Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Safety Instructions

Proline Prosonic Flow 93

HART, PROFIBUS DP/PA, FOUNDATION Fieldbus

Division 1

Ex documentation

FM

Safety instructions for electrical apparatus for explosion-hazardous areas according to FACTORY MUTUAL standards → Page 3

Safety instructions for electrical apparatus for explosion-hazardous areas according to CANADIAN STANDARDS ASSOCIATION → Page 17

XA134D/06/en/07.10
71116528

Endress+Hauser

People for Process Automation

Examples for markings according to FM and CSA:

FM APPROVALS

Type of Protection

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

XP	Explosionproof
IS	Intrinsically Safe Apparatus
AIS	Associated Apparatus with Intrinsically Safe Connections
ANI	Associated Nonincendive Field Wiring Apparatus
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 dust 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

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

Canadian Standards Association

Class

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

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 dust 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 (Class I)	0.18
E	Metallic powder (Class II)	
F	Coal dust (Class II)	
G	Mill dust (Class II)	
	Textile fibres (Class III)	

Type of Protection

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

Temperature Class

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

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Level


Pressure


Flow


Temperature


Liquid Analysis


Registration


Systems Components


Services


Solutions

Safety Instructions

Proline Prosonic Flow 93

HART, PROFIBUS DP/PA, FOUNDATION Fieldbus

Division 1

FM Ex documentation

This document is an integral part of the following Operating Instructions:

- BA070D, Proline Prosonic 93 HART
- BA076D, Proline Prosonic 93 PROFIBBUS DP/PA
- BA078D, Proline Prosonic 93 FOUNDATION Fieldbus

Table of Contents (FM)

XA134D/06/en/07.10
71116528

Endress+Hauser

People for Process Automation

Special conditions

- 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.
- Control room equipment shall not use or generate more than 250 V rms.
- The device must be integrated into the potential equalization system.
- 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 output circuits).
- The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 8.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Use of the devices is restricted to mediums against which the process-wetted materials are adequately resistant.
- Substitution of components may impair intrinsic safety.

⚠ Warning!
The transmitter must be grounded by means of a ground screw on the outside of the transmitter housing (see Fig. 1).

☝ Caution!
Use supply wires suitable for 41 °F above ambient temperature, but at least for 176 °F.

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 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).

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.

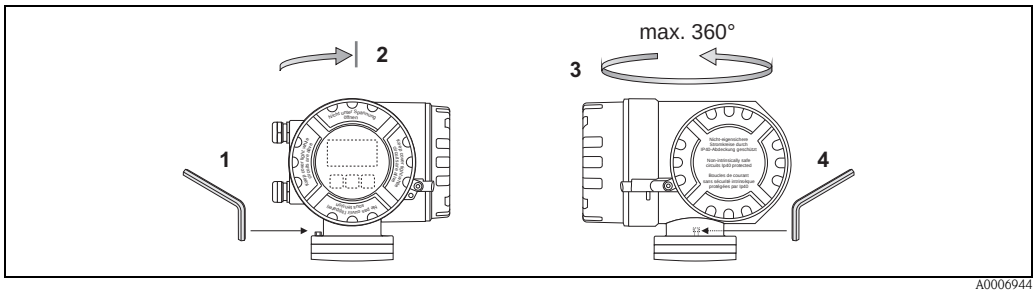

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Fig. 1: Turning the transmitter housing

Approvals

General

The system meets the fundamental health and safety requirements for the design and construction of devices and protective systems intended for use in potentially explosive atmospheres in accordance with the National Electrical Code.

No. / approval type

J.I. 3010849

Notified body

FM: Factory Mutual Research

Identification

The identification of the system must contain the following specifications:

- Prosonic Flow 93 transmitter (93**-******N****): XP-AIS-DIP / I, II, III / 1 / ABCDEFG / T6
- Prosonic Flow P sensor: IS-DIP / I, II, III / 1 / ABCDEFG / T6-T1
- Prosonic Flow DDU18: IS-DIP / I, II, III / 1 / ABCDEFG / T6-T1
- Prosonic Flow DDU19: IS-DIP / I, II, III / 1 / ABCDEFG / T6-T1

Caution!

The installation instructions for the safe use of the system must be observed → Page 4 .

Description of measuring system

The measuring system consists of transmitters and sensors. Transmitters and sensors are separated by open ground when installed and connected to each other via a connecting cable.

Nameplate

The nameplates, which are mounted in a clearly visible position on the transmitter and sensor, contain all of the relevant information about the measuring system.

