

PROline prowirl 72 / prowirl 73

PROFIBUS PA

Ex-i intrinsically safe version (IS)

Division 1



Ex documentation for the BA 085D (Prowirl 72 PROFIBUS PA) /
BA 093D (Prowirl 73 PROFIBUS PA) operating instruction
according to FACTORY MUTUAL standards



Ex documentation for the BA 085D (Prowirl 72 PROFIBUS PA) /
BA 093D (Prowirl 73 PROFIBUS PA) operating instruction
according to CANADIAN STANDARDS ASSOCIATION



Endress + Hauser

The Power of Know How



PROline prowirl 72 / prowirl 73 PROFIBUS PA, Ex-i intrinsically safe version (IS), Division 1

Ex documentation for the BA 085D
(Prowirl 72 PROFIBUS PA) and BA 093D
(Prowirl 73 PROFIBUS PA) operating instruction
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

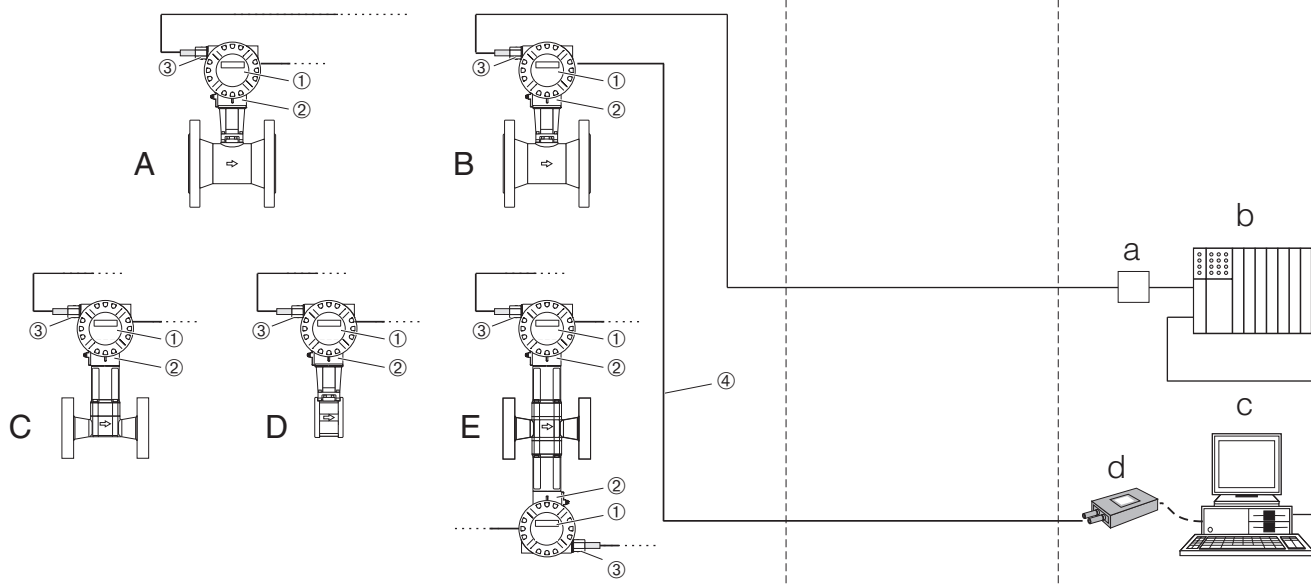
FM / NEC	Gases, vapours and dusts (Examples)	Min. ignition temperature [μ J]
A	Acetylene, carbon disulfide (Class I)	0.02
B	Hydrogen, ethyl nitrate (Class I)	0.02
C	Ethylene, isoprene (Class I)	0.06
D	Acetone, ethane, benzene, ethanoic acid, gasoline, diesel oil, aircraft fuel, methane, heating oil, 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



Measuring system Prowirl 72 / Prowirl 73 PROFIBUS PA, compact version

Hazardous area		Safe area
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	
		
F06-7xxxxxZZ-16-xx-xx-xx-004		
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	Safe area
Hazardous area		
Prowirl 73 PROFIBUS PA: A = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K D = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K Prowirl 72 PROFIBUS PA: B = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K C = Sensor F (DN 1/2"...6"); High pressure version PN 64...160; CI 600; JIS 40K D = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K E = Sensor F (DN 1/2"...6"); Dualsens PN 10...160; CI 150...600; JIS 10...40K	① Transmitter electronics Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA in: Cl. I Div. 1 Groups ABCD Cl. I Div. 1 Zone 0 AEx ia IIC Cl. II Div. 1 Groups EFG Cl. III ② Prowirl 72 resp. 73 standard housing ③ Cable entries: Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread. ④ Only the "PROLINE EX-ZWEILEITER-KABEL" connection cable can be used to connect a Prowirl 72 or 73 to the Service Interface FXA 193.  Note! For ambient and fluid temperature ranges, and temperature class, see Page 5.	a = Segment coupler b = PLC/DCS c = PC with configuration tool d = Service Interface FXA 193 (see Page 10)

Measuring system Prowirl 72 / Prowirl 73 PROFIBUS PA, remote version

Hazardous area		Safe area
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	
F06-7xxxxxZZ-16-xx-xx-xx-005		
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	Safe area
Hazardous area		
Prowirl 73 PROFIBUS PA: A = Transmitter Prowirl 73 PROFIBUS PA 1 = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K 2 = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K Prowirl 72 PROFIBUS PA: B = Transmitter Prowirl 72 PROFIBUS PA 1 = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K 2 = Sensor F (DN 1/2"...6"); High pressure version PN 64...160; CI 600; JIS 40K 3 = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K 4 = Sensor F (DN 1/2"...6"); Dualsens PN 10...160; CI 150...600; JIS 10...40K	① Transmitter electronics Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA in: CI. I Div. 1 Groups ABCD CI. I Div. 1 Zone 0 AEx ia IIC CI. II Div. 1 Groups EFG CI. III ② Prowirl 72 resp. 73 standard housing ③ Cable entries: Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread. ④ Connecting cable remote version: see Page 10. ⑤ Only the "PROLINE EX-ZWEILEITER-KABEL" connection cable can be used to connect a Prowirl 72 or 73 to the Service Interface FXA 193. Note! For ambient and fluid temperature ranges, and temperature class, see Page 6.	a = Segment coupler b = PLC/DCS c = PC with configuration tool d = Service Interface FXA 193 (see Page 10)

Temperature tables compact version

Measuring system Prowirl 72 PROFIBUS PA (compact version)

- Sensor standard temperature version:

Prowirl 72*.0*****H**

Prowirl F/W	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +158\text{ °F}$	266	374	536	536

The minimum medium temperature is -40 °F .

- High/low temperature sensor version, high pressure version and Dualsens version:

Prowirl 72*.1*****H, Prowirl 72***.2*****H, Prowirl 72***.3*****H**

Prowirl F/W	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +158\text{ °F}$	266	374	554	824

The minimum medium temperature is -328 °F .

