

**873 and 875 Series Analyzers,
870IT and 876 Series Transmitters,
871, PH10 and ORP10 Series Sensors**

**Intrinsic Safety Connector Diagrams and
Nonincendive Circuits**

Contents

1. 875 Analyzers	1
FM Entity Approval, 875 Analyzers, Nonincendive	1
FM Approved 875 Analyzers With Nonincendive Field Wiring	2
Nonincendive Field Wiring Circuit Concept	3
Analyzer Installed In Non-Hazardous Area With Sensor Installed In The Division 2 Area ...	3
Analyzer and Sensor Installed in Division 2 Area	3
Nonincendive Sensor	3
FM Definition of Simple Apparatus:	3
875 Panel-Mounted Analyzer	4
FM Approvals Listing	4
CSA Loop Certified Nonincendive Circuit	5
IECEX Entity Approval, 875 Analyzers, Type n	6
Analyzer Identification	6
Hazardous Location Code	7
Field Mounted Enclosures	9
Panel-Mounted Enclosures	9
Electrical Connection Warning	9
Grounding Warning	9
Origin Code	10
Supply Voltage Operative Limits	10
Alarm Contact Limits	10
Ambient Temperature Limits	10
Installation Instructions	10
CE Compliance	10
2. 870IT Transmitters	11
FM Entity Approval, Intrinsic Safety	11
FM Loop Approval, Intrinsic Safety	12
FM Loop Approval Nonincendive Circuit	13
CSA Loop Certified Intrinsic Safety	14
CSA Loop Certified Nonincendive Circuit	16
3. 873 and 873A Analyzers	17
FM Loop Approval Nonincendive Circuit	17
CSA Loop Certified Nonincendive Circuit	18
4. pH, ORP, and ISE Sensors	19
FM Entity Approval, pH, ORP, and ISE Sensors, Intrinsically Safe and Nonincendive	19
Intrinsically Safe Field Wiring Circuit Concept	20
Nonincendive Field Wiring Circuit Concept	20

Associated Apparatus in Non-hazardous Area; Sensor in Hazardous Area	20
Associated Apparatus and Sensor in Hazardous Area	21
Entity and Field Wiring Parameters	22
Pin Terminated Integral Cable Connections	23
Patch Cable Connections	24
FM Approvals Listing	26
IECEX Entity Approval, 871PH, 871A, PH10, and ORP10 Sensors, Type ia and Type n	28
Associated Apparatus in Non-hazardous Area, Sensor in Hazardous Area	29
Associated Apparatus and Sensor in Hazardous Area	30
871PH	31
871A	35
PH10 and ORP10	38
5. Electrodeless Conductivity Sensors	41
FM Entity Approval, FT10 Noninvasive Nonmetallic Electrodeless Conductivity Sensors, Intrinsically Safe and Nonincendive	41
Intrinsically Safe Field Wiring Circuit Concept	42
Nonincendive Field Wiring Circuit Concept	42
Associated Apparatus in Non-hazardous Area; Sensor in Hazardous Area	42
Associated Apparatus and Sensor in Hazardous Area	43
Entity and Field Wiring Parameters	44
Pin Terminated Integral Cable and Patch Cable Connections	44
Patch Cable Connector	45
FM Approvals Listing	46
IECEX Entity Approval, FT10 Noninvasive Nonmetallic Electrodeless Conductivity Sensor, Type ia and Type n	48
Sensor Identification	49
Associated Apparatus in Non-hazardous Area, Sensor in Hazardous Area	50
Associated Apparatus and Sensor in Hazardous Area	51
Entity and Field Wiring Parameters	52
Pin Terminated Integral Cable and Patch Cable Connections	52
Patch Cable Connector	53
Special Conditions of use	54
6. 876 Transmitters	57
FM Entity Approval	57
CSA Entity Approval	60
IECEX Entity Approval	63
Transmitter Identification	64
Electrical Certification Rating	65
Origin Code	67
Special Warnings	67

1. 875 Analyzers

FM Entity Approval, 875 Analyzers, Nonincendive

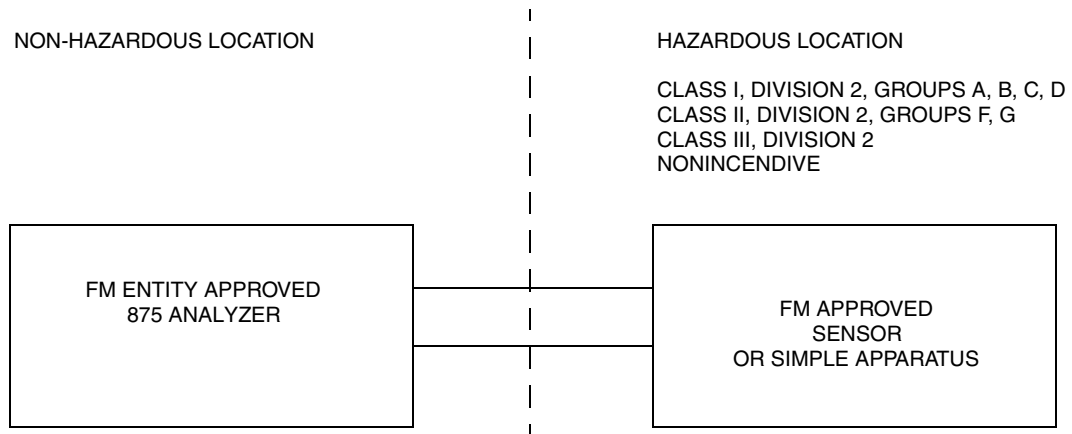


Figure 1. Analyzer in Non-hazardous Location

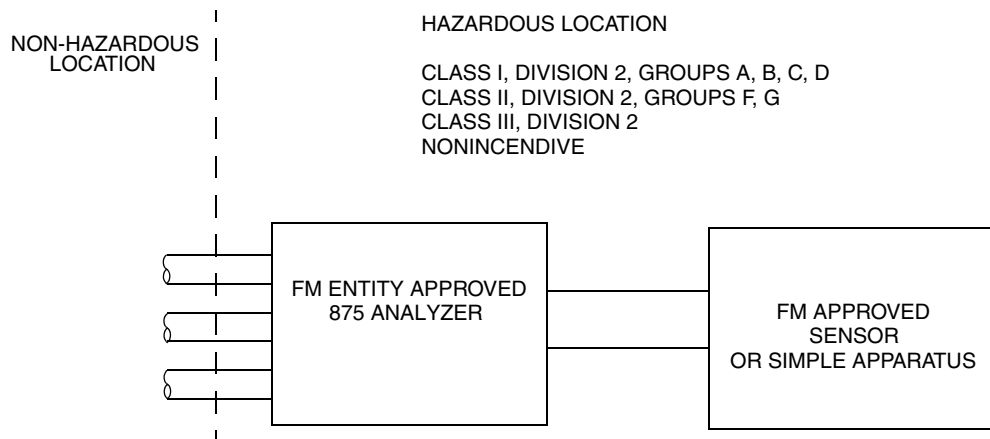


Figure 2. Analyzer in Hazardous Location

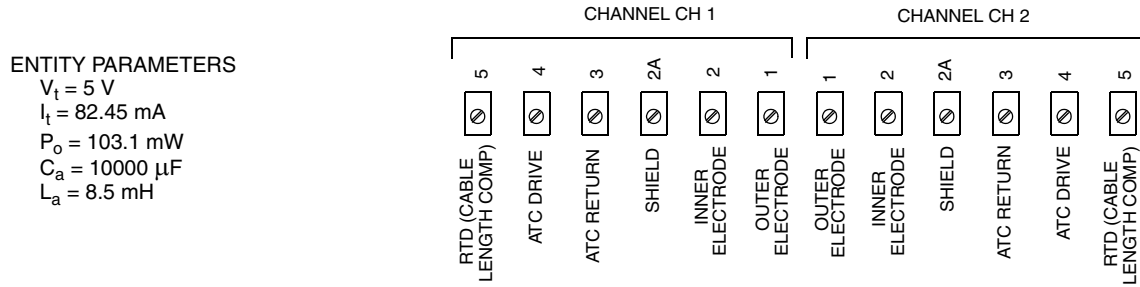


Figure 3. 875CR Analyzer Entity Parameters and Connections

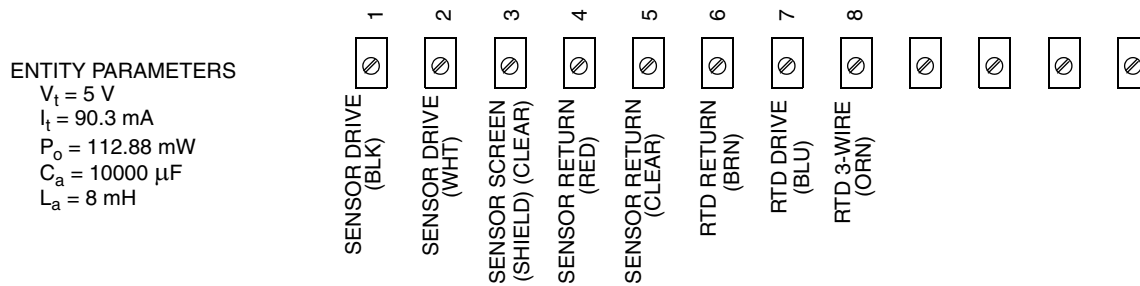


Figure 4. 875EC Analyzer Entity Parameters and Connections

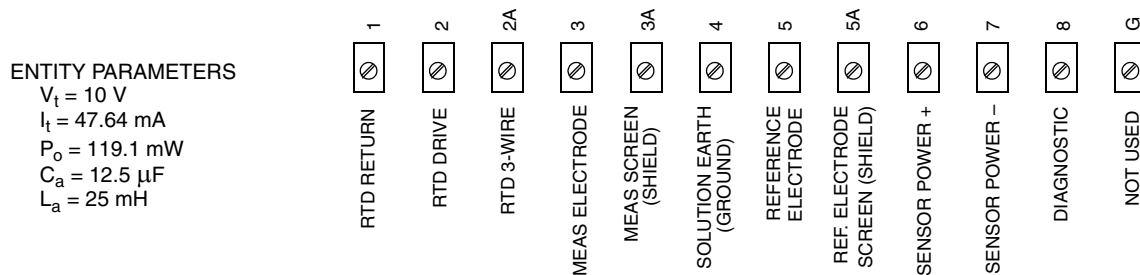


Figure 5. 875PH Analyzer Entity Parameters and Connections

FM Approved 875 Analyzers With Nonincendive Field Wiring

The sensor interface of the 875 Analyzers is FM Approved as nonincendive for use in Division 2 hazardous (classified) areas. The analyzers can be installed in a non-hazardous area with the sensor in a hazardous area or the analyzer and sensor can be installed in a hazardous area. Wiring and installation methods are determined by the area in which the 875 Analyzer is installed. In all cases, installation should be in accordance with the National Electric Code (ANSI/NFPA 70) and any applicable local code requirements.

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

Nonincendive Field Wiring Circuit Concept

The nonincendive field wiring circuit concept allows interconnection of nonincendive apparatus with associated nonincendive apparatus not specifically examined in combination as a system when:

$$V_{\max} \text{ or } U_i \geq V_{oc}, V_t \text{ or } U_o; C_a = C_i + C_{\text{cable}}; L_a \geq L_i + L_{\text{cable}}$$

! CAUTION
 The associated apparatus manufacturer's installation drawing must be followed when installing this equipment.

Analyzer Installed In Non-Hazardous Area With Sensor Installed In The Division 2 Area

There are no special requirements when the 875 Analyzer is installed in a non-hazardous location. See Figure 1.

Analyzer and Sensor Installed in Division 2 Area

All connections to the analyzer must be protected by conduit to prevent damage to the wiring in the hazardous area except the connections to the sensor do not need to be protected by conduit. Conduit and all fittings to the 875 Analyzer housing including the sensor cable fitting must meet ingress protection ratings of Type 4X and IP66 within the hazardous area. See Figure 2.

Nonincendive Sensor

The sensor must either be an FM Approved Nonincendive Apparatus with compatible entity parameters, be in the table of loop-approved 875 Analyzer and Sensor systems or be considered a simple apparatus. Refer to Sensor Terminal Block diagrams in Figures 3 through 5 for a listing of Entity Parameters for each of the 875 Analyzer models. Refer to the definition of Simple Apparatus below.

FM Definition of Simple Apparatus:

An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 V, 100 mA, and 25 mW or a passive component that does not dissipate more than 11.3 W and is compatible with the intrinsic safety of the circuit in which it is used.

875 Panel-Mounted Analyzer

The panel mounted 875 Analyzer provides a Type 4X or IP66 Ingress Protection rating when used in conjunction with the Foxboro provided Mounting Kit and a user-supplied FM approved enclosure.

— NOTE

No revision is allowed to this 875 Series Analyzer Nonincendive Installation Instruction (FM Control Drawing) without prior FM approval.

FM Approvals Listing

875a-bcF-d Intelligent Electrochemical Analyzer

NI/I/2/ABCD/T4A Ta=75 °C-MI 611-206; NIFW; S/II/2/FG/T4A Ta=75 °C-MI 611-206; NIFW; S/III/2/T4A Ta=75 °C-MI 611-206; NIFW; Type 4X, 3S, IP66

Nonincendive Field Wiring Parameters:

When a = CR:

$V_t = 5 \text{ V}$, $I_t = 82.45 \text{ mA}$, $P_o = 103.10 \text{ mW}$, $C_\alpha = 10,000 \text{ }\mu\text{F}$, $L_\alpha = 8.5 \text{ mH}$

When a = EC:

$V_t = 5 \text{ V}$, $I_t = 90.30 \text{ mA}$, $P_o = 112.88 \text{ mW}$, $C_a = 10,000 \text{ }\mu\text{F}$, $L_a = 8.0 \text{ mH}$

When a = PH:

$V_t = 10 \text{ V}$, $I_t = 47.64 \text{ mA}$, $P_o = 119.10 \text{ mW}$, $C_a = 12.5 \text{ }\mu\text{F}$, $L_a = 25.0 \text{ mH}$

a = Type: CR, EC or PH

b = Supply Voltage: A, B, C, D, E or J

c = Mounting: 1, 2, 3 or 4

d = Options: A, C, F, N or P

Special Conditions of Use

1. The Model 875a-b1F-d front panel analyzer shall be installed in compliance with the enclosure mounting, spacing and segregation requirements of the ultimate application.
2. The Model 875a-b1F-d front panel analyzer has been tested for Class II/III, IP66 and Type 4X only. To maintain these ratings, the Model 875a-b1F-d shall be mounted in an enclosure, which has been tested and found to have met these ratings.

CSA Loop Certified Nonincendive Circuit

Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations	Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations
875PH Series Electrochemical Analyzers	871PH Series Sensors 871A Series Sensors PH10 Series Sensors ORP10 Series Sensors
875EC Series Electrochemical Analyzers	871EC Series Sensors 871FT Series Sensors
875CR Series Electrochemical Analyzers	871CC Series Sensors 871CR Series Sensors

Maximum cable length of certified 871EC or 871FT: 100 ft; 871PH, 871A, PH10, ORP10, 871CC, or 871CR: 500 ft.

— ! WARNING —

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

— TIP —

Risque D'explosion - La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2. Avant de deconnecter l'équipement couper le courant ou s'assurer que l'emplacement est désigné non dangereux.

— ! WARNING —

Wiring method must be in accordance with the Canadian Electrical Code, Part I.

