Instruction

MI 020-427
August 2005

I/A Series® Pressure Transmitter Intrinsic Safety Connection Diagrams and Nonincendive Circuits

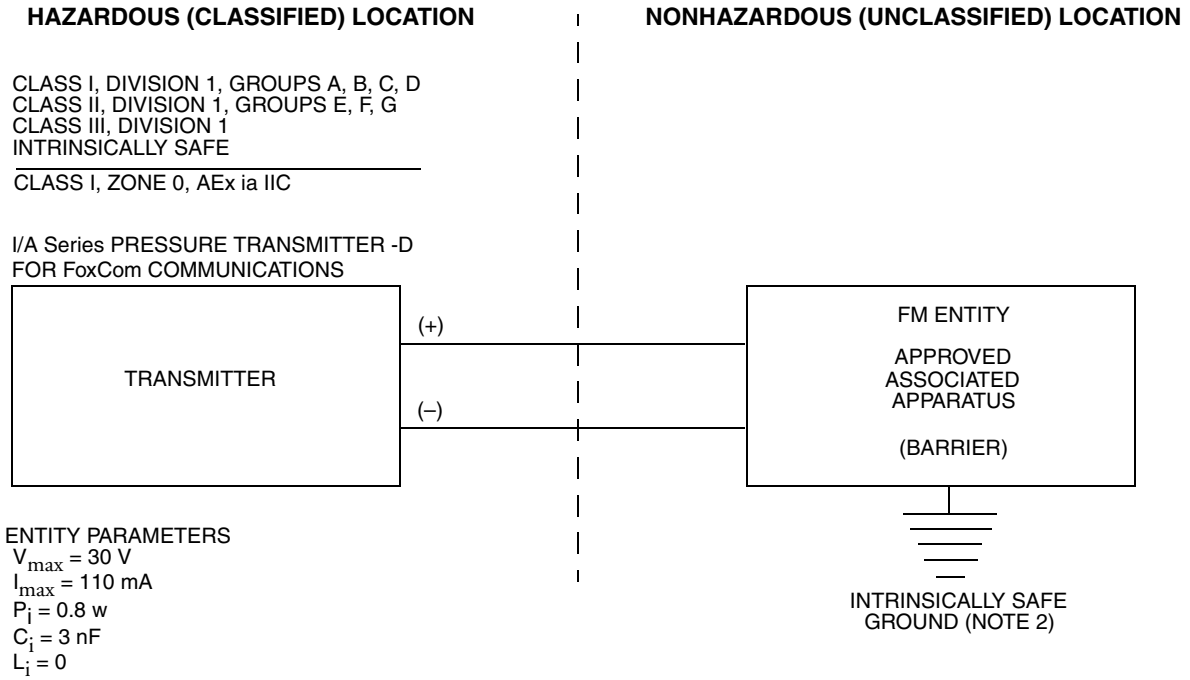
Invensys®
FOXBORO®

Contents

Digital FoxCom or 4 to 20 mA Output Signal

If your I/A Series pressure transmitter with a digital FoxCom or 4 to 20 mA output signal is classified as intrinsically safe, connect per the following control diagrams for the appropriate agency.

FM Approvals



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 ASSOCIATED APPARATUS OR BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 “INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS”, $V_{max} \geq V_{oc}$ OR V_t, $I_{max} \geq I_{sc}$ OR I_t, $C_i + C_{cable} \leq C_a$, $L_i + L_{cable} \leq L_a$ (TERMS DEFINED IN DOCUMENT) ANSI/NFPA 70 “NATIONAL ELECTRICAL CODE” AND MANUFACTURER’S CONTROL DRAWING FOR ASSOCIATED APPARATUS.
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.

Figure 1. Entity Parameters for FoxCom Transmitters

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe Approval

Divisions

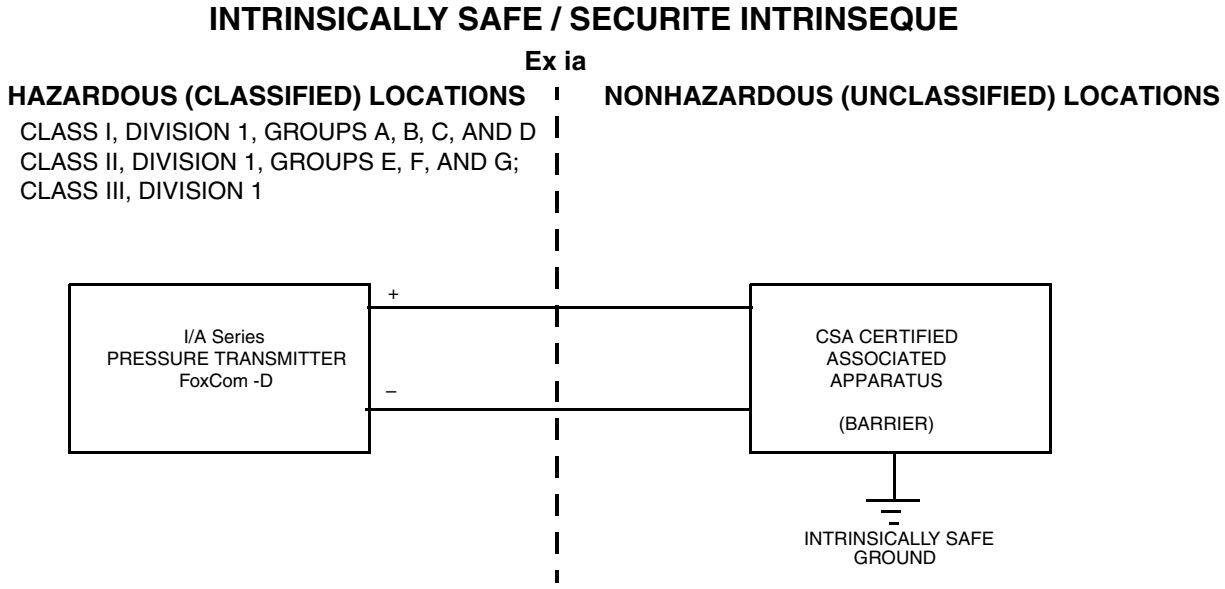


Figure 2. Divisions Loop Diagram for FoxCom Transmitters with CSA Certified Zener Barriers

Table 1. Foxboro Intrinsically Safe Apparatus Connected to CSA Certified Zener Barriers (Other Manufacturer's Associated Apparatus)

Barriers	Temp. Class	Parameters		Hazardous (Classified) Locations
		Vmax	Rmin	
CSA Approved Safety Zener Barriers	T3C	30 V or less 28 V or less 25 V or less 22 V or less	330 Ω or more 300 Ω or more 200 Ω or more 180 Ω or more	Class I, Groups A, B, C, and D, Division 1 Locations

NOTE

1. Figure 2 and/or Table 1 must **not** be modified without prior CSA approval.
2. Control room equipment shall **not** use or generate more than 250 Vrms or V dc.
3. Observe associated apparatus (barrier) and communication manufacturer's instructions when installing this equipment.
4. Install in accordance with Canadian electrical code (part 1).

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Zones

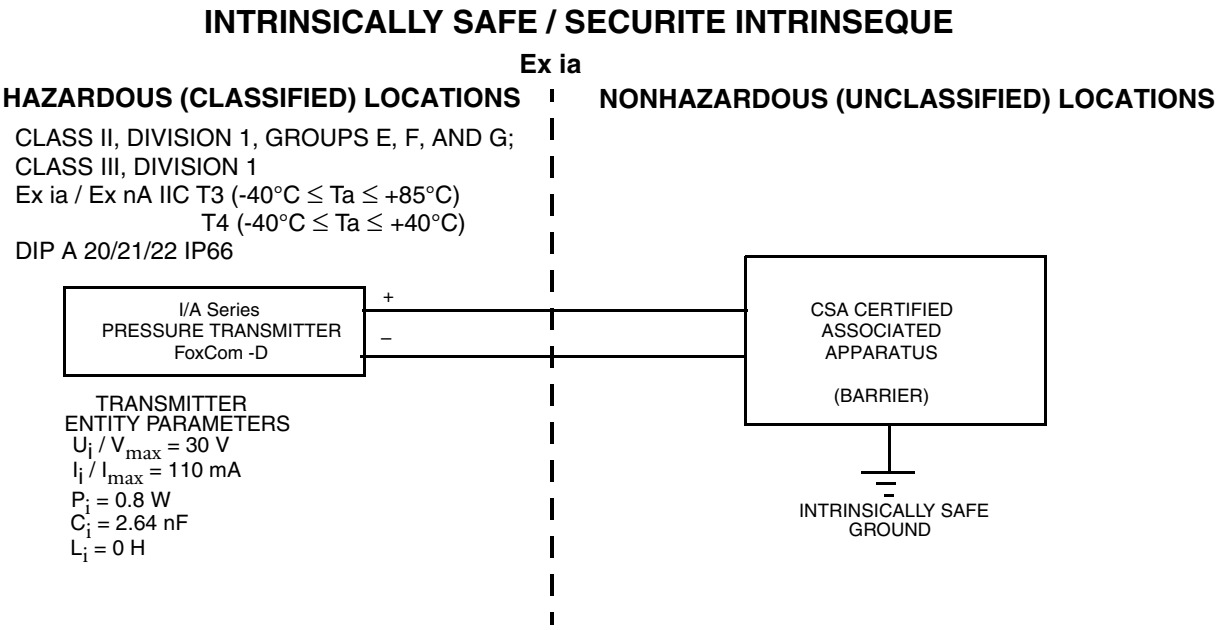


Figure 3. Zones Loop Diagram for FoxCom Transmitters Using Entity Parameters

NOTE

1. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
2. Maximum nonhazardous area voltage must not exceed 250 V.
3. Install in accordance with Canadian Electrical Code, Part 1.
4. Entity parameters must meet the following requirements:
   $U_o / V_{oc} \leq U_i / V_{max}$
   $I_o / I_{sc} \leq I_i / I_{max}$
   C_o or $C_a \leq C_i + C_{cable}$
   L_o or $L_a \leq L_i + L_{cable}$
5. Total resistance between Intrinsic Safety Ground and Earth Ground must be less than 1 ohm.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