Measuring system Prowirl 73 PROFIBUS PA (compact version)

- Sensor standard temperature version:

Prowirl 73*.4*****H**

Prowirl F	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +158\text{ °F}$	266	374	554	824

The minimum medium temperature is -328 °F .

Temperature tables remote version

Measuring system Prowirl 72 PROFIBUS PA (remote version)

- Sensor standard temperature version:

Prowirl 72*-0*****H**

Prowirl F/W	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +185\text{ °F}$	266	374	536	536

The minimum medium temperature is -40 °F.

- High/low temperature sensor version, high pressure version and Dualsens version:

Prowirl 72*-1*****H, Prowirl 72***-2*****H, Prowirl 72***-3*****H**

Prowirl F/W	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +185\text{ °F}$	266	374	554	824

The minimum medium temperature is -328 °F.

- Transmitter Prowirl 72 PROFIBUS PA:

Prowirl 72*-*****H**

	Max. ambient temperature [°F] in			
	T4	T3	T2	T1
Prowirl 72 PROFIBUS PA	176	176	176	176

The minimum ambient temperature is -40 °F.

Measuring system Prowirl 73 PROFIBUS PA (remote version)

- Sensor standard temperature version:

Prowirl 73*-4*****H**

Prowirl F/W	Max. medium temperature [°F] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °F} \dots +185\text{ °F}$	266	374	554	824

The minimum medium temperature is -328 °F.

- Transmitter Prowirl 73 PROFIBUS PA:

Prowirl 73*-*****H**

	Max. ambient temperature [°F] in			
	T4	T3	T2	T1
Prowirl 73 PROFIBUS PA	176	176	176	176

The minimum ambient temperature is -40 °F.

Approvals

No. / approval type	Description
I.D. 3015769 (see Page 8 for notes on special conditions)	for the electric flow measuring system Prowirl 72 resp. 73 PROFIBUS PA
	Identification: see below

Measuring system Prowirl 72 PROFIBUS PA, intrinsically safe version IS (compact version)

P r o w i r l 7 2 * * * _ * * * * * * . * * * * .		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Prowirl 72 F	DN 1/2"...12"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 72 W	DN 1/2"...6"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Measuring system Prowirl 72 PROFIBUS PA, intrinsically safe version IS (remote version)

P r o w i r l 7 2 * * * _ * * * * * * . * * * * .		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Transmitter Prowirl 72 PROFIBUS PA (remote version)		
Prowirl 72 PROFIBUS PA		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Sensor Prowirl F/W (remote version)		
Prowirl 72 F	DN 1/2"...12"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 72 W	DN 1/2"...6"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Measuring system Prowirl 73 PROFIBUS PA, intrinsically safe version IS (compact version)

P r o w i r l 7 3 * * * _ * * * * * . * * * * *		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Prowirl 73 F	DN 1/2"...12"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 73 W	DN 1/2"...6"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Measuring system Prowirl 73 PROFIBUS PA, intrinsically safe version IS (remote version)

P r o w i r l 7 3 * * * _ * * * * * . * * * * *		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Transmitter Prowirl 73 PROFIBUS PA (remote version)		
Prowirl 73 PROFIBUS PA		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Sensor Prowirl 73 F (remote version)		
Prowirl 73 F	DN 1/2"...12"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 73 W	DN 1/2"...6"	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Notified body

The Prowirl measuring system was tested for approval by the following named entity:
FM: Factory Mutual Research

Special conditions

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



Caution!

- Use supply wires suitable for +50 °F above maximum ambient temperature.
- The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 4 and 5.
- It is not permissible to connect the service adapter in explosive atmospheres.
- Install per National Electrical Code. Install intrinsically safe circuits per NEC ANSI/NFPA 70 and ISA RP 12.6.



Warning!

- Substitution of components may impair intrinsic safety.
- The flowmeter must be integrated into the potential equalisation system (see Fig. 1).

General warnings



Warning!

- 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.
- The manufacturer's guidelines for all devices connected to the intrinsically safe circuits must be observed.
- To rotate the transmitter housing, use the same procedure as for safe area versions. The transmitter housing may also be rotated during operation.

Electrical connections

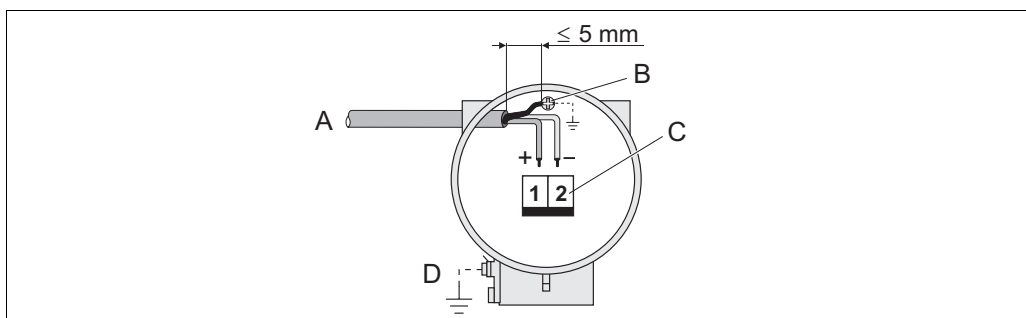


Fig. 1: Electrical connections Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA

F06-73PBxxxx-11-00-00-xx-000

A = PROFIBUS cable

B = Ground terminal in the wiring compartment (between the stripped PROFIBUS cable and the ground terminal, the cable shielding should not exceed a length of 5 mm)

C = Terminal connector (1 = PA +; 2 = PA -)

D = Ground terminal for potential equalisation (external, only relevant for remote version)



Caution!

- Ground potential equalisation must exist between the safe and hazardous area.
- The transmitter is to be securely connected to the potential equalization system using either the transmitter's external screw terminal (D), or the ground terminal (B) in the wiring compartment.
- Between the stripped PROFIBUS cable and the ground terminal, the cable shielding should not exceed a length of 5 mm.
- Alternatively, the sensor and the transmitter (compact version) or the connection housing 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 Prowirl 72***-*****N****H; Prowirl 73***-*****N****H

Terminals	1 (+)	2 (-)
Designation	PROFIBUS PA	
Intrinsically safe circuit	yes	
U_i or V_{max}	17.5 V	
I_i or I_{max}	500 mA	
P_i	5.5 W	
L_i	$\leq 10 \mu H$	
C_i	$\leq 5 \text{ nF}$	

or

Terminals	1 (+)	2 (-)
Designation	PROFIBUS PA	
Intrinsically safe circuit	yes	
U_i or V_{max}	24 V	
I_i or I_{max}	250 mA	
P_i	1.2 W	
L_i	$\leq 10 \mu H$	
C_i	$\leq 5 \text{ nF}$	

Service adapter

The service adapter is exclusively for connection to Endress+Hauser approved service interfaces FXA 193.



Warning!