IECEX Entity Approval, 875 Analyzers, Type n

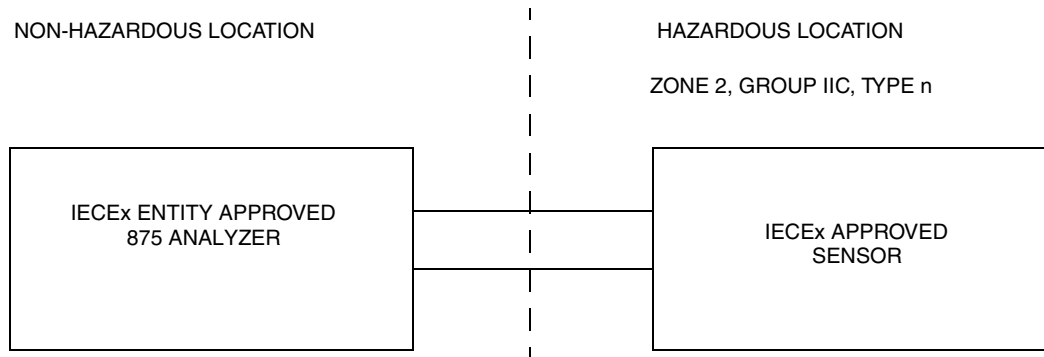


Figure 6. Analyzer in Non-hazardous Location

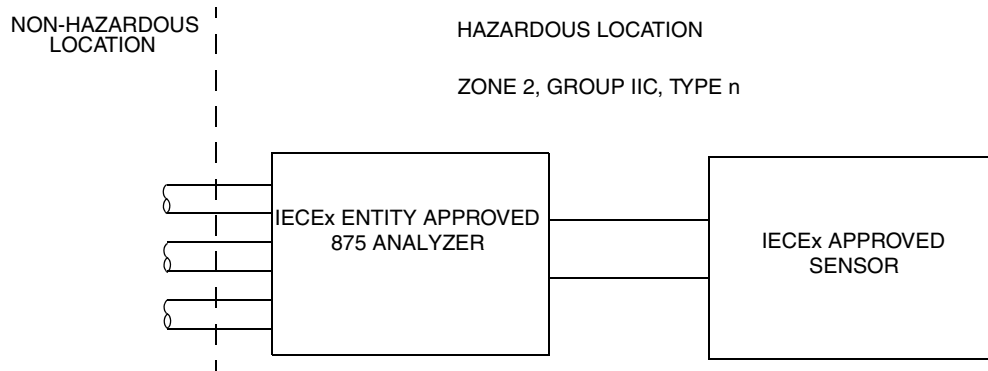


Figure 7. Analyzer in Hazardous Location

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 8. A typical agency label is shown in Figure 9.

Table 1. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
IECEX protection 'n' for Zone 2; Ex nA nL nC [nL] IIC. ^(a)	Temperature Class T4 at maximum ambient temperature of 60 °C (140 °F). See certificate IECEX FMG 06.0001 X	D

(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.

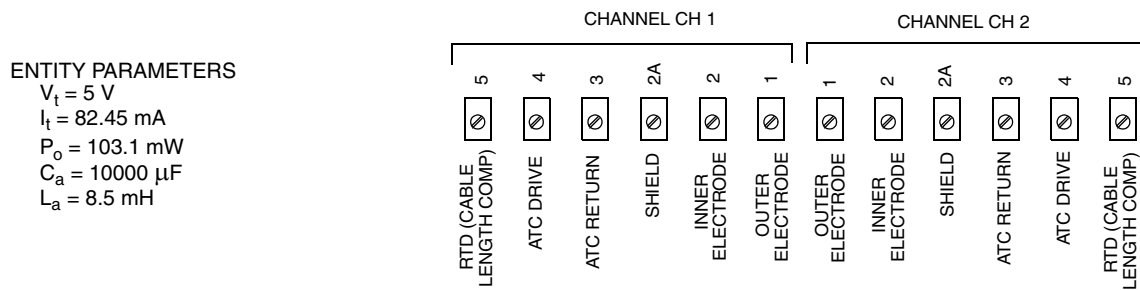


Figure 10. 875CR Analyzer Entity Parameters and Connections

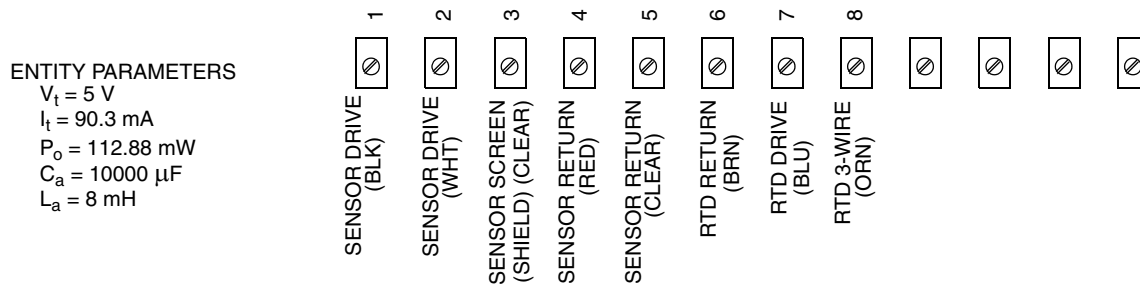


Figure 11. 875EC Analyzer Entity Parameters and Connections

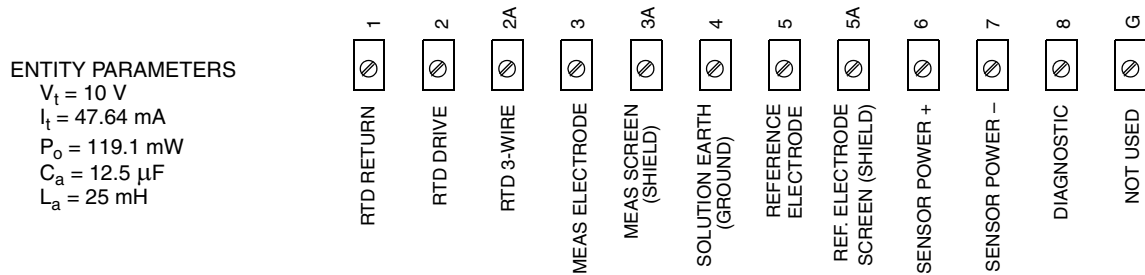


Figure 12. 875PH Analyzer Entity Parameters and Connections

Field Mounted Enclosures

IEC certified field mounted units provide an ingress protection rating of up to IP66. All fittings used for the installation must meet the minimum protection rating required for a particular installation.

Panel-Mounted Enclosures

— WARNING —

IEC certified 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 60079.15.

All fittings used for the installation must meet the minimum protection rating required for a particular installation.

Refer to the Electrical Connection Warning immediately below.

Electrical Connection Warning

— WARNING —

1. For IEC 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.

2. Wiring must comply with local codes for the country of installation.

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 8. 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 8.

Alarm Contact Limits

The alarm contact limits are shown on the data label. See Figure 8. The standard limits are 5 A at 250 V ac and 2 A at 30 V dc. The IEC 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 IEC certification, the limits are -20 and +60 °C (-4 and +140 °F).

Installation Instructions

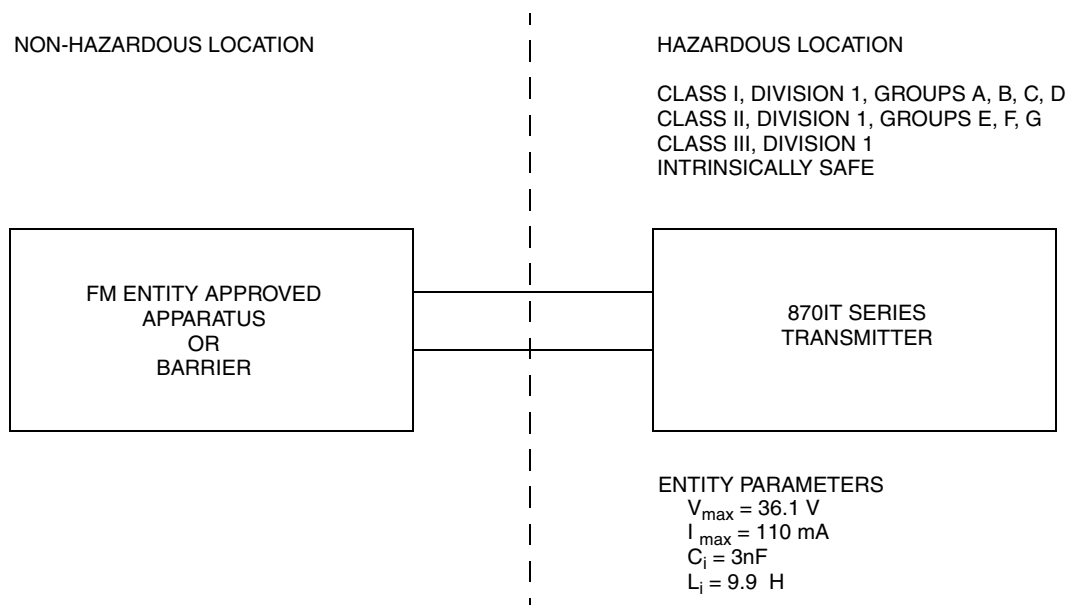
Refer to MI 611-222 (875CR), MI 611-224 (875EC), or MI 611-225 (875PH)

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.

2. 870IT Transmitters

FM Entity Approval, Intrinsic Safety



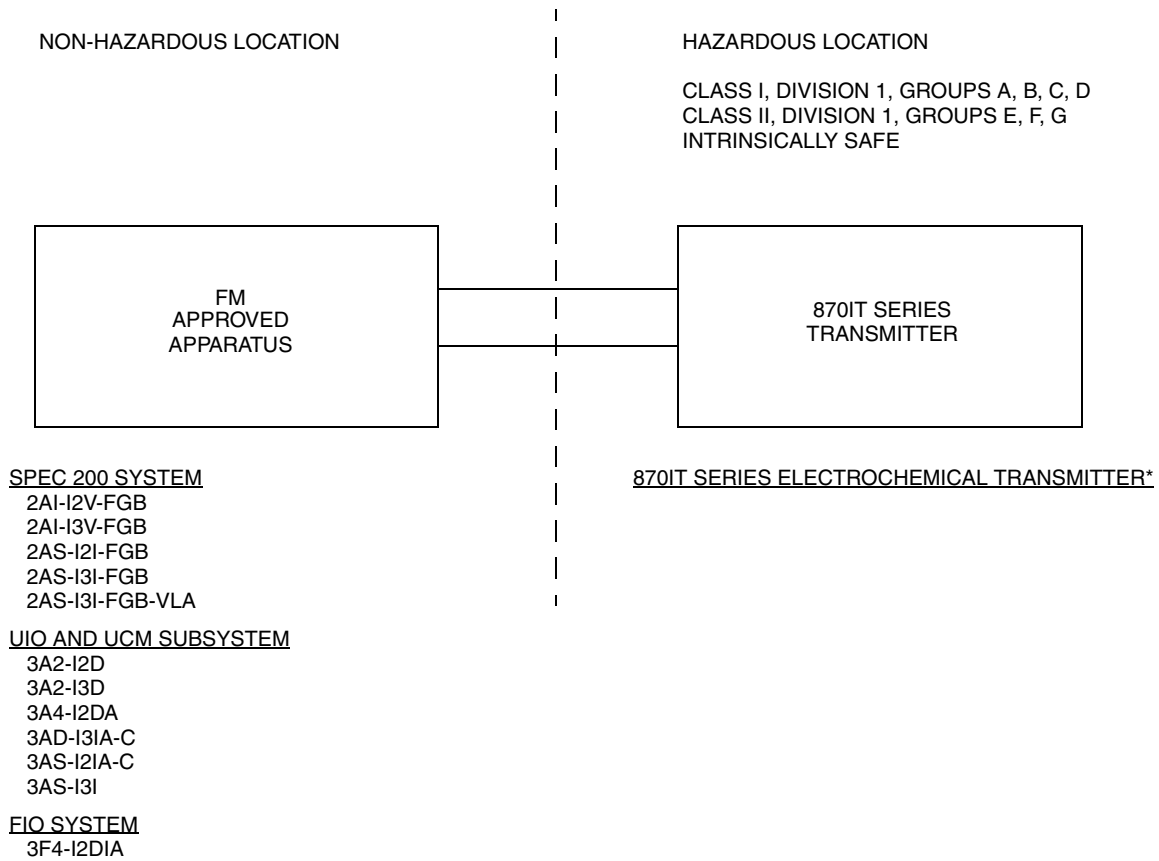
NOTES

1. BARRIER MUST BE INSTALLED IN AN ENCLOSURE THAT MEETS THE REQUIREMENTS OF ANSI/ISA S82.01.
2. RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THAN 1 OHM.
3. CONTROL EQUIPMENT CONNECTED TO BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.¹
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 "INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS", ANSI/NFPA 70 "NATIONAL ELECTRICAL CODE", THE BARRIER MANUFACTURER'S INSTALLATION REQUIREMENTS.
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.
6. 870IT SERIES TRANSMITTERS ENTITY PARAMETERS BASED UPON CONNECTION TO SENSORS LISTED BELOW. MAXIMUM CABLE LENGTH OF APPROVED 871EC OR 871FT: 100 FT; 871PH, 871A, PH10, ORP10, 871CC, OR 871CR: 500 FT.

870ITPH Series Electrochemical Transmitters	871PH Series Sensors 871A Series Sensors PH10 Sensors ORP10 Sensors
870ITEC Series Electrochemical Transmitters	871EC Series Sensors 871FT Series Sensors
870ITCR Series Electrochemical Transmitters	871CC Series Sensors 871CR Series Sensors

1. 870IT Series Transmitters generate less than 250 V_{rms} or V dc.

FM Loop Approval, Intrinsic Safety



*870IT SERIES TRANSMITTERS ENTITY PARAMETERS BASED UPON CONNECTION TO SENSORS LISTED BELOW.
MAXIMUM CABLE LENGTH OF APPROVED 871EC OR 871FT: 100 FT; 871PH, 871A, PH10, ORP10, 871CC,
OR 871CR: 500 FT.

870ITPH Series Electrochemical Transmitters	871PH Series Sensors 871A Series Sensors PH10 Sensors ORP10 Sensors
870ITEC Series Electrochemical Transmitters	871EC Series Sensors 871FT Series Sensors
870ITCR Series Electrochemical Transmitters	871CC Series Sensors 871CR Series Sensors

FM Loop Approval Nonincendive Circuit

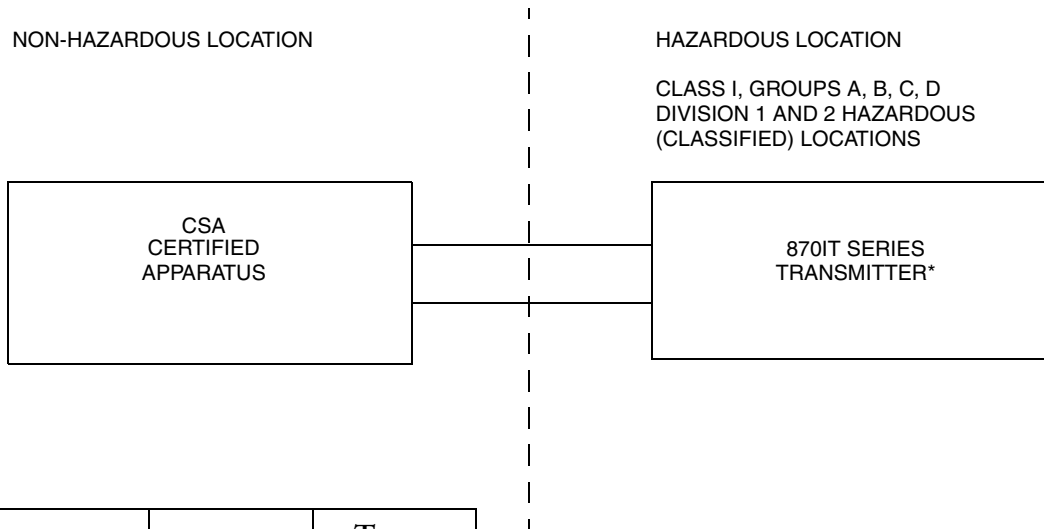
Ordinary Location and Class I, II, and III, Division 2, Groups A, B, C, D, E, and G Hazardous Locations	Ordinary Location and Class I, II, and III, Division 2, Groups A, B, C, D, E, and G Hazardous Locations
870ITPH Series Electrochemical Transmitters	871PH Series Sensors 871A Series Sensors PH10 Series Sensors ORP10 Series Sensors
870ITEC Series Electrochemical Transmitters	871EC Series Sensors 871FT Series Sensors
870ITCR Series Electrochemical Transmitters	871CC Series Sensors 871CR Series Sensors

Maximum cable length of approved 871EC or 871FT: 100 ft; 871PH, 871A, PH10, ORP10, 871CC, or 871CR: 500 ft.