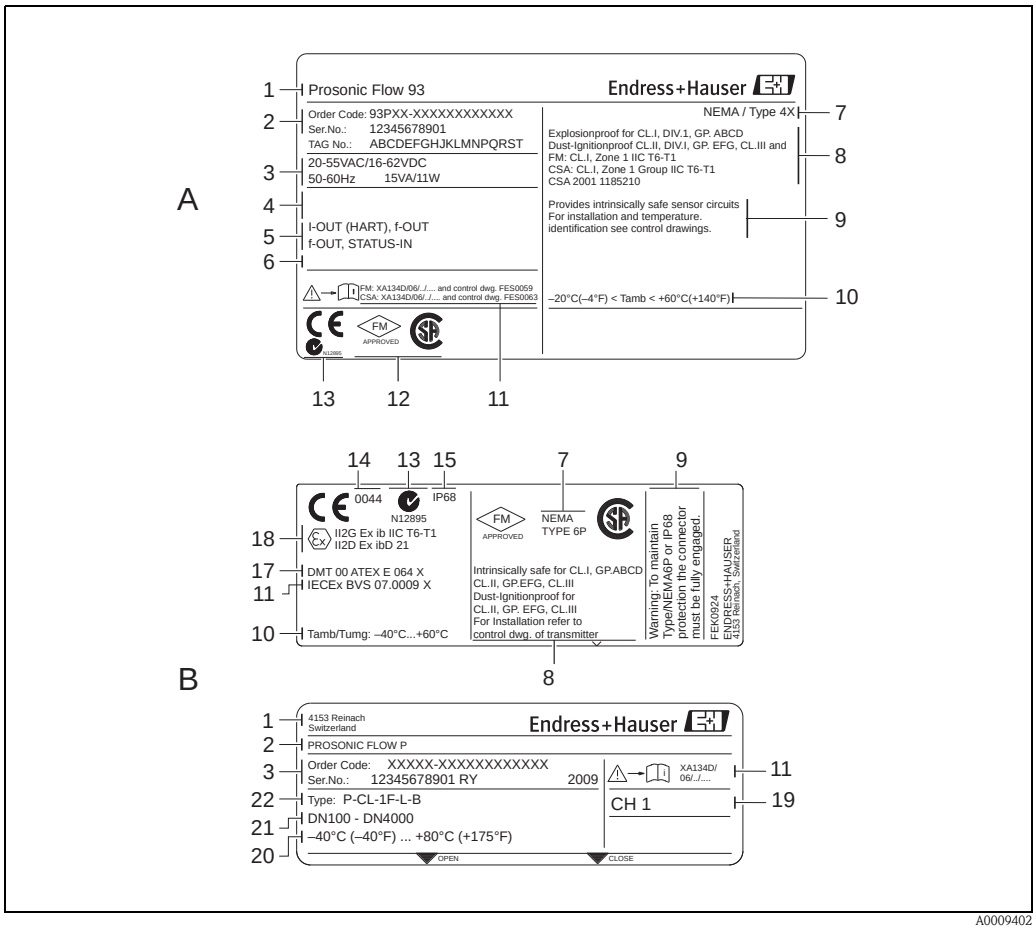

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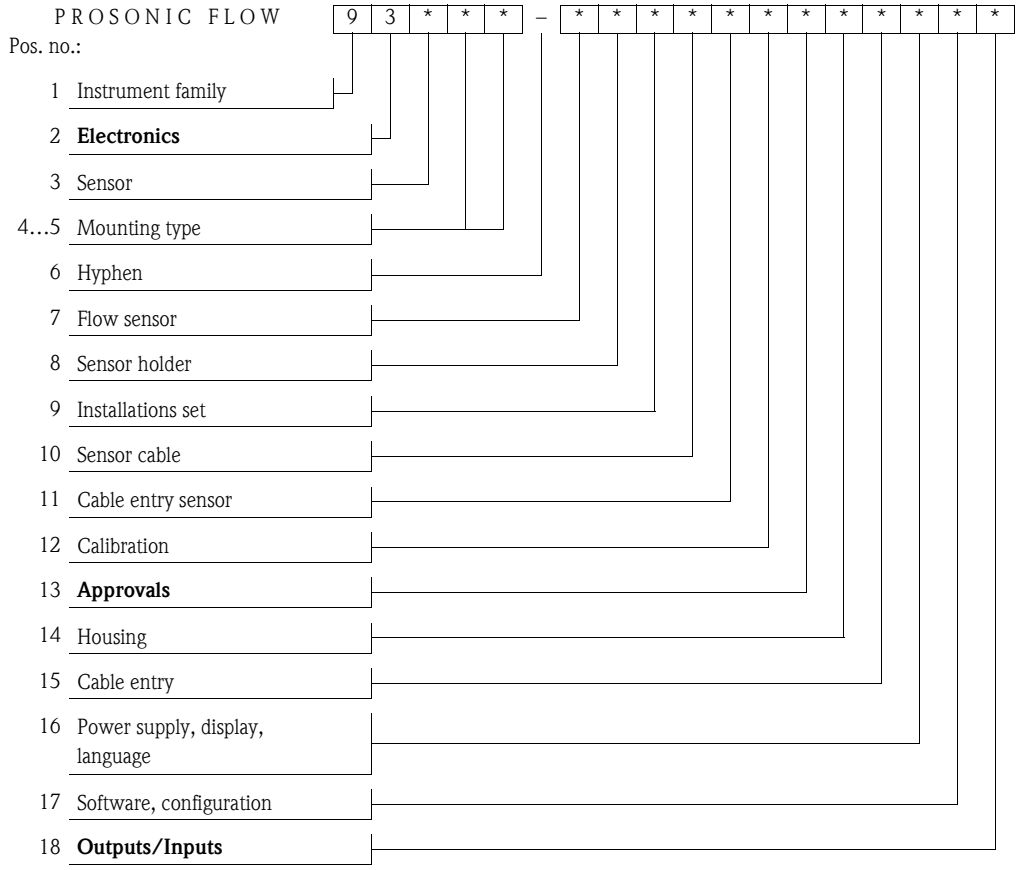
Fig. 2: Example for nameplates of a transmitter and of a sensor

A Transmitter nameplate
B Sensor nameplate

1 Transmitter or sensor type
2 Order code and serial number
3 Power supply, frequency and power consumption
4 Additional specifications (only if present)
5 Available inputs/outputs
6 Space for additional information on special products
7 Type of housing protection
8 Identification of the type of protection, explosion group, temperature class
9 Notes, e.g. delays, etc.
10 Ambient temperature range
11 Associated Ex documentation
12 Label of notified body: Factory Mutual Research resp. Canadian Standards Association
13 C-Tick symbol
14 Notified body for quality assurance monitoring
15 Type of housing protection
16 Number of the IECEx declaration of conformity
17 Number of the EC type-examination certificate
18 Equipment group and equipment category as per directive 94/9/EC
19 Channel 1
20 Fluid temperature range
21 Nominal diameter
22 Sensor type
23 Production site

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 the type code)

*	Transmitter
3	Prosonic Flow 93

Approvals (Pos. no. 13 in the type code)

*	Application/Zone	
N	**Transmitter**	
	XP-AIS-DIP / I, II, III / 1 / ABCDEFG / T6	
	Sensor	
	Prosonic P, Clamp on version	IS-DIP / I, II, III / 1 / ABCDEFG / T6-T1
	DDU18 (Sound velocity measurement)	
	DDU19 (Wall thickness measurement)	

Outputs/Inputs (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-intrisically safe outputs
F, G, S, T	Ex ia

✎ Note!
A detailed explanation of these values with regard to the outputs and inputs available, as well as a description of the associated terminal assignment and connection data can be found as of Page 12 ff.

