

RTT15
I/A Series[®] Temperature Transmitter
Intrinsic Safety Connection Diagrams

FM/CSA Installation for Models RTT15-H, -T

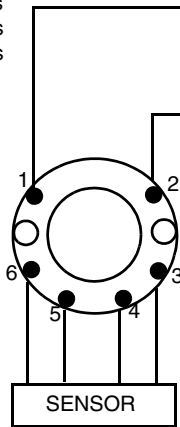
Hazardous (Classified) Location

Class I, Division 1, Groups A, B, C, D or
 Class I, Zone 0, AEx ia IIC
 Class II, Division 1, Groups E, F, G or
 (only for model code selections RTT15-**L, M, S, and T)

Ambient temperature limits
 T4: -40 to +85 deg. Celsius
 T6: -40 to +60 deg. Celsius

Terminal 1, 2
 V_{max} or U_i : 28 V
 I_{max} or I_i : 120 mA
 P_{max} or P_i : 0.84W
 C_i : 1 nF
 L_i : 10 μ H

Terminal 3,4,5,6
 V_t or U_o : 9.6 V
 I_t or I_o : 28 mA
 P_t or P_o : 67.2 mW
 C_a or C_o : 3.5 μ F
 L_a or L_o : 35 mH



Non Hazardous (Unclassified) Location

Associated Apparatus
 or Barrier
 with
 Entity Parameters:

$UM \leq 250$ V
 V_{oc} or $U_o \leq V_{max}$ or U_i
 I_{sc} or $I_o \leq I_{max}$ or I_i
 $P_o \leq P_i$
 C_a or $C_o \geq C_i + C_{cable}$
 L_a or $L_o \geq L_i + L_{cable}$

This device must not be
 connected to any associated
 apparatus which uses or
 generates more than 250 V_{rms}

The Transmitter must be installed according to National Electrical Code (ANSI-NFPA 70). When installed in Class II locations, the Transmitter shall be installed in an enclosure with a specified ingress protection of IP6X according to IEC60529 and dust-tight conduit seals must be used.

Equipment that is FM-approved for intrinsic safety may be connected to barriers based on the ENTITY CONCEPT. This concept permits interconnection of approved transmitters, meters and other devices in combinations which have not been specifically examined by FM, provided that the agency's criteria are met. The combination is then intrinsically safe, if the entity concept is acceptable to the authority having jurisdiction over the installation.

The entity concept criteria are as follows:

- ◆ The intrinsically safe devices, other than barriers, must not be a source of power.
- ◆ The maximum voltage U_i (V_{max}) and current I_i (I_{max}), and maximum power P_i (P_{max}), which the device can receive and remain intrinsically safe, must be equal to or greater than the voltage (U_o or V_{oc} or V_t) and current (I_o or I_{sc} or I_t) and the power P_o which can be delivered by the barrier.
- ◆ The sum of the maximum unprotected capacitance (C_i) for each intrinsically safe device and the interconnecting wiring must be less than the capacitance (C_a) which can be safely connected to the barrier.
- ◆ The sum of the maximum unprotected inductance (L_i) for each intrinsically safe device and the interconnecting wiring must be less than the inductance (L_a) which can be safely connected to the barrier.
- ◆ The entity parameters U_o , V_{oc} , or V_t and I_o , I_{sc} or I_t , and C_a and L_a for barriers are provided by the barrier manufacturer.

FM Installation for RTT15-H, -T with L1 Display

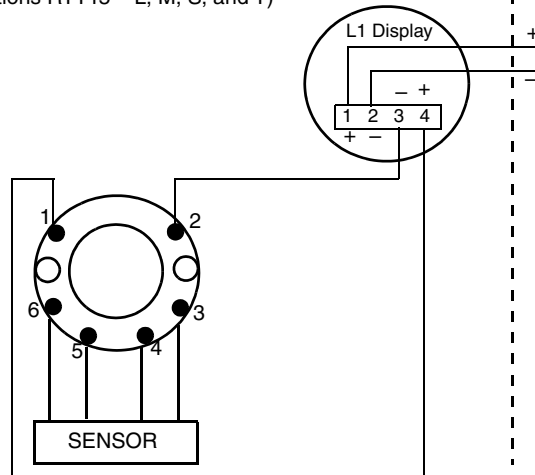
Hazardous (Classified) Location

Class I, Division 1, Groups A, B, C, D or
 Class I, Zone 0, AEx ia IIC
 Class II, Division 1, Groups E, F, G or
 (only for model code selections RTT15-**L, M, S, and T)