! WARNING

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

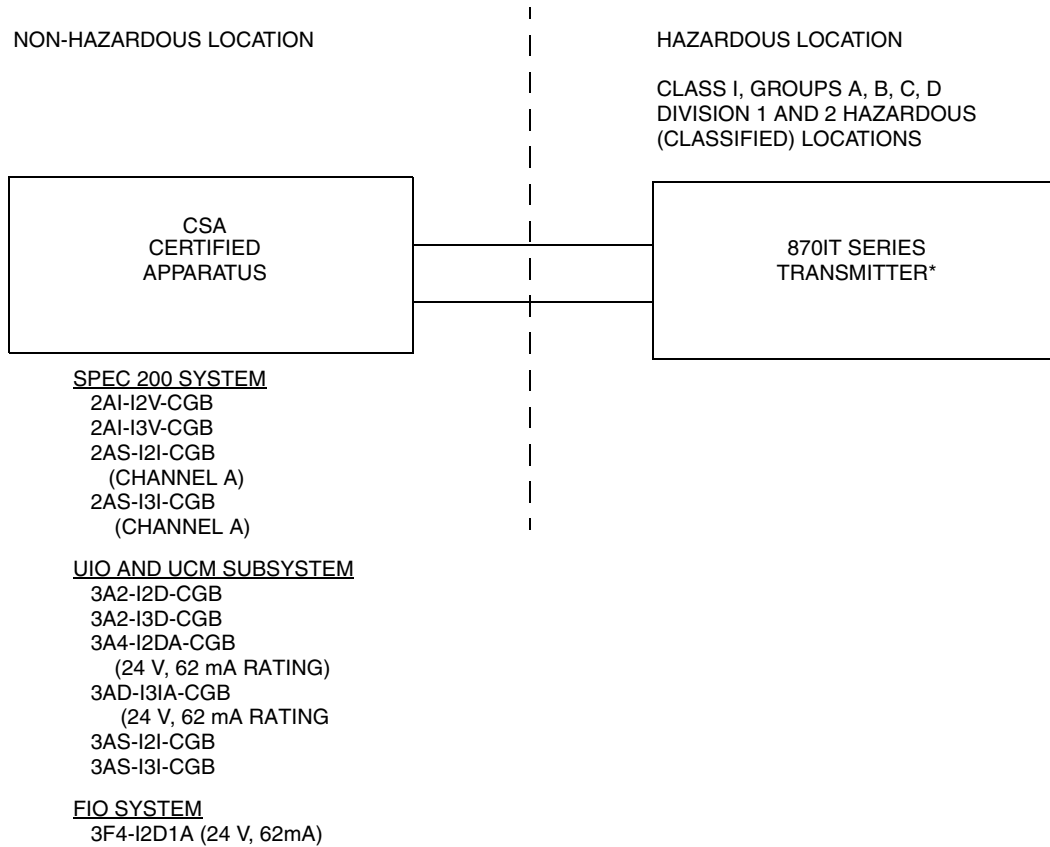
CSA Loop Certified Intrinsic Safety



V_{max}	R_{min}	Temp. Class
28 V	300 Ω	T3C
28 V Diode	300 Ω –	T3C Return
28 V 10 V	300 Ω 50 Ω	T3C Return

*MAXIMUM CABLE LENGTH OF CERTIFIED 871EC OR 871FT: 100 FT; 871PH, 871A, PH10, ORP10, 871CC, OR 871CR, 500 FT.

1. BARRIERS MUST BE CSA CERTIFIED AND MUST BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
2. CONTROL EQUIPMENT CONNECTED TO THE BARRIER MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
3. INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1.
4. RESISTANCE BETWEEN INTRINSICALLY SAFE AND GROUND MUST BE LESS THAN 1 OHM.



*MAXIMUM CABLE LENGTH OF CERTIFIED 871EC OR 871FT: 100 FT; 871PH, 871A, PH10, ORP10, 871CC, OR 871CR, 500 FT.

1. BARRIERS MUST BE CSA CERTIFIED AND MUST BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
2. CONTROL EQUIPMENT CONNECTED TO THE BARRIER MUST NOT USE OR GENERATE MORE THAN 250 VOLTS.
3. INSTALLATION MUST BE IN ACCORDANCE WITH THE CANADIAN ELECTRICAL CODE, PART 1.
4. RESISTANCE BETWEEN INTRINSICALLY SAFE AND GROUND MUST BE LESS THAN 1 OHM.

CSA Loop Certified Nonincendive Circuit

Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations	Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations
870ITPH Series Electrochemical Transmitters	871PH Series Sensors; 871A Series Sensors PH10 Series Sensors; ORP10 Series Sensors
870ITEC Series Electrochemical Transmitters	871EC Series Sensors 871FT Series Sensors
870ITCR Series Electrochemical Transmitters	871CC Series Sensors 871CR Series Sensors

Maximum cable length of certified 871EC or 871FT: 100 ft; 871PH, 871A, PH10, ORP10, 871CC, or 871CR: 500 ft.

! WARNING

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

TIP

Risque D'explosion - La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2. Avant de déconnecter l'équipement couper le courant ou s'assurer que l'emplacement est désigné non dangereux.

Installation and wiring method must be in accordance with the Canadian Electrical Code, Part 1.

3. 873 and 873A Analyzers

FM Loop Approval Nonincendive Circuit

Ordinary Location and Class I, II, and III, Division 2, Groups A, B, C, D, E, and G Hazardous Locations	Ordinary Location and Class I, II, and III, Division 2, Groups A, B, C, D, E, and G Hazardous Locations
873PH Series Electrochemical Analyzer 873APH Series Electrochemical Analyzer	871PH Series Sensors 871A Series Sensors PH10 Series Sensors ORP10 Series Sensors
873RS Series Electrochemical Analyzer 873ARS Series Electrochemical Analyzer	871CC Series Sensors
873CC Series Electrochemical Analyzer 873ACC Series Electrochemical Analyzer	871CC Series Sensors 871CR Series Sensors
873EC Series Electrochemical Analyzer 873AEC Series Electrochemical Analyzer	871EC Series Sensors 871FT Series Sensors
873DPX Series Electrochemical Analyzer	871PH Series Sensors 871A Series Sensors PH10 Series Sensors ORP10 Series Sensors

Maximum cable length of certified 871EC or 871FT: 100 ft; 871PH, 871A, PH10, ORP10, 871CC, or 871CR: 500 ft.

! WARNING

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

CSA Loop Certified Nonincendive Circuit

Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations	Ordinary Locations and Class I, Division 2, Groups A, B, C, D Hazardous Locations
873PH Series Electrochemical Analyzer 873APH Series Electrochemical Analyzer	871PH Series Sensors; 871A Series Sensors PH10 Series Sensors; ORP10 Series Sensors
873RS Series Electrochemical Analyzer 873ARS Series Electrochemical Analyzer	871CC Series Sensors
873CC Series Electrochemical Analyzer 873ACC Series Electrochemical Analyzer	871CC Series Sensors 871CR Series Sensors
873EC Series Electrochemical Analyzer 873AEC Series Electrochemical Analyzer	871EC Series Sensors 871FT Series Sensors
873DO Series Electrochemical Analyzer	871DO Series Sensors
873DPX Series Electrochemical Analyzer	871PH Series Sensors; 871A Series Sensors PH10 Series Sensors; ORP10 Series Sensors

Maximum cable length of certified 871EC or 871FT: 100 ft; 871PH, 871A, PH10, ORP10, 871CC, or 871CR: 500 ft.

— **WARNING** —

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

— **TIP** —

Risque D'explosion - La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de Classe I, Division 2. Avant de deconnecter l'equipement couper le courant ou s'assurer que l'emplacement est designe non dangereux.

4. pH, ORP, and ISE Sensors

FM Entity Approval, pH, ORP, and ISE Sensors, Intrinsically Safe and Nonincendive

The 871A, 871PH, PH10, and ORP10 series of pH, ORP, and ISE sensors are FM Approved as intrinsically safe and nonincendive for use in Division 1 and Division 2 hazardous (classified) areas respectively.

These sensors without preamplifiers meet the simple apparatus requirements as defined in ANSI/ISA-PR12.06.01 and NEC NFPA 70. The nonamplified sensors do not generate more than 1.5 volt, 100 mA, and 25 mW, or dissipate more than 1.3 W.

The sensor is typically installed in the (potentially) hazardous area. The 875PH Analyzer, the 870ITPH Transmitter or other FM 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 non-hazardous) in which the associated equipment is installed. In all cases, installation should be in accordance with “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations” (ANSI/ISA-PR12.06.01 or NEC NFPA 70) as appropriate and any applicable local requirements.

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

— ! WARNING —
Component Replacement or Substitution - Substitution of components may impair intrinsic safety rating.

— ! 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.

The 871A, PH10, and ORP10 Sensors are designed as ‘consumables’. They cannot be repaired or refurbished. Discard at end of life.

The 871PH Sensors can be rebuilt. Use only Foxboro rebuild kits to maintain the intrinsically safe or nonincendive ratings. Refer to MI 611-148 for additional information.

— ! WARNING —
Intrinsically Safe Ground - The resistance between the intrinsically safe ground and earth ground must be less than 1.0 ohm.

— NOTE —

No revision is allowed to the 871A, 871PH, PH10, or ORP10 Sensor intrinsically safe or nonincendive installation instruction (FM control drawing) without prior FM approval.

Intrinsically Safe Field Wiring Circuit Concept

The intrinsically safe field wiring circuit concept allows interconnection of intrinsically safe apparatus with associated intrinsically safe apparatus not specifically examined as a system when the entity parameters are compatible such that:

$$V_{\max} \text{ or } U_i \geq V_{oc}, V_t, \text{ or } U_o$$

$$I_{\max} \text{ or } I_i \geq I_{sc}, I_t, \text{ or } I_o$$

$$P_{\max} \text{ or } P_i \geq P_o$$

$$C_a \geq C_i + C_{cable}$$

$$L_a \geq L_i = L_{cable}$$

Nonincendive Field Wiring Circuit Concept

The nonincendive field wiring circuit concept allows interconnection of nonincendive apparatus with associated nonincendive apparatus not specifically examined as a system when the entity parameters are compatible such that:

$$V_{\max} \text{ or } U_i \geq V_{oc}, V_t, \text{ or } U_o$$

$$I_{\max} \text{ or } I_i \geq I_{sc}, I_t, \text{ or } I_o$$

$$P_{\max} \text{ or } P_i \geq P_o$$

$$C_a \geq C_i + C_{cable}$$

$$L_a \geq L_i = L_{cable}$$

— ! WARNING —

The associated apparatus must be FM approved as either intrinsically safe or nonincendive and must have compatible entity parameters. The associated apparatus manufacturer's installation drawing must be followed when installing the associated equipment.

Associated Apparatus in Non-hazardous Area; Sensor in Hazardous Area

There are no special requirements when an 875PH Analyzer, 870ITPH Transmitter, or other FM entity approved associated apparatus is installed in a non-hazardous area. See Figure 13.

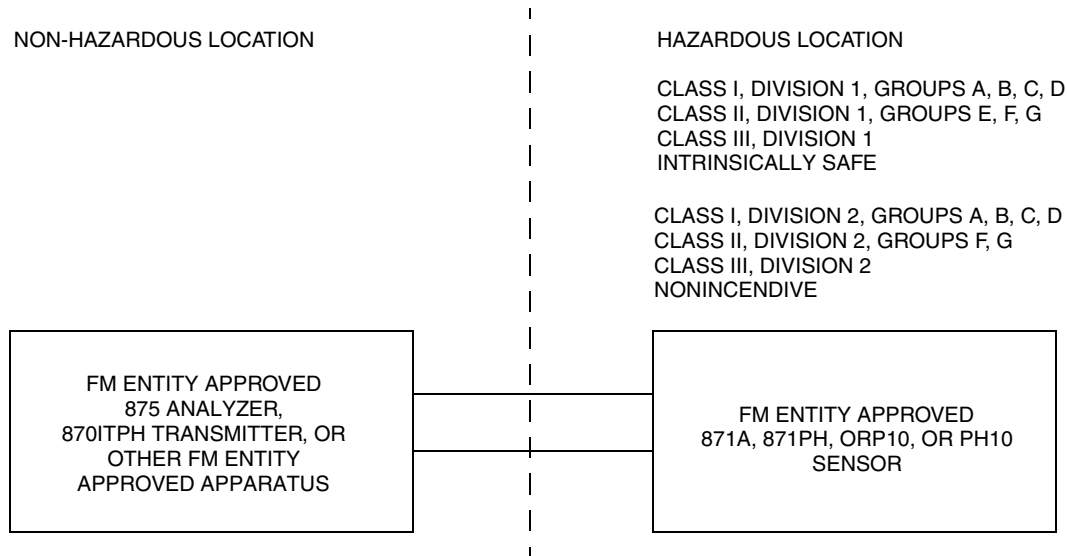


Figure 13. Sensor in Hazardous Location

Associated Apparatus and Sensor in Hazardous Area

All connections to the 875PH Analyzer, 870ITPH Transmitter, or other FM 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 875PH Analyzer, 870ITPH Transmitter, or associated apparatus, including the sensor cable fitting, must meet ingress protection ratings of Type 4X and IP66 within the Hazardous area; follow the manufacturer’s instructions for the associated apparatus. See Figure 14.