Temperature table

Prosonic Flow**PA*-1/2*****N*****

at T_a = 140 °F		Max. medium temperature [°C] in					
		T6 185 °F	**T5 212 °F**	**T4 275 °F**	**T3 392 °F**	**T2 572 °F**	**T1 842 °F**
SensorsPA*-1*****N*******	TPE-V cables	176	203	212	212	212	212
SensorsPA*-2*****N*******	TPE-V cables	176	203	266	302	302	302

The minimum medium temperature is –40 °F.

Prosonic Flow**PA*-A/B*****N***** and Sound velocity measuring sensors DDU18-A***

at T_a = 140 °F		Max. medium temperature [°C] in					
		T6 185 °F	**T5 212 °F**	**T4 275 °F**	**T3 392 °F**	**T2 572 °F**	**T1 842 °F**
SensorsPA*-A/B*****N*****	PVC cables	176	176	176	176	176	176
Sensors DDU18-A*	PVC cables	176	176	176	176	176	176

The minimum medium temperature is –40 °F.

Prosonic Flow**PA*-E/F*****N***** and Sound velocity measuring sensors DDU18-B***

at T_a = 140 °F		Max. medium temperature [°C] in					
		T6 185 °F	**T5 212 °F**	**T4 275 °F**	**T3 392 °F**	**T2 572 °F**	**T1 842 °F**
SensorsPA*-E/F*****N*****	PTFE cables	176	203	266	338	338	338
Sensors DDU18-B*	PTFE cables	176	203	266	338	338	338

The minimum medium temperature is +32 °F.

Wall thickness measuring sensor DDU19-A***

at T_a = 140 °F		Max. medium temperature [°C] in					
		T6 185 °F	**T5 212 °F**	**T4 275 °F**	**T3 392 °F**	**T2 572 °F**	**T1 842 °F**
Sensor DDU19-A*	PVC or PTFE cables	176	176	176	176	176	176

The minimum medium temperature is –4 °F.

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

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 = 140 °F. The maximum ambient temperature range is –4…+140 °F.

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

Design of measuring system

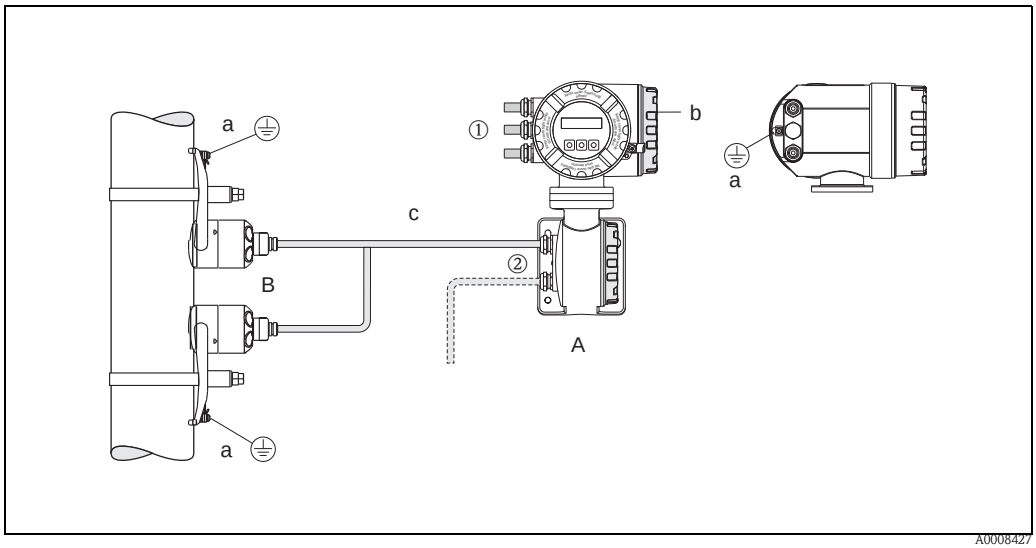


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Fig. 3: Design of the measuring system (remote version)

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 (XP version): power supply cable and cable of the communication circuit
  → Choice of thread for cable entry ½" NPT.

  Make sure that the XP cable glands/entries are secured to prevent working loose and that the seals are installed immediately adjacent to the housing.
- ② for remote version connecting cable:
  → Choice of cable gland for cable entry ½" NPT

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

Cable specification

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

Potential equalization

The transmitter 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

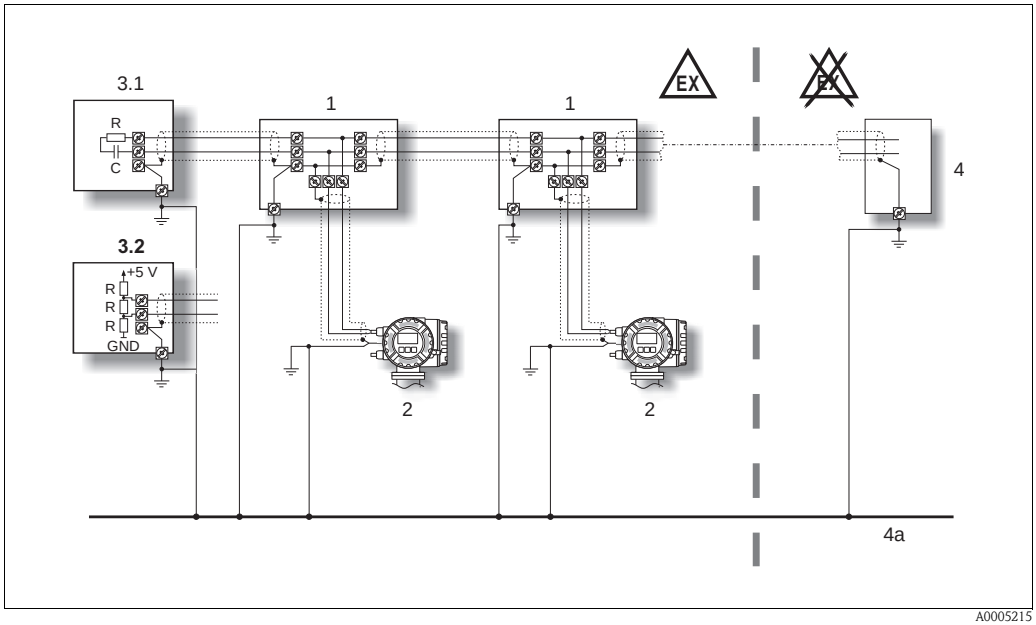


Fig. 4: Example for connecting potential equalization lines

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
4 Bus supply unit or automation system
4a Potential equalization line is fed out into the safe area

