Instruction

MI 611-208
June 2011

Electrochemical Products Safety Information

invensys
Foxboro®

Contents

1. General Warnings

Local Code Warning

WARNING

These products must be installed to meet all applicable local installation regulations, such as hazardous location requirements, electrical wiring codes, and mechanical piping codes. Persons involved in the installation must be trained in these code requirements to ensure that the installation takes maximum advantage of the safety features designed into the device.

Parts Replacement Warning

WARNING

This product contains components that have critical safety characteristics. Do **not** substitute components. Replace components only with factory-supplied components. Component substitution may impair the electrical safety of this equipment and its suitability for use in hazardous locations.

2. 875 Series Analyzers

Analyzer Identification

On panel-mounted analyzers, a data label and agency label are fastened to the top surface of the enclosure. On surface- or pipe-mounted devices, the data label is located on the right side and the agency label (if applicable) on the left side of the analyzer. A third label containing user information is also on the analyzer. A typical data label is shown in Figure 1. A typical agency label is shown in Figure 2.

Refer to the data label to determine the model, origin code, supply voltage, maximum power, maximum VA, and alarm contact ratings.

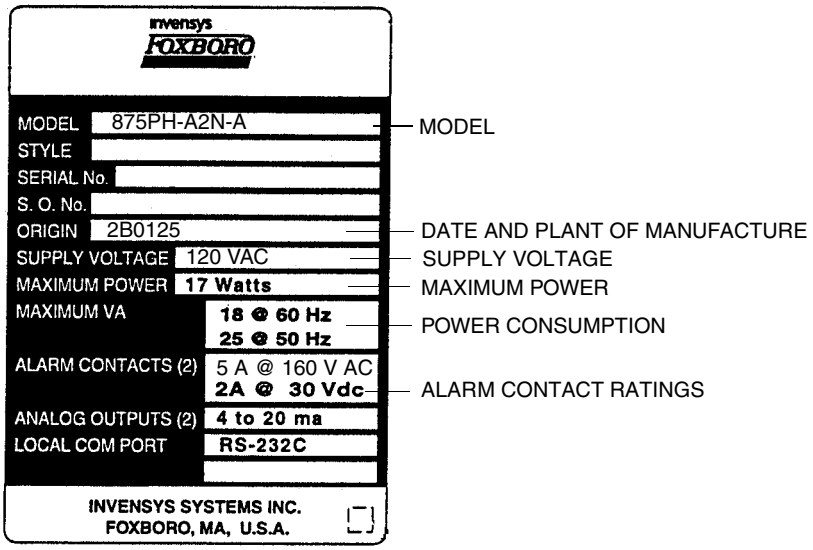


Figure 1. Sample 875 Analyzer Data Label

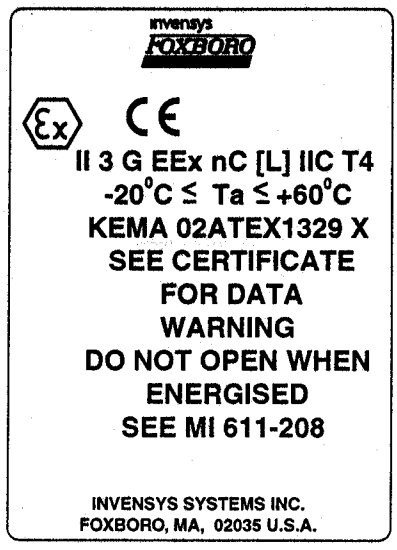


Figure 2. Sample 875 Analyzer Agency Label

Hazardous Location Code

The electrical safety design code is printed on the data label as part of the model number. See Figure 1. The location of the code within the model number is shown below:

See Table 1 to identify this code. The type of protection is also located on the agency label. See Figure 2.

Table 1. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX protection 'n' for Zone 2; II 3 G EEx nC[L] IIC. [(a)]	Temperature Class T4 at maximum ambient temperature of 60 °C (140 °F. See certificate KEMA 02ATEX1329 X	N

(a) The L means that the unit contains energy limited circuits to the sensor.

— NOTE

These analyzers have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for 875PH-..N

The entity parameters for the sensor circuit (Terminals 1, 2, 2A, 3, 3A, 4, 5, 5A, 6, 7, and 8) in type of explosion protection energy limited EEx nC[L], with the following maximum values are:

Uo = 10 V
Io = 125 mA
Po = 0.3 W
Co = 20 µF
Lo = 5 mH

Entity Parameters for 875EC-..N

The entity parameters for the sensor circuit (Terminals 1, 2, 3, 4, 5, 6, 7, and 8) in type of explosion protection energy limited EEx nC[L], with the following maximum values are:

Uo = 5 V
Io = 45 mA
Po = 100 mW
Co = 1000 µF
Lo = 40 mH

Entity Parameters for 875CR-..N

The entity parameters for the sensor circuit (Terminals 1, 2, 2A, 3, 4, and 5) in type of explosion protection energy limited EEx nC[L], with the following maximum values are:

Uo = 5 V
Io = 85 mA
Po = 150 mW
Co = 1000 µF
Lo = 10 mH

Panel-Mounted Enclosure Warning

WARNING

ATEX panel-mounted units must be installed in an enclosed panel or rack whose degree of ingress protection must be at least IP54 in accordance with EN 60529 and comply with clause 6 of EN 50021.

Electrical Connection Warning

WARNING

For ATEX certified analyzers, electrical connections must be made in such a way that the degree of ingress protection of the enclosure remains at least IP54 per EN 60529 and is suitable for the environment.

Grounding Warning

WARNING

The grounding stud or conductive mounting means of the enclosure must be connected to the potential equalizing system within the explosive atmosphere.

Origin Code

The origin code identifies the area of manufacture and the year and week of manufacture. See Figure 1. In the example, 2B means the product was manufactured in the Analytical Division, 01 identifies the year of manufacture as 2001, and 25, the week of manufacture in that year.

Supply Voltage Operative Limits

The supply voltage operative limits are the voltage shown on the data label +15% and -20%. See Figure 1.

Alarm Contact Limits

The alarm contact limits are shown on the data label. See Figure 1. The standard limits are 5 A at 250 V ac and 2 A at 30 V dc. The ATEX limits are 5 A at 160 V ac and 2 A at 30 V dc.

Ambient Temperature Limits

The ambient temperature operative limits of the analyzer are -20 and +75 °C (-4 and +165 °F). For analyzers with ATEX certification, the limits are -20 and +60 °C (-4 and +140 °F).

Installation Instructions

Refer to MI 611-222 (875CR), MI 611-224 (875EC), or MI 611-225 (875PH)

CE Compliance

For the 875 panel mounted analyzer to meet CE requirements, a grounded metal enclosure is required. To assure a good ground, the edges of the panel opening that receives the analyzer must **not** be painted.

3. Sensors

Dangers, Warnings, and Cautions

DANGER

When installing or removing sensors, wear appropriate protective clothing including safety goggles. Escaping chemicals can cause severe injury including blindness.

WARNING

1. Use care when connecting and disconnecting high-pressure service connections. Use proper gloves and follow the recommended procedures to avoid injury to personnel or damage to equipment.
2. When processing hazardous liquids, follow the recommended procedures. Failure to do so could result in injury to personnel and damage to equipment.

WARNING

In addition to the pressure and temperature limits of the sensor, the sensor mounting accessories also have pressure and temperature limits. The specifications for the mounting accessories may be greater or less than the sensor specifications. Always use the lesser of the specification limits when designing the installation of a sensor with accessories.

CAUTION

To prevent damage, use care when handling sensitive sensor components such as glass electrodes.

Origin Code

The origin code identifies the area of manufacture and the year and week of manufacture. See the agency label in the “Sensor Identification” section for your sensor. In the example 2B0412, 2B means the product was manufactured in the Analytical Division, 04 identifies the year of manufacture as 2004, and 12, the week of manufacture in that year.

871PH

Sensor Identification

Typical agency, body, and data labels are shown in Figures 3 and 4.

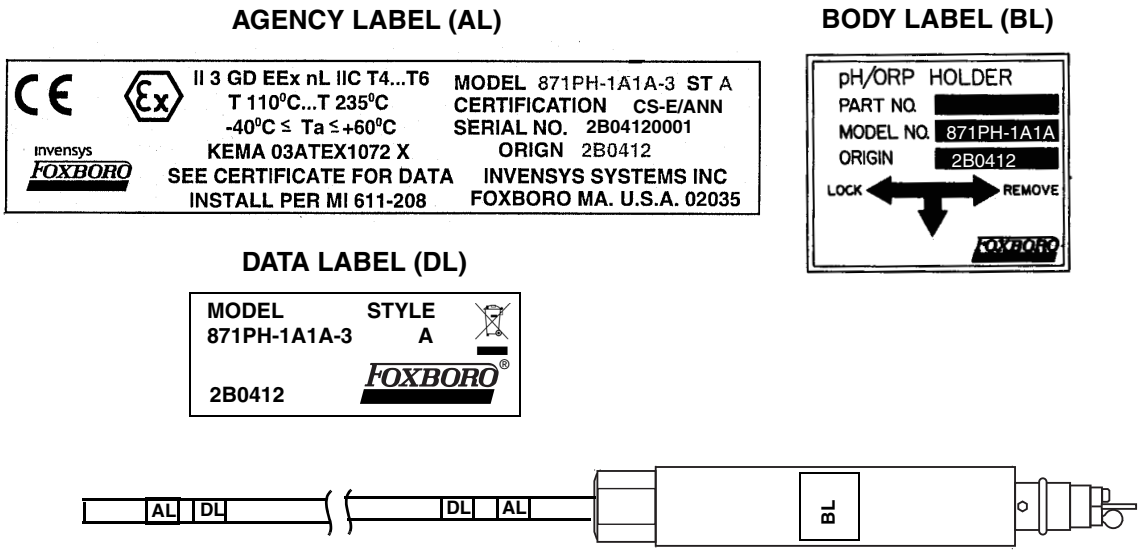


Figure 3. Sample 871PH (Cable Terminated) Sensor Identification

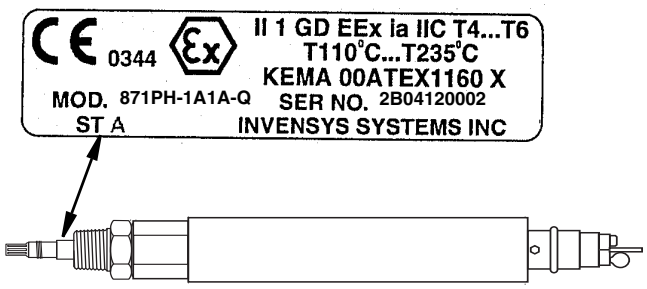


Figure 4. Sample 871PH (Quick Connector Terminated) Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency label. See Figures 3 and 4. See Table 2 for additional information.

Table 2. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/ANN

— NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA and CS-E/ANN are as follows:

U_i = 10 V
I_i = 125 mA
P_i = See Table 3
C_i = 0.15 µF for 871PH-1, -2, -3, and -4 (with preamplifier)
C_i = 0 µF for 871PH-5 and -6 (without preamplifier)
L_i = 0 mH

Table 3. Maximum Input Power (Pi)

Model	Temperature Class	Max Process Temp	P_i
871PH-1 871PH-2 871PH-3 871PH-4 (with preamplifier)	T4	80 °C	0.6 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W
871PH-5 871PH-6 (without preamplifier)	T4	121 °C	1.0 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W

Table 4. Relationship Between Input Power (P_i), Max Process Temp, and Surface Temp 'T'

P_i	Maximum Process Temperature	Surface Temperature 'T'
0.6 W	50 °C	T110 °C
	60 °C	T120 °C
	80 °C	T140 °C
	85 °C	T145 °C
	125 °C	T185 °C
	135 °C	T195 °C
	175 °C	T235 °C
	200 °C	T260 °C

Electromagnetic Compatibility (EMC)

The 871PH Sensor complies with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873PH*, 873APH*, 873DPX*, and 875PH Analyzers, and 870ITPH Transmitters.
(*220 V ac, 240 V ac metal enclosures only)

Pressure and Temperature Limits

The pressure and operating temperature limits vary depending on the sensor body material, the measuring electrode type, and whether a ball valve, submersible, or in-line installation is used. The sensor body material and measuring electrode is identified in the model number on the data label. See Figure 5.