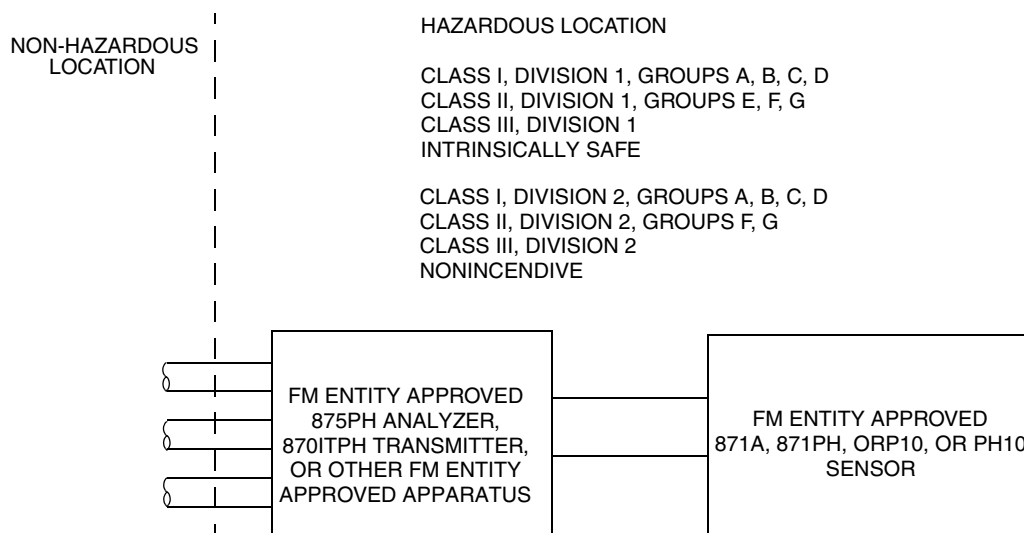


Figure 14. Sensor and Associated Apparatus in Hazardous Location

Entity and Field Wiring Parameters

The entity and field wiring parameters listed below apply to all models of the pH, ORP, and ISE sensors of the 871A, 871PH, PH10, and ORP10 families of sensors.

$$V_{\max} (U_i) = 10 \text{ V}$$

$$I_{\max} (I_i) = 80 \text{ mA}$$

$$P_{\max} (P_i) = 0.63 \text{ W}$$

$$C_i = 0.15 \text{ } \mu\text{F}$$

$$L_i = 0 \text{ mH}$$

Pin Terminated Integral Cable Connections

Sensors Without Preamplifier

Table 2. Cable Connections - Sensors Without Preamplifier

Function/Signal Description	Wire Sleeve Designation	Standard Temperature Cable	High Temperature Cable
RTD/Thermistor Return	1	BLK	BLK
RTD Thermistor Drive	2	DRK GRN	BRN
RTD/Thermistor 3-Wire	2A	WHT	ORN
Measuring Electrode	3	CLEAR (Coax)	CLEAR (Coax)
Measuring Electrode Shield	3A	CLEAR (Coax Shield)	CLEAR (Coax Shield)
Solution Ground	4	GRN (Outer Shield)	GRN (Outer Shield)
Reference Electrode	5	RED	RED

Sensors With Preamplifier

Table 3. Cable Connections - Sensors With Preamplifier

Function/Signal Description	Wire Sleeve Designation	Standard Temperature Cable
RTD/Thermistor Return	1	BLK
RTD Thermistor Drive	2	WHT
RTD/Thermistor 3-Wire	2A	ORN
Measuring Electrode	3	RED
Solution Ground	4	CLEAR (Outer Shield)
Reference Electrode	5	YEL
Power to Sensor (+)	6	BRN
Power to Sensor (-)	7	BLU
Diagnostic Drive	8	GRN

Patch Cable Connections

Variopin Connector - Sensors Without Preamplifier

Table 4. Cable Connections - Variopin Connector/Sensors Without Preamplifier

Function/Signal Description	Wire Sleeve Designation	Variopin Contact	Standard Temperature Cable	High Temperature Cable
RTD/Thermistor Return	1	3	BLK	BLK
RTD Thermistor Drive	2	5	DRK GRN	BRN
RTD/Thermistor 3-Wire	2A	6	WHT	ORN
Measuring Electrode	3	1	CLEAR (Coax)	WHITE (Coax)
Measuring Electrode Shield	3A	8	CLEAR (Coax Shield)	CLEAR (Coax Shield)
Solution Ground	4	7	GRN (Outer Shield)	GRN (Outer Shield)
Reference Electrode	5	2	RED	RED
Unused	---	4	---	---

Variopin connector pin numbers on sensors with integrally mounted connectors correspond to the function/signal description listed. Refer to Figure 15 for connector pin identification.

Variopin Connector - Sensors With Preamplifier

Table 5. Cable Connections - Variopin Connector/Sensors With Preamplifier

Function/Signal Description	Wire Sleeve Designation	Variopin Contact	Standard Temperature Cable
RTD/Thermistor Return	1	3	BLK
RTD Thermistor Drive	2	5	WHT
Measuring Electrode	3	1	RED
Solution Ground	4	7	CLEAR (Outer Shield)
Reference Electrode	5	2	YEL
Power to Sensor (+)	6	4	BRN
Power to Sensor (-)	7	6	BLU
Diagnostic Drive	8	8	GRN

Variopin connector pin numbers on sensors with integrally mounted connectors correspond to the function/signal description listed. Refer to Figure 15 for connector pin identification.

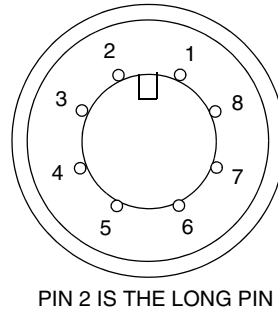


Figure 15. Variopin Connector Pin Identification

Tajimi Connector - Sensors With Preamplifier

Table 6. Cable Connections - Tajimi Connector/Sensors With Preamplifier

Function/Signal Description	Wire Sleeve Designation	Tajimi Contact	Standard Temperature Cable
RTD/Thermistor Return	1	D	BLK
RTD Thermistor Drive	2	C	WHT
Measuring Electrode	3	F	RED
Solution Ground	4	B	CLEAR (Outer Shield)
Reference Electrode	5	E	YEL
Power to Sensor (+)	6	A	BRN
Power to Sensor (-)	7	G	BLU

Refer to Figure 16 for connector pin identification.

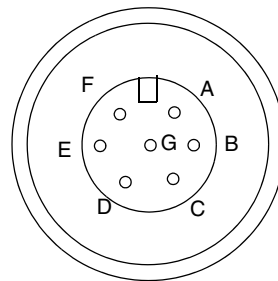


Figure 16. Tajimi Connector Pin Identification

FM Approvals Listing

871 pH/ORP Series Sensors

IS / I,II,III / 1 / ABCDEFG / T4 Ta = 60 °C; Entity; Type 4X

Ni / I / 2 ABCD / T4 Ta = 60 °C; Nonincendive field wiring

S / II, III / 2 /FG / T4 Ta = 60 °C

Entity Parameters

$V_{max} (U_i) = 10 \text{ V}$

$I_{max} (I_i) = 80 \text{ mA}$

$P_{max} (P_i) = 0.63 \text{ W}$

$C_i = 0.15 \text{ } \mu\text{F}$

$L_i = 0 \text{ mH}$

Field Wiring Parameters

$V_{max} (U_i) = 10 \text{ V}$

$I_{max} (I_i) = 80 \text{ mA}$

$P_{max} (P_i) = 0.63 \text{ W}$

$C_i = 0.15 \text{ } \mu\text{F}$

$L_i = 0 \text{ mH}$

871A-ab-c-CS-E/Fd. Sensor

a = Integral preamplifier and diagnostic configuration: 1, 2, 3, or 4

b = Measuring Electrode: D, E, or F

c = Options: 1, 3, 5, 7, 13, B, or Q

d = Hazardous Approval AA or NN

871PH-abcd-e-CS-E/Ff. Sensor

a = Sensor body materials integral preamplifier and diagnostic configuration: 1, 2, 3, 4, 5, or 6

b = Measuring Electrode and electrode body material: A, B, C, D, E, F, G, P, Q, R, S, T, U, or X

c = Sensor wetted metallic parts material: 1, 2, 3, 5, or 6

d = Reference junction and junction body material: A, B, or D

e = Options: 3, 4, 34, 5, 7, B, C, E, H, Q, or T

f = Hazardous Approval: AA or NN

PH10-abcd-e-CS-E/Ff. Sensor

a = PH electrode: 1, 2, 3, or 4

b = Preamplifier: P or N

c = Temperature compensation: 1, 2, 3, 4, or 5

d = Termination: A, B, or Q

e = Options: E, C, 2, 3, 4, 5, 1H, 2H, 3H, 4H, or 5H

f = Hazardous Approval: AA or NN

ORP10-abcd-e-CS-E/Ff. Sensor

a = ORP electrode: 1 or 2

b = Preamplifier: P or N

c = Temperature compensation: 1, 2, 3, 4, or 5

d = Termination: A, B, or Q

e = Options: E, C, 2, 3, 4, 5, 1H, 2H, 3H, 4H, or 5H

f = Hazardous Approval: AA or NN

Equipment Ratings

Evaluated as intrinsically safe electrical apparatus with entity requirements for use in Class I, II, III, Division 1, Groups A, B, C, D, E, F, and G in accordance with manufacturing control drawing; Nonincendive with nonincendive field wiring for Class I, Division 2, Groups A, B, C, and D; Suitable for Class II, Division 2, Groups F and G indoor/outdoor Type 4X hazardous (classified) locations.

IECEX Entity Approval, 871PH, 871A, PH10, and ORP10 Sensors, Type ia and Type n

The 871PH, 871A, PH10, and ORP10 Sensors are IECEx Approved as Type ia and Type n for use in Zone 0 and Zone 2 hazardous (classified) areas respectively.

These sensors without preamplifiers meet the simple apparatus requirements as defined in ANSI/ISA-PR12.06.01 and NEC NFPA 70. The nonamplified sensors do not generate more than 1.5 volt, 100 mA, and 25 mW, or dissipate more than 1.3 W.

The sensors are typically installed in the (potentially) hazardous area. The 875PH Analyzer or other IECEx 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 non-hazardous) in which the associated equipment is installed. In all cases, installation should be in accordance with regulations of the country of installation

— **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.

— **WARNING**

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

— **WARNING**

Component Replacement or Substitution - Substitution of components may impair IECEx safety ratings.

— **WARNING**

Associated Apparatus - The associated apparatus must be IECEx 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

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.

! CAUTION

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

Associated Apparatus in Non-hazardous Area, Sensor in Hazardous Area

There are no special requirements when the 875PH Analyzer or other IECEx entity approved associated apparatus is installed in a non-hazardous area. See Figure 17.

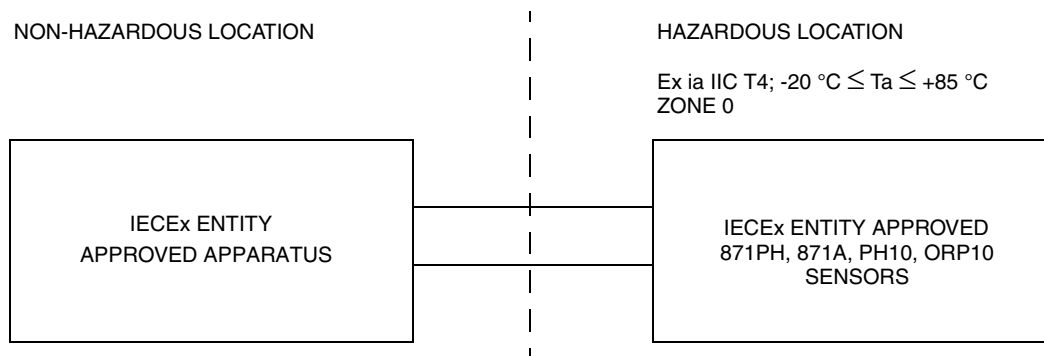


Figure 17. Sensor in Zone 0 Hazardous Location

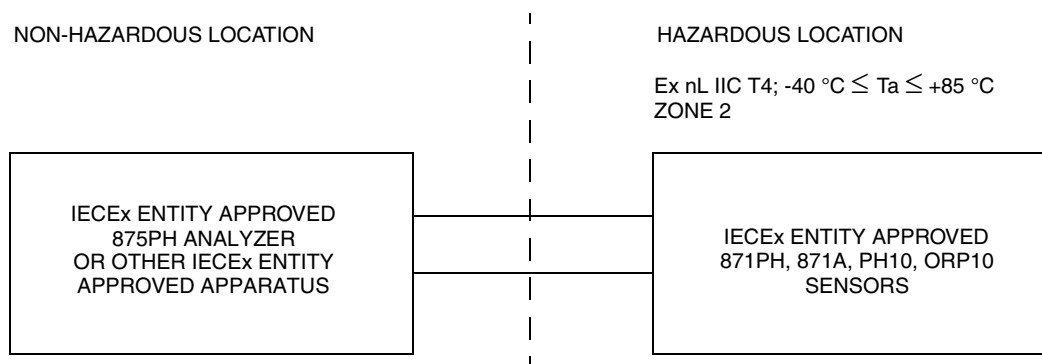


Figure 18. Sensor in Zone 2 Hazardous Location

Associated Apparatus and Sensor in Hazardous Area

All connections to the 875PH Analyzer or other IECEx 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 875PH Analyzer 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 19.

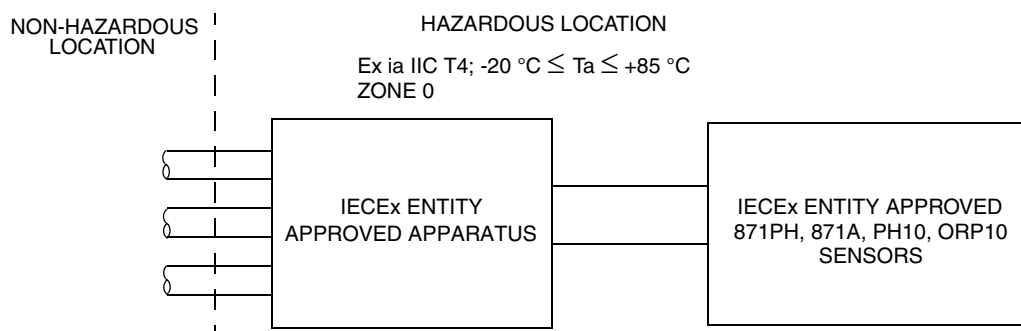


Figure 19. Sensor and Associated Apparatus in Zone 0 Hazardous Location

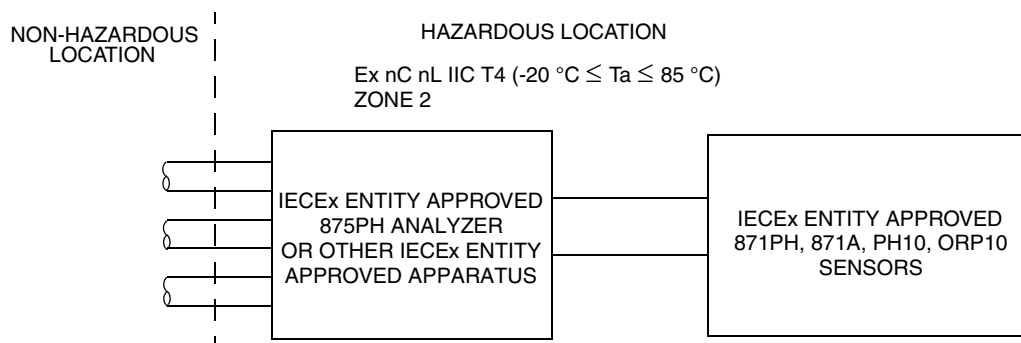


Figure 20. Sensor and Associated Apparatus in Zone 2 Hazardous Location

871PH

Sensor Identification

Typical agency, body, and data labels are shown in Figures 21 and 22.

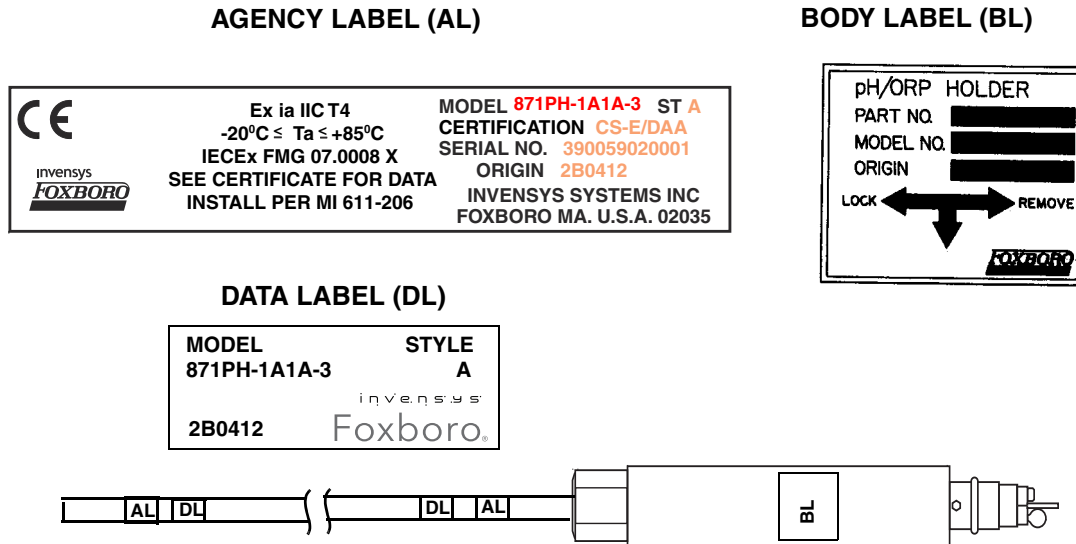


Figure 21. Sample 871PH (Cable Terminated) Sensor Identification

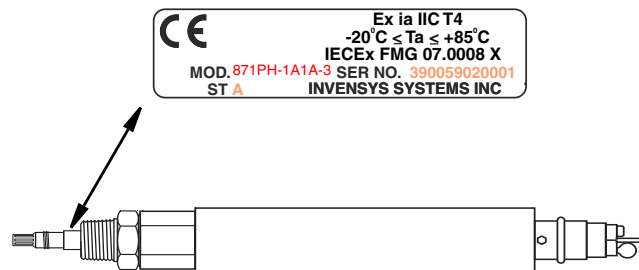


Figure 22. Sample 871PH (Quick Connector Terminated) Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency label. See Figures 21 and 22. See Table 7 for additional information.