Connecting the sensor connecting cable

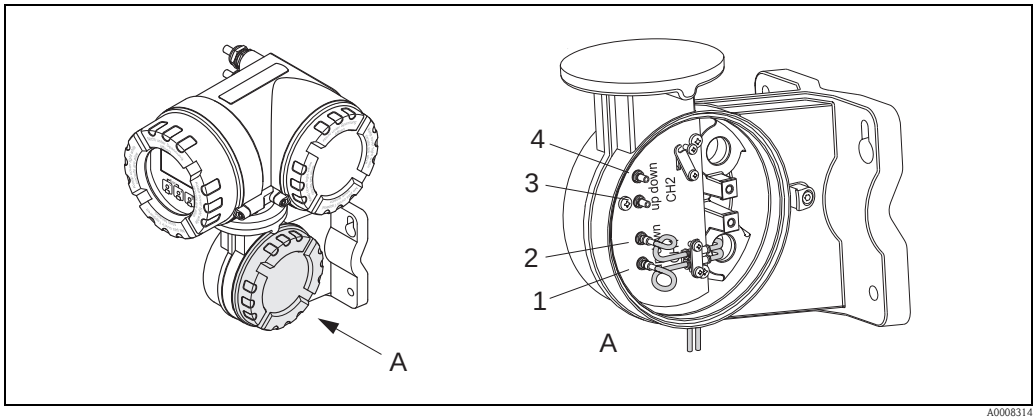


Fig. 5: Connecting the sensor connecting cable

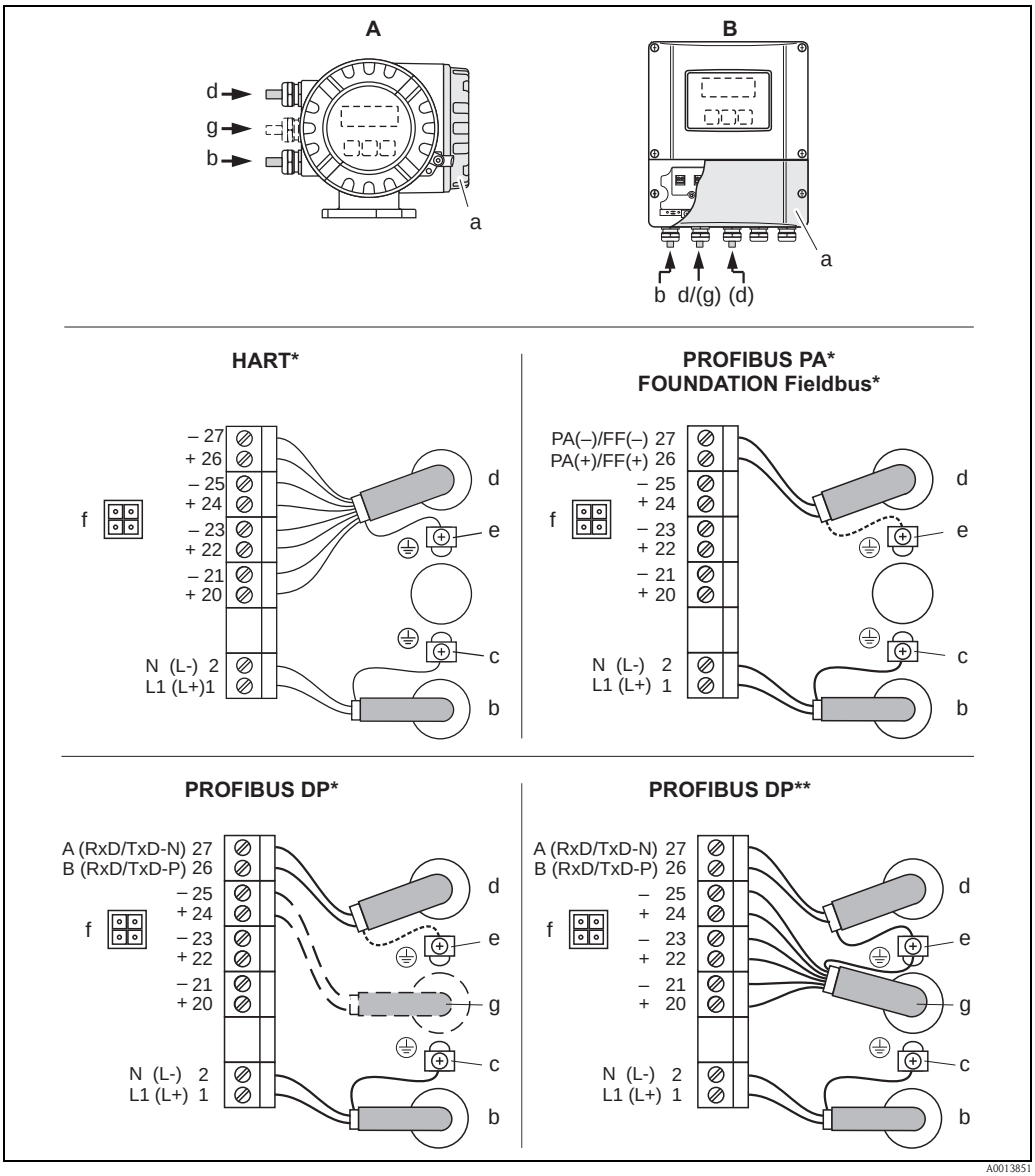
1 Channel 1 (upstream)
2 Channel 1 (downstream)
3 Channel 2 (upstream)
4 Channel 2 (downstream)

✎ 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 → Page 12 ff.)



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

A *Aluminum field housing*
B *Wall-mount housing*

**)* *Permanent assignment communication boards*
***)* *Flexible assignment communication boards*

a *Cover of the connection compartment*
b *Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC*
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 1: N for AC, L- for DC
c *Ground terminal for protective ground*
d *Signal cable: see terminal assignment*
Fieldbus:
- Terminal 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 / fieldbus cable*
f *Service connector for connecting service interface FXA 193 (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 can be found on Page 11.