It is not permissible to connect the service adapter in explosive atmospheres.

Cable entries

Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread (see also the figures on Pages 2 and 3, number ③).

Cable specifications

The sensor cable connection between sensor and transmitter has an IS type of protection rating (see also the figures on Pages 2 and 3, number ④).

The max. cable length is 320 ft (100 m) for intrinsically safe use. Functionally the cable length is limited to 98 ft (30 m).

The max. capacitance of the cable is 300 $\mu\text{F}/\text{ft}$ (1 $\mu\text{F}/\text{km}$).

The max. cable inductivity is 0.30 $\mu\text{H}/\text{ft}$ (1 mH/km).

The cable delivered by E+H (max. 98 ft (30 m)) fulfils these requirements.

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: $C_i \leq 5 \text{ nF}$, $L_i \leq 10 \mu\text{H}$
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 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 11)

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)	

Shielding and grounding

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.

Potential equalisation with shielding grounded at both ends

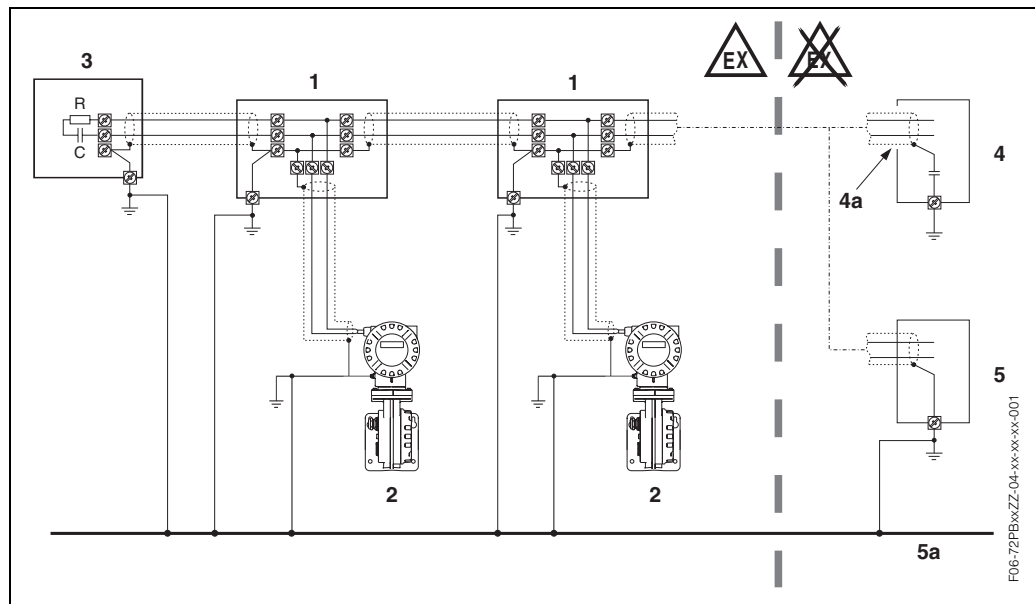


Fig. 2: Examples for connection of potential matching cables

1 = distributor/T-box

2 = Prowirl 72 resp. Prowirl 73 PROFIBUS PA bus devices for hazardous area

3 = bus termination: $R = 90 \dots 100 \Omega$, $C = 0 \dots 2.2 \mu F$

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

Transmitter Prowirl 72 PROFIBUS PA and F/W sensor resp. Prowirl 73 PROFIBUS PA and F/W sensor.

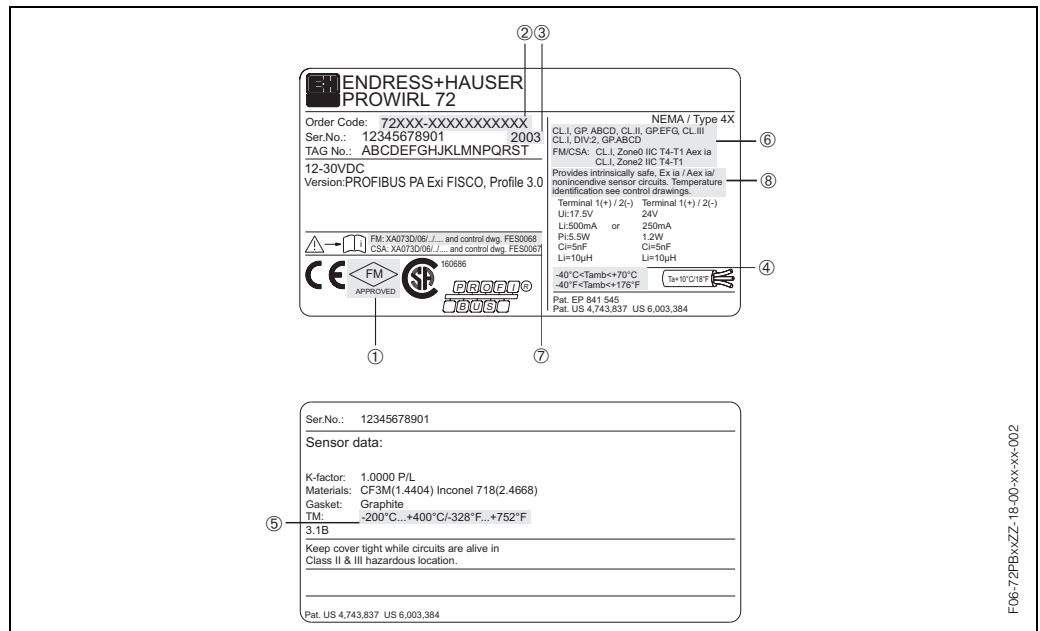


Fig. 3: Nameplate of transmitter and nameplate of sensor (example)

No.	Meaning
①	Label of the notified body: Factory Mutual Research
②	Type code
③	Year of manufacture
④	Ambient temperature range
⑤	Maximum medium temperature
⑥	Type of protection and explosion group for the measuring system
⑦	Applicable Ex documentation
⑧	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 0 Group IIC
and Class II and III Division 1 Groups EFG

Remote version

Sensor:
Prowirl 7**...1**N****, Prowirl 7**...2**N****,
Prowirl 7**...3**N****, Prowirl 7**...4**N**** and
Prowirl 7**...6**N****.

	Max. medium temperature				
	T6 2)	T5 2)	T4	T3	T2 - T1
Ta = 104°F	176°F	203°F	266°F	374°F	554°F 824°F
Ta = 140°F	---	203°F	266°F	374°F	554°F 824°F
Ta = 158°F	---	---	266°F	374°F	554°F 824°F

Transmitter:
Prowirl 7**...0**N****, Prowirl 7**...1**N****,
Prowirl 7**...2**N****, Prowirl 7**...3**N****,
Prowirl 7**...4**N**** and Prowirl 7**...6**N****.

