated Operating Instructions.
- The length of the spur must be observed.

Potential equalization with shield grounded at both sides for fieldbus version

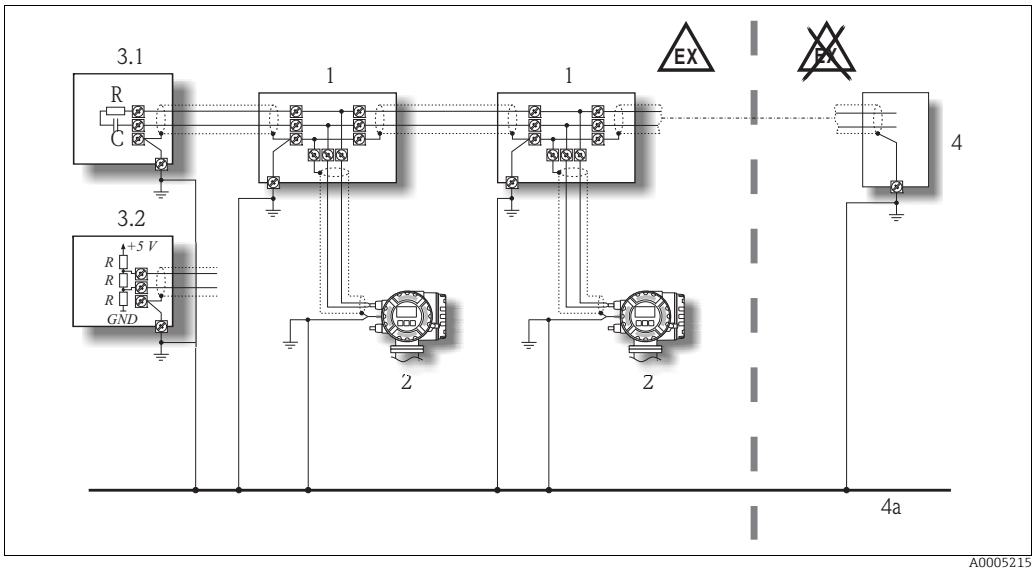

Fig. 4: Example for connecting potential equalization lines

1 Distributor/T-Box
2 Bus devices for potentially explosive atmospheres
3.1 Bus terminator PROFIBUS PA and FOUNDATION Fieldbus
3.2 Bus terminator PROFIBUS DP and MODBUS
4 Bus supply unit or automation system
4a Potential equalization line is fed out into the safe area

Connection of connecting cable

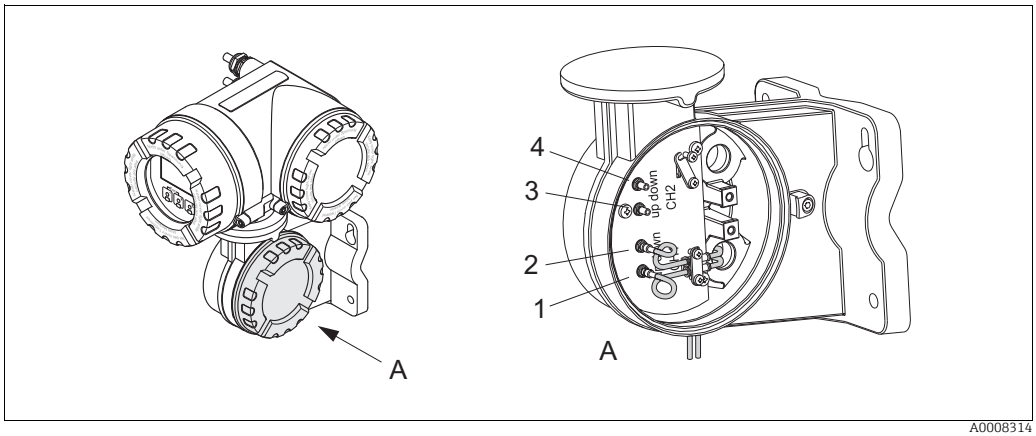

Fig. 5: Connection of connecting cable

1 Channel 1 upstream
2 Channel 1 downstream
3 Channel 2 upstream
4 Channel 2 downstream

✎ Note!
You can find information about connecting the sensor connecting cable in the associated Operating Instructions.