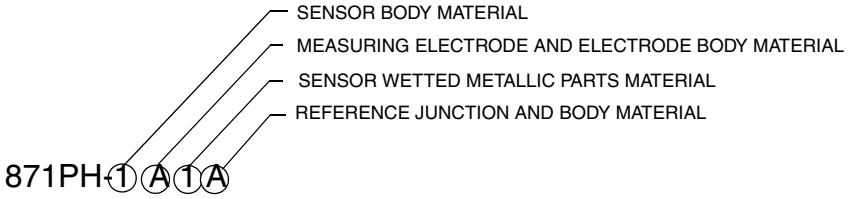


Figure 5. 871PH Model Coded Example

Sensor Body Material

-1, -3, or -5 = Ryton
-2, -4, or -6 = CPVC

Measuring Electrode and Electrode Body Material

Table 5. Measuring Electrode and Electrode Body Material

Code	Electrode Material	Body Material
A	pH, Spherical Glass	Ryton
B	pH, Antimony	Ryton
D	ORP, Platinum	Ryton
E	ORP, Gold	Ryton
F	pH, Flat Glass	Ryton
G	pH, Domed High Temperature Glass	Ryton
P	pH, Spherical Glass	ptfe
Q	pH, Antimony	ctfe
R	ORP, Platinum	ctfe
S	ORP, Gold	ctfe
T	pH, Flat Glass	ptfe
U	pH, Domed High Temperature Glass	ptfe
X	None	

Refer to Tables 6 and 7 for pressure and temperature limits.

— NOTE

In the tables, in-line installation means that only the sensing end, not the sensor body, is immersed in the solution. Submersion installation is when the entire sensor assembly (sensing end and body) is completely submersed.

Table 6. Maximum Pressure and Operating Temperature Limits for Sensor with Ryton Body

Measuring Electrode Type	Ball Valve or Submersible Installation		In-Line Installation	
	Maximum Pressure	Temperature Range	Maximum Pressure	Temperature Range
Flat Glass pH	1 MPa (150 psi)	-5 to +80 °C (20 to 175 °F)	1 MPa (150 psi)	-5 to +85 °C (20 to 185 °F)
Spherical Glass pH	0.7 MPa (100 psi)	-5 to +80 °C (20 to 175 °F)	0.7 MPa (100 psi)	-5 to +100 °C (20 to 212 °F)
Domed Glass pH	0.7 MPa (100 psi)	0 to +80 °C (32 to 175 °F)	0.7 MPa (100 psi)	0 to +121 °C (32 to 250 °F)
Antimony pH	1 MPa (150 psi)	-5 to +80 °C (20 to 175 °F)	1 MPa (150 psi)	-5 to +125 °C (20 to 255 °F)
ORP	1 MPa (150 psi)	-5 to +80 °C (20 to 175 °F)	1 MPa (150 psi)	-5 to +125 °C (20 to 255 °F)

WARNING

Maximum allowable temperature and pressure may be limited by installation hardware used. Refer also to the temperature and pressure specifications on all appropriate bushings, tees, flow chambers, and ball valve assemblies.

Table 7. Maximum Pressure at Various Operating Temperatures for Sensor with CPVC Body

Measuring Electrode Type	Ball Valve or Submersible Installation			In-Line Installation		
	Maximum Pressure at Operating Temperature			Maximum Pressure at Operating Temperature		
Flat Glass pH	0.9 MPa (125 psi) at -5 °C (20 °F)	0.6 MPa (90 psi) at 50 °C (120 °F)	0.3 MPa (50 psi) at 80 °C (175 °F)	0.9 MPa (125 psi) at -5 °C (20 °F)	0.3 MPa (50 psi) at 80 °C (175 °F)	0.1 MPa (15 psi) at 100 °C (212 °F)
Spherical Glass pH*						
Domed Glass pH*						
Antimony pH						
ORP						

* Maximum pressure at -5 °C (20 °F) for Spherical Glass pH and at 0 °C (32 °F) for Domed Glass pH Electrode is 0.7 MPa (100 psi).

WARNING

Maximum allowable temperature and pressure may be limited by installation hardware used. Refer also to the temperature and pressure specifications on all appropriate bushings, tees, flow chambers, and ball valve assemblies.

Process Wetted Materials

The process wetted materials of your sensor are identified in the model code on the data label. See Figure 5 and the following text.

Sensor Body Material

-1, 3, or 5 = Ryton
-2, 4, or 6 = CPVC

Sensor Wetted Metallic Parts Material

1 = Titanium
2 = Carpenter 20 Cb-3
3 = 316L Stainless Steel
5 = Monel®
6 = Tantalum

Reference Junction and Body Material

Table 8. Reference Junction and Body Material

Code	Reference Junction Material	Body Material
A	Ceramic	Ryton
B	Ceramic	ptfe
D	Ceramic	pvdf

871A

Sensor Identification

Typical agency and data labels are shown in Figure 6.

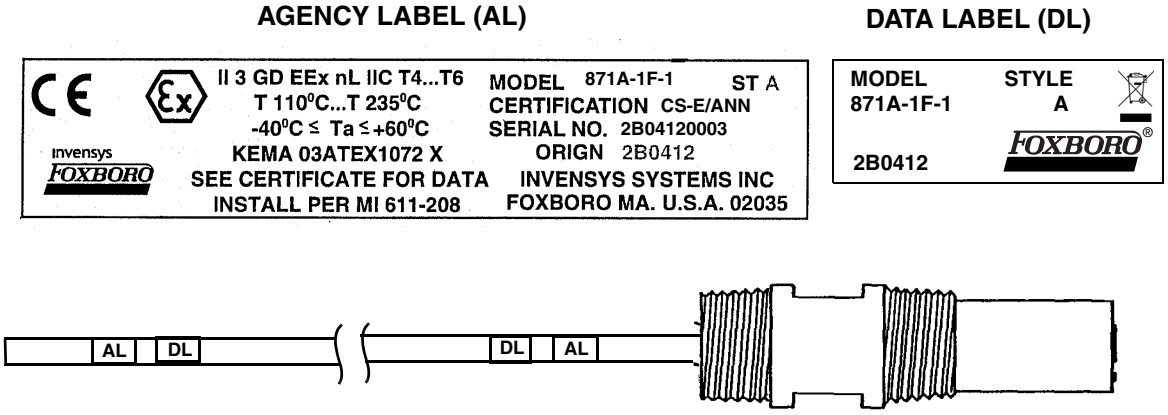


Figure 6. Sample 871A Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency label. See Figure 6. See Table 9 for additional information.

Table 9. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/ANN

— NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA and CS-E/ANN are as follows

U_i = 10 V
I_i = 125 mA
P_i = See Table 10
C_i = 0.15 µF for 871A-2, and -4 (with preamplifier)
C_i = 0 µF for 871A-1 and -3 (without preamplifier)
L_i = 0 mH

Table 10. Maximum Input Power (P_i)

Model	Temperature Class	Max Process Temp	P_i
871A-2 871A-4 (with preamplifier)	T4	80 °C	0.6 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W
871A-1 871A-3 (without preamplifier)	T4	121 °C	1.0 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W

For the relationship between the input power P_i, the process temperature, and the surface temperature 'T', refer to Table 4.

Electromagnetic Compatibility (EMC)

The 871A Sensor complies with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873PH*, 873APH*, 873DPX*, and 875PH Analyzers, and 870ITPH Transmitters.
(*220 V ac, 240 V ac metal enclosures only)

Pressure and Temperature Limits

Pressure and temperature limits are shown in Figure 7.

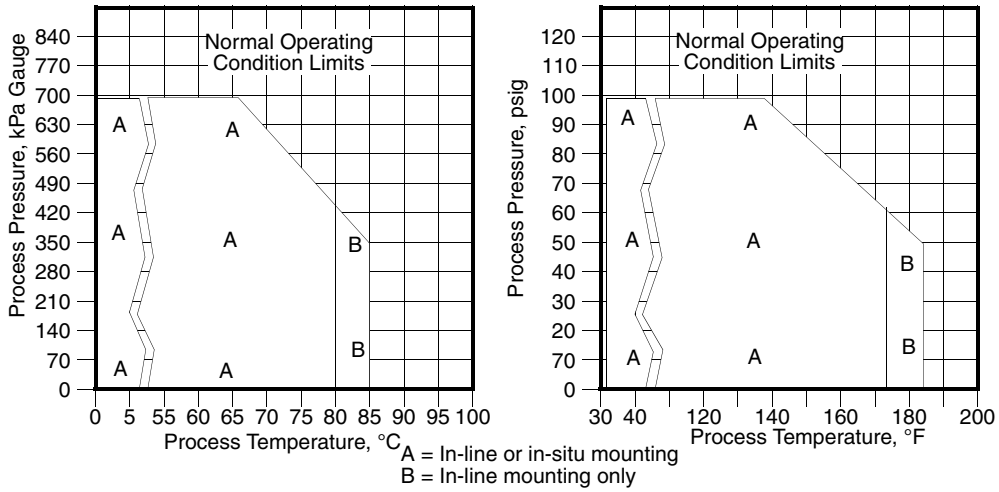


Figure 7. Pressure and Temperature Limits

Process Wetted Parts

Process wetted parts are as follows:

Body: PVDF (polyvinylidene fluoride)

Reference Electrode: Ceramic Junction

O-ring: EPR (ethylene propylene rubber)

Measuring Electrode: Per the model number on the data label. See Figure 8

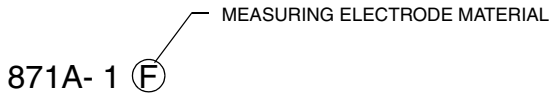


Figure 8. 871A Model Code Example

where:

D = ORP, Platinum
E = ORP, Gold
F = pH, Flat Glass

PH10 and ORP10

Sensor Identification

Typical agency and data labels are shown in Figures 9 and 10.

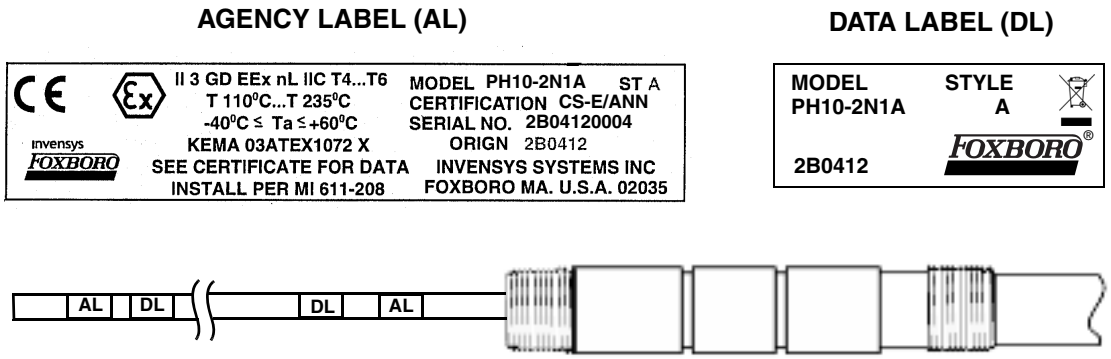


Figure 9. Sample PH10 or ORP10 (Cable Termination) Sensor Identification

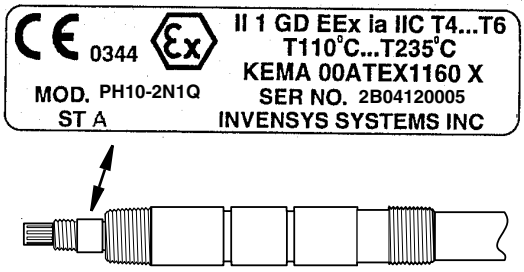


Figure 10. Sample PH10 or ORP10 (Quick Connector Termination) Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 9. See Table 11 for additional information.

Table 11. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/ANN

NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA and CS-E/ANN are as follows

U_i = 10 V
I_i = 125 mA
P_i = See Table 12
C_i = 0.15 µF for PH10-.P and ORP10-.P (with preamplifier)
C_i = 0 µF for PH10-.N and ORP10-.N (without preamplifier)
L_i = 0 mH

Table 12. Maximum Input Power (Pi)

Model	Temperature Class	Max Process Temp	Pi
PH10-.P ORP10-.P (with preamplifier)	T4	80 °C	0.6 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W
PH10-.N ORP10-.N (w/o preamplifier)	T4	121 °C	1.0 W
	T5	80 °C	0.5 W
	T6	60 °C	0.35 W

For the relationship between the input power P_i, the process temperature, and the surface temperature 'T', refer to Table 4.