	Max. medium temperature				
	T6 2)	T5 2)	T4	T3	T2 - T1
Ta = 104°F	176°F	203°F	266°F	374°F	536°F
Ta = 140°F	---	203°F	266°F	374°F	536°F
Ta = 158°F	---	---	266°F	374°F	536°F

Compact version

Sensor:
Prowirl 7**...1**N****, Prowirl 7**...2**N****,
Prowirl 7**...3**N****, Prowirl 7**...4**N**** and
Prowirl 7**...6**N****.

	Max. medium temperature				
	T6 2)	T5 2)	T4	T3	T2 - T1
Ta = 104°F	176°F	203°F	266°F	374°F	554°F 824°F
Ta = 140°F	---	203°F	266°F	374°F	554°F 824°F
Ta = 158°F	---	---	266°F	374°F	554°F 824°F

Notes:
1) Assignment of Drawings:
Drawing-No. Model Codes:
FES0068 B Prowirl 7**...0**N****
FES0068-0001 B Prowirl 7**...1**N****A and Prowirl 7**...1**N****W
FES0068-0002 B Prowirl 7**...2**N****H and Prowirl 7**...2**N****K
FES0068-0003 B Prowirl 7**...3**N****H and Prowirl 7**...3**N****K
FES0068-0004 B Prowirl 7**...4**N**** with Fieldbus Cable Connector

2) Temperature class T6 and T5 is not allowed for versions of Profibus PA and Fieldbus Foundation (not for Prowirl 7**...0**N****H and Prowirl 7**...0**N****K)

3) Max. cable length for intrinsically safe installation 100m / 320ft for using cable parameters $L_{cable} = 1\text{mH/km} / 0.3\mu\text{H/ft}$ and $C_{cable} = 1\mu\text{F/km} / 300\mu\text{F/ft}$

4) Caution: Use supply wires suitable for 50°F above maximum ambient temperature

5) Caution: Surface temperature of transmitter enclosure can exceed 158°F depending on ambient temperature or medium temperature

6) Dust tight seals must be used at conduit entries for Class II and III installation

7) Fieldbus cable connectors are suitable for Class I, Div. 2, Groups ABCD if non-incendive circuits are connected (see FES0068-0004 B)

8) Prowirl 72 and Prowirl 73 transmitter is intended for installation to Service Interface FXA 193 when using the PROLINE EX-ZWEILEITER-KABEL (blue cable)

FM CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Compact Version, Remote version

FES0068 B

Massstab Gezeichnet 23.09.02 Bn
Geprüft
Ex-geprüft 08.09.03 Bn
Gesehen

This page applies to model code: **Prowirl 7**...0**N****H and Prowirl 7**...0**N****K**

FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc), the current (Io or Isc) and the power (Po) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH 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 Uo of the associated apparatus has to be limited to the 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 to a leakage current of 50 µA 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 parameters in the following range:

- loop resistance R' : 15 ... 150 Ω/km
- inductance per unit length L' : 0.4 ... 1 mH/km
- capacitance per unit length C' : 80 ... 200 nF/km
- 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 spur cable : ≤ 30 m
- length of trunk cable : ≤ 1 km
- length of splice : ≤ 1 m

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

- R = 90 ... 100 Ω
- C = 0 ... 2.2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices 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 the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:
Intrinsically safe installation
1) Control room equipment may not use or generate over 250 Vrms.
2) Wire all circuits for power supply per NEC ANSI/NFPA 70.
3) Be aware of multiple earthing of the screen. The screen must be connected in accordance with ISA RP 12.06.01
4) WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
Division 2 installation
5) Transmitter circuit wiring in conduit in accordance with NEC ANSI/NFPA 70.
6) WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
Class II installation
7) Transmitter circuit wiring in conduit in accordance with NEC ANSI/NFPA 70.

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A,B,C,D
Class I, Zone 0, Group IIC
Class II, Division 1, Groups E,F,G
Class III, Division 1

NONHAZARDOUS LOCATION

Prowirl 72, Prowirl 73
Ui or Vmax = 17.5 V
Ii or Imax = 500mA
Pi = 5.5 W
Ci ≤ 5nF Li ≤ 10 µH
Leakage current ≤ 50µA

Temperature classes, ambient temperature and medium temperature see page 1

FM CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Div. 1 / Zone 0
FISCO - Concept

FES0068-0002 B

Massstab Gezeichnet 23.09.02 Bn
Geprüft
Ex-geprüft 08.09.03 Bn
Gesehen

This page applies to model code: **Prowirl 7* **-*****N****H and Prowirl 7* **-*****N****K**

Intrinsically safe installation:

- Control room equipment may not use or generate over 250 Vrms.
- Wire all circuits for power supply per NEC ANSI/NFPA 70 and ISA RP 12.6.01
- Use entity approved safety barrier or other associated equipment that satisfy the following conditions:
 $V_{oc} \leq V_{max}$, $I_{sc} \leq I_{max}$, $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$ transmitter entity parameters are as follows:

V_{max}	I_{max}	P_i	C_i	L_i
17.5 V	500 mA	5.5 W	≤ 5 nF	≤ 10 μ H
or 24 V	250 mA	1.2 W	≤ 5 nF	≤ 10 μ H

- WARNING:** SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
- Ex ia is defined as Intrinsically Safe

Division 2 installation (without barrier):

- Control room equipment may not use or generate over 250 Vrms.
- Installation of transmitter circuit wiring according to NEC using threaded conduit.
- Wire all circuits for power supply per ISA RP 12.06.01
- Terminals 1 and 2
 $V \leq 30$ V, $I \leq 40$ mA

- WARNING:** SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I DIVISION 2.

Class II, III installation (without barrier)

- Transmitter circuit wiring in conduit in accordance with NEC ANSI/NFPA 70.

Non Hazardous Locations

Hazardous Locations
 Class I Division 1 Groups ABCD or Class I Zone 0 AEx ia IIC and Class II and III Division 1 Groups EFG

FM CONTROL DRAWING (IS and NI)
PROWIRL 72, PROWIRL 73
 Fieldbus Foundation and Profibus PA
 IS installation, Entity - Concept

FES0068-0003 B

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

This page applies to model code: **Prowirl 7* **-*****N**** with Fieldbus Cable Connector**

Non Hazardous Locations

Hazardous Locations
 Class I Division 2 Groups ABCD or Class I Zone 2 Groups IIC,

Fieldbus PA connector

Fieldbus Foundation connector

Pin assignment:

Profibus PA

1 = Brown wire, PA+ (terminal 26)
 2 = Not connected
 3 = Blue wire, PA- (terminal 27)
 4 = Black wire, ground
 5 = Female connector not assigned
 6 = Positioning groove
 7 = Positioning key

Fieldbus Foundation

2.1 = Brown wire, FF+ (terminal 26)
 2.2 = Blue wire, FF- (terminal 27)
 2.3 = Not connected
 2.4 = Yellow/green wire, ground

Notes:

- Install per National Electrical Code
- Fieldbus cable connectors are suitable for Class I, Div. 2, Groups ABCD if non-incendive circuits are connected
- For nonincendive wiring of fieldbus communication circuit, make sure that
 $C_{cable} \leq C_a$ and $L_{cable} \leq L_a$