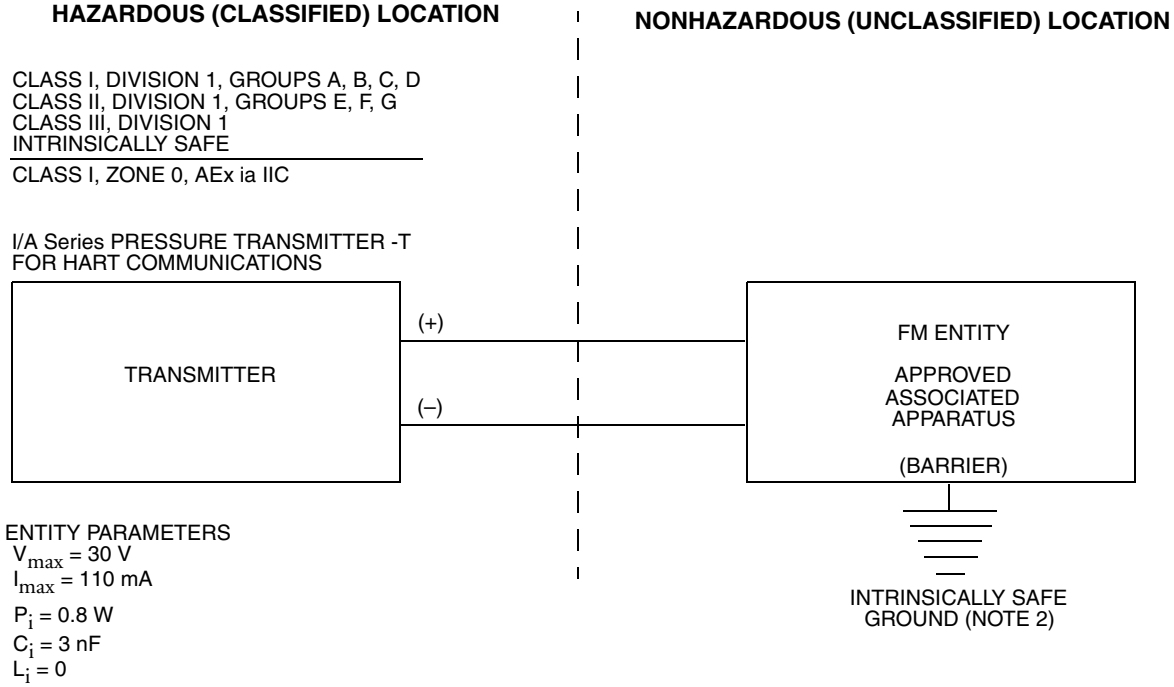
AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

HART Communication Protocol

If your I/A Series pressure transmitter with HART communication protocol is classified as intrinsically safe, connect per the following control diagrams for the appropriate agency.

FM Approvals



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 ASSOCIATED APPARATUS OR BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 “INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS”, $V_{max} \geq V_{oc}$ OR V_t, $I_{max} \geq I_{sc}$ OR I_t, $C_i + C_{cable} \leq C_a$, $L_i + L_{cable} \leq L_a$ (TERMS DEFINED IN DOCUMENT) ANSI/NFPA 70 “NATIONAL ELECTRICAL CODE” AND MANUFACTURER’S CONTROL DRAWING FOR ASSOCIATED APPARATUS.
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.

Figure 4. Loop Diagram for HART Transmitters Using Entity Parameters

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe Approval

Divisions

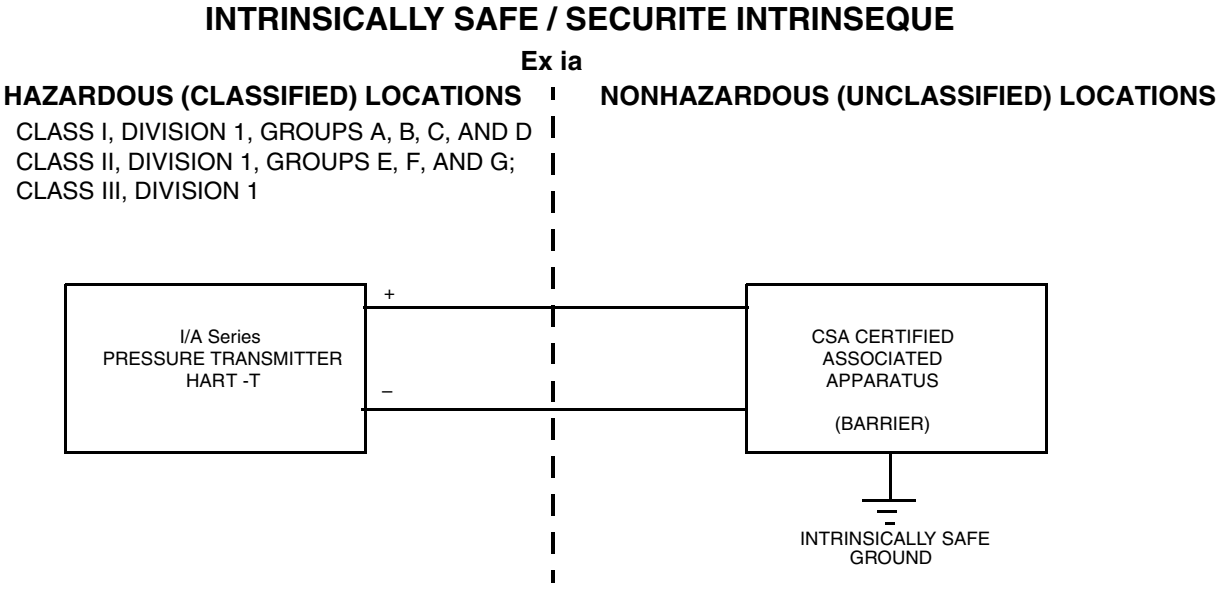


Figure 5. Divisions Loop Diagram for HART Transmitters with CSA Certified Zener Barrier

Table 2. Foxboro Intrinsically Safe Apparatus Connected to CSA Certified Zener Barriers (Other Manufacturer's Associated Apparatus)

Barriers	Temp. Class	Parameters		Hazardous (Classified) Locations
		Vmax	Rmin	
CSA Approved Safety Zener Barriers	T3C	30 V or less 28 V or less 25 V or less 22 V or less	330 Ω or more 300 Ω or more 200 Ω or more 180 Ω or more	Class I, Groups A, B, C, and D, Division 1 Locations

NOTE

1. Figure 5 and/or Table 2 must **not** be modified without prior CSA approval.
2. Control room equipment shall **not** use or generate more than 250 Vrms or V dc.
3. Observe associated apparatus (barrier) and communication manufacturer's instructions when installing this equipment.
4. Install in accordance with Canadian electrical code (part 1).