Ambient temperature limits
 T4: -40 to +85 deg. Celsius
 T5: -40 to +60 deg. Celsius

Terminal 1, 2 (Display)
 V_{max} or U_i : 28 V
 I_{max} or I_i : 120 mA
 P_{max} or P_i : 0.84W
 C_i : 2 nF
 L_i : 10 μ H

Terminal 3,4,5,6
 (RTT15-H, -T)
 V_t or U_o : 9.6 V
 I_t or I_o : 28 mA
 P_t or P_o : 67.2 mW
 C_a or C_o : 3.5 μ F
 L_a or L_o : 35 mH



Non Hazardous (Unclassified) Location

Associated Apparatus or Barrier with Entity Parameters with Linear Characteristics

$UM \leq 250$ V

V_{oc} or $U_o \leq V_{max}$ or U_i

I_{sc} or $I_o \leq I_{max}$ or I_i

$P_o \leq P_i$

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

L_a or $L_o \geq L_i + L_{cable}$

This device must not be connected to any associated apparatus which uses or generates more than 250 V_{rms}

Installation must be in accordance with ANSI/ISA-RP12.06.01 “Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instruments Part 1: Intrinsic Safety” and the National Electrical Code (ANSI-NFPA 70). When installed in Class II locations, the Transmitter shall be installed in an enclosure with a specified ingress protection of IP6X according to IEC60529 and dust-tight conduit seals must be used.

Equipment that is FM-approved for intrinsic safety may be connected to FM approved barriers based on the ENTITY CONCEPT. This concept permits interconnection of approved transmitters, meters and other devices in combinations which have not been specifically examined by FM, provided that the agency's criteria are met. The combination is then intrinsically safe, if the entity concept is acceptable to the authority having jurisdiction over the installation.

The entity concept criteria are as follows:

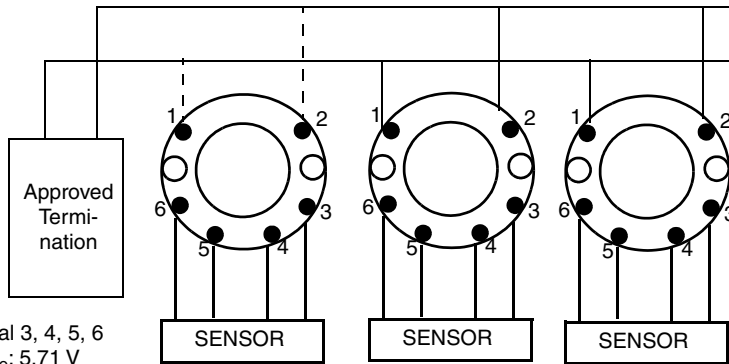
- ◆ The intrinsically safe devices, other than barriers, must not be a source of power.
- ◆ The maximum voltage U_i (V_{max}) and current I_i (I_{max}), and maximum power P_i (P_{max}), which the device can receive and remain intrinsically safe, must be equal to or greater than the voltage (U_o or V_{oc} or V_t) and current (I_o or I_{sc} or I_t) and the power P_o which can be delivered by the barrier.
- ◆ The sum of the maximum unprotected capacitance (C_i) for each intrinsically safe device and the interconnecting wiring must be less than the capacitance (C_a) which can be safely connected to the barrier.
- ◆ The sum of the maximum unprotected inductance (L_i) for each intrinsically safe device and the interconnecting wiring must be less than the inductance (L_a) which can be safely connected to the barrier.
- ◆ The entity parameters U_o , V_{oc} , or V_t and I_o , I_{sc} or I_t , and C_a and L_a for barriers are provided by the barrier manufacturer.