FM CONTROL DRAWING
PROWIRL 72, PROWIRL 73
 Fieldbus Cable Connector
 NI installation

FES0068-0004 B

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

**Supplementary
documentation**

Prowirl 72 PROFIBUS PA:

TI064D/06/

BA085D/06/

Prowirl 73 PROFIBUS PA:

TI064D/06/

BA093D/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 prowirl 72 / prowirl 73
PROFIBUS PA, Ex-i intrinsically safe
version (IS), Division 1

en

Ex documentation for the BA 085D
(Prowirl 72 PROFIBUS PA) and BA 093D
(Prowirl 73 PROFIBUS PA) operating instruction
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 [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	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

Measuring system Prowirl 72 / Prowirl 73 PROFIBUS PA, compact version

Hazardous area		Safe area
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	
		F06-7xPBxxZZ-16-xx-xx-xx-009
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	Safe area
Hazardous area		
Prowirl 73 PROFIBUS PA: A = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K D = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K Prowirl 72 PROFIBUS PA: B = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K C = Sensor F (DN 1/2"...6"); High pressure version PN 64...160; CI 600; JIS 40K D = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K E = Sensor F (DN 1/2"...6"); Dualsens PN 10...160; CI 150...600; JIS 10...40K	① Transmitter electronics Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA in: CI. I Div. 1 Groups ABCD CI. I Div. 1 Zone 0 AEx ia IIC CI. II Div. 1 Groups EFG CI. III ② Prowirl 72 resp. 73 standard housing ③ Cable entries: Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread. ④ Only the "PROLINE EX-ZWEILEITER-KABEL" connection cable can be used to connect a Prowirl 72 or 73 to the Service Interface FXA 193. Note! For ambient and fluid temperature ranges, and temperature class, see Page 4.	a = Segment coupler b = PLC/DCS c = PC with configuration tool d = Service Interface FXA 193 (see Page 8)

Measuring system Prowirl 72 / Prowirl 73 PROFIBUS PA, remote version

Hazardous area		Safe area
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	
F06-7xPBxxZZ-16-xx-xx-xx-010		
Division 1 / Zone 0 / Zone 1	Division 2 / Zone 2	Safe area
Hazardous area		
Prowirl 73 PROFIBUS PA: A = Transmitter Prowirl 73 PROFIBUS PA 1 = Sensor F (DN 1/2"...12") Standard version PN 10...40; CI 150...300; JIS 10...20K 2 = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K Prowirl 72 PROFIBUS PA: B = Transmitter Prowirl 72 PROFIBUS PA 1 = Sensor F (DN 1/2"...12"); Standard version PN 10...40; CI 150...300; JIS 10...20K 2 = Sensor W (DN 1/2"...6"); Wafer PN 10...40; CI 150...300; JIS 10...20K 3 = Sensor F (DN 1/2"...6"); High pressure version PN 64...160; CI 600; JIS 40K 4 = Sensor F (DN 1/2"...6"); Dualsens PN 10...160; CI 150...600; JIS 10...40K	① Transmitter electronics Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA in: Cl. I Div. 1 Groups ABCD Cl. I Div. 1 Zone 0 AEx ia IIC Cl. II Div. 1 Groups EFG Cl. III ② Prowirl 72 resp. 73 standard housing ③ Cable entries: Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread. ④ Connecting cable remote version: see Page 8. ⑤ Only the "PROLINE EX-ZWEILEITER-KABEL" connection cable can be used to connect a Prowirl 72 or 73 to the Service Interface FXA 193. Note! For ambient and fluid temperature ranges, and temperature class, see Page 4.	a = Segment coupler b = PLC/DCS c = PC with configuration tool d = Service Interface FXA 193 (see Page 8)

Temperature tables compact version

Measuring system Prowirl 72 PROFIBUS PA (compact version)

- Sensor standard temperature version:

Prowirl 72***-**0*****H

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +70\text{ °C}$	130	190	280	280

The minimum medium temperature is -40 °C.

- High/low temperature sensor version, high pressure version and Dualsens version:

Prowirl 72***-**1*****H, Prowirl 72***-**2*****H, Prowirl 72***-**3*****H

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +70\text{ °C}$	130	190	290	440

The minimum medium temperature is -200 °C.

Measuring system Prowirl 73 PROFIBUS PA (compact version)

- Sensor standard temperature version:

Prowirl 73***-**4*****H

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +70\text{ °C}$	130	190	290	440

The minimum medium temperature is -200 °C.

Temperature tables remote version

Measuring system Prowirl 72 PROFIBUS PA (remote version)

- Sensor standard temperature version:

Prowirl 72***-**0*****H

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +85\text{ °C}$	130	190	280	280

The minimum medium temperature is -40 °C.

- High/low temperature sensor version, high pressure version and Dualsens version:

Prowirl 72***-**1*****H, Prowirl 72***-**2*****H, Prowirl 72***-**3*****H

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +85\text{ °C}$	130	190	290	440

The minimum medium temperature is -200 °C.

- Transmitter Prowirl 72 PROFIBUS PA:

Prowirl 72***-*****H

	Max. medium temperature [°C] in			
	T4	T3	T2	T1
Prowirl 72 PROFIBUS PA	80	80	80	80

The minimum ambient temperature is -40 °C.



Measuring system Prowirl 73 PROFIBUS PA (remote version)

- Sensor standard temperature version:

Prowirl 73*_**4*****H**

Prowirl F/W	Max. medium temperature [°C] in			
	T4	T3	T2	T1
at $T_a = -40\text{ °C} \dots +85\text{ °C}$	130	190	290	440

The minimum medium temperature is –200 °C.

- Transmitter Prowirl 73 PROFIBUS PA:

Prowirl 73*_*****H**

	Max. medium temperature [°C] in			
	T4	T3	T2	T1
Prowirl 73 PROFIBUS PA	80	80	80	80

The minimum ambient temperature is –40 °C.