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Zones

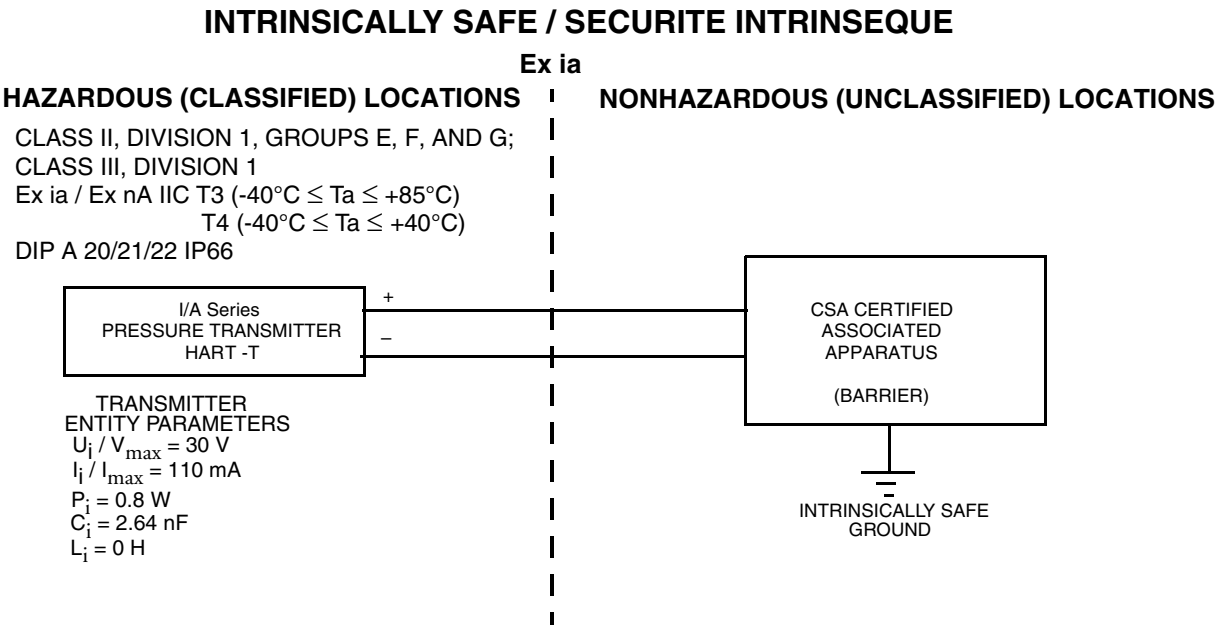


Figure 6. Zones Loop Diagram for HART Transmitters Using Entity Parameters

NOTE

1. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
2. Maximum nonhazardous area voltage must not exceed 250 V.
3. Install in accordance with Canadian Electrical Code, Part 1.
4. Entity parameters must meet the following requirements:
   $U_o / V_{oc} \leq U_i / V_{max}$
   $I_o / I_{sc} \leq I_i / I_{max}$
   C_o or $C_a \leq C_i + C_{cable}$
   L_o or $L_a \leq L_i + L_{cable}$
5. Total resistance between Intrinsic Safety Ground and Earth Ground must be less than 1 ohm.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

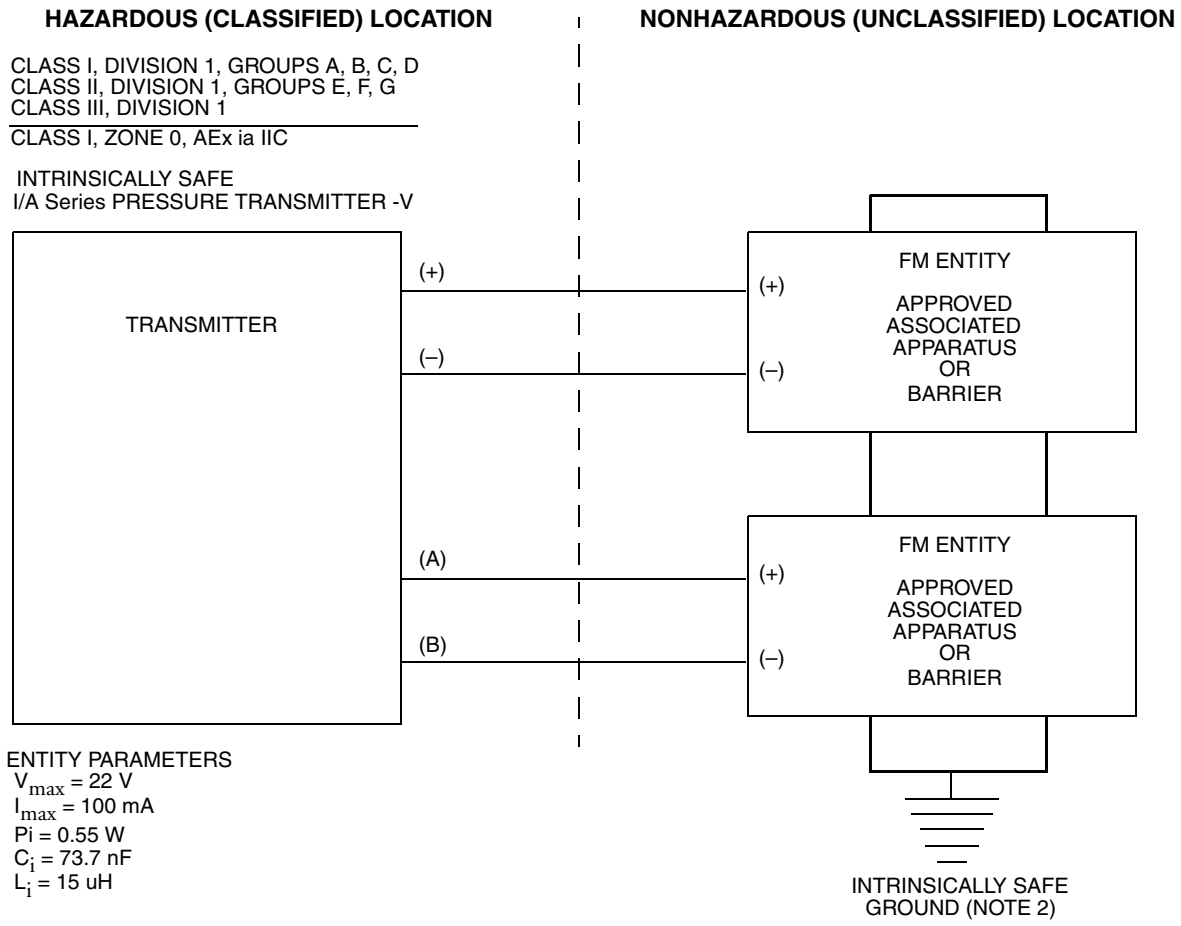
AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Voltage Output Signal

If your I/A Series pressure transmitter with voltage output is classified as intrinsically safe, connect per the following control diagram for the appropriate agency.

FM Approvals



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 ASSOCIATED APPARATUS OR BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 “INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS”, $V_{max} \geq V_{oc}$ OR V_t , $I_{max} \geq I_{sc}$ OR I_t , $C_i + C_{cable} \leq C_a$, $L_i + L_{cable} \leq L_a$ (TERMS DEFINED IN DOCUMENT) ANSI/NFPA 70 “NATIONAL ELECTRICAL CODE” AND MANUFACTURER’S CONTROL DRAWING FOR ASSOCIATED APPARATUS).
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.

Figure 7. Loop Diagram for Voltage Output Transmitters Using Entity Parameters

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe Approval

Divisions

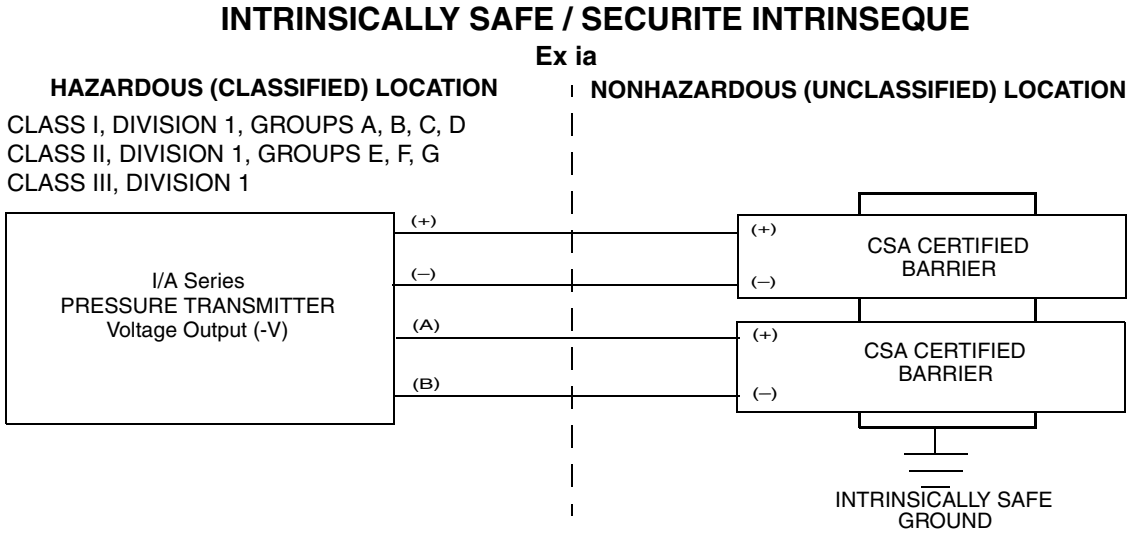


Figure 8. Divisions Loop Diagram for Voltage Output Transmitters With CSA Certified Barriers

Table 3. Foxboro Intrinsically Safe Apparatus Connected to CSA Certified Zener Barriers (Other Manufacturer's Associated Apparatus)

Barriers	Temp. Class	Parameters		Hazardous (Classified) Locations
		Vmax	Rmin	
CSA Approved Safety Zener Barriers	T3C	21 V or less 16.5 V or less 12 V or less 12 V or less 9 V or less	420 Ω or more 165 Ω or more 150 Ω or more 1000 Ω or more 90 Ω or more	Class I, Groups A, B, C, and D, Division 1 Locations

NOTE

1. Figure 8 and/or Table 3 must **not** be modified without prior CSA approval.
2. Control room equipment shall **not** use or generate more than 250 Vrms or V dc.
3. Observe associated apparatus (barrier) and communication manufacturer's instructions when installing this equipment.
4. Install in accordance with Canadian electrical code (part 1).