FM/CSA Installation for Models RTT15-F, -P

Hazardous (Classified) Location

Class I, Division 1, Groups A, B, C, D or
 Class I, Zone 0, AEx ia IIC
 Class II, Division 1, Groups E, F, G or
 (only for model code selections RTT15-**L, M, S, and T)

Non Hazardous (Unclassified) Location



Terminal 3, 4, 5, 6
 V_i or U_o : 5.71 V
 I_i or I_o : 8.4 mA
 P_i or P_o : 12 mW
 C_a or C_o : 40 μ F
 L_a or L_o : 200 mH

Associated Apparatus
 Barrier
 with
 Entity Parameters:

$UM \leq 250$ V
 V_{oc} or $U_o \leq V_{max}$ or U_i
 I_{sc} or $I_o \leq I_{max}$ or I_i
 $P_o \leq P_i$
 C_a or $C_o \geq C_i + C_{cable}$
 L_a or $L_o \geq L_i + L_{cable}$

This device must not be
 connected to any
 associated apparatus
 which uses or generates
 more than 250 V_{rms}

Entity Parameters

Terminal 1,2				
Class I, Zone 0, AEx ia IIC, Entity/FISCO				
IS, Class I, Division 1, Group A, B, C, D Class II, Division 1, Group E, F, G Entity/FISCO				
Barrier Type:	Linear Barrier	Trapezoid Barrier	Suitable for FISCO Systems	Suitable for FISCO Systems
T1..T4:	$T_a \leq +85^\circ\text{C}$	$T_a \leq +75^\circ\text{C}$	$T_a \leq +85^\circ\text{C}$	$T_a \leq +85^\circ\text{C}$
T5:	$T_a \leq +70^\circ\text{C}$	$T_a \leq +65^\circ\text{C}$	$T_a \leq +60^\circ\text{C}$	$T_a \leq +60^\circ\text{C}$
T6:	$T_a \leq +60^\circ\text{C}$	$T_a \leq +45^\circ\text{C}$	$T_a \leq +45^\circ\text{C}$	$T_a \leq +45^\circ\text{C}$
V_{max} or U_i	30 V	30 V	17.5 V	15 V
I_{max} or I_i	120 mA	300 mA	250 mA	any
P_i	0.84 W	1.3 W	2.0 W	any
C_i	2.0 nF	2.0 nF	2.0 nF	2.0 nF
L_i	1 μ H	1 μ H	1 μ H	1 μ H

See Installation Notes.

FM/CSA Installation for Models RTT15-F, -P

Hazardous (Classified) Location

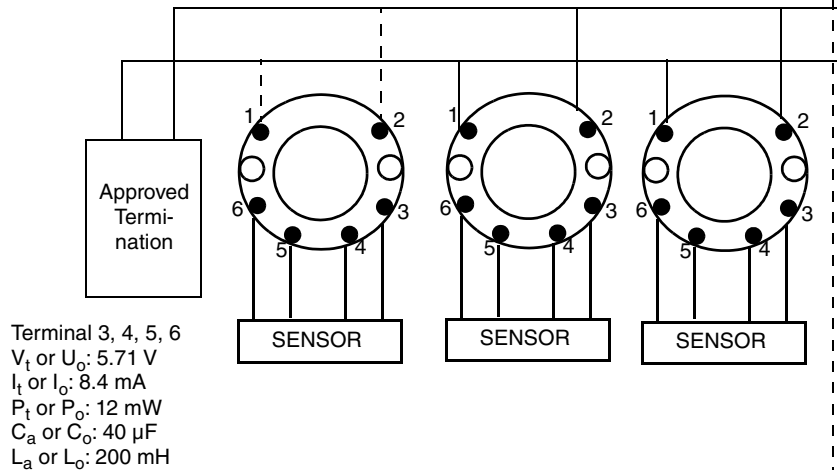
Class I, Division 2, Groups A, B, C, D
or
Class I, Zone 1, AEx ib IIC

Non Hazardous (Unclassified) Location

Associated Apparatus
Barrier
with
Entity Parameters:

$UM \leq 250 \text{ V}$
 $V_{oc} \text{ or } U_o \leq V_{max} \text{ or } U_i$
 $I_{sc} \text{ or } I_o \leq I_{max} \text{ or } I_i$
 $P_o \leq P_i$
 $C_a \text{ or } C_o \geq C_i + C_{cable}$
 $L_a \text{ or } L_o \geq L_i + L_{cable}$
 or
 FISCO Supply

This device must not be connected to any associated apparatus which uses or generates more than 250 V_{rms}



Terminal 3, 4, 5, 6
 $V_t \text{ or } U_o: 5.71 \text{ V}$
 $I_t \text{ or } I_o: 8.4 \text{ mA}$
 $P_t \text{ or } P_o: 12 \text{ mW}$
 $C_a \text{ or } C_o: 40 \mu\text{F}$
 $L_a \text{ or } L_o: 200 \text{ mH}$

Entity Parameters

Terminal 1,2		
Class I, Zone 1, AEx ib IIC Entity/FISCO		
IS, Class I, Division 2, Group A, B, C, D Entity/FISCO		
Barrier Type:	Rectangular Barrier	FISCO Segment Coupler
T1..T4:	$T_a \leq +85^\circ\text{C}$	$T_a \leq +85^\circ\text{C}$
T5:	$T_a \leq +75^\circ\text{C}$	$T_a \leq +75^\circ\text{C}$
T6:	$T_a \leq +60^\circ\text{C}$	$T_a \leq +60^\circ\text{C}$
$V_{max} \text{ or } U_i$	30 V	17.5 V
$I_{max} \text{ or } I_i$	250 mA	any
P_i	5.32 W	any
C_i	2.0 nF	2.0 nF
L_i	1 μH	1 μH

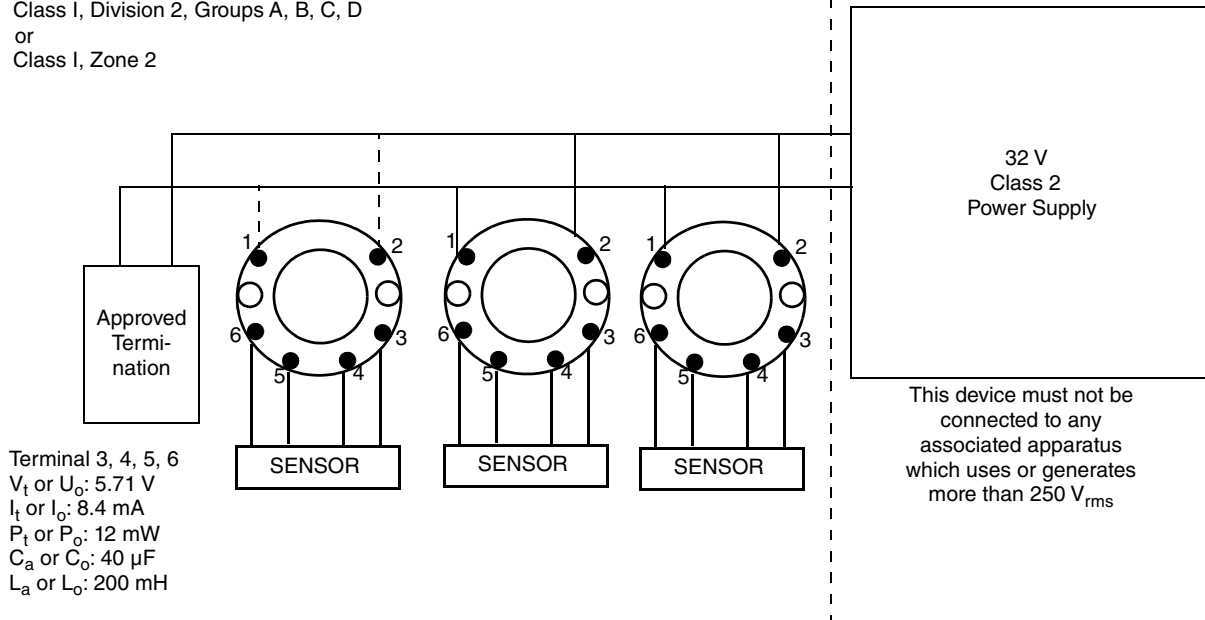
See Installation Notes.