Approvals

No. / approval type	Description
160686-135901 (see Page 6 for notes on special conditions)	for the electric flow measuring system Prowirl 72 resp. 73 Identification: see below

Prowirl 72 PROFIBUS PA, intrinsically safe version IS (compact version)

P r o w i r l 7 2 * * * _ * * * * * * * . * * * * *		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Prowirl 72 F	DN 15...300	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 72 W	DN 15...150	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Prowirl 72 PROFIBUS PA, intrinsically safe version IS (remote version)

P r o w i r l 7 2 * * * _ * * * * * * * . * * * * *		
		H = PROFIBUS PA
		N = Cl. I, Div. 1
Transmitter Prowirl 72 PROFIBUS PA (remote version)		
Prowirl 72 PROFIBUS PA		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Sensor Prowirl F/W (remote version)		
Prowirl 72 F	DN 15...300	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 72 W	DN 15...150	Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Prowirl 73 PROFIBUS PA, intrinsically safe version IS (compact version)

P r o w i r l 7 3 * * * _ * * * * * . * * * * .			
			H = PROFIBUS PA
			N = Cl. I, Div. 1
Prowirl 73 F	DN 15...300		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 73 W	DN 15...150		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Prowirl 73 PROFIBUS PA, intrinsically safe version IS (remote version)

P r o w i r l 7 3 * * * _ * * * * * . * * * * .			
			H = PROFIBUS PA
			N = Cl. I, Div. 1
Transmitter Prowirl 73 PROFIBUS PA (remote version)			
Prowirl 73 PROFIBUS PA			Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Sensor Prowirl 73 F (remote version)			
Prowirl 73 F	DN 15...300		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia
Prowirl 72 W	DN 15...150		Cl. I, Div. 1 Groups ABCD Cl. II, Div. 1 Groups EFG Cl. III Cl. I, Zone 0 IIC T4-T1 AEx ia

Notified body

The Prowirl 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 +10 °C above maximum ambient temperature.
3. The specified temperature class in conjunction with the ambient temperature and the medium temperature must be in compliance with the tables on Page 4 and 5.
4. It is not permissible to connect the service adapter in explosive atmospheres.
5. Install per National 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. 1).

General warnings



Warning!

- 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.
- The manufacturer's guidelines for all devices connected to the intrinsically safe circuits must be observed.
- To rotate the transmitter housing, use the same procedure as for safe area versions. The transmitter housing may also be rotated during operation.

Electrical connections

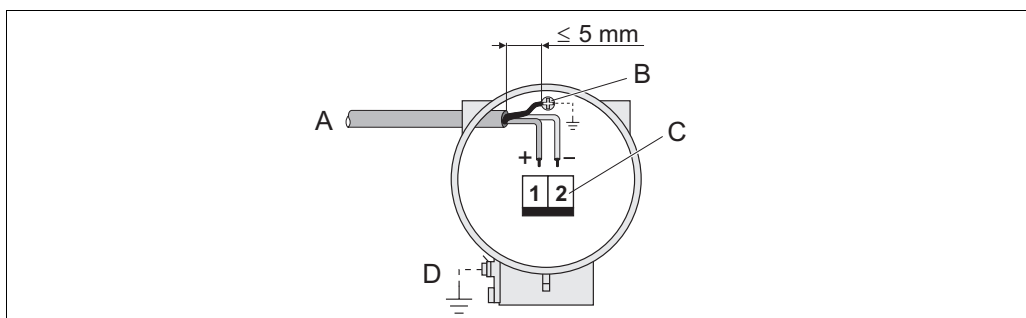


Fig. 4: Electrical connections Prowirl 72 PROFIBUS PA resp. Prowirl 73 PROFIBUS PA

F06-73PBxxxx-11-00-00-xx-000

A = PROFIBUS cable

B = Ground terminal in the wiring compartment (between the stripped PROFIBUS cable and the ground terminal, the cable shielding should not exceed a length of 5 mm)

C = Terminal connector (1 = PA +; 2 = PA -)

D = Ground terminal for potential equalisation (external, only relevant for remote version)



Caution!

- Ground potential equalisation must exist between the safe and hazardous area.
- The transmitter is to be securely connected to the potential equalization system using either the transmitter's external screw terminal (D), or the ground terminal (B) in the wiring compartment.
- Between the stripped PROFIBUS cable and the ground terminal, the cable shielding should not exceed a length of 5 mm.
- Alternatively, the sensor and the transmitter (compact version) or the connection housing 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 Prowirl 72***-*****N****H; Prowirl 73***-*****N****H

Terminals	1 (+)	2 (-)
Designation	PROFIBUS PA	
Intrinsically safe circuit	yes	
U_i or V_{max}	17.5 V	
I_i or I_{max}	500 mA	
P_i	5.5 W	
L_i	$\leq 10 \mu H$	
C_i	$\leq 5 \text{ nF}$	

or

Terminals	1 (+)	2 (-)
Designation	PROFIBUS PA	
Intrinsically safe circuit	yes	
U_i or V_{max}	24 V	
I_i or I_{max}	250 mA	
P_i	1.2 W	
L_i	$\leq 10 \mu H$	
C_i	$\leq 5 \text{ nF}$	

Service adapter

The service adapter is exclusively for connection to Endress+Hauser approved service interfaces FXA 193.



Warning!

It is not permissible to connect the service adapter in explosive atmospheres.

Cable entries

Choice of thread for cable entries, M20x1.5 or 1/2" NPT or G 1/2" thread (see also the figures on Pages 2 and 3, number ③).

Cable specifications

The sensor cable connection between sensor and transmitter has an IS type of protection rating (see also the figures on Pages 2 and 3, number ④).

The max. cable length is 100 m for intrinsically safe use. Functionally the cable length is limited to 30 m.

The max. capacitance of the cable is 1 µF/km.

The max. cable inductivity is 1 mH/km.

The cable delivered by E+H (max. 30 m) fulfils these requirements.

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: $C_i \leq 5 \text{ nF}$, $L_i \leq 10 \text{ µH}$
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: $15 \text{ Ω/km} < R' < 150 \text{ Ω/km}$
Inductance coating: $0.4 \text{ mH/km} < L' < 1 \text{ mH/km}$
Capacitance coating: $80 \text{ nF/km} < C' < 200 \text{ nF/km}$ (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:
– $90 \text{ Ω} < R < 100 \text{ Ω}$
– $0 \text{ µF} < C < 2.2 \text{ µF}$



Note!

Cable parameters and length restrictions are respected (see Page 9)

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	

Shielding and grounding

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.