Table 7. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
IECEEx intrinsically safe for Ex ia IIC	Temperature Class T4; $-20\text{ °C} \leq T_a \leq +85\text{ °C}$	CS-E/DAA
IECEEx Type n energy limited for Ex nL IIC	Temperature Class T4; $-20\text{ °C} \leq T_a \leq +85\text{ °C}$	CS-E/DNN

— 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/DAA and CS-E/DNN are as follows:

$$U_i = 10\text{ V}$$

$$I_i = 80\text{ mA}$$

$$P_i = 0.6\text{ W}$$

$$C_i = 0.15\text{ }\mu\text{F for 871PH-1, -2, -3, and -4 (with preamplifier)}$$

$$C_i = 0\text{ }\mu\text{F for 871PH-5 and -6 (without preamplifier)}$$

$$L_i = 0\text{ mH}$$

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 23.

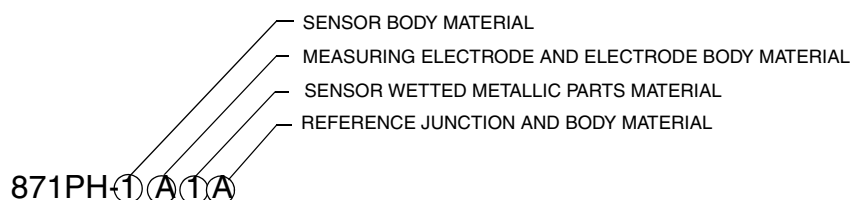


Figure 23. 871PH Model Coded Example

Sensor Body Material

-1, -3, or -5 = Ryton

-2, -4, or -6 = CPVC

Measuring Electrode and Electrode Body Material

Table 8. 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 9 and 10 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 9. 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 +85 °C (20 to 185 °F)
Domed Glass pH	0.7 MPa (100 psi)	0 to +80 °C (32 to 175 °F)	0.7 MPa (100 psi)	0 to +85 °C (32 to 185 °F)
Antimony 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)
ORP	1 MPa (150 psi)	-5 to +80 °C (20 to 175 °F)	1 MPa (150 psi)	-5 to +85 °C (20 to 185 °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 10. 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)
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 23 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 11. Reference Junction and Body Material

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

871A

Sensor Identification

Typical agency and data labels are shown in Figure 24.

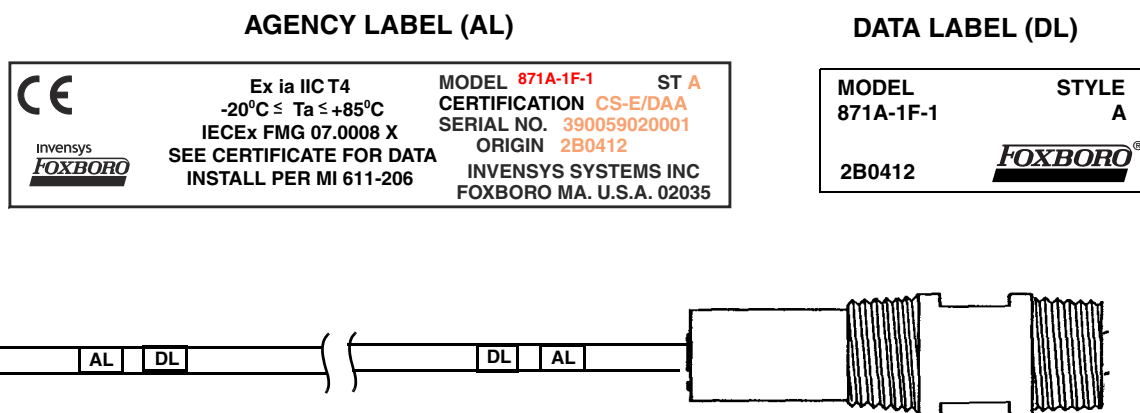


Figure 24. Sample 871A Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency label. See Figure 24. See Table 12 for additional information.

Table 12. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
IECEx intrinsically safe for Ex ia IIC	Temperature Class T4; -20 °C ≤ Ta ≤ +85 °C	CS-E/DAA
IECEx Type n energy limited for Ex nL IIC	Temperature Class T4; -20 °C ≤ Ta ≤ +85 °C	CS-E/DNN

— 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/DAA and CS-E/DNN are as follows:

$$U_i = 10 \text{ V}$$

$$I_i = 80 \text{ mA}$$

$$P_i = 0.6 \text{ W}$$

$$C_i = 0.15 \text{ } \mu\text{F} \text{ for 871A-2, and -4 (with preamplifier)}$$

$$C_i = 0 \text{ } \mu\text{F} \text{ for 871A-1 and -3 (without preamplifier)}$$

$$L_i = 0 \text{ mH}$$

Pressure and Temperature Limits

Pressure and temperature limits are shown in Figure 25.

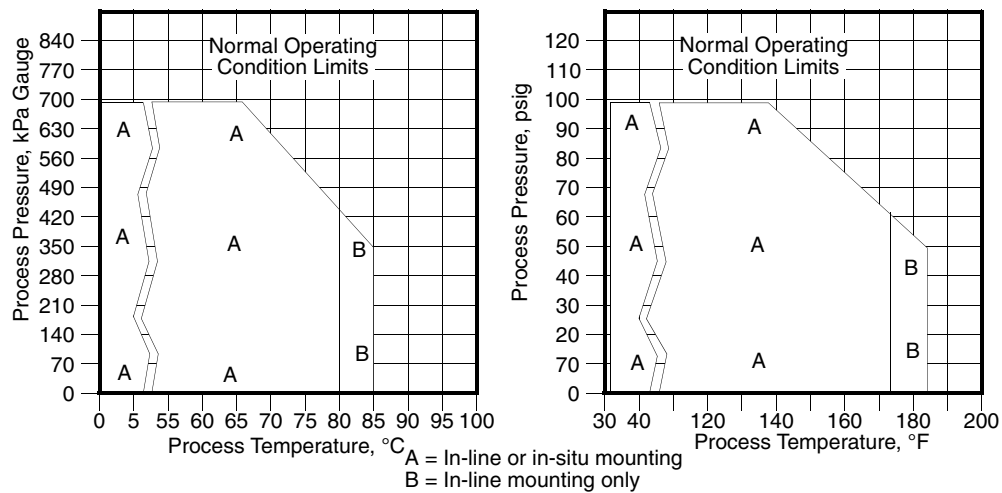


Figure 25. Pressure and Temperature Limits

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 26.

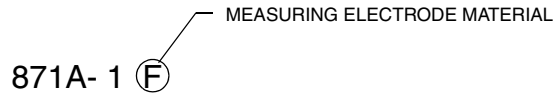


Figure 26. 871A Model Code Example

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 27 and 28.

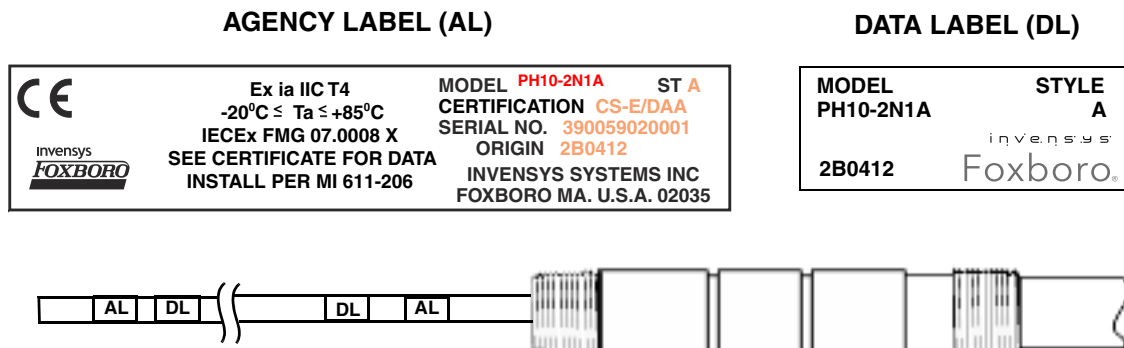


Figure 27. Sample PH10 or ORP10 (Cable Termination) Sensor Identification

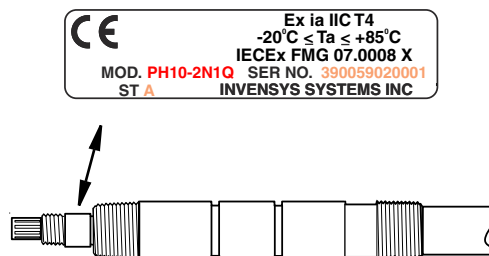


Figure 28. Sample PH10 or ORP10 (Quick Connector Termination) Sensor Identification

Electrical Safety Design Code

The electrical safety design code is printed on the agency plate. See Figure 27. See Table 13 for additional information.

Table 13. Electrical Safety Specification

Testing Laboratory, Type of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
IECEX intrinsically safe for Ex ia IIC	Temperature Class T4; $-20\text{ °C} \leq T_a \leq +85\text{ °C}$	CS-E/DAA
IECEX Type n energy limited for Ex nL IIC	Temperature Class T4; $-20\text{ °C} \leq T_a \leq +85\text{ °C}$	CS-E/DNN

— 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/DAA and CS-E/DNN are as follows

$$U_i = 10\text{ V}$$

$$I_i = 80\text{ mA}$$

$$P_i = 0.6\text{ W}$$

$$C_i = 0.15\text{ }\mu\text{F for PH10-.P and ORP10-.P (with preamplifier)}$$

$$C_i = 0\text{ }\mu\text{F for PH10-.N and ORP10-.N (without preamplifier)}$$

$$L_i = 0\text{ mH}$$

Process Pressure Limits

0 and 0.7 MPa (0 and 100 psi).

Process Temperature Limits

0 to 85 °C (32 to 185 °F). 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 29 and the following text.

ORP: Platinum or Gold as specified.

See Figure 29 and the following text.

O-Ring: Viton standard; EPDM and Chemraz optional, as specified.

See Figure 29 and the following text.

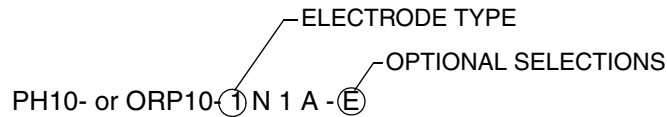


Figure 29. PH10 and ORP10 Model Code Example

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

Optional Selections

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

5. Electrodeless Conductivity Sensors

FM Entity Approval, FT10 Noninvasive Nonmetallic Electrodeless Conductivity Sensors, Intrinsically Safe and Nonincendive

The FT10 Conductivity Sensor is FM Approved as intrinsically safe and nonincendive for use in Division 1 and Division 2 hazardous (classified) areas respectively.

The sensor is typically installed in the (potentially) hazardous area. The 875EC Analyzer, the 870ITEC Transmitter or other FM 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 non-hazardous) in which the associated equipment is installed. In all cases, installation should be in accordance with "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" (ANSI/ISA RP 12.06.01) or the National Electrical Code (ANSI/NFPA 70) as appropriate and any local requirements.

Canadian installations must be in accordance with the Canadian Electrical Code.

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

— ! WARNING —
Component Replacement or Substitution - Substitution of components may impair intrinsic safety rating.

— ! WARNING —
Intrinsically Safe Ground - The resistance between the intrinsically safe ground and the earth ground must be less than 1.0 ohm.

— ! WARNING —
Ingress Protection - The FT10 sensor housing meets NEMA Type 4X 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 NEMA Type 4X ingress protection.

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

— ! WARNING —

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

— NOTE —

No revision is allowed to the FT10 Sensor Intrinsically Safe or Nonincendive Installation Instruction (FM Control Drawing) without prior FM approval.

Intrinsically Safe Field Wiring Circuit Concept

The intrinsically safe field wiring circuit concept allows interconnection of intrinsically safe apparatus with associated intrinsically safe apparatus not specifically examined as a system when the entity parameters are compatible such that:

$$V_{\max} \text{ or } U_i \geq V_{oc}, V_t, \text{ or } U_o$$

$$I_{\max} \text{ or } I_i \geq I_{sc}, I_t, \text{ or } I_o$$

$$P_{\max} \text{ or } P_i \geq P_o$$

$$C_a \geq C_i + C_{\text{cable}}$$

$$L_a \geq L_i + L_{\text{cable}}$$

Nonincendive Field Wiring Circuit Concept

The nonincendive field wiring circuit concept allows interconnection of nonincendive safe apparatus with associated nonincendive apparatus not specifically examined as a system when the entity parameters are compatible such that:

$$V_{\max} \text{ or } U_i \geq V_{oc}, V_t, \text{ or } U_o$$

$$C_a \geq C_i + C_{\text{cable}}$$

$$L_a \geq L_i + L_{\text{cable}}$$

— ! WARNING —

Associate Apparatus - The associated apparatus must be FM approved as either intrinsically safe or nonincendive and must have compatible entity parameters. The associated apparatus manufacturer's installation drawing (FM Control Drawing) must be followed when installing the associated apparatus.

— ! WARNING —

Control equipment connected to associated apparatus must not use or generate more than 250 V rms or V dc.

Associated Apparatus in Non-hazardous Area; Sensor in Hazardous Area

There are no special requirements when the 875EC Analyzer, 870ITEC Transmitter or other FM entity approved associated apparatus is installed in a non-hazardous area. All equipment must meet the safety rating required for the installation; that is, the associated apparatus and the sensor must both be IS rated or NI rated. Refer to Figure 30.