Electromagnetic Compatibility (EMC)

The PH10 and ORP10 Sensors comply with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873PH*, 873APH*, 873DPX*, and 875PH Analyzers, and 870ITPH Transmitters.
(*220 V ac, 240 V ac metal enclosures only)

Process Pressure Limits

0 and 0.7 MPa (0 and 100 psi)

Process Temperature Limits

The temperature limits vary depending on the electrode type, whether a preamplifier is integral to the sensor, and whether submersible or in-line installation is used. The electrode type and whether a preamplifier is integral to the sensor is identified in the model number on the data label. See Figure 11.

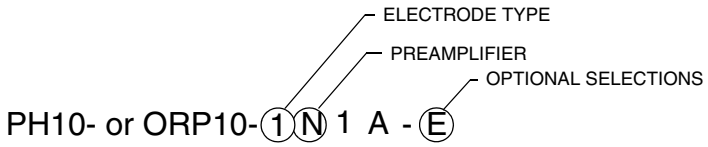


Figure 11. PH10 or ORP10 Model Code Example

Electrode Type

For pH Sensors

-1 = Domed, High Temperature, Glass Bulb with Protective Guard
-2 = Domed, High Temperature, Glass Bulb w/o Protective Guard
-3 = Flat Ruggedized Glass
-4 = Antimony

For ORP Sensors

-1 = Platinum
-2 = Gold

Preamplifier

N = No Preamplifier
P = Internal Preamplifier

NOTE

In Table 13, in-line installation means that only the sensing end, not the sensor body, is immersed in the solution. Submersion installation is when the entire sensor assembly (sensing end and body) is completely submersed.

Table 13. Process Temperature Limits

Measuring Electrode Type	Without Internal Preamplifier	With Internal Preamplifier	
		Ball Valve or Submersion Installation	In-Line Installation (a)
Domed Glass - pH	0 to 121 °C (32 to 250 °F)	0 to 85 °C (32 to 185 °F)	0 to 121 °C (32 to 250 °F)
Flat Glass - pH	0 to 85 °C (32 to 185 °F)	0 to 85 °C (32 to 185 °F)	0 to 85 °C (32 to 185 °F)
Antimony - pH	0 to 121 °C (32 to 250 °F)	0 to 85 °C (32 to 185 °F)	0 to 121 °C (32 to 250 °F)
Platinum - ORP	0 to 121 °C (32 to 250 °F)	0 to 85 °C (32 to 185 °F)	0 to 121 °C (32 to 250 °F)
Gold - ORP	0 to 121 °C (32 to 250 °F)	0 to 85 °C (32 to 185 °F)	0 to 121 °C (32 to 250 °F)

(a) For in-line installations of a DolpHin sensor with internal preamp, the upper body must be in ambient temperatures of 54 °C (130 °F) or less.

Process Wetted Parts

Process wetted parts are as follows:

Sensor Body: Kynar

Reference Electrode: Ceramic Junction

Solution Ground: Conductive Kynar

Measuring Electrode

pH: Domed Glass, Flat Glass, or Antimony as specified.
See Figure 11 and the following text.
ORP: Platinum or Gold as specified.
See Figure 11 and the following text.

O-Ring: Viton standard; EPDM and Chemraz optional, as specified.
See Figure 11 and the following text.

Electrode Type

For pH Sensors

-1 = Domed, High Temperature, Glass Bulb with Protective Guard
-2 = Domed, High Temperature, Glass Bulb w/o Protective Guard
-3 = Flat Ruggedized Glass
-4 = Antimony

For ORP Sensors

-1 = Platinum
-2 = Gold

Optional Selections

-E = EPDM O-ring
-C = Chemraz O-ring

871FT

Sensor Identification

A typical data plate is shown in Figure 12.

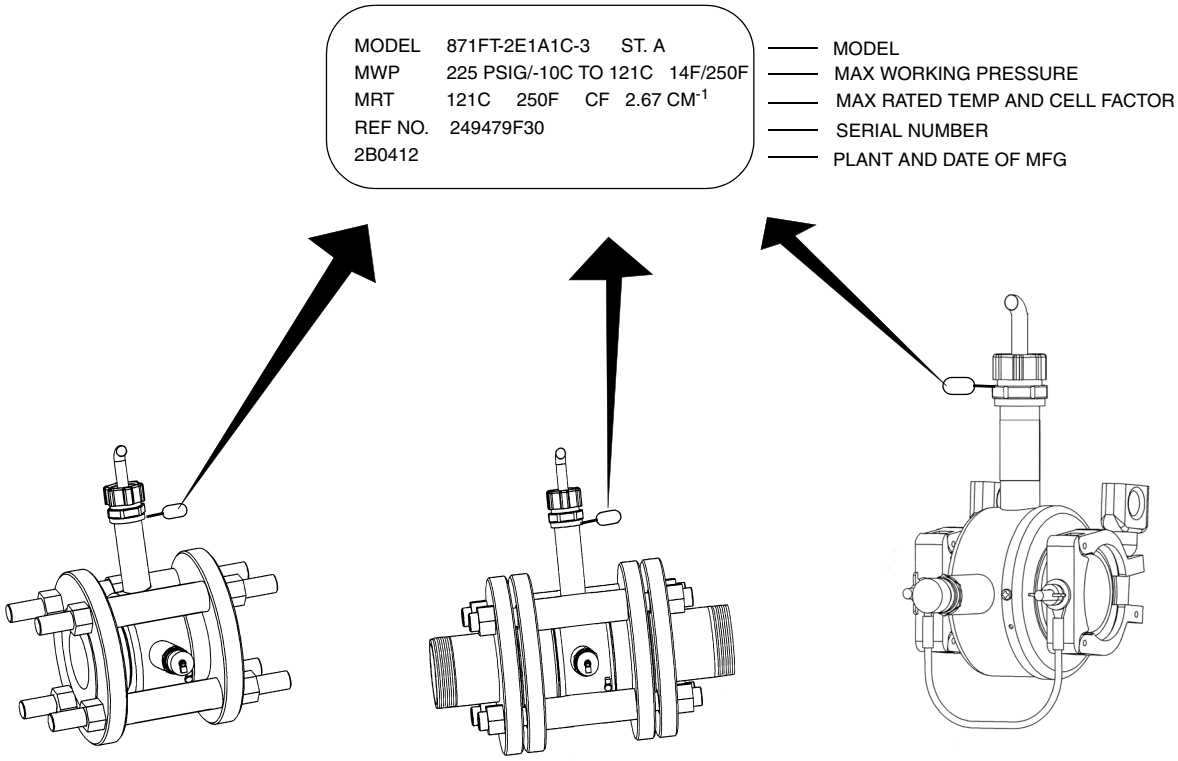


Figure 12. Sample 871FT Data Plate

A typical agency label is shown in Figure 13. The label is attached to the sensor cable.

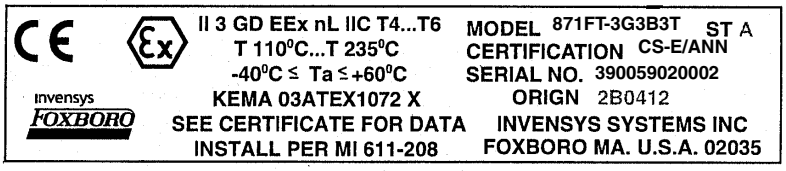


Figure 13. Sample 871FT Agency Label

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 12. See Table 14 for additional information.

Table 14. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T4 - T6 T110 °C...T235 °C	CS-E/ANN

NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA are as follows:

U_i = 7.5 V
I_i = 55 mA
P_i = 0.4 W
Effective C_i = negligibly small
Effective L_i = 11.5 mH

Entity Parameters for CS-E/ANN are as follows:

U_i = 7.5 V
I_i = 55 mA
P_i = 0.4 W
C_i = 0 nF
L_i = 11.5 mH

Table 15. Relationship Between Process Temperature and Temperature Class

Temperature Class	Max Process Temp
T4	125 °C
T5	100 °C
T6	85 °C

For the relationship between the input power P_i, the process temperature, and the surface temperature 'T', refer to Table 4.

Electromagnetic Compatibility (EMC)

The 871FT Sensor complies with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873EC*, 873AEC*, and 875EC Analyzers, and 870ITEC Transmitters.
(*220 V ac, 240 V ac metal enclosures only)

Temperature and Pressure Limits

The temperature and pressure limits vary depending on the sensor type, the nominal line size, the insulator material, and the end connection form. The sensor type, insulator material, nominal line size, and end connection form are identified in the model number on the data label. See Figure 14.

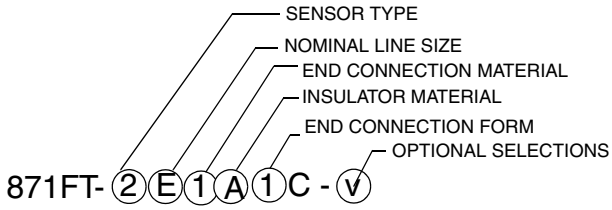


Figure 14. 871FT Model Code Example

Sensor Type

-1 = Sanitary, High Range Conductivity
-2 = Sanitary, Low Range Conductivity
-3 = Industrial, High Range Conductivity
-4 = Industrial, Low Range Conductivity

Nominal Line Size

C = 1/2 in
D = 3/4 in
E = 1 in
F = 1 1/2 in
G = 2 in
H = 3 in
J = 4 in

Insulator Material

A = VPEEK
B = PVDF
C = PCTFE
D = Glass Filled PEEK

End Connection Form

1 = Tri-Clamp Fitting
2 = Pipe Adapter
3 = ANSI Class 150 Flange
4 = ANSI Class 300 Flange

Table 16. Temperature and Pressure Limits

Item	Description
Temperature and Pressure Limits	
Sanitary Sensors with Tri-Clamp Fittings:	
Virgin PEEK: 1/2, 3/4, 1, 1 1/2, and 2 in 3 in 4 in **PCTFE:**	225 psi, -10 to +121 °C (14 to 250 °F) not derated linearly derated from 225 psi at 85 °C (185 °F) to 160 psi at 121 °C (250 °F) linearly derated from 225 psi at 43 °C (110 °F) to 150 psi at 121 °C (250 °F) 60 psi, -10 to +60 °C (14 to 140 °F) linearly derated to 10 psi at 121 °C (250 °F) *NOTE: Tri-Clamp wing nut tightened to 25 in·lb torque.*
Industrial Sensors with ANSI Class 150 Flanges or NPT Mounting:	
Glass Filled PEEK: **PVDF:** **PCTFE:**	275 psi, -10 to +60 °C (14 to 140 °F) linearly derated to 190 psi at 210 °C (411 °F) 100 psi, -10 to +60 °C (14 to 140 °F) linearly derated to 60 psi at 121 °C (250 °F) 100 psi, -10 to +60 °C (14 to 140 °F) linearly derated to 10 psi at 121 °C (250 °F)
Industrial Sensors with ANSI Class 300 Flanges:	
Glass Filled PEEK:	400 psi, -10 to +210 °C (14 to 411 °F)

Process Wetted Parts

The Sanitary sensor type has only the insulator (bore piece) as a wetted part. The Industrial sensor type has end connection, insulator (bore piece) and O-ring as wetted parts. The sensor type, end connection material, and insulator are identified in the model number on the data label. See Figure 14 and the following text. EPDM O-rings are used unless Viton or Chemraz is specified as an optional O-ring material in the last model code designator.

Sensor Type

-1 = Sanitary, High Range Conductivity
-2 = Sanitary, Low Range Conductivity
-3 = Industrial, High Range Conductivity
-4 = Industrial, Low Range Conductivity

End Connection Material

-1 = None
-2 = Hastelloy C-276
-3 = 316 ss
-4 = Carpenter 20-CB3

Insulator Material

A = VPEEK
B = PVDF
C = PCTFE
D = Glass Filled PEEK

Optional Selections

-P = Chemraz O-rings
-V = Viton O-rings

Pressure Equipment Directive (PED) Compliance

With the exception of the model codes listed in Table 17, the 871FT Sensors are in compliance with the Pressure Equipment Directive 97/23/EC as Sound Engineering Practice (SEP).