Electrical connection

Connection compartment

Transmitter housing remote version (terminal assignment, connection data →🖹 10 onwards)

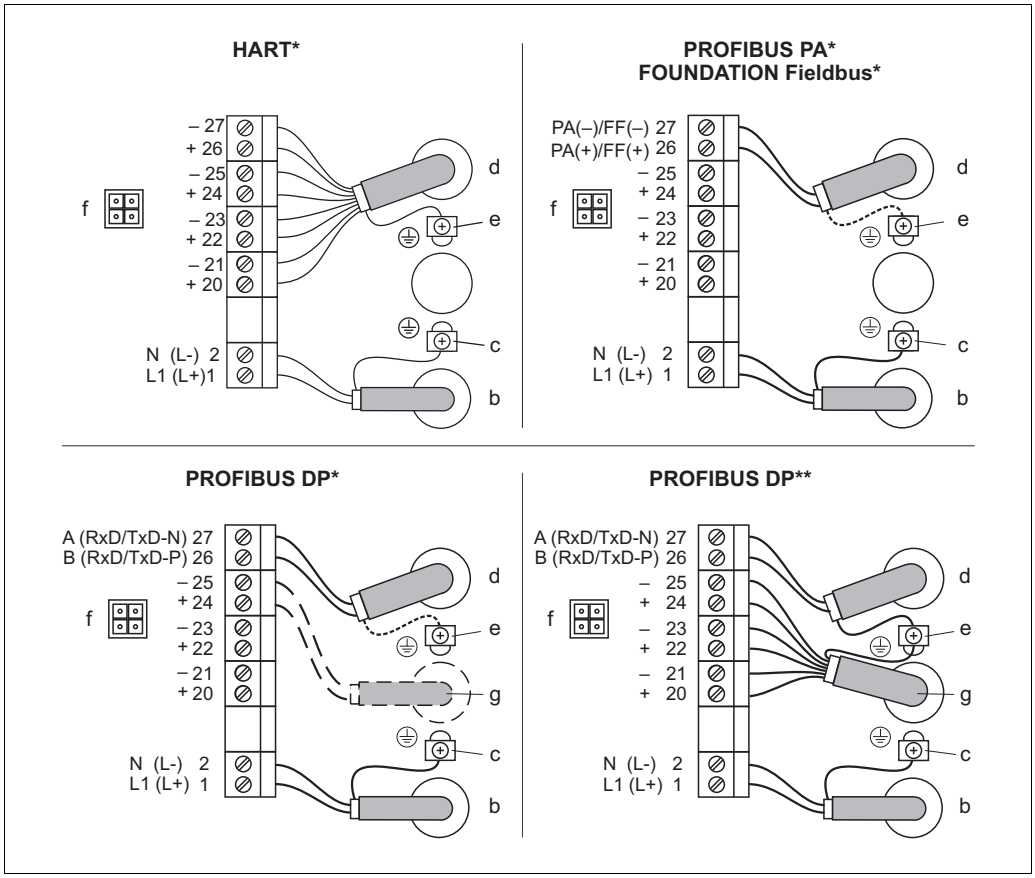

Fig. 6: Connecting the transmitter, cable cross-section max. 2.5 mm²

A Wall-mount housing
**) fixed communication boards*
***) flexible communcation boards*

a Caonnection compartment cover
b Cable for power supply : 85 to 260V 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 conductor
d Signal cable: terminal assignment
Fieldbus cable:
- Terminal No. 26: DP (B) / PA (+), FF (+) with reverse polarity protection
- Terminal 27: DP (A) / PA (–), FF (–) with reverse polarity protection
e Ground terminal for signal cable shield / fieldbus cable
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)
g Signal cable: see terminal assignment
Cable for external termination (only for PROFIBUS DP with permanent assignment communication board):
- Terminal No. 24: +5V
- Terminal No. 25: DGND