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

Transmitter	Terminal no. (inputs/outputs)							
	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 IEC 61158-2 (MBP)	

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

Transmitter	Terminal no. (inputs/outputs)							
	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 IEC 61158-2 (MBP)	

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

Transmitter	Terminal no. (inputs/outputs)							
	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. (inputs/outputs)							
	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 can be found on Page 11.

Terminal assignment

Transmitter	Terminal no. (inputs/outputs)							
	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 → Page 15

* 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 IEC 61158-2 (MBP)	
PROFIBUS DP	galvanically isolated, RS 485 as per standard ETA/TIA-485	
PROFIBUS PA	galvanically isolated, U_{Bus} = 9 to 32 V DC I_{Bus} = 11 mA IEC 61158-2 (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!
Only use the following fuse types that are mounted on the power unit 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)

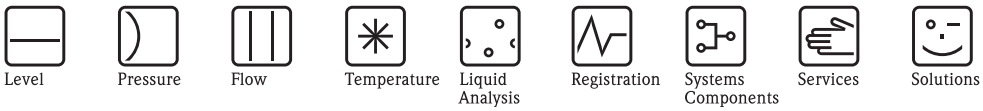
Technical Data

For dimensions and weight refer to the Technical Information:
Prosonic Flow 93P → TI083D

Control Drawings

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

✎ Note!
The "Documentation/Important Information" folder provided with the measuring device contains a CD-ROM with all the Control Drawings.



Safety Instructions

Proline Prosonic Flow 93

HART, PROFIBUS DP/PA, FOUNDATION Fieldbus

Division 1

Ex documentation

This document is an integral part of the following Operating Instructions:

- BA070D, Proline Prosonic 93 HART
- BA076D, Proline Prosonic 93 PROFIBBUS DP/PA
- BA078D, Proline Prosonic 93 FOUNDATION Fieldbus

Table of Contents (CSA)

XA134D/06/en/07.10
71116528

Endress+Hauser
People for Process Automation

Special conditions

- Install per Canadian Electrical Code.
- Control room equipment shall not use or generate more than 250 V rms.
- The device must be integrated into the potential equalization system.
- 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 output circuits).
- The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 22.
- It is not permissible to connect the service adapter whilst the atmosphere is considered to be explosive.
- Use of the devices is restricted to mediums against which the process-wetted materials are adequately resistant.
-
- Substitution of components may impair intrinsic safety.

⚠ Warning!
The transmitter must be grounded by means of a ground screw on the outside of the transmitter housing (see Fig. 1).

☝ Caution!
- Use supply wires suitable for 5 °C above ambient temperature, but at least for 80 °C.

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 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).

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.

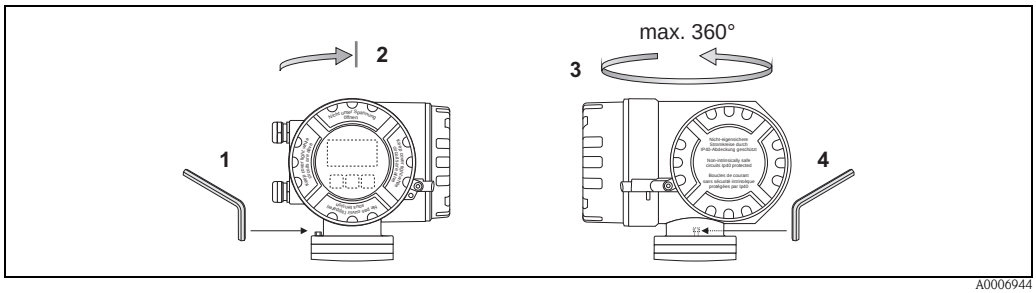


Fig. 1: Turning the transmitter housing

Approvals

General

The system meets the fundamental health and safety requirements for the design and construction of devices and protective systems intended for use in potentially explosive atmospheres in accordance with the Canadian Electrical Code.

No. / approval type

1185210

Notified body

CSA: Canadian Standard Association

Identification

The identification of the system must contain the following specifications:

- Prosonic Flow 93 transmitter (93**-******N****):
  - Explosionproof for Class I, Division 1, Groups ABCD
  - Dust-Ignitionproof for Class II, Division 1, Groups EFG; Class III
- Prosonic Flow P sensor:
  - Intrinsically safe for Class I, Groups ABCD; Class II, Groups EFG; Class III
  - Dust-Ignitionproof for Class II, Groups EFG; Class III
- Prosonic Flow DDU18:
  - Intrinsically safe for Class I, Groups ABCD; Class II, Groups EFG; Class III
  - Dust-Ignitionproof for Class II, Groups EFG; Class III
- Prosonic Flow DDU19:
  - Intrinsically safe for Class I, Groups ABCD; Class II, Groups EFG; Class III
  - Dust-Ignitionproof for Class II, Groups EFG; Class III

Caution!

The installation instructions for the safe use of the system must be observed → Page 18.

Description of measuring system

The measuring system consists of transmitters and sensors. Transmitters and sensors are separated by open ground when installed and connected to each other via a connecting cable.

Nameplate

The nameplates, which are mounted in a clearly visible position on the transmitter and sensor, contain all of the relevant information about the measuring system.