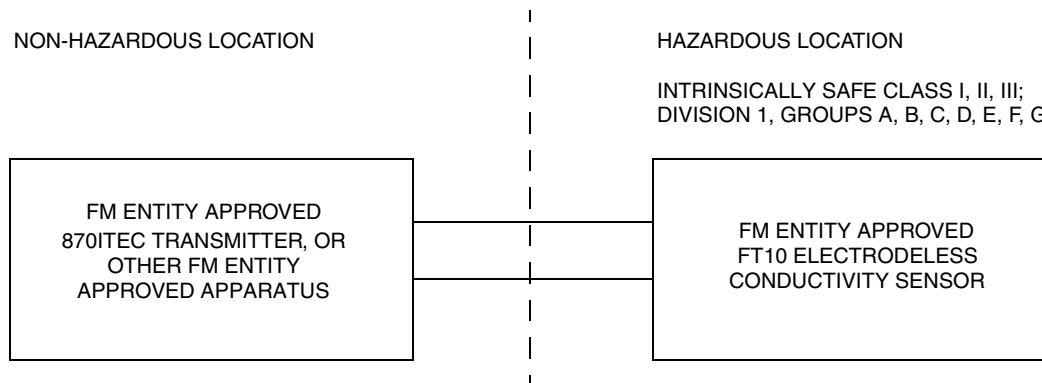


Figure 30. Sensor in Division 1 Hazardous Location

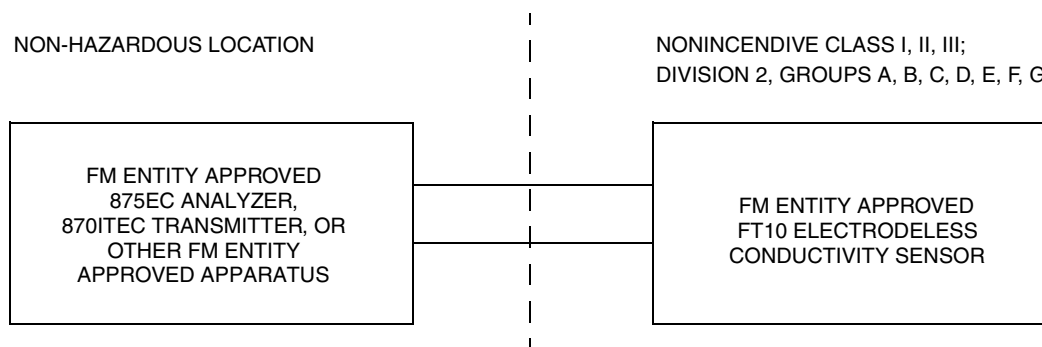


Figure 31. Sensor in Division 2 Hazardous Location

Associated Apparatus and Sensor in Hazardous Area

All connections to the 875EC Analyzer, 870ITEC Transmitter or other FM 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 NEMA TYPE 4X and IP66 within the hazardous area; follow the manufacturer's installation instructions (FM Control Drawing) for the associated apparatus. All equipment must meet the safety rating required for the installation; that is, the associated apparatus and the sensor must both be IS rated or NI rated. Refer to Figure 32.

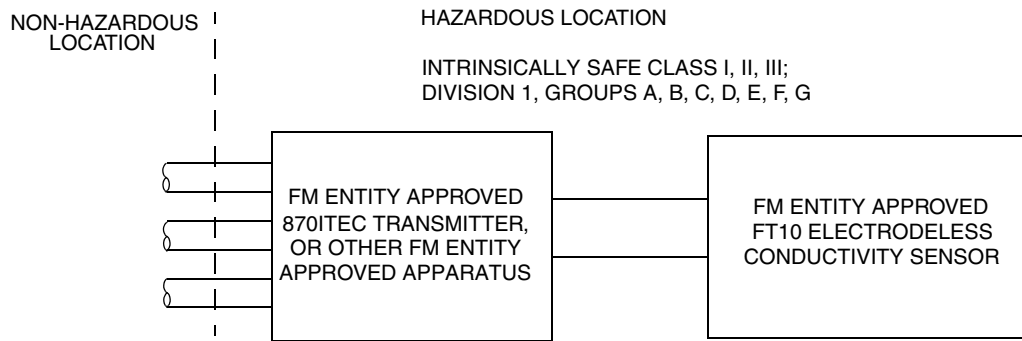


Figure 32. Sensor and Associated Apparatus in Division 1 Hazardous Location

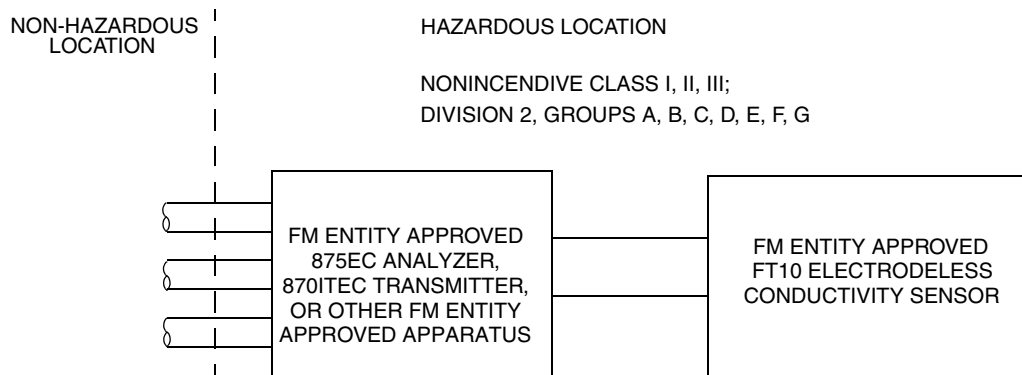


Figure 33. Sensor and Associated Apparatus in Division 2 Hazardous Location

Entity and Field Wiring Parameters

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

$$V_{\max} (U_i) = 10 \text{ V}$$

$$I_{\max} (I_i) = 80 \text{ mA}$$

$$P_{\max} (P_i) = 0.200 \text{ W}$$

$$C_i = 0 \text{ F}$$

$$L_i = 5.5 \text{ mH}$$

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 36 for 875EC Sensor Interface terminal connections or refer to MI 611-224 for this and more general information. Refer to Figure 37 for 870ITEC Sensor Interface terminal connections or refer to MI 611-212 for this and more general information.

Table 14. 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
RTD 3-Wire	8	H	ORN	ORN
Cable Shield	Ring Terminal	No Connection	Not Used	CLEAR (Shield)

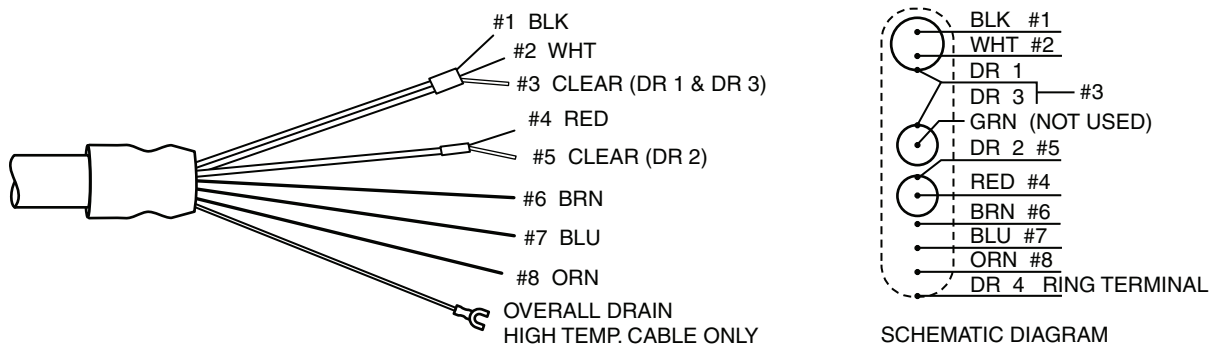


Figure 34. Cable Connections

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.

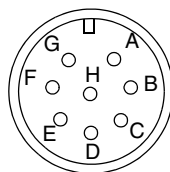


Figure 35. Patch Cable Connector (as viewed on sensor)

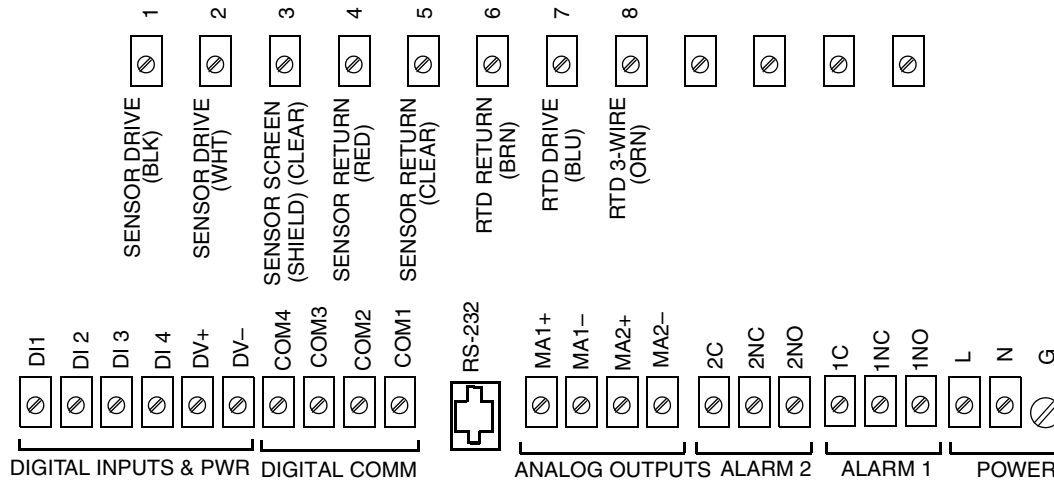


Figure 36. 875EC Analyzer Sensor Wiring Connections

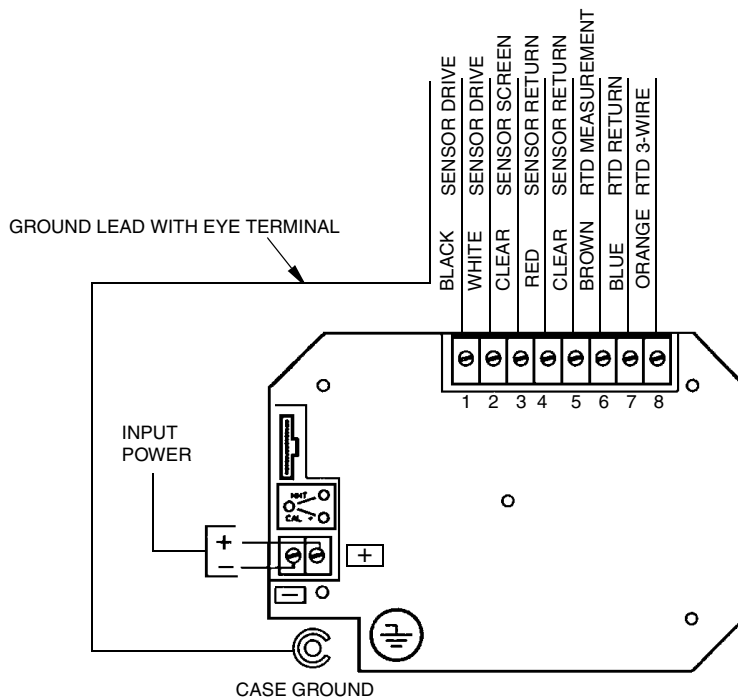


Figure 37. 870ITEC Transmitter Sensor Wiring Connections

FM Approvals Listing

FT10-MTabcd-e. Flow-through Conductivity Sensors.

IS/I,II,III/1/ABCDEFG/T6 Ta = 65 °C - MI611-206; Entity;

I/0/AEx ia IIC T6 Ta = 65 °C; MI 611-206; Entity;

NI/I/2/ABCD/T6 Ta = 65 °C; MI 611-206; NIFW;

S/II/2/EFG/T6 Ta = 65 °C; MI 611-206; NIFW;

S/III/2/T6 Ta = 65 °C; MI 611-206; NIFW;

Type 4X; IP66

Entity Parameters:

V_{max} = 10 V, I_{max} = 80 mA, P_i = 200 mW, C_i = 0 F, L_i = 5.5 mH.

a = Line Size: 08, 12 or 16.

b = End Connection Form: F or N.

c = Termination: 1, 2 or 6.

d = RTD: T or R.

e = Options: 1, 2, 3 and/or 4.

Special Conditions of use:

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

IECEX Entity Approval, FT10 Noninvasive Nonmetallic Electrodeless Conductivity Sensor, Type ia and Type n

The FT-10 Conductivity Sensor is IECEx 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 IECEx 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 non-hazardous) 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

Component Replacement or Substitution - Substitution of components may impair IECEx safety ratings.

! 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.

Associate 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 IECEx 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.

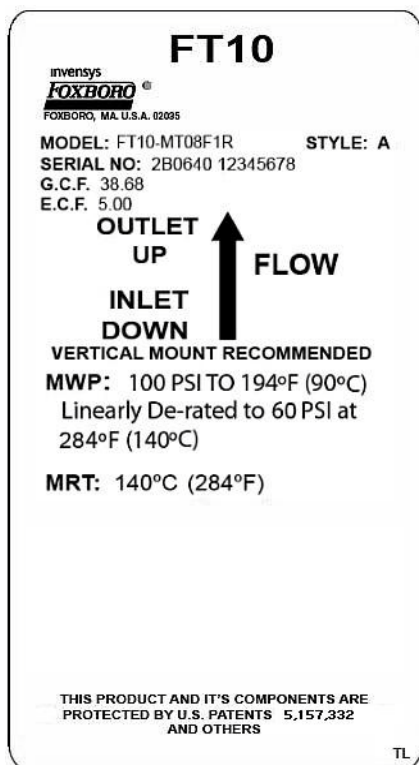
Both the Sensor and the Associated Apparatus must have the same safety rating, either both Type ia or both Type n.

! WARNING

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

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 38, 39, and 40.



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 $T_a=65^\circ\text{C}$.

Figure 38. Sample Data Label

The origin code identifies the area of manufacture and the year and week of manufacture. A typical code is 2B0725; this indicates manufacture in the Analytical Division at the Foxboro, Massachusetts facility (2B) in the year 2007 (07) in week 25 of the year (25). The individual serial number determined per manufacturing standard procedures is appended to the origin code.

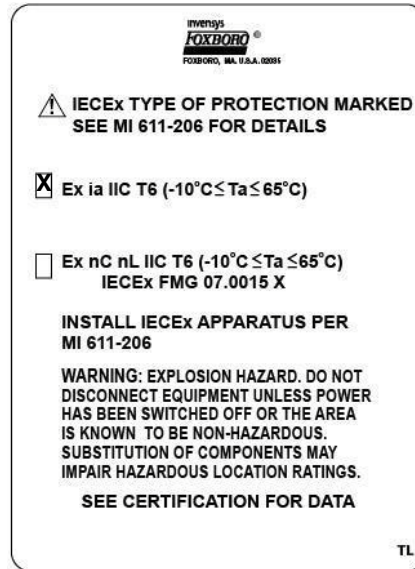


Figure 39. Sample Agency Label

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.

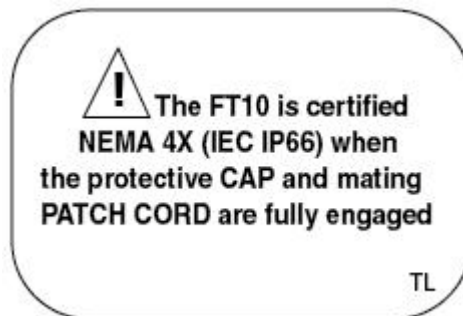


Figure 40. Sample Warning Label

Associated Apparatus in Non-hazardous Area, Sensor in Hazardous Area

There are no special requirements when the 875EC Analyzer, 870ITEC Transmitter or other IECEx entity approved associated apparatus is installed in a non-hazardous area. See Figure 41.