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Zones

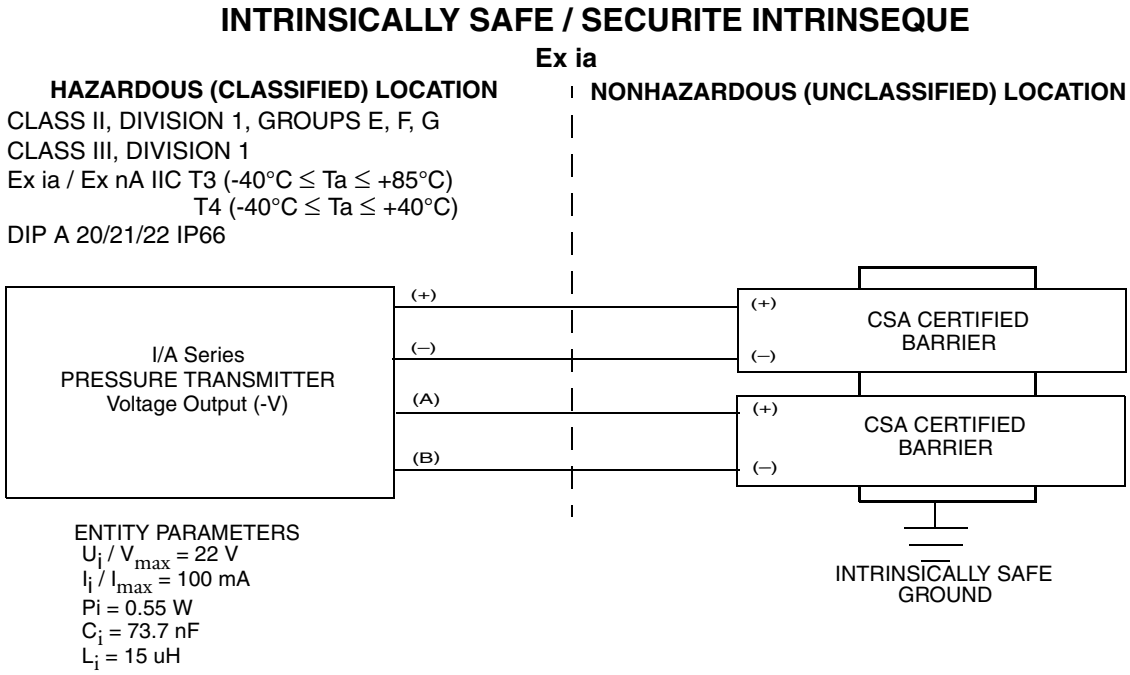


Figure 9. Zones Loop Diagram for Voltage Output Transmitter Using Entity Parameters

NOTE

1. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
2. Maximum nonhazardous area voltage must not exceed 250 V.
3. Install in accordance with Canadian Electrical Code, Part 1.
4. Entity parameters must meet the following requirements:
   $U_o / V_{oc} \leq U_i / V_{max}$
   $I_o / I_{sc} \leq I_i / I_{max}$
   C_o or $C_a \leq C_i + C_{cable}$
   L_o or $L_a \leq L_i + L_{cable}$
5. Total resistance between Intrinsic Safety Ground and Earth Ground must be less than 1 ohm.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

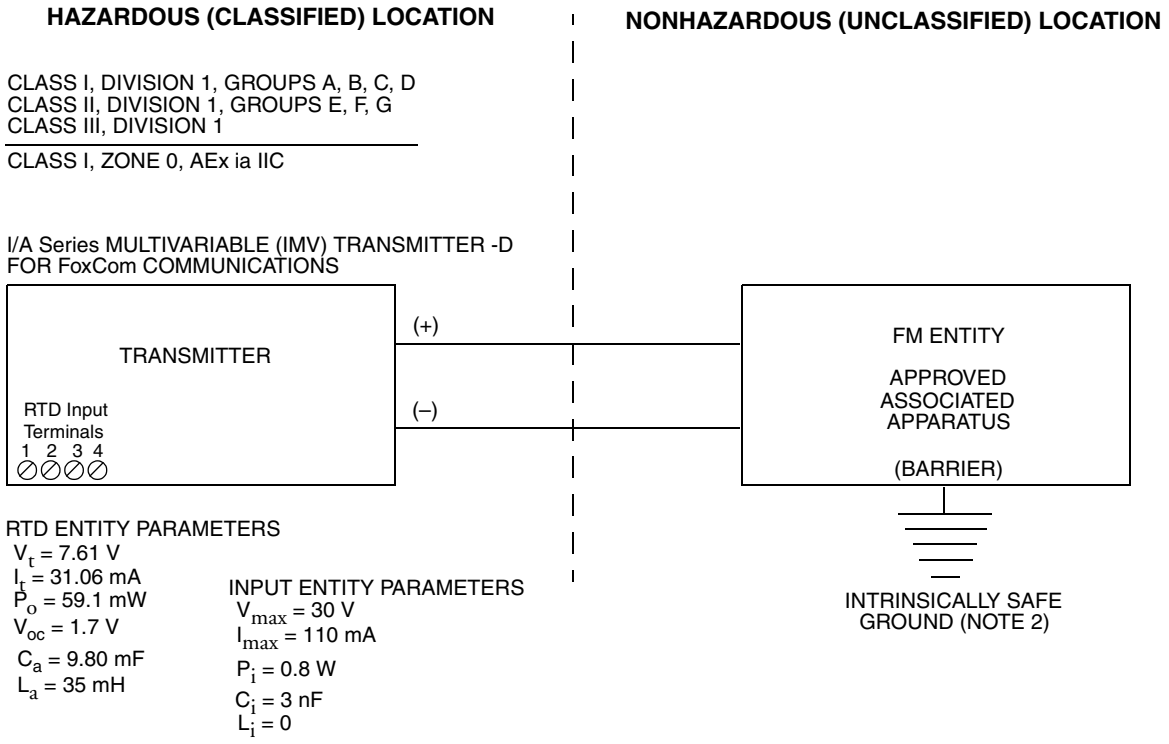
AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Multivariable (IMV) Transmitters with FoxCom Communication Protocol

If your I/A Series Multivariable (IMV) Transmitter with FoxCom communication protocol is classified as intrinsically safe, connect per the following control diagrams for the appropriate agency.

FM Approvals



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 ASSOCIATED APPARATUS OR BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 “INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS”, $V_{max} \geq V_{oc}$ OR V_t, $I_{max} \geq I_{sc}$ OR I_t, $C_i + C_{cable} \leq C_a$, $L_i + L_{cable} \leq L_a$ (TERMS DEFINED IN DOCUMENT) ANSI/NFPA 70 “NATIONAL ELECTRICAL CODE” AND MANUFACTURER’S CONTROL DRAWING FOR ASSOCIATED APPARATUS.
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.

Figure 10. Loop Diagram for FoxCom IMV Transmitters Using Entity Parameters

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe Approval

Divisions

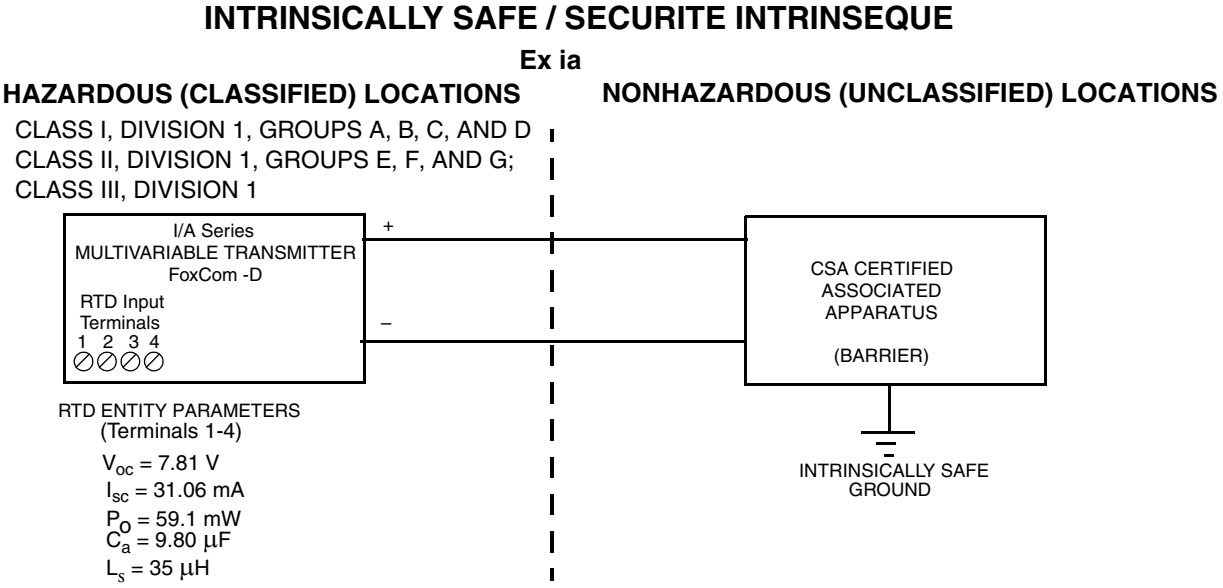


Figure 11. Divisions Loop Diagram for FoxCom IMV Transmitters With CSA Certified Zener Barriers