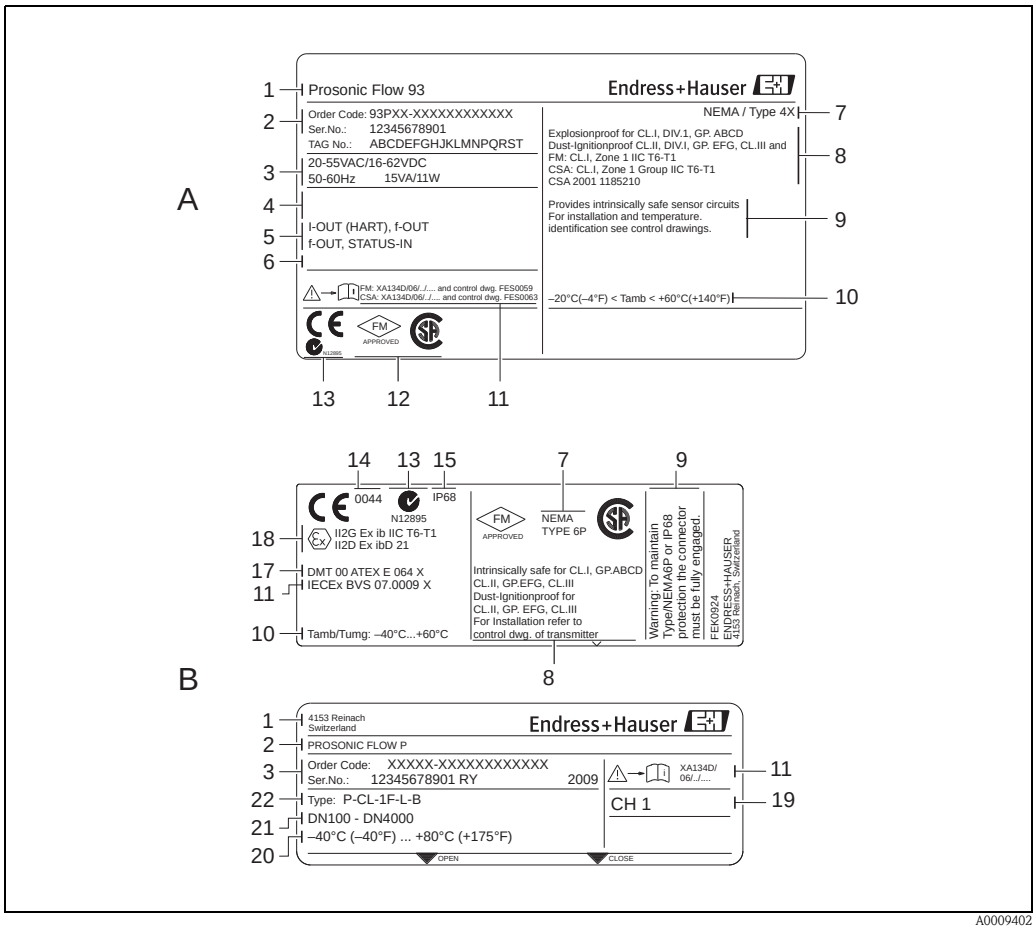


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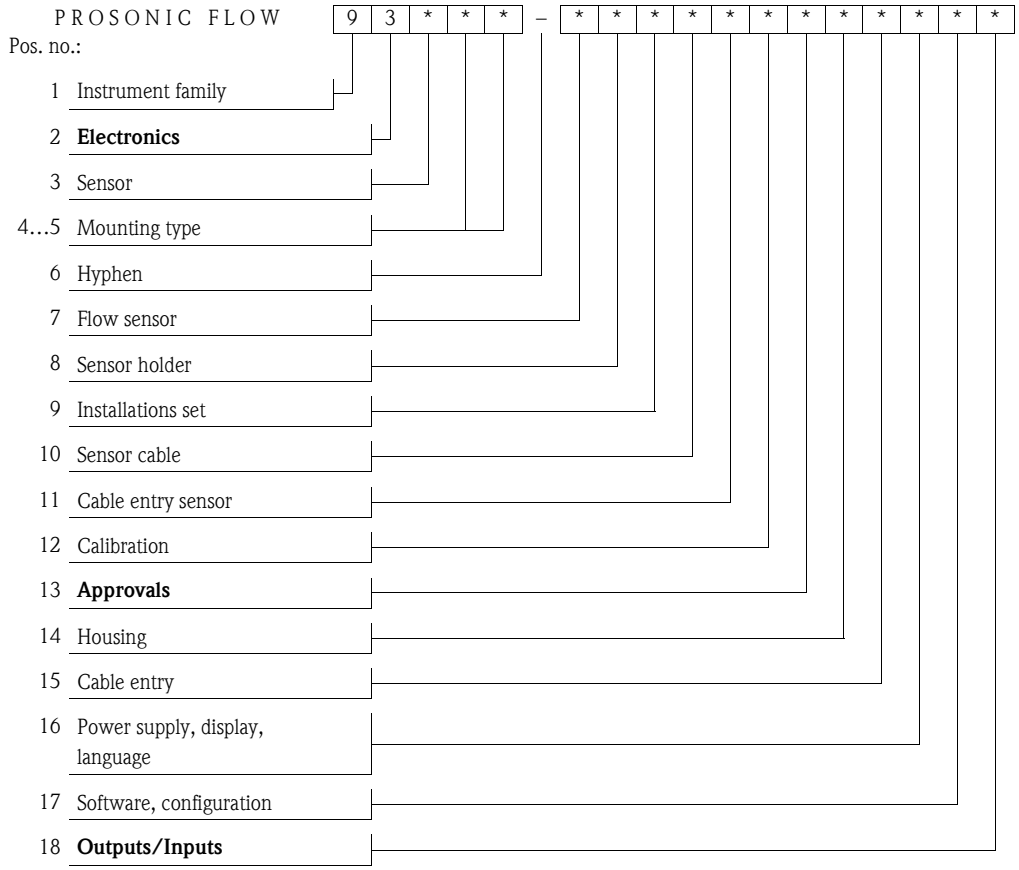
Fig. 2: Example for nameplates of a transmitter and of a sensor

A Transmitter nameplate
B Sensor nameplate

1 Transmitter or sensor type
2 Order code and serial number
3 Power supply, frequency and power consumption
4 Additional specifications (only if present)
5 Available inputs/outputs
6 Space for additional information on special products
7 Type of housing protection
8 Identification of the type of protection, explosion group, temperature class
9 Notes, e.g. delays, etc.
10 Ambient temperature range
11 Associated Ex documentation
12 Label of notified body: Factory Mutual Research resp. Canadian Standards Association
13 C-Tick symbol
14 Notified body for quality assurance monitoring
15 Type of housing protection
16 Number of the IECEx declaration of conformity
17 Number of the EC type-examination certificate
18 Equipment group and equipment category as per directive 94/9/EC
19 Channel 1
20 Fluid temperature range
21 Nominal diameter
22 Sensor type
23 Production site

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 the type code)

*	Transmitter
3	Prosonic Flow 93

Approvals (Pos. no. 13 in the type code)

*	Application/Zone	
N	**Transmitter**	
	Explosionproof for Class I, Division 1, Groups ABCD Dust-Ignitionproof for Class II, Division 1, Groups EFG; Class III	
	Sensor	
	Prosonic P, Clamp on version	Intrinsically safe for Class I, Groups ABCD; Class II, Groups EFG; Class III Dust-Ignitionproof for Class II, Groups EFG; Class III
	DDU18 (Sound velocity measurement)	
	DDU19 (Wall thickness measurement)	

Outputs/Inputs (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-intrisically safe outputs
F, G, S, T	Ex ia

✎ Note!
A detailed explanation of these values with regard to the outputs and inputs available, as well as a description of the associated terminal assignment and connection data can be found as of Page 26.