Table 17. Exceptions to PED Compliance

Model Code	Description
871FT-1J1A1 871FT-2J1A1	4 inch Sanitary Type with Virgin PEEK Insulator Material and Tri-Clamp Flange End Connections.
871FT-3H.D4 871FT-4H.D4	3-inch Industrial Type with Glass Filled PEEK Insulator Material and ANSI Class 300 End Connections
871FT-3J.D3 871FT-4J.D3	4-inch Industrial Type with Glass Filled PEEK Insulator Material and ANSI Class 150 End Connections
871FT-3J.D4 871FT-4J.D4	4-inch Industrial Type with Glass Filled PEEK Insulator Material and ANSI Class 300 End Connections

871EC

Sensor Identification

Typical agency and data labels shown in Figure 15.

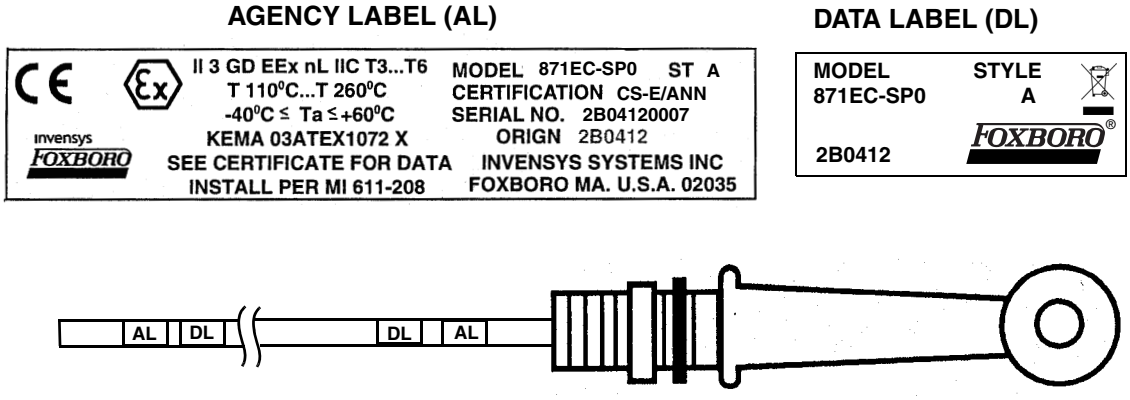


Figure 15. Sample 871EC Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 15. See Table 18 for additional information.

Table 18. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/ANN

— NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA are as follows

U_i = 7.5 V
I_i = 70 mA
P_i = 0.4 W
Effective C_i = negligibly small
Effective L_i = 7.8 mH

Entity Parameters for CS-E/ANN are as follows

U_i = 7.5 V
I_i = 65 mA
P_i = 0.4 W
C_i = 0 nF
L_i = 7.8 mH

Table 19. Relationship Between Process Temperature and Temperature Class

Temperature Class	Max Process Temp
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C

For the relationship between the input power P_i and the process temperature, refer to Table 4.

Electromagnetic Compatibility (EMC)

The 871EC Sensor complies with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873EC*, 873AEC*, and 875EC Analyzers, and 870ITEC Transmitters.
(*220 V ac, 240 V ac metal enclosures only)

Pressure and Temperature Limits

The pressure and temperature limits vary depending on the sensor type, the nominal line size, the insulator material, and the end connection form. The sensor type, insulator material, nominal line size, and end connection form are identified in the model number on the data label. See the following example:

Pressure and temperature limits vary per the sensor body code as shown in the model number. See Figure 16.

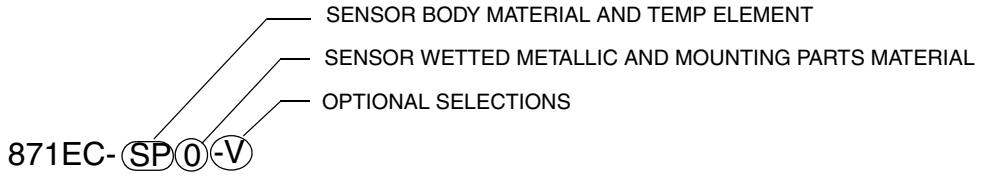


Figure 16. 871EC Model Code Example

Sensor Body Material and Temperature Element

-SP = Glass-filled PEEK, 100 kΩ Thermistor
-HP = Glass-filled PEEK, 100 Ω RTD
-PP = Virgin Polypropylene, 100 Ω RTD
-PT = Virgin Polypropylene, 100 kΩ Thermistor

-NL = Glass-filled Noryl, 100 kΩ Thermistor
-TF = Fluorocarbon head, 100 kΩ Thermistor
-PN = Glass-filled Noryl, 100 kΩ Thermistor
-PX = Glass-filled Noryl, 100 kΩ Thermistor
-RE = Glass-filled PEEK, 100 kΩ Thermistor
-LB = Glass-filled PEEK, 100 kΩ Thermistor
-BW = Glass-filled PEEK, 100 Ω RTD
-UT = Glass-filled PEEK, 100 Ω RTD
-EV = Epoxy head, 316 ss extension, 100 kΩ Thermistor
-AB = Linatex, 316 ss extension, 100 kΩ Thermistor

Table 20. Pressure and Temperature Limits

Sensor Body Code	Pressure Limits	Temperature Limits
-SP	-0.1 and +1.75 MPa (-15 and +250 psi)	-5 and +120 °C (20 and 250 °F)
-HP	-0.1 and +1.75 MPa (-15 and +250 psi)	-5 and +200 °C (20 and 390 °F)
-PP	-0.1 and +1.4 MPa (-15 and +200 psi)[(a)]	-5 and +120 °C (20 and 250 °F)
-PT	-0.1 and +1.4 MPa (-15 and +200 psi)[(a)]	-5 and +120 °C (20 and 250 °F)
-NL	-0.1 and +1.4 MPa (-15 and +200 psi)	-5 and +65 °C (20 and 150 °F)
-TF	-0.1 and +1.4 MPa (-15 and +200 psi)	-5 and +105 °C (20 and 225 °F)
-PN	-0.1 and +1.4 MPa (-15 and +200 psi)	-5 and +105 °C (20 and 225 °F)
-PX	-0.1 and +1.4 MPa (-15 and +200 psi)	-5 and +105 °C (20 and 225 °F)
-RE	-0.1 and +2.41 MPa (-15 and +350 psi)	-5 and +120 °C (20 and 250 °F)
-LB	-0.1 and +2.41 MPa (-15 and +350 psi)	-5 and +120 °C (20 and 250 °F)
-BW	-0.1 and +2.41 MPa (-15 and +350 psi)	-5 and +200 °C (20 and 390 °F)
-UT	-0.1 and +2.41 MPa (-15 and +350 psi)	-5 and +200 °C (20 and 390 °F)
-EV	-0.1 and +0.7 MPa (-15 and +100 psi)	-5 and +105 °C (20 and 225 °F)
-AB	-0.1 and +0.7 MPa (-15 and +100 psi)	-5 and +65 °C (20 and 150 °F)

(a) 1.4 MPa at 80 °C (200 psi at 176 °F) is linearly derated to 1.05 MPa at 120 °C (150 psi at 250 °F)

Process Wetted Parts

Process wetted parts vary per the sensor body material, sensor metallic parts (in some sensors) and O-ring material. The sensor body material and sensor wetted metallic parts are identified in the model number on the data label. See Figure 16 and following text. EPDM O-rings are used unless Viton, Kalrez, or Chemraz is specified as an optional O-ring material in the last model code designator.

Sensor Body Material

-SP = Glass-filled PEEK
-HP = Glass-filled PEEK
-PP = Virgin Polypropylene
-PT = Virgin Polypropylene
-NL = Glass-filled Noryl

-TF = Fluorocarbon head, 316 ss or Carpenter 20 Cb housing
-PN = Glass-filled Noryl
-PX = Glass-filled Noryl
-RE = Glass-filled PEEK
-LB = Glass-filled PEEK
-BW = Glass-filled PEEK
-UT = Glass-filled PEEK
-EV = Epoxy head, 316 ss extension
-AB = Linatex, 316 ss extension

Sensor Wetted Metallic and Mounting Parts Material

-0 = None
-2 = Carpenter 20 Cb
-3 = 316 ss Universal Mount
-7 = 316 ss Sanitary Mounting

Optional Selections

-C = Chemraz O-rings
-K = Kalrez O-rings
-V = Viton O-rings

871CC

Sensor Identification

A cell label similar to that shown in Figure 17 is attached to sensors 871CC-A, -E, -F, and -K.

Agency and data labels are attached to all 871CC cables as shown in Figure 17.

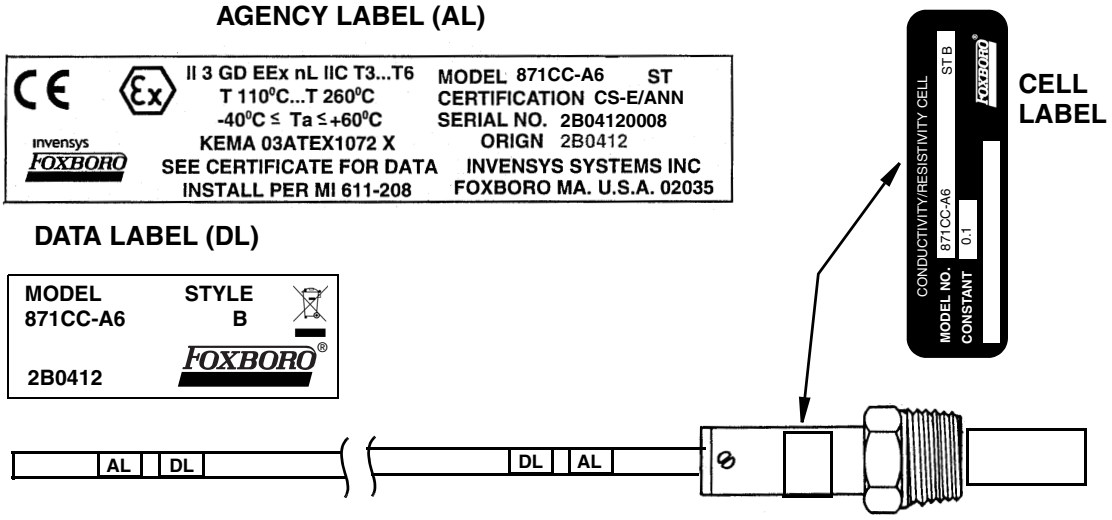


Figure 17. Sample 871CC Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 17. See Table 21 for additional information.

Table 21. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/ANN

NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA are as follows

U_i = 35 V
I_i = 150 mA
P_i = See Table 22
Effective C_i = negligibly small
Effective L_i = 0 mH

Entity Parameters for CS-E/ANN are as follows

U_i = 35 V
I_i = 150 mA
P_i = See Table 22
C_i = 0 nF
L_i = 0 mH

Table 22. Maximum Input Power (Pi)

Temperature Class	Max Process Temp(°C)	
	Pi = 0.4 W	Pi = 0.6 W
T3	175	175
T4	135	135
T5	100	85
T6	85	50*

* Maximum Ambient Temperature = +45 °C

For the relationship between the input power P_i and the process temperature, refer to Table 4.

Electromagnetic Compatibility (EMC)

The 871CC Sensor complies with the requirements of the European EMC Directive 89/336/EEC when its cable is connected through rigid metal conduit as recommended for 873CC*, 873ACC*, 873RS*, 873ARS*, and 875CC Analyzers, and 870ITCC Transmitters. (*220 V ac, 240 V ac metal enclosures only)

Pressure and Temperature Limits

Pressure and temperature limits vary per sensor mounting as shown in the model number. See Figure 18.

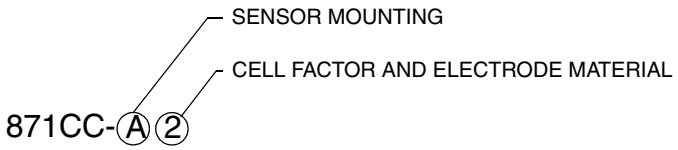


Figure 18. 871CC Model Code Example

Sensor Mounting

-A = Threaded Bushing, 3/4 NPT
-B = Universal
-C = Sanitary
-D = Insertion
-E = Twist-Lock
-F = Threaded Bushing, 3/4 NPT with 1/2 NPT Conduit Connector
-G = Dip Sensor
-K = Threaded Bushing, 3/4 NPT, High Temperature
-L = Sanitary, High Temperature
-M = Insertion, High Temperature

Table 23. Pressure and Temperature Limits

Sensor Mtg Code	Temperature Limits	Pressure Limits
-A through -G	0 and 120 °C (32 and 250 °F)	-0.1 and +1.4 MPa (-15 and +200 psi)
-K though -M	120 °C at 3.4 MPa (250 °F at 500 psi) 150 °C at 2.5 MPa (300 °F at 375 psi) 175 °C at 1.7 MPa (350 °F at 250 psi)	

Process Wetted Parts

Process wetted parts vary per the cell factor and sensor mounting codes as shown in the model number. See Figure 18 and the following text.