Potential equalisation with shielding grounded at both ends

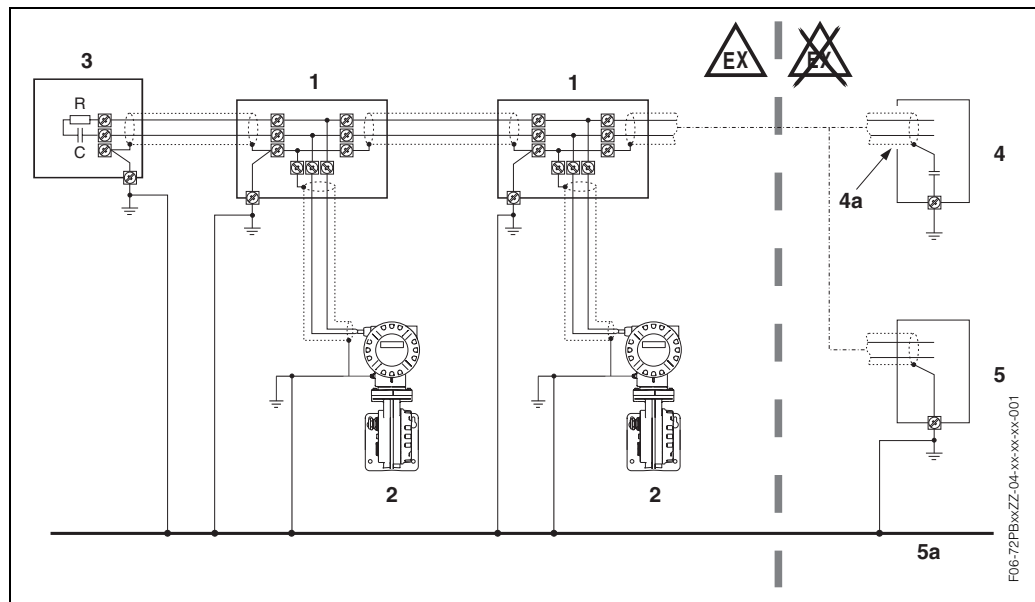


Fig. 5: Examples for connection of potential matching cables

1 = distributor/T-box

2 = Prowirl 72 resp. Prowirl 73 PROFIBUS PA bus devices for hazardous area

3 = bus termination: $R = 90 \dots 100 \Omega$, $C = 0 \dots 2.2 \mu F$

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

Transmitter Prowirl 72 PROFIBUS PA and F/W sensor resp. Prowirl 73 PROFIBUS PA and F/W sensor.

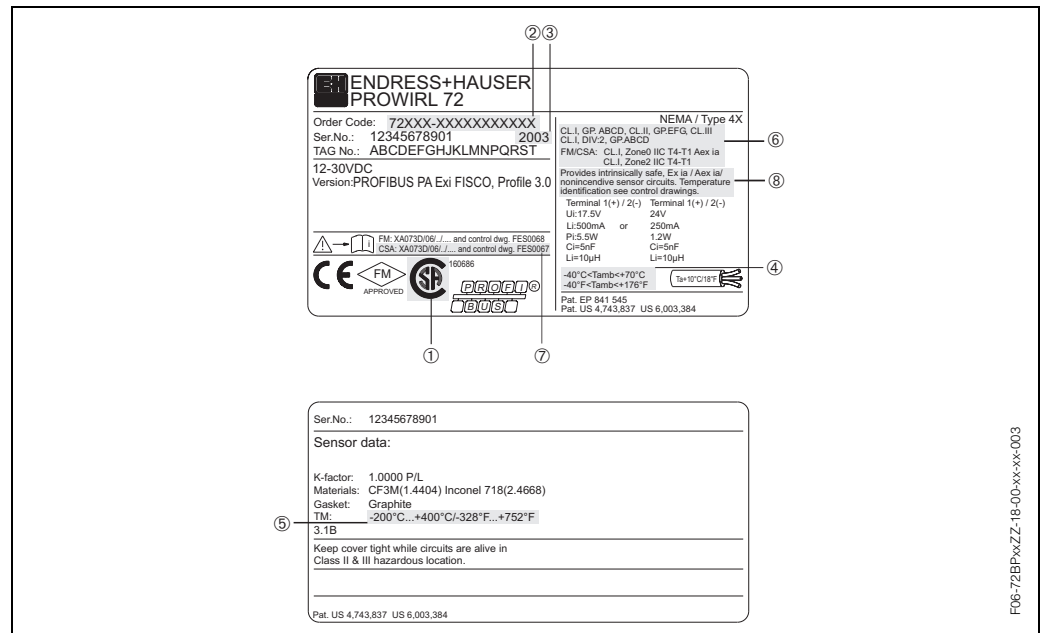


Fig. 6: Nameplate of transmitter and nameplate of sensor (example)

No.	Meaning
①	Label of the notified body: Canadian Standards Association
②	Type code
③	Year of manufacture
④	Ambient temperature range
⑤	Maximum medium temperature
⑥	Type of protection and explosion group for the measuring system
⑦	Applicable Ex documentation
⑧	Warning

Control drawings

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

Hazardous Locations

Class I Division 1 Groups ABCD or Class I Zone 0 Group IIC
and Class II and III Division 1 Groups EFG

Remote version

Prowirl 72/73 W Prowirl 72/73 F Prowirl 72/73 F (Dualsensor)

Sensor:

PROWIRL 7**..**1**N****, PROWIRL 7**..**2**N****,
PROWIRL 7**..**3**N****, PROWIRL 7**..**4**N**** and
PROWIRL 7**..**6**N****:

	T6 2)	T5 2)	T4	T3	T2	T1
Ta = 40°C	80°C	95°C	130°C	190°C	290°C	440°C
Ta = 60°C	---	95°C	130°C	190°C	290°C	440°C
Ta = 85°C	---	---	130°C	190°C	290°C	440°C

PROWIRL 7**..**0**N****:

	T6 2)	T5 2)	T4	T3	T2 - T1
Ta = 40°C	80°C	95°C	130°C	190°C	280°C
Ta = 60°C	---	95°C	130°C	190°C	280°C
Ta = 85°C	---	---	130°C	190°C	280°C

Transmitter:

PROWIRL 7**..**0**N****, PROWIRL 7**..**1**N****,
PROWIRL 7**..**2**N****, PROWIRL 7**..**3**N****,
PROWIRL 7**..**4**N**** and PROWIRL 7**..**6**N****:

	T6 2)	T5 2)	T4 - T1
Ta =	40°C	60°C	80°C

Compact version

Prowirl 72/73 W Prowirl 72/73 F Prowirl 72/73 F (Dualsensor)

PROWIRL 7**..**1**N****, PROWIRL 7**..**2**N****,
PROWIRL 7**..**3**N**** and PROWIRL 7**..**4**N**** and
PROWIRL 7**..**6**N****:

	T6 2)	T5 2)	T4	T3	T2	T1
Ta = 40°C	80°C	95°C	130°C	190°C	290°C	440°C
Ta = 60°C	---	95°C	130°C	190°C	290°C	440°C
Ta = 70°C	---	---	130°C	190°C	290°C	440°C

PROWIRL 7**..**0**N****:

	T6 2)	T5 2)	T4	T3	T2 - T1
Ta = 40°C	80°C	95°C	130°C	190°C	280°C
Ta = 60°C	---	95°C	130°C	190°C	280°C

Notes:

- 1) Assignment of Drawings:

Drawing-No.	Model Codes:
FES0067 B	Prowirl 7**..**N****
FES0067-0001 B	Prowirl 7**..**N****A and Prowirl 7**..**N****W
FES0067-0002 B	Prowirl 7**..**N****H and Prowirl 7**..**N****K
FES0067-0003 B	Prowirl 7**..**N****H and Prowirl 7**..**N****K
FES0067-0004 B	Prowirl 7**..**N**** with Fieldbus Cable Connector