FM/CSA Installation for Models RTT15-F, -P

Hazardous (Classified) Location

Class I, Division 2, Groups A, B, C, D
or
Class I, Zone 2

Non Hazardous (Unclassified) Location



T1..T4:	$-40^{\circ}\text{C} \leq T_a \leq +85^{\circ}\text{C}$
T5:	$-40^{\circ}\text{C} \leq T_a \leq +75^{\circ}\text{C}$
T6:	$-40^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$

See Installation Notes.

Installation Notes for RTT15-F and RTT15-P

FM/CSA

For installation in the US, the RTT15-F, -P must be installed according to National Electrical Code (ANSI-NFPA 70). When installed in Class II locations, the Transmitter RTT15-F, -P shall be installed in an enclosure with a specified ingress protection of IP6X according to IEC60529 or 250 Type 4, 4X, 6 or 6P.

For installation in Canada, the transmitter must be installed in a suitable enclosure to meet installation codes stipulated in the Canadian Electrical Code (CEC).

The Entity Concept

Equipment that is FM/CSA-approved for intrinsic safety may be connected to barriers based on the ENTITY CONCEPT. This concept permits interconnection of approved transmitters, meters, and other devices in combinations which have not been specifically examined by FM/CSA, provided that the agency's criteria are met. The combination is intrinsically safe if the entity concept is acceptable to the authority having jurisdiction over the installation.

The entity concept criteria are as follows:

- ◆ The intrinsically safe devices, other than barriers, must not be a source of power.
- ◆ The maximum voltage U_i (V_{max}) and current I_i (I_{max}), and maximum power P_i (P_{max}), which the device can receive and remain intrinsically safe, must be equal to or greater than the voltage (U_o or V_{oc} or V_t) and current (I_o or I_{sc} or I_t) and the power P_o which can be delivered by the barrier.
- ◆ The sum of the maximum unprotected capacitance (C_i) for each intrinsically safe device and the interconnecting wiring must be less than the capacitance (C_a) which can be safely connected to the barrier.
- ◆ The sum of the maximum unprotected inductance (L_i) for each intrinsically safe device and the interconnecting wiring must be less than the inductance (L_a) which can be safely connected to the barrier.
- ◆ The entity parameters U_o , V_{oc} or V_t and I_o , I_{sc} or I_t and C_a and L_a for barriers are provided by the barrier manufacturer.

FISCO

The FISCO Concept 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_l), the current (I_o, I_{sc}, I_r) 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 μ H respectively.

In each I.S. 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_l) of the associated apparatus used to supply the bus must be limited to the range of 14 V dc to 24 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 to a leakage current of 50 μ A 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 needs to 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

$C' = C' \text{ line/line} + 0.5 C' \text{ line/screen}$, if both lines are floating

or

$C' = C' \text{ line/line} + C' \text{ line/screen}$, if the screen is connected to one line

Length of spur Cable: max. 30 m

Length of trunk cable: max. 1 km

Length of splice: max. 1 m

Terminators

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

$R = 90 \dots 100 \Omega$

$C = 0 \dots 2.2 \mu\text{F}$

System evaluation

The number of passive devices like transmitters, actuators, connected to a single bus segment is not limited due to I.S. reasons. Furthermore, if the above results are respected, the inductance and capacitance of the cable need not be considered and will not impair the intrinsic safety of the installation.

The sensor circuit is not infallibly galvanic isolated from the fieldbus input circuit. However, the galvanic isolation between the circuits is capable of withstanding a test voltage of 500 V ac during 1 minute.