Table 4. Foxboro Intrinsically Safe Apparatus Connected to CSA Certified Zener Barriers (Other Manufacturer's Associated Apparatus)

Barriers	Temp. Class	Parameters		Hazardous (Classified) Locations
		Vmax	Rmin	
CSA Approved Safety Zener Barriers	T3C	30 V or less 28 V or less 25 V or less 22 V or less	330 Ω or more 300 Ω or more 200 Ω or more 180 Ω or more	Class I, Groups A, B, C, and D, Division 1 Locations

NOTE

1. Figure 11 and/or Table 4 must **not** be modified without prior CSA approval.
2. Control room equipment shall **not** use or generate more than 250 V_{rms} or V dc.
3. Observe associated apparatus (barrier) and communication manufacturer's instructions when installing this equipment.
4. Install in accordance with Canadian electrical code (part 1).
5. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Zones

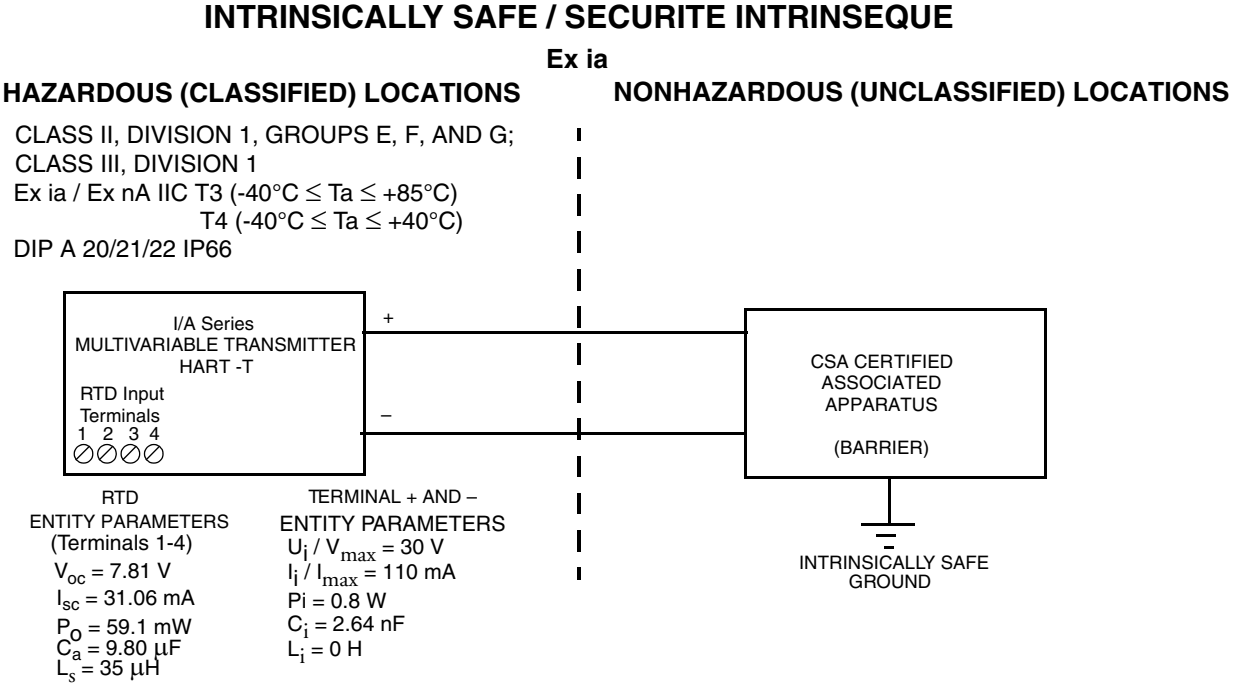


Figure 12. Zones Loop Diagram for HART IMV Transmitters Using Entity Parameters

NOTE

1. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
2. Maximum nonhazardous area voltage must not exceed 250 V.
3. Install in accordance with Canadian Electrical Code, Part 1.
4. Entity parameters must meet the following requirements:
   $U_o / V_{oc} \leq U_i / V_{max}$
   $I_o / I_{sc} \leq I_i / I_{max}$
   C_o or $C_a \leq C_i + C_{cable}$
   L_o or $L_a \leq L_i + L_{cable}$
5. Total resistance between Intrinsic Safety Ground and Earth Ground must be less than 1 ohm.
6. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

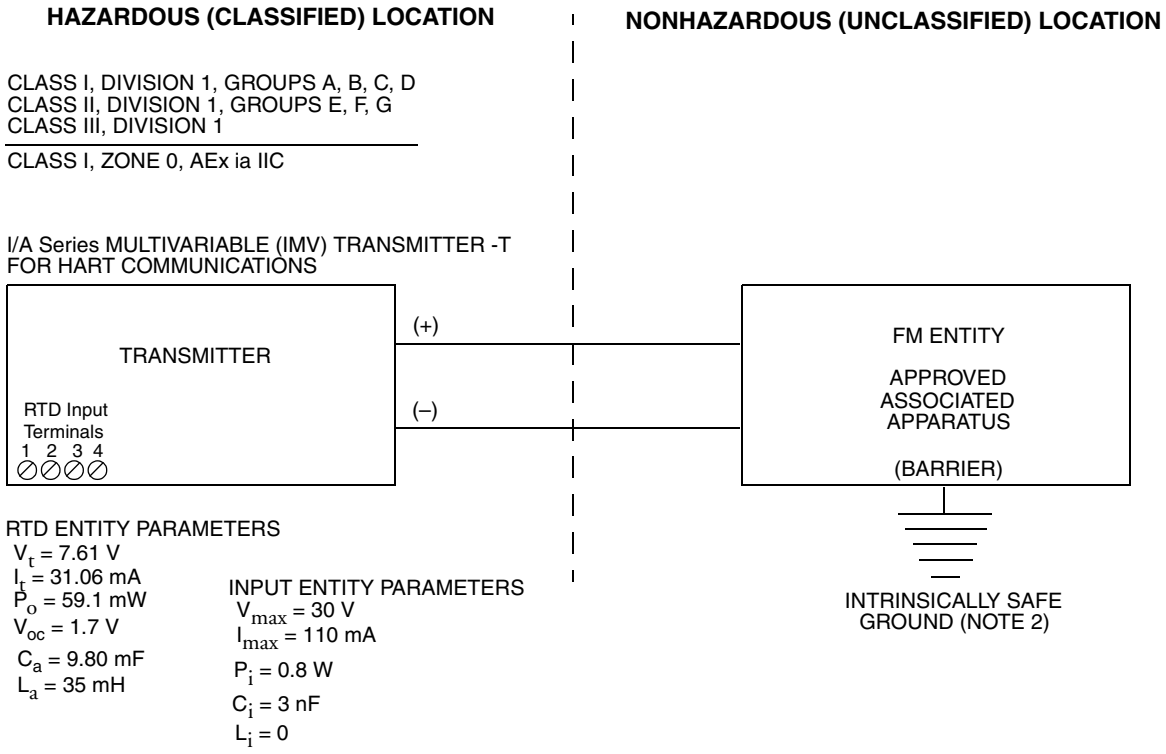
AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Multivariable (IMV) Transmitters with HART Communication Protocol

If your I/A Series Multivariable (IMV) Transmitter with HART communication protocol is classified as intrinsically safe, connect per the following control diagrams for the appropriate agency.

FM Approvals



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 ASSOCIATED APPARATUS OR BARRIER MUST NOT USE OR GENERATE MORE THAN 250 V_{rms} OR V dc.
4. INSTALLATION SHOULD BE IN ACCORDANCE WITH ANSI/ISA RP 12.6 “INSTALLATION OF INTRINSICALLY SAFE SYSTEMS FOR HAZARDOUS (CLASSIFIED) LOCATIONS”, $V_{max} \geq V_{oc}$ OR V_t, $I_{max} \geq I_{sc}$ OR I_t, $C_i + C_{cable} \leq C_a$, $L_i + L_{cable} \leq L_a$ (TERMS DEFINED IN DOCUMENT) ANSI/NFPA 70 “NATIONAL ELECTRICAL CODE” AND MANUFACTURER’S CONTROL DRAWING FOR ASSOCIATED APPARATUS.
5. AN APPROVED DUST-TIGHT SEAL IS REQUIRED FOR CLASS II AND III APPLICATIONS.