Terminal assignment and connection data, power supply

All transmitters	1 L (+)	2 N (–)	⏚
Designation	Supply voltage		Protective earth
Functional values	AC: U = 85 to 260 V AC: U = 20 to 55 V DC: U = 16 to 62 V Power consumption: 15 VA / 15 W		Caution! Observe the grounding plans of the system!
Intrinsically safe circuit	no		
U_m	260 V AC		

Terminal assignment and connection data for signal circuits (intrinsically safe circuits)

✎ Note!
The following tables contain values/specifications, which are dependent on the type code (type of measuring device). Please compare the following type code to the one shown on the nameplate of your measuring device. A graphic representation of the electrical connections: → 9.

Terminal assignment of transmitter 93***-**********F

Transmitter	Terminal no. (Output, Input)							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		–		PROFIBUS PA PA +	PA –
Electric circuit	–		–		–		Ex ia	
Safety-related values	–		–		–		U_i 30 V DC I_i 600 mA P_i 8.5 W L_i ≤ 10 µH C_i ≤ 5 nF FISCO Field device	
Functional values	–		–		–		galvanically isolated, U_{Bus} 9 to 32 V DC I_{Bus} 11 mA GB/T 16657.2 (MBP)	

Terminal assignment of transmitter 93***-**********G

Transmitter	Terminal no. (Output, Input)							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		–		FOUNDATION Fieldbus FF +	FF –
Electric circuit	–		–		–		Ex ia	
Safety-related values	–		–		–		U_i 30 V DC I_i 600 mA P_i 8.5 W L_i ≤ 10 µH C_i ≤ 5 nF FISCO Field device	
Functional values	–		–		–		galvanically isolated, U_{Bus} 9 to 32 V DC I_{Bus} 12 mA GB/T 16657.2 (MBP)	

Terminal assignment of transmitter 93***-**********S

Transmitter	Terminal no. (Output, Input)							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		Pulse/frequency output, passive		Current output HART, active	
Electric circuit	–		–		Ex ia		Ex ia	
Safety-related values	–		–		U_i 30 V DC I_i 500 mA P_i 600 mW L_i negligible C_i 6 nF		U_o 21.8 V DC I_o 90 mA P_o 491 mW L_o IIC/IIB 4.1 mH/15 mH C_o IIC/IIB 160 nF/1160 nF [1] L_o IIC/IIB 2 mH/10 mH [1] C_o IIC/IIB 80 nF/300 nF U_i 30 V DC [2] I_i 10 mA [2] P_i 0.3 W [2] L_i negligible C_i 6 nF	
Functional values	–		–		galvanically isolated, passive: 30 V DC / 250 mA Open Collector Full scale freq. 2 to 5000 Hz		galvanically isolated, active: 0/4 to 20 mA R_L < 400 Ω R_L HART ≥ 250 Ω	

[1] Permitted values in the event of simultaneous occurrence of concentrated inductances and capacitances.
[2] The interconnection must be assessed according to the valid construction provisions.

Terminal assignment of transmitter 93***-**********T

Transmitter	Terminal no. (Output, Input)							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Assignment	–		–		Pulse/frequency output, passive		Current output HART, passive	
Electric circuit	–		–		Ex ia		Ex ia	
Safety-related values	–		–		U_i 30 V DC I_i 500 mA P_i 600 mW L_i negligible C_i 6 nF		U_i 30 V DC I_i 100 mA P_i 1.25 W L_i negligible C_i 6 nF	
Functional values	–		–		galvanically isolated, passive: 30 V DC / 250 mA Open Collector Full scale frequency 2 to 5000 Hz		galvanically isolated, passive: 4 to 20 mA voltage drop ≤ 9 V $R_L < [(V_{p.\,supply} - 9\,V) \div 25\,mA]$	

Terminal assignment and connection data for signal circuits (non-intrinsically safe circuits)

✎ Note!
The following tables contain values/specifications, which are dependent on the type code (type of measuring device). Please compare the following type code to the one shown on the nameplate of your measuring device. A graphic representation of the electrical connections: → 9.