Installation Notes for FISCO and Entity Concepts

1. For FM approvals, the associated apparatus must be FM approved. For CSA approvals, the associated apparatus must be CSA approved.
2. The Intrinsic Safety Entity concept allows the interconnection of FM/CSA approved intrinsically safe devices (Div. 1 or Zone 0 or Zone 1) and nonincendive apparatus (Div. 2 or Zone 2), with entity parameters not specifically examined in combination as a system when: U_o or V_{oc} or $V_t \leq V_{max}$, I_o or I_{sc} or $I_t \leq I_{max}$, $P_o \leq P_i$.
 C_a or $C_o \geq \Sigma C_i + \Sigma C_{cable}$, L_a or $L_o \geq \Sigma L_i + \Sigma L_{cable}$, $P_o \leq P_i$.
3. The Intrinsic Safety FISCO concept allows the interconnection of FM/CSA approved intrinsically safe devices with FISCO parameters not specifically examined in combination as a system when:
 U_o or V_{oc} or $V_t \leq V_{max}$, I_o or I_{sc} or $I_t \leq I_{max}$, $P_o \leq P_i$.
4. Dust-tight conduit seals must be used when installed in Class II and Class III environments.
5. Control equipment connected to the Associated Apparatus must not use or generate more than 250 V_{rms} or V_{dc} .
6. Installation should be in accordance with ANSI/ISA RP12.6 (except Chapter 5 for FISCO Installations) “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations” and the National Electrical Code[®] (ANSI/NFPA 70) Sections 504 and 505.
7. The configuration of associated Apparatus must be Factory Mutual Research or CSA approved under the associated concept.
8. Associated Apparatus manufacturer’s installation drawing must be followed when installing this equipment.
9. The (Product Name) Series are approved for Class I, Zone 0, applications. If connecting AEx[ib] associated Apparatus or AEx ib I.S. Apparatus to the (Product Name) Series the I.S. circuit is only suitable for Class I, Zone 1, or Class I, Zone 2, and is not suitable for Class I, Zone 0 or Class I, Division 1, Hazardous (Classified) Locations.
10. No revision to drawing without prior FM/CSA approval.
11. Simple Apparatus is defined as a device that neither generates nor stores more than 1.5 V, 100 mA, or 25 mW.
12. The termination must be NRTL approved, and the resistor must be infallible.
13. Resistance between intrinsically safe ground and earth ground must be less than 1.0 ohm.

WARNING

For applications in Div. 2 or Zone 2 (Classified Locations) Explosion hazard: Except for field circuits, do not disconnect the apparatus unless the area is known to be nonhazardous.

⚠ WARNING

Substitution of components may impair safety.

⚠ WARNING

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

ATEX

The sensor circuit is not infallibly galvanically isolated from the fieldbus input circuit. However, the galvanic isolation between the circuits is capable of withstanding a test voltage of 500 V ac during 1 minute.

The transmitter must be mounted in an enclosure in order to provide a degree of ingress protection of at least IP 20. If the transmitter is installed in a potentially explosive atmosphere where equipment category 1 G is required and if the enclosure in which the transmitter is mounted is made of aluminum, then the requirements of EN 50284, clause 4.3.1 must be taken into account.

The transmitter may only be installed in a potentially explosive atmosphere caused by the presence of combustible dust when mounted in a metal enclosure form B according to DIN43729 that is providing a degree ingress protection of at least IP 6X in accordance with EN 60529, that is suitable for the application and is correctly installed.

Cable entries and blanking elements shall be used that are suitable for the application and correctly installed.

For ambient temperature $\geq 60^{\circ}\text{C}$, heat resistant cables shall be used with a rating of at least 20 K above the ambient temperature.

For Zone 2 installation of EEx nA IIC without barrier, provisions must be made to the supply to prevent transients from exceeding 40% of V_{max} .

Production year of RTT15-F, -P can be taken from the first 2 digits of the serial number.

There are no user serviceable parts inside the transmitter.

ISSUE DATES

MAR 2004
JUN 2007
FEB 2014
FEB 2016

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



Invensys Systems, Inc.
38 Neponset Avenue
Foxboro, MA 02035
United States of America
<http://www.fielddevices.foxboro.com>

Global Customer Support
Inside U.S.: 1-866-746-6477
Outside U.S.: 1-508-549-2424
Website: <http://support.ips.invensys.com>

Copyright 2004-2016 Invensys Systems, Inc.
All rights reserved.

Invensys, Foxboro, and I/A Series are trademarks of
Invensys Limited, its subsidiaries, and affiliates. All other
trademarks are the property of their respective owners.

Invensys is now part of Schneider Electric.