Figure 13. Loop Diagram for HART IMV Transmitters Using Entity Parameters

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe Approval

Divisions

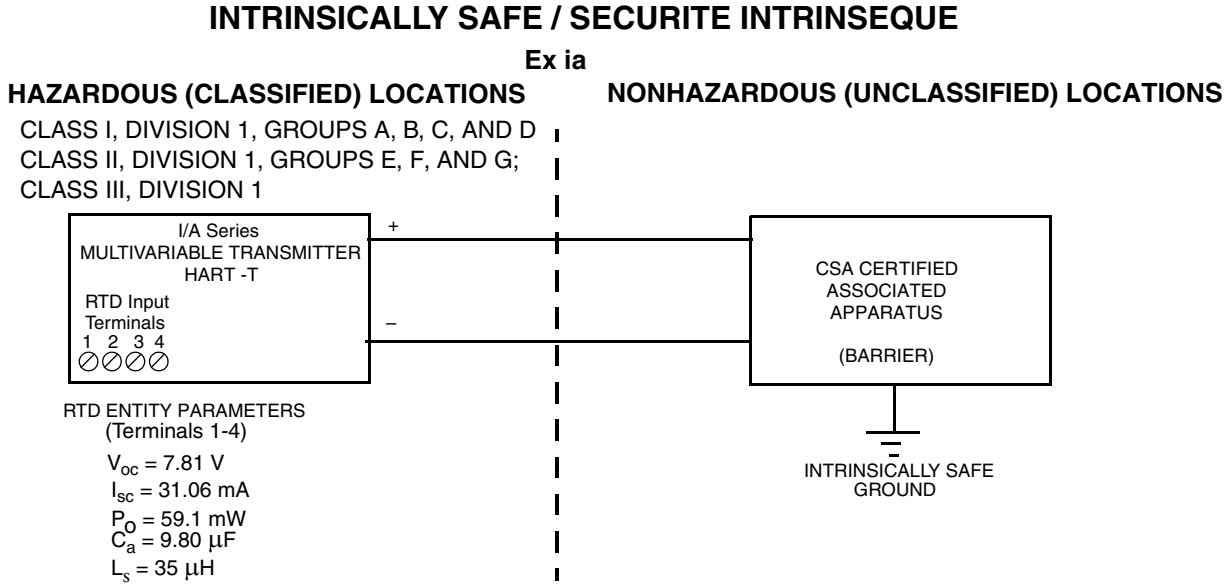


Figure 14. Divisions Loop Diagram for HART IMV Transmitters With CSA Certified Zener Barriers

Table 5. Foxboro Intrinsically Safe Apparatus Connected to CSA Certified Zener Barriers (Other Manufacturer's Associated Apparatus)

Barriers	Temp. Class	Parameters		Hazardous (Classified) Locations
		Vmax	Rmin	
CSA Approved Safety Zener Barriers	T3C	30 V or less 28 V or less 25 V or less 22 V or less	330 Ω or more 300 Ω or more 200 Ω or more 180 Ω or more	Class I, Groups A, B, C, and D, Division 1 Locations

NOTE

1. Figure 14 and/or Table 5 must **not** be modified without prior CSA approval.
2. Control room equipment shall **not** use or generate more than 250 V_{rms} or V dc.
3. Observe associated apparatus (barrier) and communication manufacturer's instructions when installing this equipment.
4. Install in accordance with Canadian electrical code (part 1).
5. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Zones

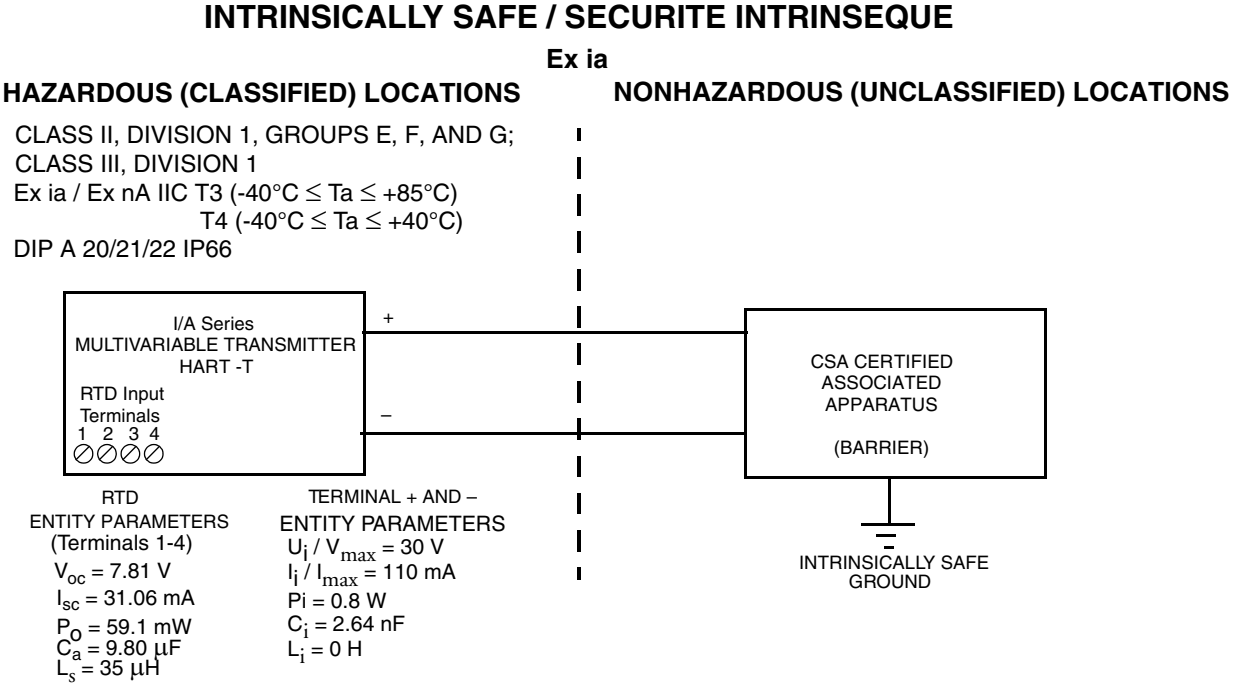


Figure 15. Zones Loop Diagram for HART IMV Transmitters Using Entity Parameters

NOTE

1. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
2. Maximum nonhazardous area voltage must not exceed 250 V.
3. Install in accordance with Canadian Electrical Code, Part 1.
4. Entity parameters must meet the following requirements:
   $U_o / V_{oc} \leq U_i / V_{max}$
   $I_o / I_{sc} \leq I_i / I_{max}$
   C_o or $C_a \leq C_i + C_{cable}$
   L_o or $L_a \leq L_i + L_{cable}$
5. Total resistance between Intrinsic Safety Ground and Earth Ground must be less than 1 ohm.
6. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Foundation™ Fieldbus Communication Protocol FISCO

The **F**ieldbus **I**ntrinsically **S**afe **CO**ncept (FISCO) allows the interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (V_{max}), the current (I_{max}), and the power (P_i) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater than the voltage (U_o, V_{oc}, V_t), the current (Io, I_{sc}, I_t), and the power (P_o) which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the Fieldbus must be less than or equal to 5 nF and 10 µH respectively.

In each Intrinsically Safe Fieldbus segment only one active source, normally the associated apparatus is allowed to provide the necessary power for the Fieldbus system. The allowed voltage (U_o, V_{oc}, V_t) of the associated apparatus used to supply the bus must be limited to the range of 14 V dc to 17.5 V dc. All other equipment connected to the bus cable has to be passive, meaning that the apparatus is not allowed to provide energy to the system, except for a leakage current not greater than 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to insure that the intrinsically safe Fieldbus circuit remains passive.

The cable used to interconnect the devices shall comply with the following parameters:

- Loop resistance R': 15 ...150 Ω/km
- Inductance per unit length L': 0.4…1 mH/km
- Capacitance per unit length C': 80 ...200 nF/km
- C' = C' line/line + 0.5 C' line/screen, if both lines are floating

  or

  C'= C' line/line + C' line/screen, if the screen is connected to one line
- Length of spur Cable: maximum 30 m
- Length of trunk cable: maximum 1 km
- Length of splice: maximum 1 m

At each end of the trunk cable an appropriate agency approved line terminator with the following parameters is suitable:

- Resistance R = 90 to 100 Ω
- Capacitance C = 0 to 2.2 µF

Where a system comprises of one FISCO approved associated apparatus, with a cable complying to the specification listed above, any number of FISCO approved field devices up to 32 and two FISCO approved terminators, are allowed and they shall be considered to be adequately safe.

If your I /A Series pressure transmitter with FOUNDATION™ Fieldbus communication protocol is classified as intrinsically safe Fieldbus Intrinsically Safe COncept (FISCO) compliant connect per the following control diagrams for the appropriate agency.