Sensor Mounting

-A = Threaded Bushing, 3/4 NPT
-B = Universal
-C = Sanitary
-D = Insertion
-E = Twist-Lock
-F = Threaded Bushing, 3/4 NPT with 1/2 NPT Conduit Connector
-G = Dip Sensor
-K = Threaded Bushing, 3/4 NPT, High Temperature
-L = Sanitary, High Temperature
-M = Insertion, High Temperature

Cell Factor and Electrode Material

2 = 0.1 cm^{-1}, Titanium
4 = 10 cm^{-1}, Graphite
6 = 0.1 cm^{-1}, Monel

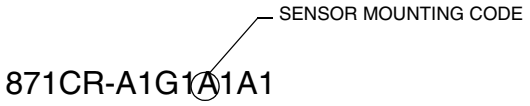
Table 24. Process Wetted Parts

Cell Factor	Sensor Mounting Code	Seals/ O-Rings	Insulator	Removable Sheath	Bushing	Electrodes
Sensors with 3/4 NPT Bushing or Twist-Lock Process Connection						
0.1 cm^{-1}	-A	EPDM	Ryton (a)	None	Teflon-S Coated 300 Grade ss	Titanium or Monel, as specified by Model Code
	-F	EPDM	Ryton	None		
	-K	EPDM	pctfe (a)	None		
	-E	EPDM	Ryton	None	None (Twist Lock)	
10 cm^{-1}	-A	EPDM	Noryl	ptfe (a)	Teflon-S Coated 300 Grade ss	High density graphite encapsulated in gold-plated cups
	-F	EPDM	Noryl	ptfe		
	-K	EPDM	pctfe	ptfe	None (Twist Lock)	
	-E	EPDM	Noryl	ptfe		
Universal Mount, Insertion, and Dip Sensors						
0.1 cm^{-1}	-B	EPDM	Ryton	None	316 ss	Titanium or Monel, as specified by Model Code
	-G	EPDM	Ryton	None	Noryl	
	-D	EPDM	Ryton	None	316 ss (Includes insertion shaft)	
	-M	EPDM	pctfe	None		
10 cm^{-1}	-B	EPDM	Noryl	ptfe	316 ss	High density graphite encapsulated in gold-plated cups
	-G	EPDM	Noryl	ptfe	Noryl	
	-D	EPDM	Noryl	ptfe	316 ss (Includes insertion shaft)	
	-M	EPDM	pctfe	ptfe		
Sensors with Sanitary Fittings						
0.1 cm^{-1}	-C	EPDM	Ryton	None	316 ss	Titanium or Monel, as specified by Model Code
	-L	EPDM	pctfe	None	316 ss	
10 cm^{-1}	-C	EPDM	Noryl	ptfe	316 ss	High density graphite encapsulated in gold-plated cups
	-L	EPDM	pctfe	ptfe	316 ss	

871CR

Sensor Identification

A cell label similar to that shown in Figure 19 is attached to sensors with sensor mounting codes A, B, C, D, E, J, and K.



Agency and data labels are attached to all 871CR cables as shown in Figure 19.

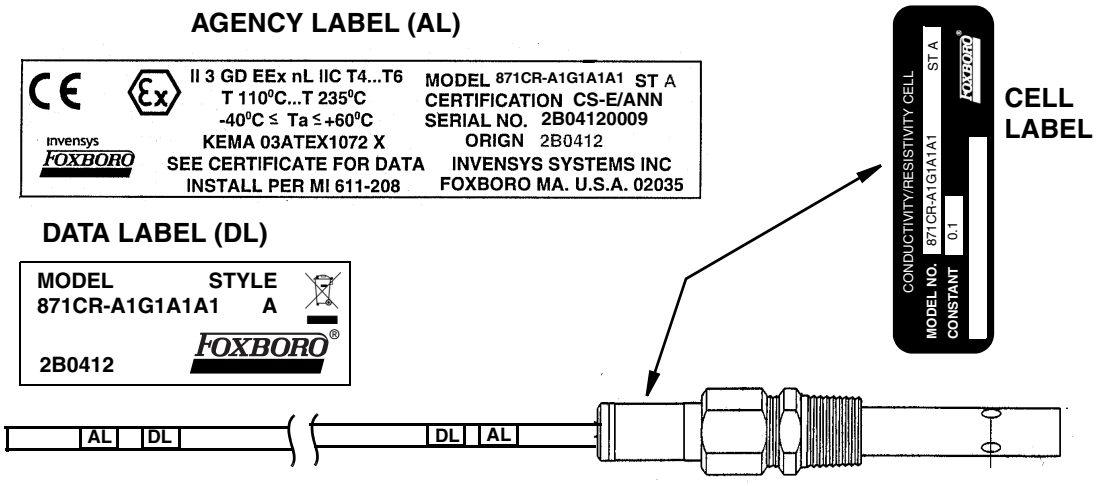


Figure 19. Sample 871CR Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 19. See Table 25 for additional information.

Table 25. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 GD EEx ia IIC, Zone 0	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/AAA
ATEX Type n energy limited for II 3 GD EEx nL IIC, Zone 2	Temperature Class T3 - T6 T110 °C...T260 °C	CS-E/ANN

NOTE

These sensors have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

Entity Parameters for CS-E/AAA are as follows:

U_i = 35 V
I_i = 150 mA
P_i = 0.6 W
Effective C_i = negligibly small
Effective L_i = negligibly small

Entity Parameters for CS-E/ANN are as follows:

U_i = 35 V
I_i = 150 mA
P_i = 0.6 W
C_i = 0 nF
L_i = 0 mH

Table 26. Relationship Between Process Temperature and Temperature Class

Temperature Class	Max Process Temp
T3	175 °C
T4	135 °C
T5	85 °C
T6	45 °C

For the relationship between the input power P_i, and the process temperature, refer to Table 4.

Electromagnetic Compatibility (EMC)

The 871CR Sensor with Integral Conduit Fitting (Sensor Mounting Code K) and cable connected through rigid metal conduit as recommended to 870ITCR Transmitters, complies with the requirements of the European EMC Directive 89/336/EEC and CENELEC standards for electromagnetic compatibility for generic emissions EN50081-2 and immunity EN50082-2 (Part 2: Industrial Environment).

Pressure and Temperature Limits

Pressure and temperature limits vary per the sensor accessory used for mounting and the insulator material. The insulator material is identified in the model number. See Figure 20.

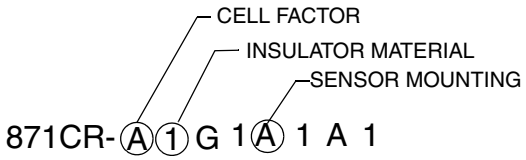


Figure 20. 871CR Model Code Example

Insulator Material

1 = CPVC
2 = Virgin PVDF
3 = Virgin PEEK
4 = Glass-filled PEEK
5 = Glass-filled Noryl

Refer to Tables 27 through 31 for pressure and temperature limits.

Table 27. Maximum Pressure/Temperature Ratings for Sensors in Bushing Mounts

Bushing Material/Insulator Material	Maximum Pressure/ Temperature Rating
CPVC/CPVC	250 psig at 27 °C (80 °F) (a)
Virgin PVDF/Virgin PVDF	250 psig at 24 °C (75 °F) (b)
Virgin PEEK/Virgin PEEK	250 psig at 175 °C (350 °F)
Titanium/Virgin PVDF	250 psig at 121 °C (250 °F)
Titanium/Virgin PEEK	250 psig at 175 °C (350 °F)
Glass-Filled Noryl/Glass-Filled Noryl	150 psig at 121 °C (250 °F)
Glass-Filled PEEK/Glass-Filled PEEK	250 psig at 175 °C (350 °F)
316 SS/Glass-Filled Noryl	250 psig at 121 °C (250 °F)
316 SS/Glass-Filled PEEK	250 psig at 175 °C (350 °F)

(a)Linearly derated to 50 psig at 88 °C (190 °F)

(b)Linearly derated to 42 psig at 121 °C (250 °F)

Table 28. Maximum Pressure/Temperature Ratings for Flow Chambers

Material	Maximum Pressure/ Temperature Rating[(a)]
PVC	60 psig at 50 °C (122 °F)
CPVC	60 psig at 50 °C (122 °F)
Virgin PVDF	60 psig at 50 °C (122 °F)
Virgin PEEK	250 psig at 175 °C (350 °F)
316 SS	500 psig at 175 °C (350 °F)

(a) Actual sensor rating may derate actual pressure-temperature ratings listed.

Table 29. Maximum Pressure/Temperature Ratings for Sensors in Tri-Clamp Mountings

Used With Insulator	Maximum Pressure/Temperature Rating
Virgin PDVF	250 psig at 121 °C (250 °F)
Virgin PEEK	250 psig at 175 °C (350 °F)
Glass-Filled PEEK	250 psig at 175 °C (350 °F)
Glass-Filled Noryl	250 psig at 121 °C (250 °F)

Table 30. Maximum Pressure/Temperature Ratings for Sensors in Flange Mounts

Used With Insulator	Maximum Pressure/Temperature Rating
CPVC	198 psi at 88 °C (190 °F)
Virgin PDVF	184 psig at 121 °C (250 °F)
Virgin PEEK	167 psig at 175 °C (350 °F)
Glass-Filled PEEK	167 psig at 175 °C (350 °F)
Glass-Filled Noryl	184 psig at 121 °C (250 °F)

Table 31. Maximum Pressure/Temperature Ratings for Ball Valves and Insertion Sensors

Ball Valve/Insertion Sensor Material	Maximum Pressure/ Temperature Rating
Virgin PVDF/Virgin PVDF	100 psig at 60 °C (140 °F)
316 ss/CPVC	250 psig at 82 °C (180 °F)
316 ss/Virgin PVDF	250 psig at 121 °C (250 °F)
316 ss/Virgin PEEK	500 psig at 175 °C (350 °F)
316 ss/Glass-Filled PEEK	500 psig at 175 °C (350 °F)
316 ss/Glass-Filled Noryl	250 psig at 175 °C (350 °F)

(a)Linearly derated to 60 psig at 121 °C (250 °F)

Process Wetted Parts

Process wetted parts vary per the cell factor and sensor mounting codes as shown in the model number. See Figure 20 and the following text.

Cell Factor

-A = 0.1 cm^{-1} Conductivity/Resistivity with Class B 1000 Ω RTD
-B = 0.1 cm^{-1} Resistivity with Class A 1000 Ω RTD
-C = 10 cm^{-1} Conductivity with Class B 1000 Ω RTD

Sensor Mounting

A = Universal Bore Piece with 3/4 NPT CPVC Bushing
B = Universal Bore Piece with 3/4 NPT Virgin PVDF Bushing
C = Universal Bore Piece with 3/4 NPT Virgin PEEK Bushing
D = Universal Bore Piece with 3/4 NPT Glass Filled PEEK Bushing
E = Universal Bore Piece with 3/4 NPT Glass Filled Noryl Bushing
F = Universal Bore Piece with 1 1/2 inch Tri-Clamp Fitting

Table 32. Process Wetted Parts

Cell Factor	Mounting Code	Mounting	Insulator	Electrodes	Seals/O-ring	Sheath
0.1 cm^{-1}	A, B, C, F, J, K	CPVC, Virgin PVDF, Virgin PEEK, or Titanium Bushings; Titanium or 316 ss Tri-Clamp Fittings; or 316 ss Flanges	CPVC or Virgin PVDF or Virgin PEEK	Titanium or Monel	Teflon-coated EPDM	–
	G	PVDF Insertion Shaft	Virgin PVDF	Titanium or Monel		
	H	316 ss Insertion Shaft	CPVC or Virgin PVDF or Virgin PEEK	Titanium		
10 cm^{-1}	D, E, F, J, K	Glass-Filled PEEK, Glass-Filled Noryl, 316 ss Bushings, or 316 ss Tri-Clamp Fittings; or 316 ss Flanges	Glass-Filled PEEK or Glass-Filled Noryl	Graphite/ Titanium Cup	EPDM and Teflon-coated EPDM	Teflon and Titanium (a)
	H	316 ss Insertion Shaft	Glass-Filled PEEK or Glass-Filled Noryl	Graphite/ Titanium Cup		

FT10 Electrodeless Conductivity Sensor, ATEX Entity Approval as Type ia and Type n

The FT10 Conductivity Sensor is ATEX Approved as Type ia and Type n for use in Zone 0 and Zone 2 hazardous (classified) areas respectively.