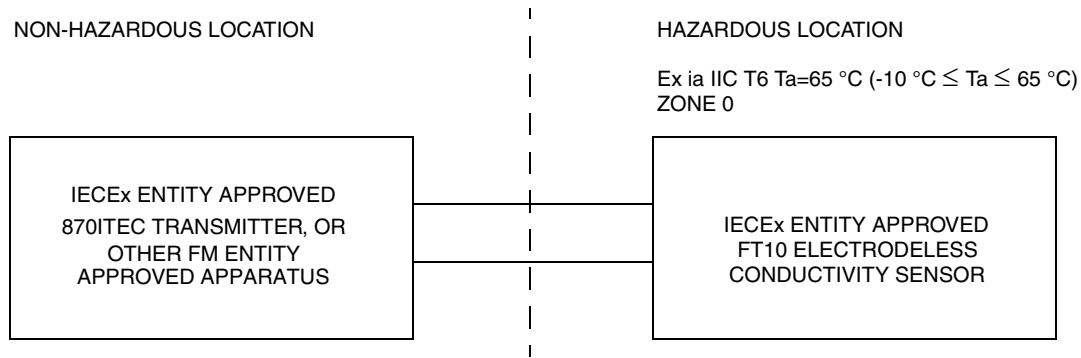


Figure 41. Sensor in Zone 0 Hazardous Location

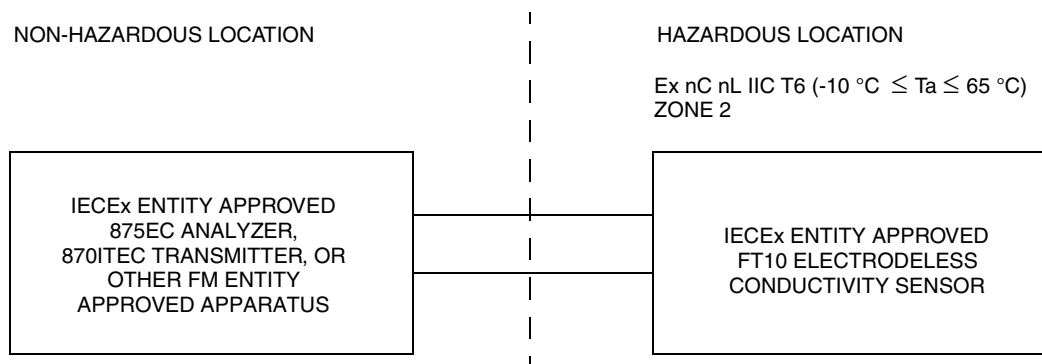


Figure 42. Sensor in Zone 2 Hazardous Location

Associated Apparatus and Sensor in Hazardous Area

All connections to the 875EC Analyzer, 870ITEC Transmitter or other IECEx 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 43.

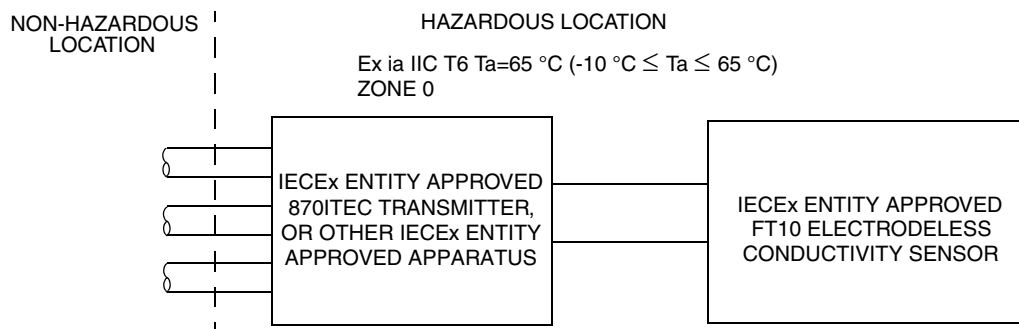


Figure 43. Sensor and Associated Apparatus in Zone 0 Hazardous Location

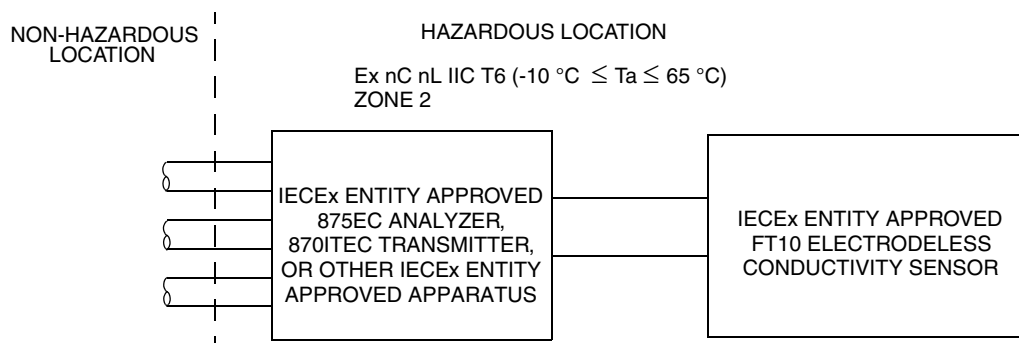


Figure 44. Sensor and Associated Apparatus in Zone 2 Hazardous Location

Entity and Field Wiring Parameters

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

$$V_{\max}(U_i) = 10 \text{ V}$$

$$I_{\max}(I_i) = 80 \text{ mA}$$

$$P_{\max}(P_i) = 0.200 \text{ W}$$

$$C_i = 0 \text{ F}$$

$$L_i = 5.5 \text{ mH}$$

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 47 for 875EC Sensor Interface terminal connections or refer to MI 611-224 for this and more general information. Refer to Figure 48 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 15. 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 15. 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)

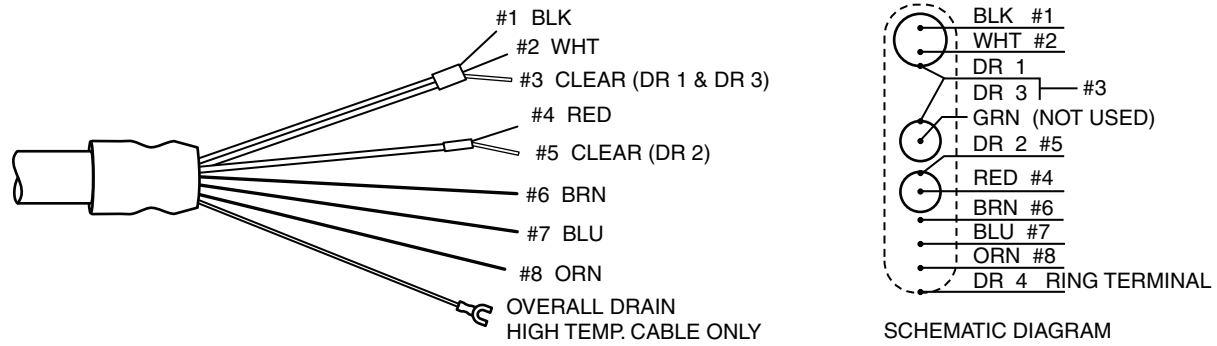


Figure 45. Cable Connections

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.

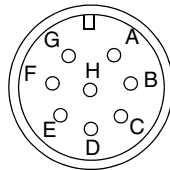


Figure 46. Patch Cable Connector (as viewed on sensor)

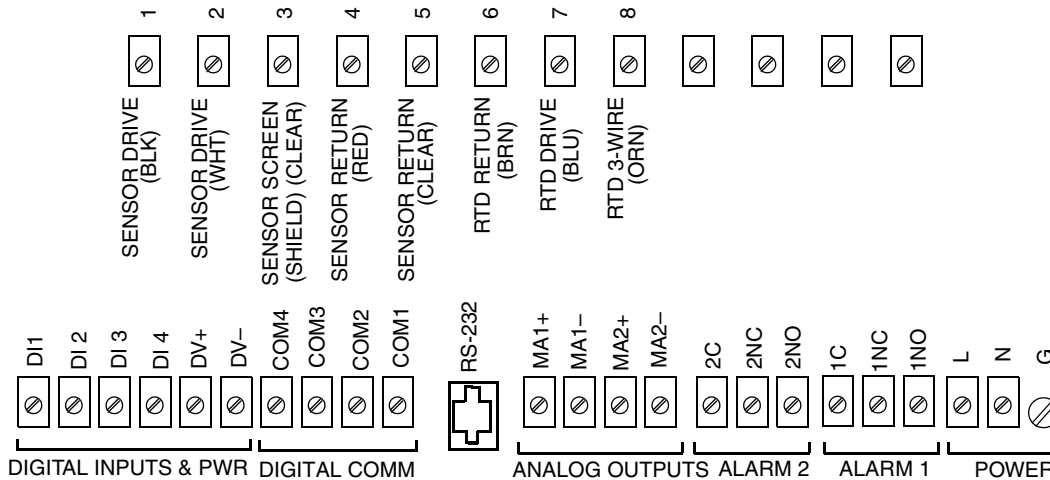


Figure 47. 875EC Analyzer Sensor Wiring Connections

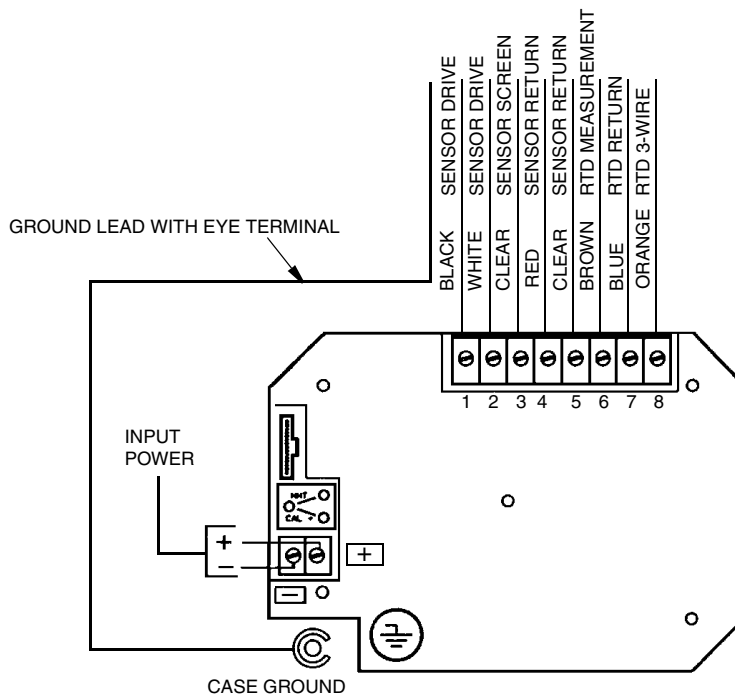


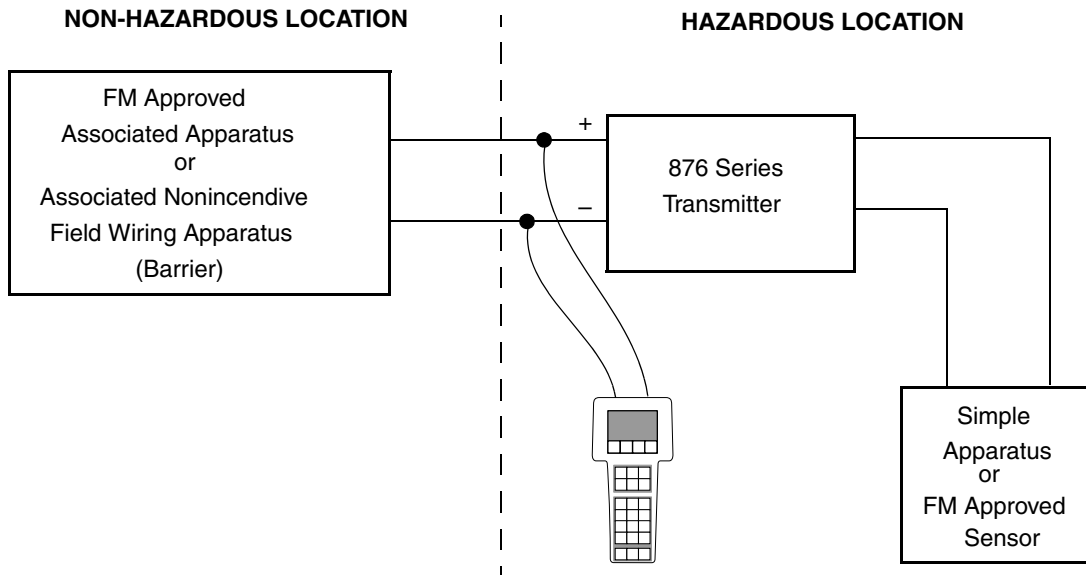
Figure 48. 870ITEC Transmitter Sensor Wiring Connections

Special Conditions of use

The housing is designed for indoor use only. Refer to Ultra-Violet Radiation Exposure warning on page 47.

6. 876 Transmitters

FM Entity Approval



INTRINSICALLY SAFE IS Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G Class III, Division 1 Class I, Zone 0, AEx ia IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 30$ V dc I_i or $I_{max} \leq 110$ mA $P_i \leq 800$ mW $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 8.6$ V dc I_o or $I_{sc} = 40$ mA $P_o = 350$ mW $C_o = 0.5$ μ F $L_o = 1.0$ mH	<u>876EC Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 6.5$ V dc I_o or $I_{sc} = 110$ mA $P_o = 0.10$ W $C_o = 0.3$ μ F $L_o = 0.1$ mH	<u>876CR Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 13$ V dc I_o or $I_{sc} = 40$ mA $P_o = 0.35$ W $C_o = 0.5$ μ F $L_o = 1.0$ mH
NONINCENDIVE, FIELD WIRING NI Class I, Division 2, Groups A, B, C, D Class II, Division 2, Groups E, F, G Class III, Division 2 Class I, Zone 2, AEx nC IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 42$ V dc I_i or $I_{max} \leq 22$ mA $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 8.6$ V dc I_o or $I_{sc} = 40$ mA $P_o = 350$ mW $C_o = 43$ μ F $L_o = 28$ mH	<u>876EC Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 6.5$ V dc I_o or $I_{sc} = 110$ mA $P_o = 0.10$ W $C_o = 300$ μ F $L_o = 3.7$ mH	<u>876CR Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 13$ V dc I_o or $I_{sc} = 40$ mA $P_o = 0.35$ W $C_o = 5.5$ μ F $L_o = 28$ mH

! WARNING
Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

! WARNING
To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

! 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 ANSI/IEC 60529 and is suitable for the environment.

! CAUTION
The associated apparatus manufacturer's installation drawing must be followed when installing this equipment.

General Notes

1. No revision to drawing without prior FM approval.
2. Associated apparatus (Barrier) manufacturer's installation drawings must be followed when installing this equipment.
3. Associated apparatus (Barrier) must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.
4. The Associated Apparatus (Barrier) must be FM approved.
5. Control equipment connected to barrier must not use or generate more than 250 Vrms or V dc.

6. Resistance between Intrinsically Safe ground and earth ground must be less than 1.0 ohm.
7. Installation should be in accordance with ANSI/ISA RP 12.06.01 “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations”, and the National Electrical Code (ANSI/NFPA 70).
8. Simple Apparatus or FM approved sensor should be connected to the transmitter’s sensor terminals.
Simple Apparatus as defined by NEC is an electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 milliamperes, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.
9. An approved dust-tight seal is required for Class II and III applications.