FM Approvals

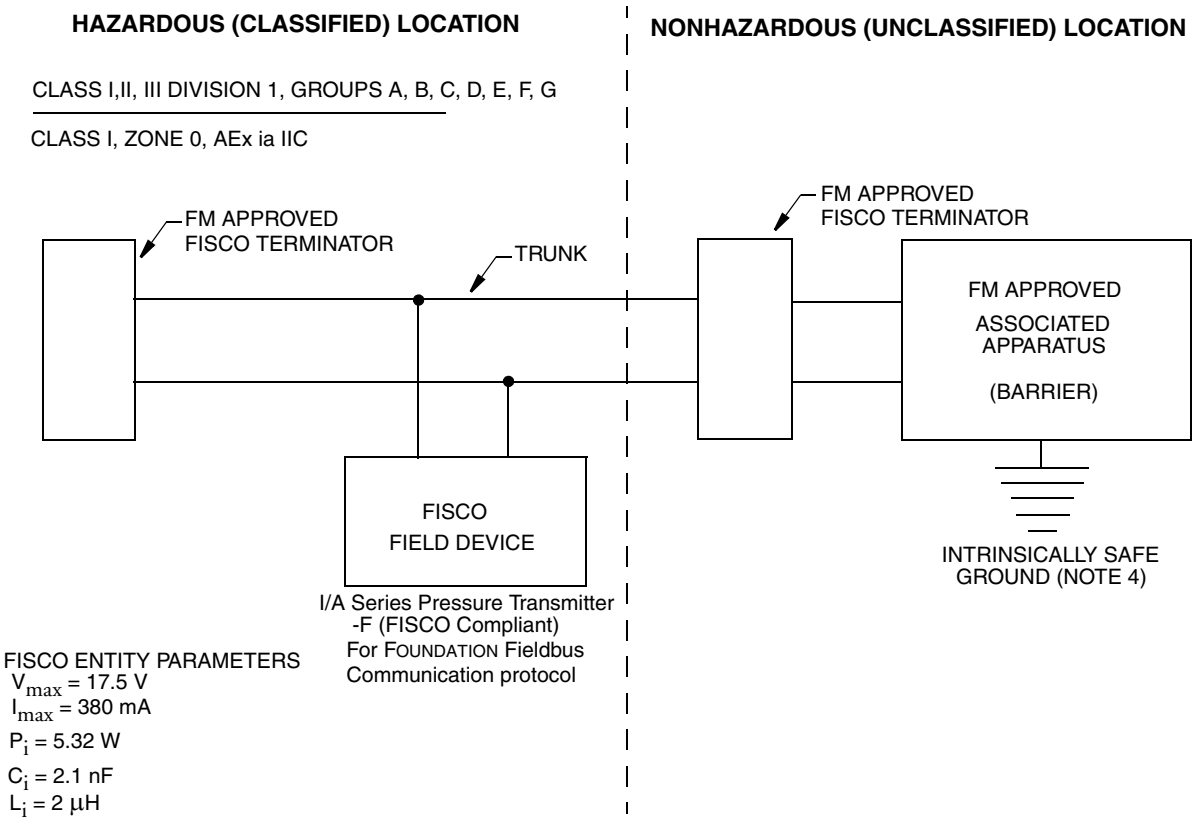


Figure 16. Loop Diagram for FISCO Compliant Transmitters

NOTE

1. No revision to drawing without prior FM approval.
2. Associated apparatus manufacturer's installation drawings must be followed when installing this equipment.
3. The FISCO Associated Apparatus must be FM approved.
4. Control equipment connected to FISCO barrier must not use or generate more than 250 V_{rms} or V dc.
5. Resistance between FISCO Intrinsically Safe ground and earth ground must be less than 1.0 ohm.
6. 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).
7. The FISCO Concept allows the interconnection of Fieldbus intrinsically safe apparatus with FISCO associated apparatus when the following is true:
   V_{max} or $U_i \geq V_{oc}$, V_t or U_o
   I_{max} or $Ii \geq I_{sc}$, I_t or I_o
   P_{max} or $P_i \geq P_o$
8. An approved dust-tight seal is required for Class II and III applications.

⚠ WARNING

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

Canadian Standards Association (CSA) Intrinsically Safe / Securite Intrinseque

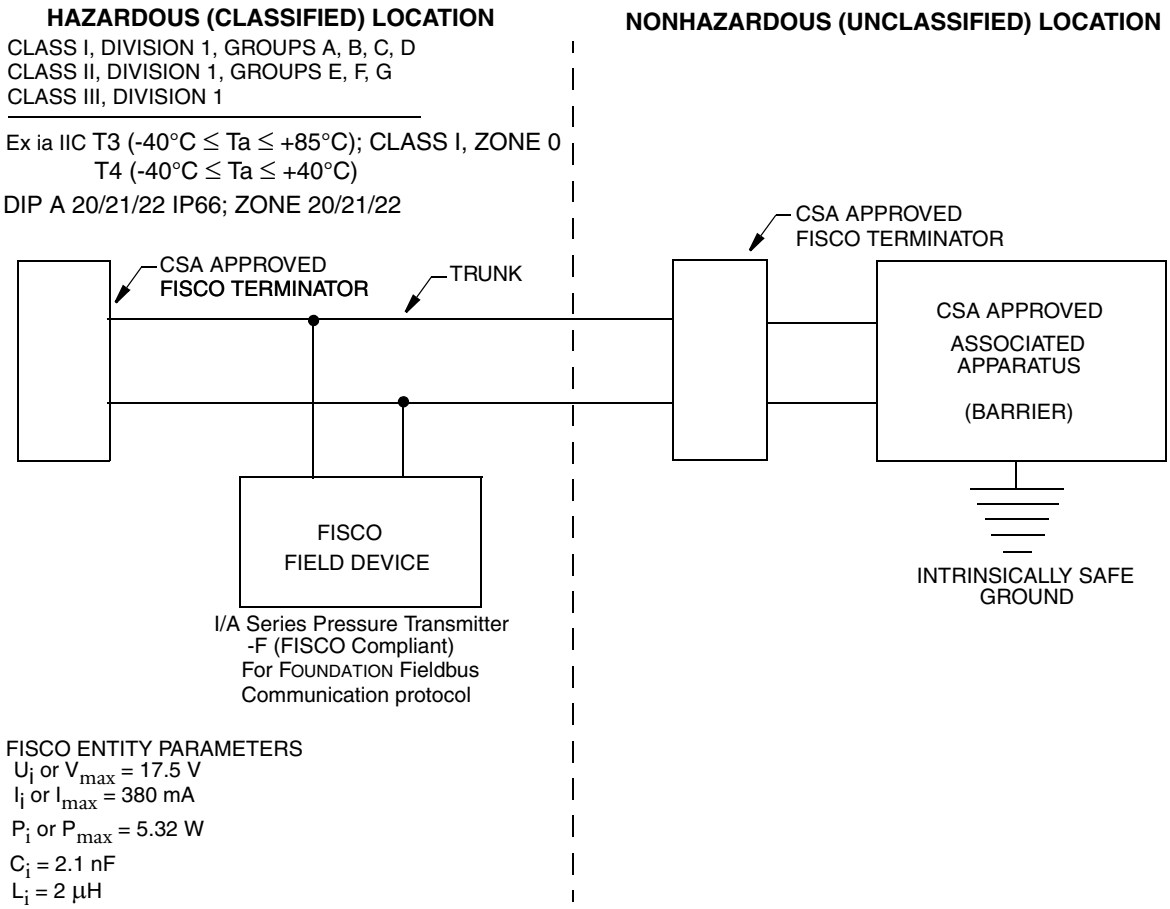


Figure 17. Loop Diagram for FISCO Compliant Transmitters

NOTE

1. No revision to drawing without prior CSA approval.
2. Associated apparatus manufacturer's installation drawings must be followed when installing this equipment.
3. The FISCO Associated Apparatus must be CSA approved.
4. Resistance between FISCO Intrinsically Safe ground and earth ground must be less than 1.0 ohm.

5. The FISCO Concept allows the interconnection of Fieldbus intrinsically safe apparatus with FISCO associated apparatus when the following is true:
   V_{max} or $U_i \geq V_{oc}$, or U_o
   I_{max} or $Ii \geq I_{sc}$, or I_o
   P_{max} or $P_i \geq P_o$
   $C_i \leq C_o$
   $L_i \leq L_o$
6. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
7. Maximum nonhazardous area voltage must not exceed 250 V.
8. Install in accordance with Canadian Electrical Code, Part 1.
9. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

Substitutions of components may impair intrinsic safety.

AVERTISSEMENT:

La substitution de composantes peut compromettre la securite intrinseque.

Foundation™ Fieldbus Communication Protocol FNICO

If your I/A Series pressure transmitter with FOUNDATION™ Fieldbus communication protocol is classified as intrinsically safe Fieldbus Non-Incendive COncept (FNICO) compliant connect per the following control diagrams for the appropriate agency.

The **F**ieldbus **Non-Incendive CO**ncept (FNICO) allows the interconnection of nonincendive apparatus to associated apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (V_{max}), the current (I_{max}), which nonincendive apparatus can receive and remain safe, must be equal to or greater than the voltage (U_o, V_{oc}, V_t), the current (Io, I_{sc}, I_t), which can be provided by the associated apparatus (supply unit). In addition, the maximum unprotected residual capacitance (C_i) and inductance (L_i) of each apparatus (other than the terminators) connected to the Fieldbus must be less than or equal to 5 nF and 20 µH respectively.

In each nonincendive fieldbus segment only one active source, normally the associated apparatus is allowed to provide the necessary power for the fieldbus system. The allowed voltage (U_o, V_{oc}, V_t) of the associated apparatus used to supply the bus must be limited to the range of 14 to 17.5 V dc. All other equipment connected to the bus cable has to be passive, meaning that the apparatus is not allowed to provide energy to the system, except for a leakage current not greater than 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to insure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices shall comply with the following parameters:

- Loop resistance R': 15 ...150 Ω/km
- Inductance per unit length L': 0.4…1 mH/km
- Capacitance per unit length C': 80 ...200 nF/km
- C' = C' line/line + 0.5 C' line/screen, if both lines are floating

  or

  C'= C' line/line + C' line/screen, if the screen is connected to one line
- Length of spur Cable: maximum 30 m
- Length of trunk cable: maximum 1 km
- Length of splice: maximum 1 m

At each end of the trunk cable an appropriate agency approved line terminator with the following parameters is suitable:

- Resistance R = 90 to 100 Ω
- Capacitance C = 0 to 2.2 µF

Where a system comprises of one FNICO approved associated apparatus, with a cable complying to the specification listed above, any number of FNICO approved field devices up to 32 and two FNICO approved terminators, are allowed and they shall be considered to be adequately safe.