Temperature table

Prosonic Flow**PA*-1/2*****N*****

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*-1*****N*******	TPE-V cables	80	95	100	100	100	100
SensorsPA*-2*****N*******	TPE-V cables	80	95	130	150	150	150

The minimum medium temperature is –40 °C.

Prosonic Flow**PA*-A/B*****N***** 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*****N*****	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 Flow**PA*-E/F*****N***** 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*****N*****	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**-**********

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.

Design of measuring system

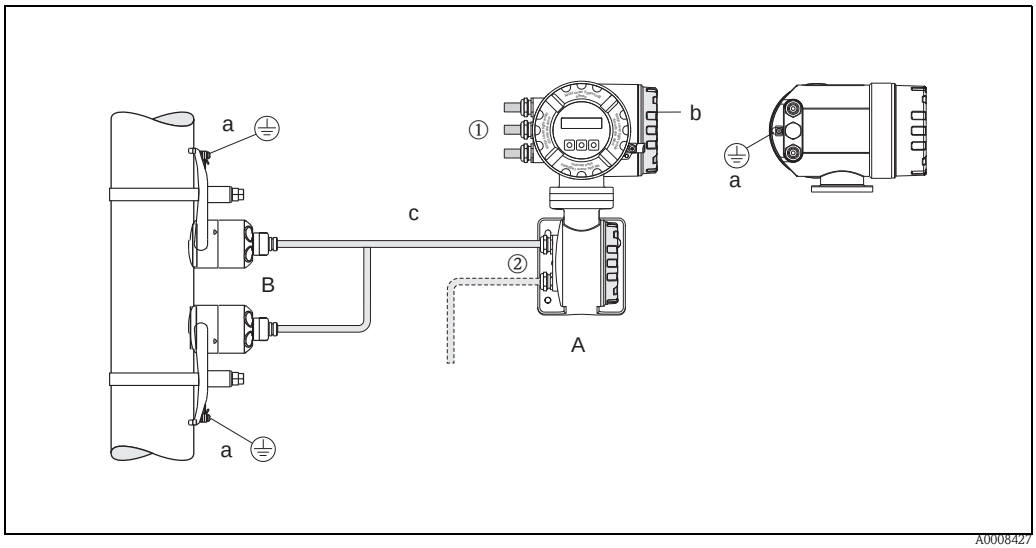


Fig. 3: Design of the measuring system (remote version)

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 (XP version): power supply cable and cable of the communication circuit → Choice of thread for cable entry ½" NPT.

  Make sure that the XP cable glands/entries are secured to prevent working loose and that the seals are installed immediately adjacent to the housing.
- ② for remote version connecting cable:
  → Choice of cable gland for cable entry ½" NPT

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

Cable specification

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

Potential equalization

The transmitter 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

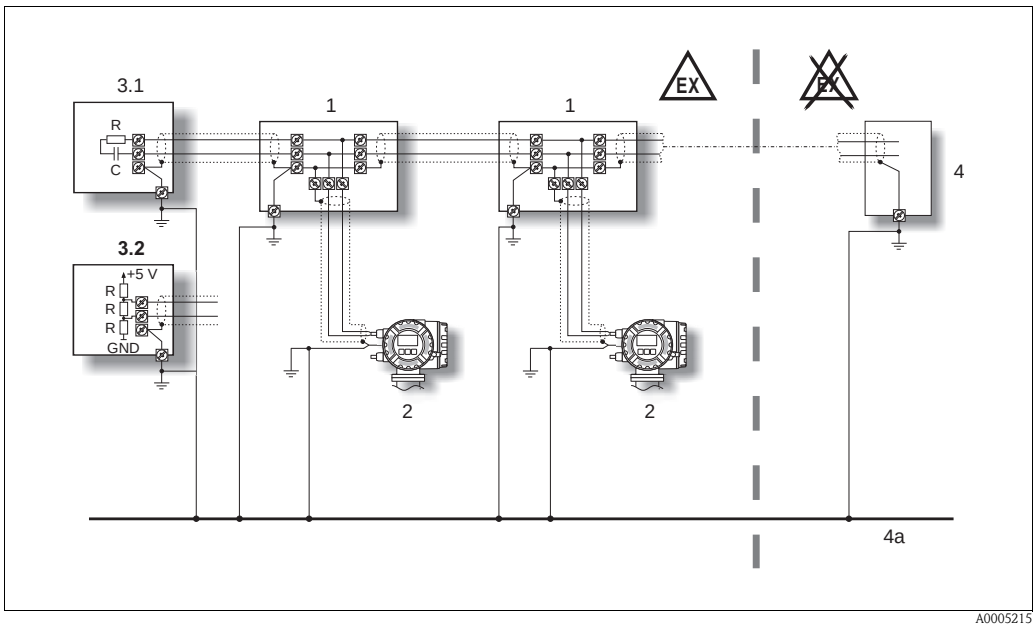


Fig. 4: Example for connecting potential equalization lines

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
4 Bus supply unit or automation system
4a Potential equalization line is fed out into the safe area