Nonincendive Notes:

1. Install per National Electrical Code (NEC) using wiring methods described in article 500 through article 510.
2. Intrinsic safety barrier not required.
3. Nonincendive field wiring installation

The Nonincendive Field Wiring Circuits Concept allows interconnection of nonincendive apparatus with associated nonincendive apparatus not specifically examined in combination as system when:

$$V_{\max} \geq V_{oc} \text{ or } V_t; C_a \geq C_i + C_{\text{cable}}; L_a \geq L_i + L_{\text{cable}}$$

Nonincendive field wiring enables interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus not specifically examined in combination as a system under one of the following conditions:

a. Current Controlled

Normal operating current controlled or limited by the nonincendive field wiring apparatus (unlike the requirements for intrinsically safe apparatus I_{\max} of the nonincendive field wiring apparatus need not be greater than the I_{sc} of the associated nonincendive field wiring apparatus)

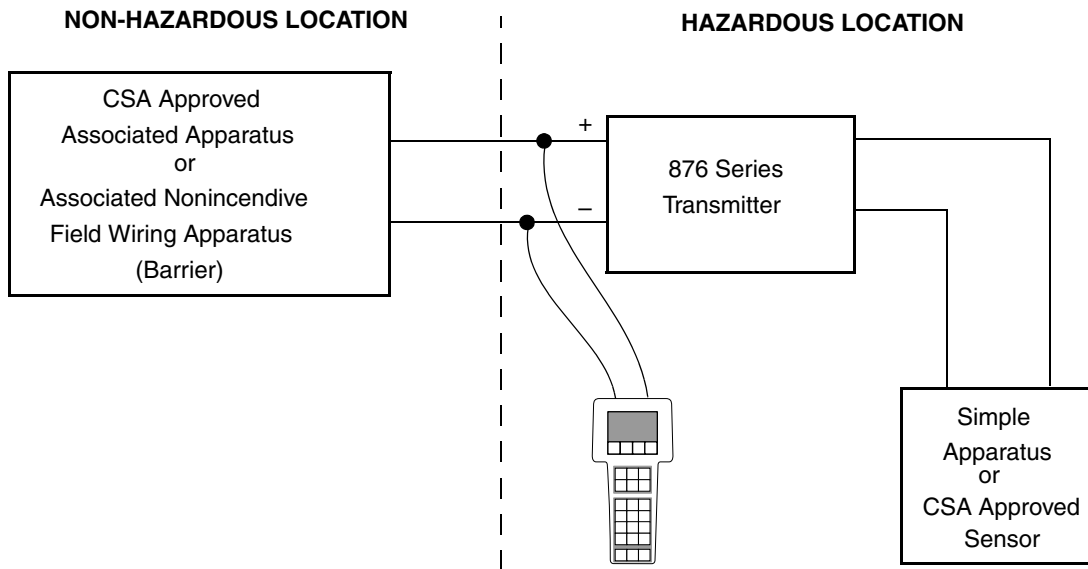
$$V_{\max} \geq V_{oc} \text{ or } V_t; C_a \geq C_i + C_{\text{cable}}; L_a \geq L_i + L_{\text{cable}}$$

b. Not Current Controlled

Normal operating voltage or current not controlled or limited by the nonincendive field wiring apparatus

$$V_{\max} \geq V_{oc} \text{ or } V_t; I_{\max} \geq I_{sc} \text{ or } I_t; C_a \geq C_i + C_{\text{cable}}; L_a \geq L_i + L_{\text{cable}}$$

CSA Entity Approval



INTRINSICALLY SAFE IS Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G Class III, Division 1 Class I, Zone 0, Ex ia IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 30$ V dc I_i or $I_{max} \leq 110$ mA $P_i \leq 800$ mW $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 8.6$ V dc I_o or $I_{sc} = 40$ mA $P_o = 350$ mW $C_o = 0.5$ μ F $L_o = 1.0$ mH	<u>876EC Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 6.5$ V dc I_o or $I_{sc} = 110$ mA $P_o = 0.10$ W $C_o = 0.3$ μ F $L_o = 0.1$ mH	<u>876CR Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 13$ V dc I_o or $I_{sc} = 40$ mA $P_o = 0.35$ W $C_o = 0.5$ μ F $L_o = 1.0$ mH
NONINCENDIVE, FIELD WIRING NI Class I, Division 2, Groups A, B, C, D Class II, Division 2, Groups E, F, G Class III, Division 2 Class I, Zone 2, Ex nL IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 42$ V dc I_i or $I_{max} \leq 22$ mA $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 8.6$ V dc I_o or $I_{sc} = 40$ mA $P_o = 350$ mW $C_o = 43$ μ F $L_o = 28$ mH	<u>876EC Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 6.5$ V dc I_o or $I_{sc} = 110$ mA $P_o = 0.10$ W $C_o = 300$ μ F $L_o = 3.7$ mH	<u>876CR Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 13$ V dc I_o or $I_{sc} = 40$ mA $P_o = 0.35$ W $C_o = 5.5$ μ F $L_o = 28$ mH

— ! WARNING —

Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2. Do **not** disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

— TIP —

Risque D'explosion - La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de Classe I, Division 2. Avant de deconnecter l'equipement couper le courant ou s'assurer que l'emplacement est designe non dangereux.

— ! WARNING —

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

— ! 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.

— ! CAUTION —

The associated apparatus manufacturer's installation drawing must be followed when installing this equipment.

General Notes

1. No revision to drawing without prior CSA approval.
2. Associated apparatus (Barrier) manufacturer's installation drawings must be followed when installing this equipment.
3. Associated apparatus (Barrier) must be installed in an enclosure that meets the requirements of ANSI/ISA S82.01.

4. The Associated Apparatus (Barrier) must be CSA approved.
5. Control equipment connected to barrier must not use or generate more than 250 Vrms or V dc.
6. Resistance between Intrinsically Safe ground and earth ground must be less than 1.0 ohm.
7. Installation should be in accordance with Canadian Electrical Code.
8. Simple Apparatus or CSA approved sensor should be connected to transmitter's sensor terminals.
Simple Apparatus as defined by the CEC is an electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 milliamperes, and 25 milliwatts or 20 microjoules.
9. An approved dust-tight seal is required for Class II and III applications.

Nonincendive Notes:

1. Install per Canadian Electrical Code (CEC).
2. Intrinsic safety barrier not required.
3. Nonincendive field wiring installation

The Nonincendive Field Wiring Circuits Concept allows interconnection of nonincendive apparatus with associated nonincendive apparatus not specifically examined in combination as system when:

$$V_{max} \geq V_{oc} \text{ or } V_t; C_a \geq C_i + C_{cable}; L_a \geq L_i + L_{cable}$$

Nonincendive field wiring enables interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus not specifically examined in combination as a system under one of the following conditions:

a. Current Controlled

Normal operating current controlled or limited by the nonincendive field wiring apparatus (unlike the requirements for intrinsically safe apparatus I_{max} of the nonincendive field wiring apparatus need not be greater than the I_{sc} of the associated nonincendive field wiring apparatus)

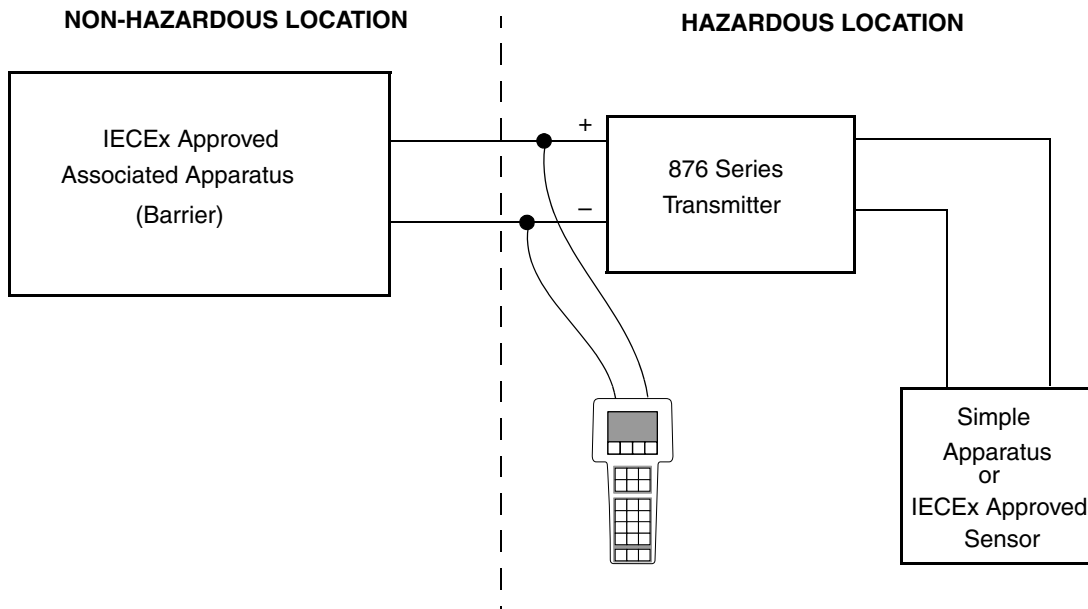
$$V_{max} \geq V_{oc} \text{ or } V_t; C_a \geq C_i + C_{cable}; L_a \geq L_i + L_{cable}$$

b. Not Current Controlled

Normal operating voltage or current not controlled or limited by the nonincendive field wiring apparatus

$$V_{max} \geq V_{oc} \text{ or } V_t; I_{max} \geq I_{sc} \text{ or } I_t; C_a \geq C_i + C_{cable}; L_a \geq L_i + L_{cable}$$

IECEX Entity Approval



INTRINSICALLY SAFE IECEX Type ia and ic Ex ia IIC Ex ic IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 30$ V dc I_i or $I_{max} \leq 110$ mA $P_i \leq 800$ mW $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> $U_o = 8.6$ V dc $I_o = 40$ mA $P_o = 350$ mW $C_o = 0.5$ μ F $L_o = 1.0$ mH	<u>876EC Sensor Terminal Entity Parameters</u> $U_o = 6.5$ V dc $I_o = 110$ mA $P_o = 0.10$ W $C_o = 0.3$ μ F $L_o = 0.1$ mH	<u>876CR Sensor Terminal Entity Parameters</u> $U_o = 13$ V dc $I_o = 40$ mA $P_o = 0.35$ W $C_o = 0.5$ μ F $L_o = 1.0$ mH
IECEX Type nL Ex nL IIC			
<u>876 Series Transmitter Entity Parameters</u> U_i or $V_{max} \leq 42$ V dc I_i or $I_{max} \leq 22$ mA $C_i = 3$ nF $L_i = 9.9$ μ H	<u>876PH Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 8.6$ V dc I_o or $I_{sc} = 40$ mA $P_o = 350$ mW $C_o = 43$ μ F $L_o = 28$ mH	<u>876EC Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 6.5$ V dc I_o or $I_{sc} = 110$ mA $P_o = 0.10$ W $C_o = 300$ μ F $L_o = 3.7$ mH	<u>876CR Sensor Terminal Entity Parameters</u> U_o or $V_{oc} = 13$ V dc I_o or $I_{sc} = 40$ mA $P_o = 0.35$ mW $C_o = 5.5$ μ F $L_o = 28$ mH

! WARNING

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

General Notes

1. No revision to drawing without prior FM approval.
2. Associated apparatus (Barrier) manufacturer's installation drawings must be followed when installing this equipment.
3. The Associated Apparatus (Barrier) must be IECEx approved.
4. Control equipment connected to barrier must not use or generate more than 250 Vrms or V dc.
5. Resistance between Intrinsically Safe ground and earth ground must be less than 1.0 ohm.
6. Simple Apparatus or IECEx approved sensor should be connected to transmitter's sensor terminals.

Simple Apparatus is defined as an electrical component or combination of components of simple construction with well-defined electrical parameters that does not generate more than 1.5 volts, 100 milliamperes, and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

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 49. A typical agency label is shown in Figure 50.

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




i n v e n s y s Foxboro	
MODEL / ST	— MODEL AND STYLE
CERT SPEC	— ELECTRICAL CLASSIFICATION CODE
REF NO	— SALES ORDER / SERIAL NUMBER (IF APPLICABLE)
ORIGIN	— PLANT OF MANUFACTURE, DATE, SERIAL NO.
SUPPLY	— SUPPLY VOLTAGE
POWER	— POWER CONSUMPTION
CALIB	— MEASUREMENT RANGE
CONFIG CD	— COMMUNICATIONS
OUTPUT	— OUTPUT
CUST DATA	— USER INFORMATION
INVENSY PROCESS SYSTEMS INC FOXBORO, MA 02035 U.S.A. 	

Figure 49. Sample 876 Transmitter Data Label


i n v e n s y s
Foxboro


....

 II 1 G Ex ia IIC T4 Ga
-20°C ≤ Ta ≤ 60°C FM10ATEX 0026X

 II 3 G Ex ic IIC T4 Gc
-20°C ≤ Ta ≤ 60°C FM10ATEX 0027X

INSTALL PER MI 611-208

Ex ia IIC T4 Ga; -20°C ≤ Ta ≤ 60°C
Ex ic IIC T4 Gc; -20°C ≤ Ta ≤ 60°C
 IECEx FMG10.0013X

 Ex nL IIC T4; -20°C ≤ Ta ≤ 60°C
IECEx FMG10.0014X

INSTALL PER MI 611-206

PERMANENTLY MARK ONE TYPE OF PROTECTION, ONCE CHOSEN, IT CAN NOT CHANGE. NOT FOLLOWING THESE INSTRUCTIONS WILL JEOPARDIZE EXPLOSION SAFETY.

WARNING: EXPLOSIVE HAZARD. DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

IP66




Figure 50. Sample Type ia Certified 876 Transmitter Agency Label

Electrical Certification Rating

The electrical certification information is printed on the agency label. See Figure 50. See Table 16 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 16. Product Safety Specifications

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Electrical Safety Design Code
IECEX intrinsically safe for Zone 0 Ex ia IIC	IECEX FMG10.0013X Temperature Class T4. $-20 \leq T_a \leq +60 \text{ }^\circ\text{C}$	DA
IECEX intrinsically safe for Zone 2 Ex ic IIC	IECEX FMG10.0014X Temperature Class T4. $-20 \leq T_a \leq +60 \text{ }^\circ\text{C}$	DN

— **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:

$$U_i \leq 30 \text{ V}$$

$$I_i \leq 110 \text{ mA}$$

$$P_i \leq 800 \text{ mW}$$

$$C_i = 3 \text{ nF}$$

$$L_i = 9.9 \text{ } \mu\text{H}$$

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

876PH--DA- (Terminals 1, 2, 2A, 3, 3A, 4, 5, 5A, 6, 7, 8)	876EC--DA- (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	876CR--DA- (Terminals 1, 2, 2A, 3, 4, 5)
$U_o = 8.6 \text{ V}$	$U_o = 6.5 \text{ V}$	$U_o = 13 \text{ V}$
$I_o = 40 \text{ mA}$	$I_o = 110 \text{ mA}$	$I_o = 40 \text{ mA}$
$P_o = 0.35 \text{ W}$	$P_o = 0.10 \text{ W}$	$P_o = 0.35 \text{ W}$

$$C_o = 0.5 \mu\text{F}$$

$$L_o = 1 \text{ mH}$$

$$C_o = 0.3 \mu\text{F}$$

$$L_o = 0.1 \text{ mH}$$

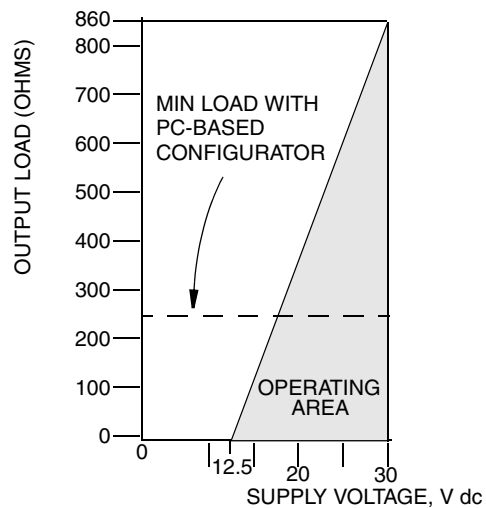
$$C_o = 0.5 \mu\text{F}$$

$$L_o = 1 \text{ mH}$$

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

876PH--DN- (Terminals 1, 2, 2A, 3, 3A, 4, 5, 5A, 6, 7, 8)	876EC--DN- (Terminals 1, 2, 3, 4, 5, 6, 7, 8)	876CR--DN- (Terminals 1, 2, 2A, 3, 4, 5)
$U_o = 8.6 \text{ V}$	$U_o = 6.5 \text{ V}$	$U_o = 13 \text{ V}$
$I_o = 40 \text{ mA}$	$I_o = 110 \text{ mA}$	$I_o = 40 \text{ mA}$
$P_o = 0.35 \text{ W}$	$P_o = 0.10 \text{ W}$	$P_o = 0.35 \text{ W}$
$C_o = 43 \mu\text{F}$	$C_o = 300 \mu\text{F}$	$C_o = 5.5 \mu\text{F}$
$L_o = 1 \text{ mH}$	$L_o = 3.7 \text{ mH}$	$L_o = 28 \text{ mH}$

The power supply requirements for a 4 to 20 mA output are 12.5 to 30 V dc for 876 Series IECEx certified products. See Figure 51.



$$\text{MAX LOAD} = (V-12.5)/0.0204$$

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 51. 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 49. 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

JUN 2000	MAY 2006
FEB 2001	NOV 2007
OCT 2005	DEC 2008
FEB 2006	DEC 2010
APR 2006	JUN 2011

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