The sensor is typically installed in the (potentially) hazardous area. The 875EC Analyzer, the 870ITEC Transmitter or other ATEX Approved apparatus can be installed in either the non-hazardous or the hazardous area. Wiring and installation methods are determined by the area (hazardous or nonhazardous) in which the associated equipment is installed. In all cases, installation should be in accordance with regulations of the country of installation

WARNING

Explosion Hazard - Do not disconnect equipment when a flammable or combustible atmosphere is present unless power has been switched off.

WARNING

Safety Ground - The grounding stud or conductive mounting means of the enclosure of the associated apparatus must be connected to the potential equalizing system within the explosive atmosphere.

WARNING

Ingress Protection - The FT10 sensor housing meets IP66 ingress protection only when the Calibration Port Cover is securely installed on the sensors with integral cable (FT10-MT…1 or FT10-MT…2). The patch cable or protective cover must also be securely installed on the sensors with cable connector (FT10-MT…6) to meet IP66 ingress protection.
Associated Apparatus - Connection of the FT10 Sensor to the associated apparatus must be made in such a way that the degree of ingress protection remains at least IP54 per EN 60529 and is suitable for the environment.

WARNING

Calibration Port Cover - The Calibration Port Cover must remain securely installed during normal operation in a (potentially) hazardous location.

WARNING

Associated Apparatus - The associated apparatus must be ATEX certified as either Type ia or Type n and must have compatible entity parameters. The associated apparatus manufacturer's installation instructions must be followed when installing the associated apparatus.
Both the Sensor and the Associated Apparatus must have the same safety rating, either both Type ia or both Type n.

WARNING

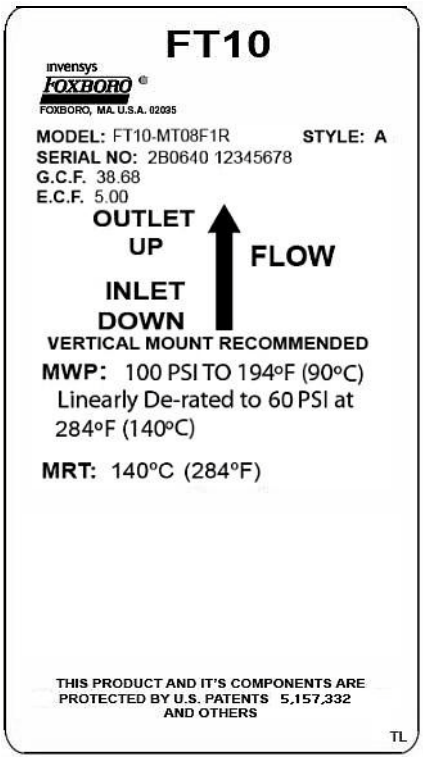
Ultra-Violet Radiation Exposure - The housing material will yellow and become brittle with extended exposure to UV radiation (sunlight).

WARNING

Parts of the enclosure are non-conducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Ensure that the equipment is not installed in a location where it may be subjected to external conditions which might cause a build up of electrostatic charge on nonconducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

Sensor Identification

A Data Label with model number, serial number including date of manufacture, cell constants, pressure and temperature information is affixed to the front surface of the sensor. An Agency Label with certification information is affixed to the rear surface. A third Warning Label is affixed to the side with the calibration connector. Refer to the sample labels in Figures 21, 22, and 23.



Model Number: Per Sales Order

Serial Number: Origin code followed by a number set per manufacturing standard procedures. The Origin Code is explained immediately below this figure.

GCF and ECF: Geometric and Electronic Cell Factor values are determined by the model number (line size) of the sensor.

MWP: Maximum Working Pressure values are determined by the model number (line size) of the sensor.

MRT: Maximum Rated Temperature is the maximum process fluid temperature allowed at the maximum ambient temperature Ta=65 °C.

Figure 21. Sample Data Label

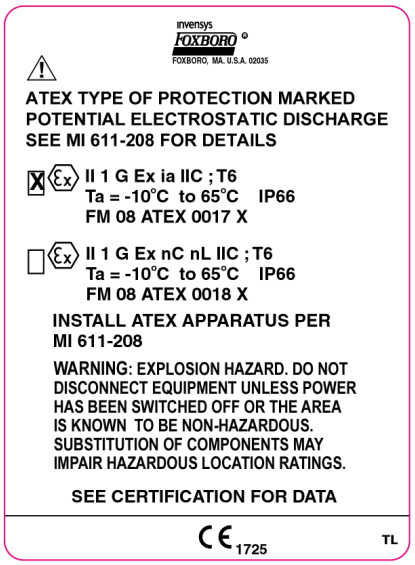


Figure 22. Sample Agency Label

The type of protection (Type ia or Type n) is determined during fabrication and marked on the Agency Label. Once determined, the type of protection may not be changed.

Figure 23. Sample Warning Label

Associated Apparatus in Nonhazardous Area, Sensor in Hazardous Area

There are no special requirements when the 875EC Analyzer, 870ITEC Transmitter or other ATEX entity approved associated apparatus is installed in a nonhazardous area. See Figure 24.

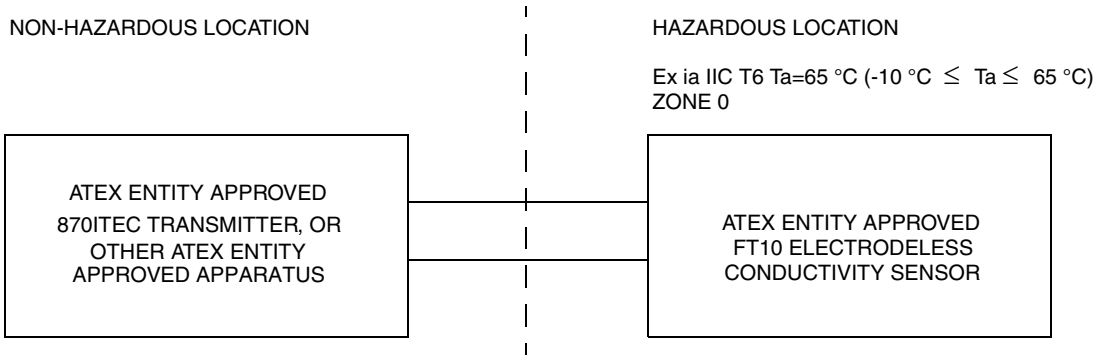


Figure 24. Sensor in Zone 0 Hazardous Location

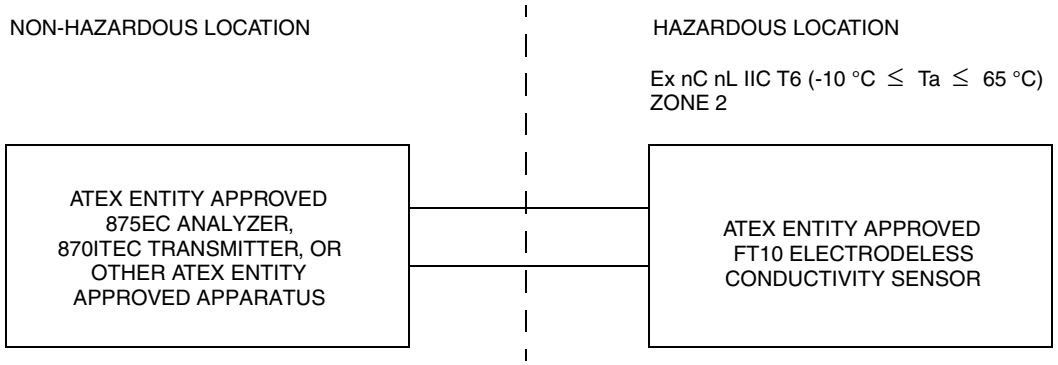


Figure 25. Sensor in Zone 2 Hazardous Location

Associated Apparatus and Sensor in Hazardous Area

All connections to the 875EC Analyzer, 870ITEC Transmitter or other ATEX entity approved associated apparatus (except connections to the sensor) must be protected by conduit to prevent damage to the wiring in the hazardous area. Conduit and all fittings to the 875EC Analyzer, 870ITEC Transmitter or associated apparatus, including the sensor cable fitting must meet ingress protection ratings of IEC IP66 within the hazardous area; follow the manufacturer's safety installation instructions for the associated apparatus. See Figure 26.

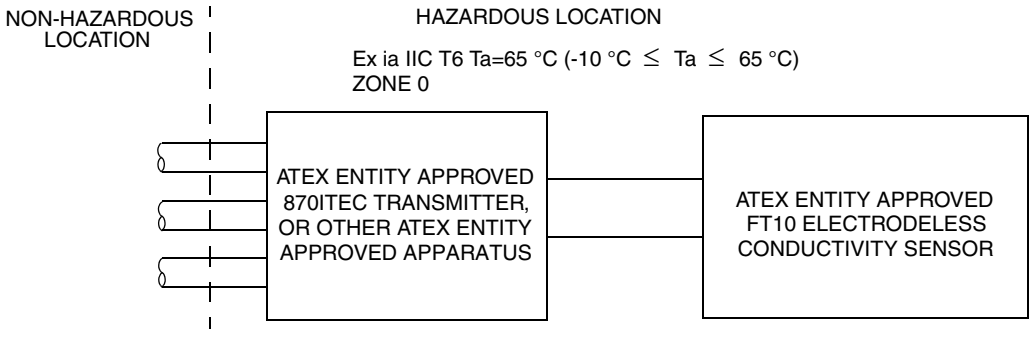


Figure 26. Sensor and Associated Apparatus in Zone 0 Hazardous Location

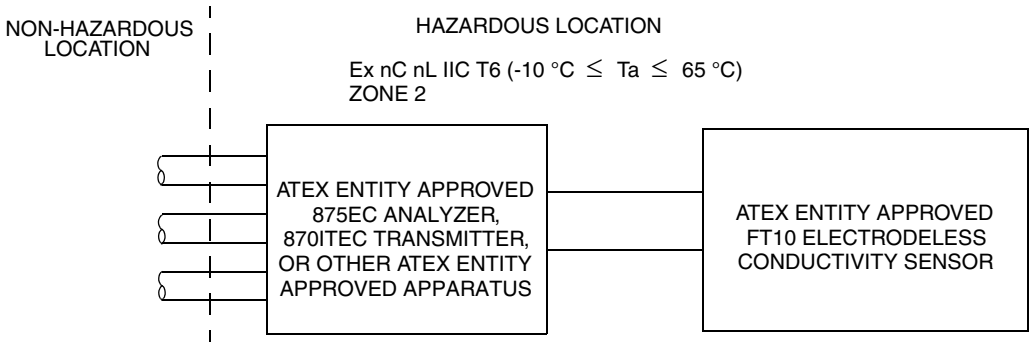


Figure 27. Sensor and Associated Apparatus in Zone 2 Hazardous Location

Entity and Field Wiring Parameters

The entity and field wiring parameters listed below apply to all models of the FT10 Electrodeless Conductivity Sensor.

Vmax (Ui) = 10 V
Imax (Ii) = 80 mA
Pmax (Pi) = 0.200 W
Ci = 0 F
Li = 5.5 mH

Pin Terminated Integral Cable and Patch Cable Connections

The individual connections are color coded. Additionally, each connection has a numbered sleeve corresponding to the terminal number on the 875EC Analyzer or 870ITEC Transmitter for increased wiring ease. Refer to Figure 30 for 875EC Sensor Interface terminal connections or refer to MI 611-224 for this and more general information. Refer to Figure 31 or 870ITEC Sensor Interface terminal connections or refer to MI 611-212 for this and more general information. The ring terminal on the high temperature cable should be connected to chassis or earth ground in the associated apparatus.