Connecting the sensor connecting cable

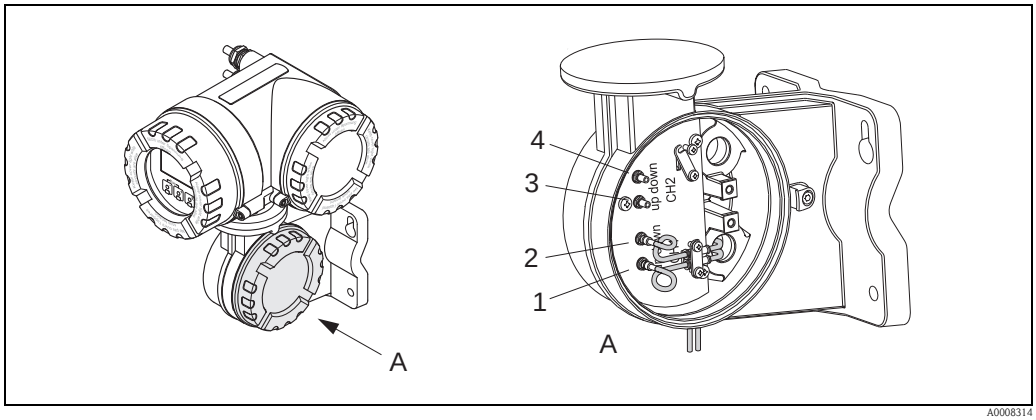


Fig. 5: Connecting the sensor connecting cable

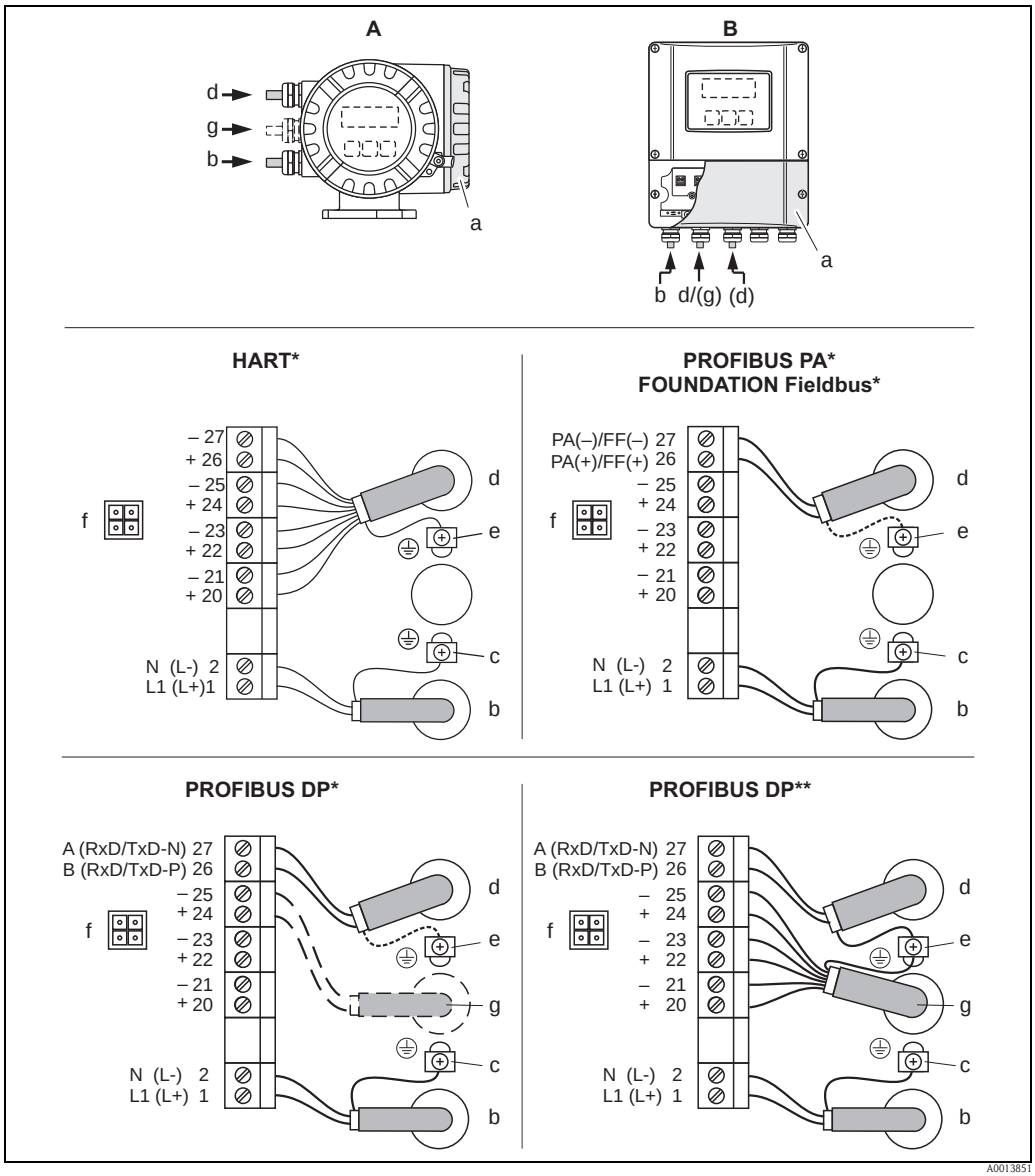
1 Channel 1 (upstream)
2 Channel 1 (downstream)
3 Channel 2 (upstream)
4 Channel 2 (downstream)

✎ 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 → Page 26 ff.)



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

A *Aluminum field housing*
B *Wall-mount housing*

**)* *Permanent assignment communication boards*
***)* *Flexible assignment communication boards*

a *Cover of the connection compartment*
b *Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC*
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 1: N for AC, L- for DC
c *Ground terminal for protective ground*
d *Signal cable: see terminal assignment*
Fieldbus:
- Terminal 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 / fieldbus cable*
f *Service connector for connecting service interface FXA 193 (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 can be found on Page 25.

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

Transmitter	Terminal no. (inputs/outputs)							
	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 IEC 61158-2 (MBP)	

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

Transmitter	Terminal no. (inputs/outputs)							
	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 IEC 61158-2 (MBP)	

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

Transmitter	Terminal no. (inputs/outputs)							
	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. (inputs/outputs)							
	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 can be found on Page 25.

Terminal assignment

Transmitter	Terminal no. (inputs/outputs)							
	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 → Page 29

* 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 IEC 61158-2 (MBP)	
PROFIBUS DP	galvanically isolated, RS485 as per standard ETA/TIA-485	
PROFIBUS PA	galvanically isolated, U_{Bus} = 9 to 32 V DC I_{Bus} = 11 mA IEC 61158-2 (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!
Only use the following fuse types that are mounted on the power unit 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 → TI083D

Control Drawings

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

✎ Note!
The "Documentation/Important Information" folder provided with the measuring device contains a CD-ROM with all the Control Drawings.

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