- 2) Temperature class T6 and T5 is not allowed for versions of Profibus PA and Fieldbus Foundation
- 3) Max. cable length for intrinsically safe installation 100m for using cable parameters $L_{\text{Cable}} = 1\text{mH/km}$ and $C_{\text{Cable}} = 1\mu\text{F/km}$
- 4) Caution: Use supply wires suitable for 10°C above maximum ambient temperature
- 5) Caution: Surface temperature of transmitter enclosure can exceed 70°C depending on ambient temperature or medium temperature
- 6) Dust tight seals must be used at conduit entries for Class II and III installation
- 7) Fieldbus cable connectors are suitable for Class I, Div. 2, Groups A,B,C,D if non-incendive circuits are connected (see FES0067-0004 B)
- 8) Prowirl 72 and Prowirl 73 transmitter is intended for installation to Service Interface FXA 193 when using the PROLINE EX-ZWEILEITER-KABEL (blue cable)

Aenderungen:

	A	B	C	D	E
24.03.03 / Bn	F	G	H	J	K

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

Erstellt durch:
Ersteller: FES/Bn
File: M:\ZEICHNUNG\030908c.doc ID 1113

CSA CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Compact Version, Remote version

Masstab: Gezeichnet: 23.09.02 Bn
Geprüft: Ex-geprüft: 08.09.03 Bn
Gesehen:

FES0067 B

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

This page applies to model code: **Prowirl 7**..**N****H and Prowirl 7**..**N****K**

FISCO-Concept

The FISCO Concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in this combination. The criteria for interconnection is that the voltage (Ui or Vmax), the current (Ii or Imax) and the power (Pi) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (Uo or Voc), the current (Io or Isc) and the power (Po) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance (Ci) and inductance (Li) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH 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 Uo of the associated apparatus has to be limited to the 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 to a leakage current of 50 µA 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 parameters in the following range:

loop resistance R'	: 15 ... 150 Ω/km
inductance per unit length L'	: 0.4 ... 1 mH/km
capacitance per unit length C'	: 80 ... 200 nF/km
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 spur cable	: ≤ 30 m
length of trunk cable	: ≤ 1 km
length of splice	: ≤ 1 m

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

R = 90 ... 100 Ω
C = 0 ... 2.2 µF

One of the allowed terminations might already be integrated in the associated apparatus.

The number of passive devices 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 the length of trunk cable and all spur cables), the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

Intrinsically safe installation

- 1) Control room equipment may not use or generate over 250 Vrms.
- 2) Wire all circuits for power supply per Canadian Electrical Code Part I.
- 3) Be aware of multiple earthing of the screen. The screen must be connected in accordance with ISA RP 12.06.01
- 4) WARNING: SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

Division 2 installation

- 5) Transmitter circuit wiring in conduit in accordance with the Canadian Electrical Code Part I
- 6) WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

Class II installation

- 7) Transmitter circuit wiring in conduit in accordance with the Canadian Electrical Code Part I

HAZARDOUS (CLASSIFIED) LOCATION

Class I, Division 1, Groups A,B,C,D
Class I, Zone 0, Group IIC
Class II, Division 1, Groups E,F,G
Class III, Division 1

NONHAZARDOUS LOCATION

Prowirl 72, Prowirl 73

Ui or Vmax = 17.5 V
Ii or Imax = 500mA
Pi = 5.5 W
Ci ≤ 5nF Li ≤ 10 µH
Leakage current ≤ 50µA

Temperature classes, ambient temperature and medium temperature see page 1

Any CSA Approved Intrinsic Safe Apparatus suitable for FISCO Concept

Any CSA Approved Termination with R = 90...100Ω C = 0...2.2µF

Aenderungen:

	A	B	C	D	E
24.03.03 / Bn	F	G	H	J	K

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

Erstellt durch:
Ersteller: FES/Bn
File: M:\ZEICHNUNG\030908c.doc ID 1113

CSA CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Div. 1 / Zone 0
FISCO - Concept

Masstab: Gezeichnet: 23.09.02 Bn
Geprüft: Ex-geprüft: 08.09.03 Bn
Gesehen:

FES0067-0002 B

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

Non Hazardous Locations

Hazardous Locations
Class I Division 1 Groups ABCD or Class I Zone 0 Group IIC
and Class II and III Division 1 Groups EFG

This page applies to model code: **Prowirl 7* **-*****N****H and Prowirl 7* **-*****N****K**

Intrinsically safe installation:

- Control room equipment may not use or generate over 250 Vrms.
- Wire all circuits for power supply per ISA RP 12.6.
- Use entity approved safety barrier or other associated equipment that satisfy the following conditions:
 $V_{oc} \leq V_{max}$, $I_{sc} \leq I_{max}$, $C_p \geq C_1 + C_{cable}$, $L_p \geq L_1 + L_{cable}$ transmitter entity parameters are as follows:

V_{max}	I_{max}	P_1	C_1	L_1
17.5 V	500 mA	5.5 W	≤ 5 nF	≤ 10 μ H
or 24 V	250 mA	1.2 W	≤ 5 nF	≤ 10 μ H

4) **WARNING:** SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.

5) Ex ia is defined as Intrinsically Safe

Division 2 installation (without barrier):

- Control room equipment may not use or generate over 250 Vrms.
- Installation of transmitter circuit wiring according to Canadian Electrical Code using threaded conduit.
- Wire all circuits for power supply per ISA RP 12.06.01
- Terminals 1 and
 $V \leq 30$ V, $I \leq 40$ mA

10) **WARNING:** SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I DIVISION 2.

Class II, III installation (without barrier)

11) Transmitter circuit wiring in conduit in accordance with the Canadian Electrical Code.

A	24.03.03 / Bn	F	
B	08.09.03 / Bn	G	
C		H	
D		J	
E		K	

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

Erstellt durch:
Ersatz für:
Ersteller: FES/Bn
File: M:\ZEICHNUNG\...030908c.doc ID 1113

CSA CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Fieldbus Foundation and Profibus PA
IS installation, Entity - Concept

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

Massstab

Gezeichnet	23.09.02	Bn
Geprüft		
Ex-geprüft	08.09.03	Bn
Gesehen		

FES0067-0003 B

Profibus PA connector

Fieldbus Foundation connector

This page applies to model code: **Prowirl 7* **-*****N**** with Fieldbus Cable Connector**

Notes:

- Fieldbus cable connectors are suitable for Class I, Div. 2, Groups A,B,C,D if non-incendive circuits are connected

A	24.03.03 / Bn	F	
B	08.09.03 / Bn	G	
C		H	
D		J	
E		K	

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

Erstellt durch:
Ersatz für:
Ersteller: FES/Bn
File: M:\ZEICHNUNG\...030908c.doc ID 1113

CSA CONTROL DRAWING
PROWIRL 72, PROWIRL 73 (IS and NI)
Fieldbus Cable Connector
NI installation

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

Massstab

Gezeichnet	23.09.02	Bn
Geprüft		
Ex-geprüft	08.09.03	Bn
Gesehen		

FES0067-0004 B



Supplementary documentation

Prowirl 72 PROFIBUS PA:

TI064D/06/
BA085D/06/

Prowirl 73 PROFIBUS PA:

TI064D/06/
BA093D/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