Table 33. Cable Connections

Function/Signal Description	Wire Sleeve Designation	Connector Pin	Standard Temperature (PVC) Cable	High Temperature (TFE) Cable
Sensor Drive	1	A	BLK	BLK
Sensor Drive	2	B	WHT	WHT
Drive Screen	3	C	CLEAR (Shield 1)	CLEAR (Shield 1)
Sensor Return	4	D	RED	RED
Sensor Return	5	E	CLEAR (Shield 2)	CLEAR (Shield 2)
RTD Return	6	F	BRN	BRN
RTD Drive	7	G	BLU	BLU

Table 33. Cable Connections

Function/Signal Description	Wire Sleeve Designation	Connector Pin	Standard Temperature (PVC) Cable	High Temperature (TFE) Cable
RTD 3-Wire	8	H	ORN	ORN
Cable Shield	Ring Terminal	No Connection	Not Used	CLEAR (Shield)

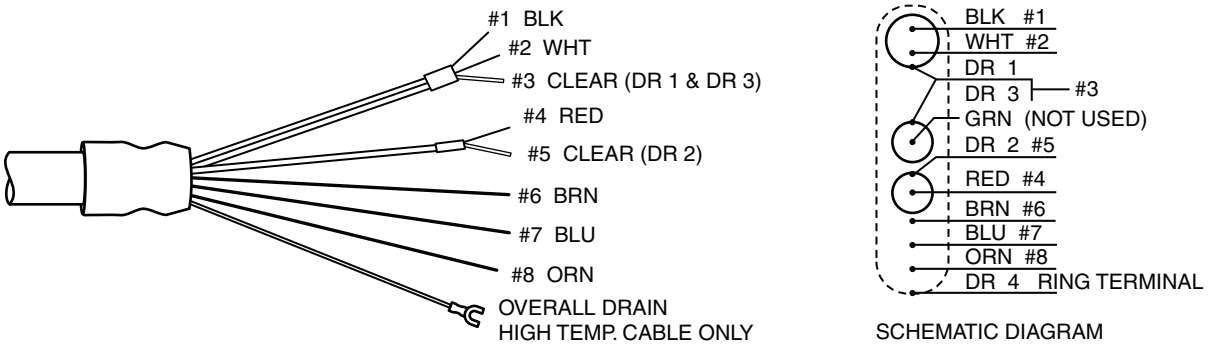


Figure 28. Cable Connections

Patch Cable Connector

Connector pin designations and the connector layout are shown for reference. Patch Cables in both PVC (standard temperature) and TFE (high temperature) are available. Refer to MI 611-217 for information.

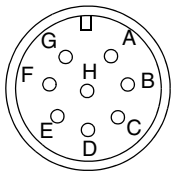


Figure 29. Patch Cable Connector (as viewed on sensor)

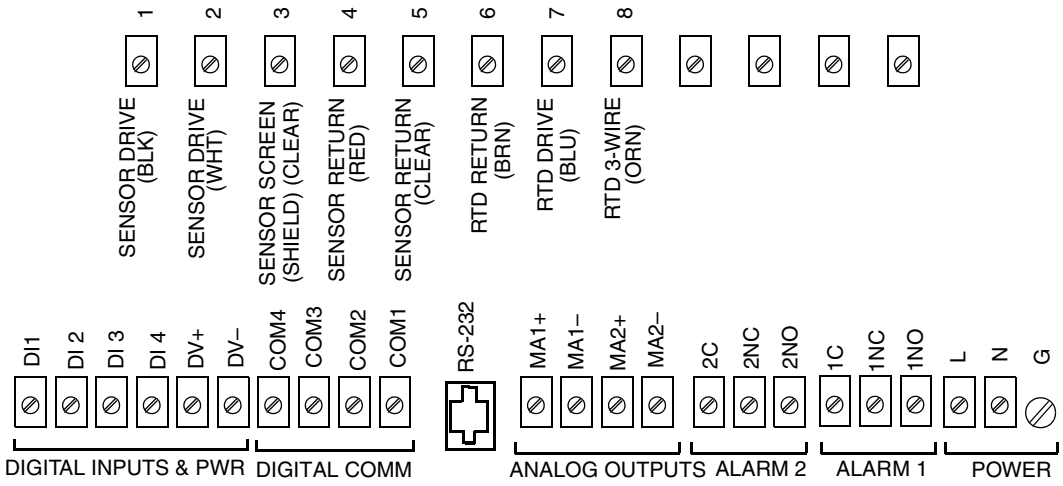


Figure 30. 875EC Analyzer Sensor Wiring Connections

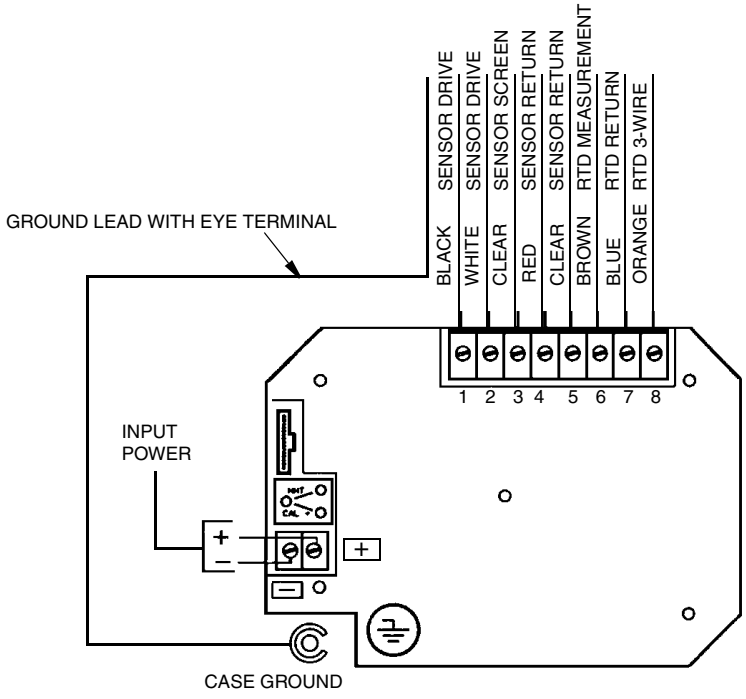


Figure 31. 870ITEC Transmitter Sensor Wiring Connections

Special Conditions of use

The housing is designed for indoor use only. Refer to Ultra-Violet Radiation Exposure warning on page 40.

4. 870IT Series Transmitters

Transmitter Identification

The data label and agency label are fastened to left side surface of the enclosure. A typical data label is shown in Figure 32. A typical agency label is shown in Figure 33.

Refer to the data label to determine the model number, origin code, supply voltage, and maximum power.

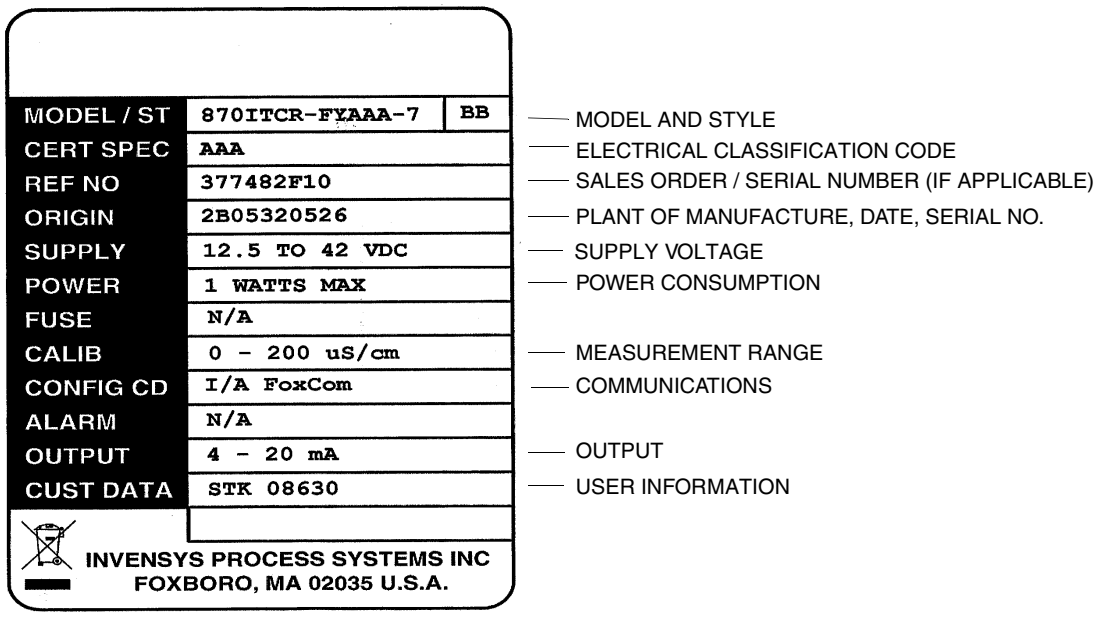


Figure 32. Sample 870IT Transmitter Data Label

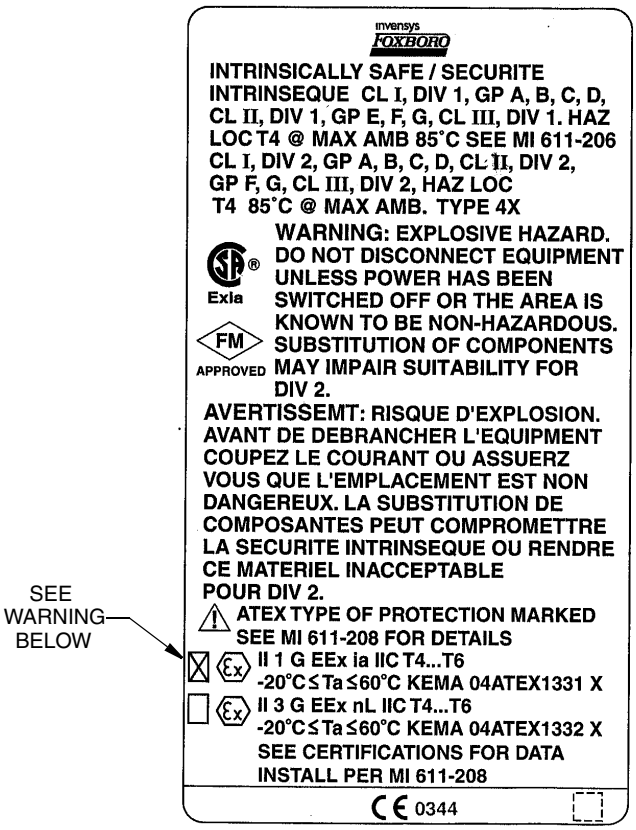


Figure 33. Sample Type ia Certified 870IT Transmitter Agency Label

Electrical Certification Rating

The electrical certification information is printed on the agency label. See Figure 33. See Table 34 for additional information.

WARNING

The type of protection (Type ia or Type n) is determined at the time of fabrication and the agency label is appropriately marked. Once determined, this certification may not be changed.

Table 34. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for II 1 G EEx ia IIC	Temperature Class T4 -T6.	AAA
ATEX Type n energy limited for II 3 G EEx nL IIC	Temperature Class T4 -T6.	ANN

— NOTE

These transmitters have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

The entity parameters for the supply and output circuit in type of protection EEx ia IIC and EEx nL IIC with the following maximum values are:

Ui = 30 V
Ii = 110 mA
Pi = See Table 35 for EEx ia IIC; Table 36 for EEx nl IIC
Ci = 2 nF
Li = 0 mH

The entity parameters for the sensor circuit in type of protection intrinsic safety EEx ia IIC with the following maximum values are:

870ITPH-..AAA-. (Terminals 1, 2, 2A, 3 3A, 4, 5, 5A, 6, 7, 8, G)	870ITEC-..AAA-. (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	870ITCR-..AAA-. (Terminals 1, 1A, 1B, 1C, 1D, 1E, 2, 3, 4, 5)
Uo = 8.6 V	Uo = 6.5 V	Uo = 13 V
Io = 40 mA	Io = 110 mA	Io = 40 mA
Po = 0.35 W	Po = 0.1 W	Po = 0.35 W
Co = 0.5 µF	Co = 0.3 µF	Co = 0.5 µF
Lo = 1 mH	Lo = 0.1 mH	Lo = 1 mH

The entity parameters for the sensor circuit in type of protection EEx nL IIC, with the following maximum values are:

— NOTE

The 870ITEC-..AAA-. Transmitter is also approved for Type ia protection when used with a Type ia certified 871EC or 871FT Sensor with a maximum cable length of 30 m (100 ft).