FM Approvals

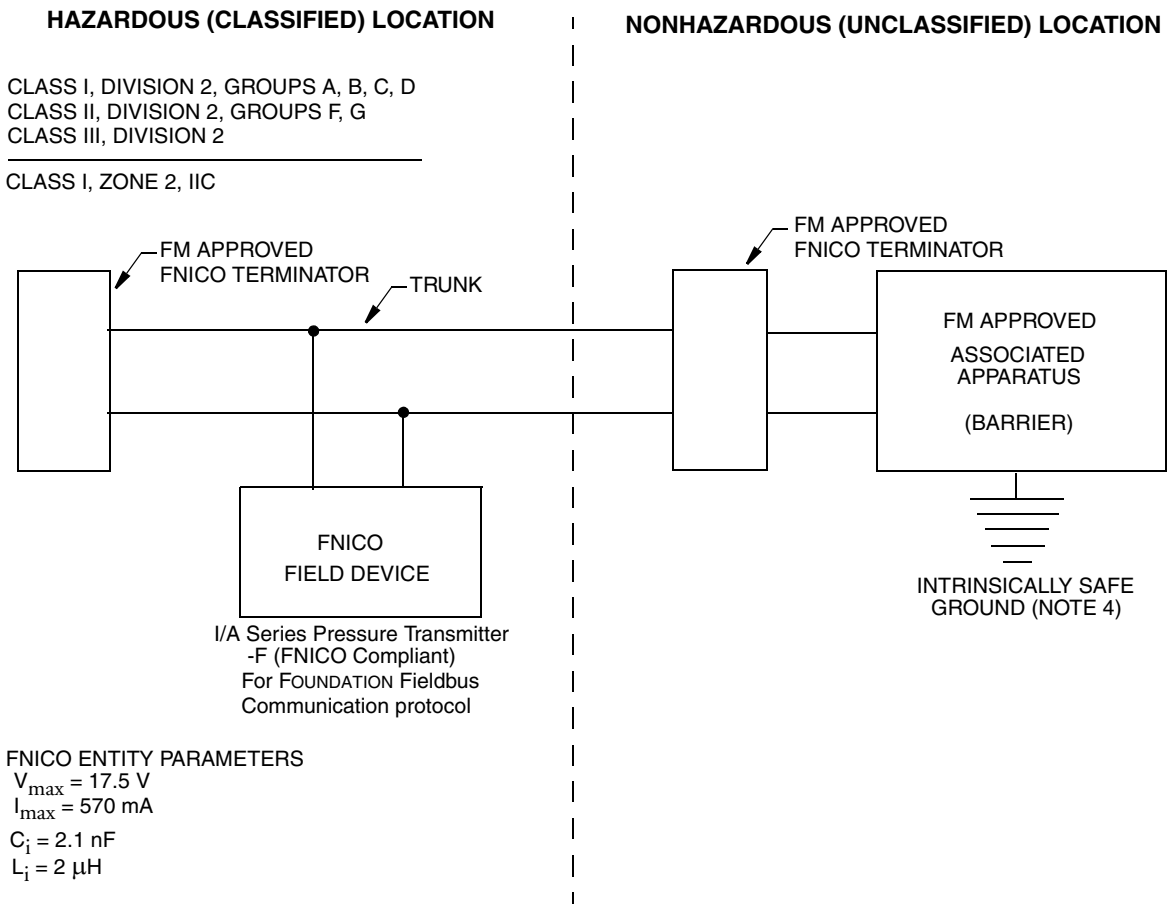


Figure 18. Loop Diagram for FNICO Compliant Transmitters

NOTE

1. No revision to drawing without prior FM approval.
2. Associated apparatus manufacturer's installation drawings must be followed when installing this equipment.
3. The FNICO Associated Apparatus must be FM approved.
4. Control equipment connected to FNICO barrier must not use or generate more than 250 V_{rms} or V dc.
5. Resistance between FNICO ground and earth ground must be less than 1.0 ohm.
6. 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).

7. The FNICO Concept allows the interconnection of fieldbus limited energy apparatus with FNICO associated apparatus when the following is true:
   V_{max} or $U_i \geq V_{oc}$, V_t or U_o
   I_{max} or $Ii \geq I_{sc}$, I_t or I_o
8. An approved dust-tight seal is required for Class II and III applications.

⚠ WARNING

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

Canadian Standards Association (CSA)

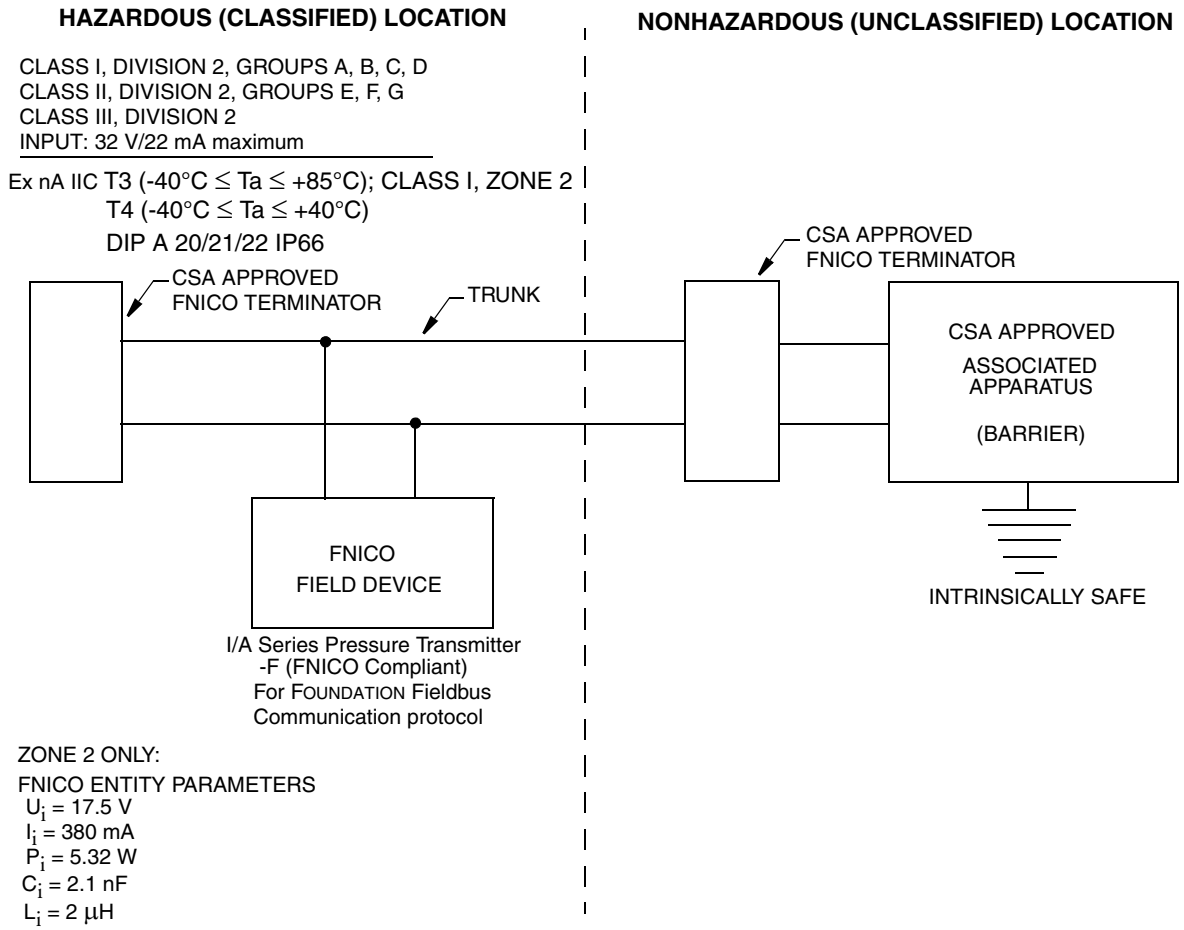


Figure 19. Loop Diagram for FNICO Compliant Transmitters

NOTE

1. No revision to drawing without prior CSA approval.
2. Associated apparatus manufacturer's installation drawings must be followed when installing this equipment.

3. The FNICO Associated Apparatus must be CSA approved.
4. Resistance between FNICO ground and earth ground must be less than 1.0 ohm.
5. The FNICO Concept allows the interconnection of fieldbus limited energy apparatus with FNICO associated apparatus when the following is true:
   $U_i \geq U_o$
   $Ii \geq I_o$
   $Ci \geq C_o$
   $Li \geq L_o$
6. Barriers must be CSA certified and must be installed in accordance with manufacturer's instructions.
7. Maximum nonhazardous area voltage must not exceed 250 V.
8. Install in accordance with Canadian Electrical Code, Part 1.
9. Metallic conduit is required between the transmitter and the RTD.

⚠ WARNING

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AVERTISSEMENT:

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