Terminal assignment

Transmitter	Terminal no. (Output, Input)							
	20 (+)	21 (–)	22 (+)	23 (–)	24 (+)	25 (–)	26 (+)	27 (–)
Non-convertible communication boards (fixed assignment)								
93***-*...*A	–		–		Pulse/frequency output		Current output HART	
93***-*...*B	Relay output 2		Relay output 1		Pulse/frequency output		Current output HART	
93***-*...*H	–		–		–		PROFIBUS PA	
							PA +	PA –
93***-*...*J	–		–		–		PROFIBUS DP*	
							B	A
93***-*...*K	–		–		–		FOUNDATION Fieldbus	
							FF +	FF –
Convertible communication boards								
93***-*...*C	Relay output 2		Relay output 1		Pulse/frequency output		Current output HART	
93***-*...*D	Status input		Relay output		Pulse/frequency output		Current output HART	
93***-*...*L	Status input		Relay output 2		Relay output 1		Current output HART	
93***-*...*M	Status input		Pulse/frequency output 2		Pulse/frequency output 1		Current output HART	
93***-*...*P	Current output		Pulse/frequency output		Status input		PROFIBUS DP*	
							B	A
93***-*...*V	Relay output		Relay output		Status input		PROFIBUS DP*	
							B	A
93***-*...*W	Relay output		Current output 3		Current output 2		Current output 1 HART	
93***- *...*2	Relay output		Current output 2		Pulse/frequency output		Current output 1 HART	
93***- *...*4	Current input		Relay output		Pulse/frequency output		Current output HART	
93***- *...*6	Status input		Current input		Current output 2		Current output HART	

Safety-related and functional values of signal circuits → *13*

** PROFIBUS DP*
- terminal 26 (+) → B (R×D/T×D-P)
- terminal 27 (–) → A (R×D/T×D-N)

Safety-related and functional values of signal circuits

Signal circuits	Functional values	Safety-related values
Current output HART	galvanically isolated, active/passive can be selected: ▪ active: 0/4 to 20 mA R_L < 700 Ω, R_L HART ≥ 250 Ω ▪ passive: 4 to 20 mA V_s = 18 to 30 V DC, R_i ≥ 150 Ω	intrinsically safe = no U_m = 260 V I_m = 500 mA
Current output	galvanically isolated, active/passive can be selected: ▪ active: 0/4 to 20 mA R_L < 700 Ω ▪ passive: 4 to 20 mA V_s = 18 to 30 V DC, R_i ≥ 150 Ω	
Pulse/frequency output	galvanically isolated, active/passive can be selected: ▪ active: 24 V DC / 25 mA (max. 250 mA during 20 ms) R_L > 100 Ω ▪ passive: 30 V DC / 250 mA Open Collector Full scale frequency 2 to 10 000 Hz (f_{max} = 12 500 Hz)	
Relay output	galvanically isolated, max. 30 V AC / 500 mA max. 60 V DC / 100 mA	
Current input	galvanically isolated, active/passive can be selected: ▪ active: 4 to 20 mA R_i ≤ 150 Ω U_{out} = 24 V DC, short-circuit proof ▪ passive: 0/4 to 20 mA R_i < 150 Ω U_{max} = 30 V DC	
Status input (93***-*...*D, L, M)	galvanically isolated, 3 to 30 V DC R_i = 5 kΩ	
FOUNDATION Fieldbus	galvanically isolated, U_{Bus} = 9 to 32 V DC I_{Bus} = 12 mA GB/T 16657.2 (MBP)	
PROFIBUS DP	galvanically isolated, RS485 as per Standard EIA/TIA-485	
PROFIBUS PA	galvanically isolated, U_{Bus} = 9 to 32 V DC I_{Bus} = 11 mA GB/T 16657.2 (MBP)	

Service adapter

The service adapter is only used for connecting service interfaces approved by Endress+Hauser.

⚠ Warning!
It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.

Device fuse

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

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

Technical Data

For dimensions and weight refer to the Technical Information:
Prosonic Flow 93P → TI00083D

www.addresses.endress.com

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