870ITPH-..ANN-. (Terminals 1, 2, 2A, 3 3A, 4, 5, 5A, 6, 7, 8, G)	870ITEC-..ANN-. (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	870ITCR-..ANN-. (Terminals 1, 1A, 1B, 1C, 1D, 1E, 2, 3, 4, 5)
Uo = 8.6 V	Uo = 6.5 V	Uo = 13 V
Io = 40 mA	Io = 110 mA	Io = 40 mA
Po = 0.35 W	Po = 0.1 W	Po = 0.35 W
Co = 43 µF	Co = 300 µF	Co = 5.5 µF
Lo = 28 mH	Lo = 3.7 mH	Lo = 28 mH

— NOTE

The 870ITEC-..ANN-. Transmitter is also approved for Type n protection when used with a Type n certified 871EC or 871FT Sensor with a maximum cable length of 30 m (100 ft).

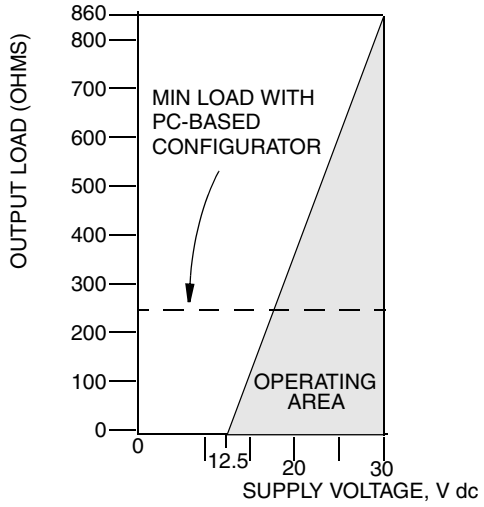
Table 35. Maximum Input Power (Pi) for Intrinsic Safety (EEx ia) Protection

Temperature Class	Max Process Temp (°C)	Pi (W)
T4	-20 to +70	0.8
T4	-20 to +75	0.7
T4	-20 to +85	0.6
T5	-20 to +40	0.7
T5	-20 to +60	0.6
T5	-20 to +85	0.5
T6	-20 to +40	0.5

Table 36. Maximum Input Power (Pi) for Energy Limited (EEx nL) Protection

Temperature Class	Max Process Temp (°C)	Pi (W)
T4	-20 to +70	0.8
T4	-20 to +75	0.7
T4	-20 to +85	0.6
T5	-20 to +70	0.8
T5	-20 to +75	0.7
T6	-20 to +60	0.8

The power supply requirements for a 4 to 20 mA output are 12.5 to 30 V dc for 870IT Series ATEX certified products. See Figure 34.



MAX LOAD = (V-12.5)/0.0204

NOTE
The transmitter will function with an output load less than 250 ohms provided that a PC-Based configurator is not connected to it. Connecting a PC-Based configurator while operating with less than a 250 ohm load may cause disturbances and/or communication problems.

Figure 34. Power Supply Requirements

Origin Code

The origin code identifies the area of manufacture, the year and week of manufacture, and the serial number. See Figure 32. In the example 2B04120526, 2B means the product was manufactured in the Analytical Division, 04 identifies the year of manufacture as 2004, 12, the week of manufacture in that year, and 0526 the serial number.

Special Warnings

WARNING

On intrinsically safe transmitters, if the optional storm door (option -7) is employed, take precautions to avoid electrostatic charges.

WARNING

The housing on 870IT transmitters is aluminum. Therefore, transmitters certified as intrinsically safe must be installed so that ignition sources due to impact and friction sparks are excluded.

WARNING

Make electrical connections in such a way that the degree of ingress protection of the enclosure remains at least IP54 per EN60529 and is suitable for the environment.

5. 876 Series Transmitters

Transmitter Identification

The data label and agency label are fastened to left side surface of the enclosure. A typical data label is shown in Figure 35. A typical agency label is shown in Figure 36.

Refer to the data label to determine the model number, origin code, supply voltage, and maximum power.

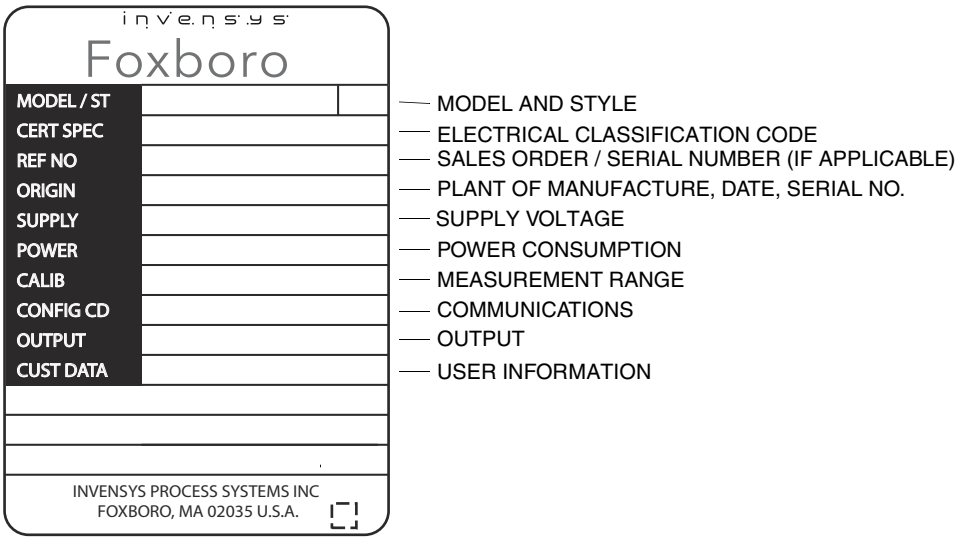


Figure 35. Sample 876 Transmitter Data Label

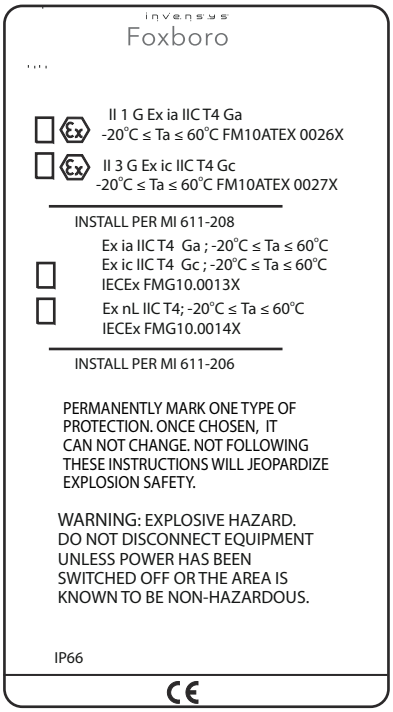


Figure 36. Sample Type ia Certified 870IT Transmitter Agency Label

Electrical Certification Rating

The electrical certification information is printed on the agency label. See Figure 36. See Table 37 for additional information.

WARNING

The type of protection (Type ia or Type ic) is determined at the time of fabrication and the agency label is appropriately marked. Once determined, this certification may not be changed.

Table 37. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
ATEX intrinsically safe for Zone 0 II 1 G Ex ia IIC T4 Ga	FM10ATEX0026X Temperature Class T4 (-20 ≤ Ta ≤ +60 °C) IP66	AA
ATEX intrinsically safe for Zone 2 II 3 G Ex ic IIC T4 Gc	FM10ATEX0027X Temperature Class T4 (-20 ≤ Ta ≤ +60 °C) IP66	AN

NOTE

These transmitters have been designed to meet the electrical safety descriptions listed in the table above. For detailed information, or status of testing laboratory approvals/certifications, contact Invensys.

The entity parameters for the supply and output circuit in type of protection Ex ia IIC and Ex ic IIC with the following maximum values are:

Ui ≤ 30 V
Ii ≤ 110 mA
Pi ≤ 800 mW
Ci = 3 nF
Li = 9.9 µH

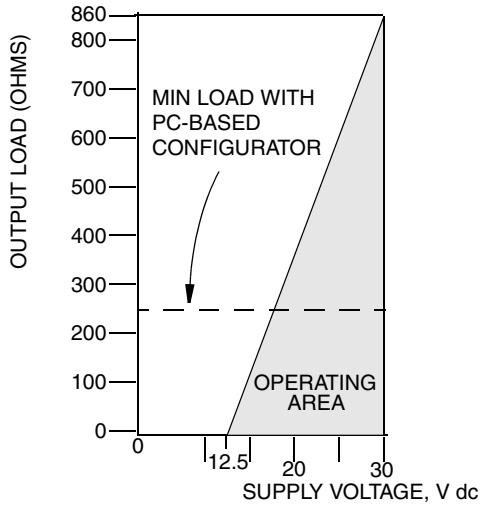
The entity parameters for the sensor circuit in type of protection intrinsic safety Ex ia IIC with the following maximum values are:

876PH-..AA-. (Terminals 1, 2, 2A, 3, 3A, 4, 5, 5A, 6, 7, 8)	876EC-..AA-. (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	876CR-..AA-. (Terminals 1, 2, 2A, 3, 4, 5)
Uo = 8.6 V	Uo = 6.5 V	Uo = 13 V
Io = 40 mA	Io = 110 mA	Io = 40 mA
Po = 0.35 W	Po = 0.10 W	Po = 0.35 W
Co = 0.5 µF	Co = 0.3 µF	Co = 0.5 µF
Lo = 1 mH	Lo = 0.1 mH	Lo = 1 mH

The entity parameters for the sensor circuit in type of protection Ex ic IIC, with the following maximum values are:

876PH-..AN-. (Terminals 1, 2, 2A, 3, 3A, 4, 5, 5A, 6, 7, 8)	876EC-..AN-. (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	876CR-..AN-. (Terminals 1, 2, 2A, 3, 4, 5)
Uo = 8.6 V	Uo = 6.5 V	Uo = 13 V
Io = 40 mA	Io = 110 mA	Io = 40 mA
Po = 0.35 W	Po = 0.10 W	Po = 0.35 W
Co = 43 µF	Co = 300 µF	Co = 5.5 µF
Lo = 28 mH	Lo = 3.7 mH	Lo = 28 mH

The power supply requirements for a 4 to 20 mA output are 12.5 to 30 V dc for 876 Series ATEX certified products. See Figure 37.



MAX LOAD = (V-12.5)/0.0204

NOTE
The transmitter will function with an output load less than 250 ohms provided that a PC-Based configurator is not connected to it. Connecting a PC-Based configurator while operating with less than a 250 ohm load may cause disturbances and/or communication problems.

Figure 37. Power Supply Requirements

Origin Code

The origin code identifies the area of manufacture, the year and week of manufacture, and the serial number. See Figure 35. In the example 2B10120526, 2B means the product was manufactured in the Analytical Division, 10 identifies the year of manufacture as 2010, 12, the week of manufacture in that year, and 0526 the serial number.

Special Warnings

WARNING

The 876 Transmitter enclosure is made of aluminum alloy. When used in a potentially explosive atmosphere requiring apparatus equipment category 1 G, the 876 Transmitter must be installed so that, even in the event of rare incidents, an ignition source due to impact or friction between the enclosure and iron/steel is excluded.

WARNING

The optional storm door (option code -7) and keypad area is nonconducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Ensure that the equipment is not installed in a location where it may be subjected to external conditions which might cause a build-up of electrostatic charge on nonconducting surfaces. Additionally, cleaning of the storm door and keypad area should only be done with a damp cloth.

WARNING

Make electrical connection in such a way that the degree of ingress protection on the enclosure remains at least IP66 per IEC 60529 and is suitable for the environment.

ISSUE DATES

DEC 2002 JUN 2011
MAR 2003
JAN 2004
SEP 2005
OCT 2005
APR 2008
DEC 2010

Vertical lines to the right of text or illustrations indicate areas changed at last issue date.

Invensys Operations Management
5601 Granite Parkway Suite 1000
Plano, TX 75024
United States of America
http://www.iom.invensys.com

Global Customer Support
Inside U.S.: 1-866-746-6477
Outside U.S.:1-508-549-2424 or contact your local Invensys representative.
Website: http://support.ips.invensys.com

Invensys and Foxboro, are trademarks of Invensys plc, its subsidiaries, and affiliates.
All other brand names may be trademarks of their respective owners.

Copyright 2002-2011 Invensys Systems, Inc.
All rights reserved

MB 100 0611