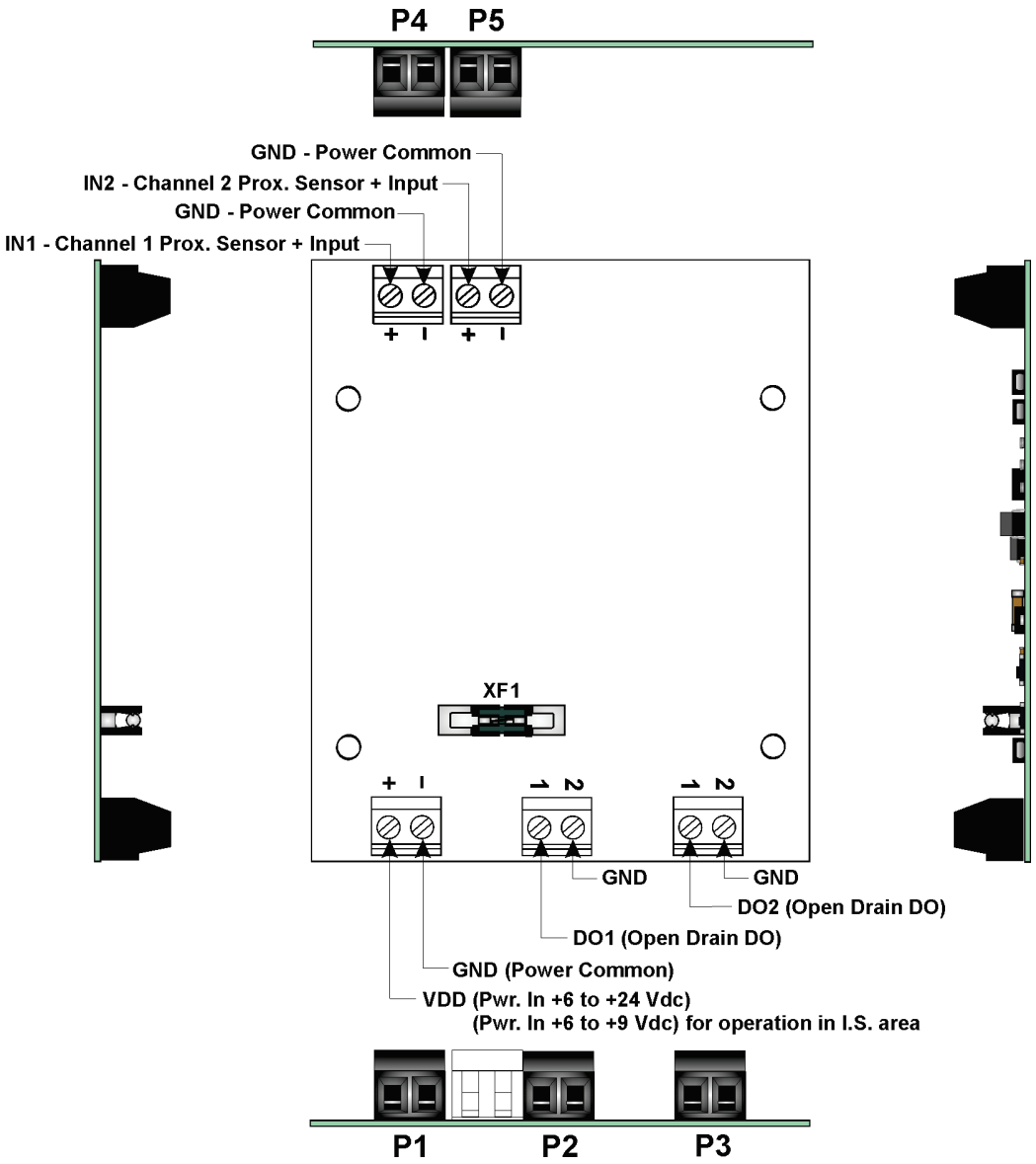
Part Number D301439X012
January 2016

ControlWave Intrinsically Safe Proximity Sensor INTF. Board (for ControlWave EFM/GFC/GFC Correctors)



Remote Automation Solutions

EMERSON
Process Management

Revision Tracking Sheet

January 2016

This manual may be revised periodically to incorporate new or updated information. The revision date of each page appears at the bottom of the page opposite the page number. A change in revision date to any page also changes the date of the manual that appears on the front cover. Listed below is the revision date of each page (if applicable):

Page	Revision
All pages	January-2016
All pages	July-2007
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Chapter 1 – Overview

1.1 Introduction

Remote Automation Solution's ControlWave Series Intrinsically Safe Proximity Sensor Interface board (or the "ISProx board") provides an intrinsically safe interface to one or two industry-standard variable impedance proximity sensors (see *Specifications & Entity Parameters*) (NAMUR Gap Sensors). The module also conditions and converts these signals to Open Drain outputs (DOs), which in turn drive ControlWave **EFM**/**GFC**/**Corrector** digital inputs (DIs) or counter inputs (HSCs). ISProx boards are snap-track mounted and are designed for installation and operation within an area requiring either Class I, Div. 2 (Groups A, B, C and D) or Class I, Div. 1 (Groups C & D) certified equipment.

ISProx boards provide the following features:

- ISProx boards are intrinsically safe (IS) and may be used as barrier between an IS device and a nonhazardous installation.
- Five (5) terminal blocks provide field device wiring flexibility and convenience:
  - Terminal block P1 accommodates 6 - 24 Vdc bulk input power input.
  - Terminal blocks P2 and P3 provide open drain outputs (DOs) (converted from the proximity sensor inputs) which are wired to ControlWave EFM/GFC/GFC Corrector digital inputs (DIs) or counter inputs (HSC).
  - Two Input Sensor terminal blocks (P4 & P5) provide an IS interface to two inductive proximity sensors (two-wire) (with entity parameters matching those of the ISProx).
- Snap-track mounting accommodated.
- Small size minimizes panel space requirements.

1.2 ISProx Component Identification

This section discusses components of the ISProx board with which you should be familiar. These components include terminal blocks P1 through P5 and fuse XF1.

- **Terminal Blocks**

  ISProx boards have five terminal blocks which accommodate up to #16 AWG size wire. *Tables 1-1* through *1-5* provide terminal block designation and connections.

Table 1-1. Bulk Input Power Connector P1

P1 PIN #	SIGNAL NAME	DESCRIPTION	NOTES
1	VDD	+6 to +24 Vdc bulk power	Bulk Input +6 to +9 (Vdc) for I.S.
2	GND	Power Common	PCB Common Ground

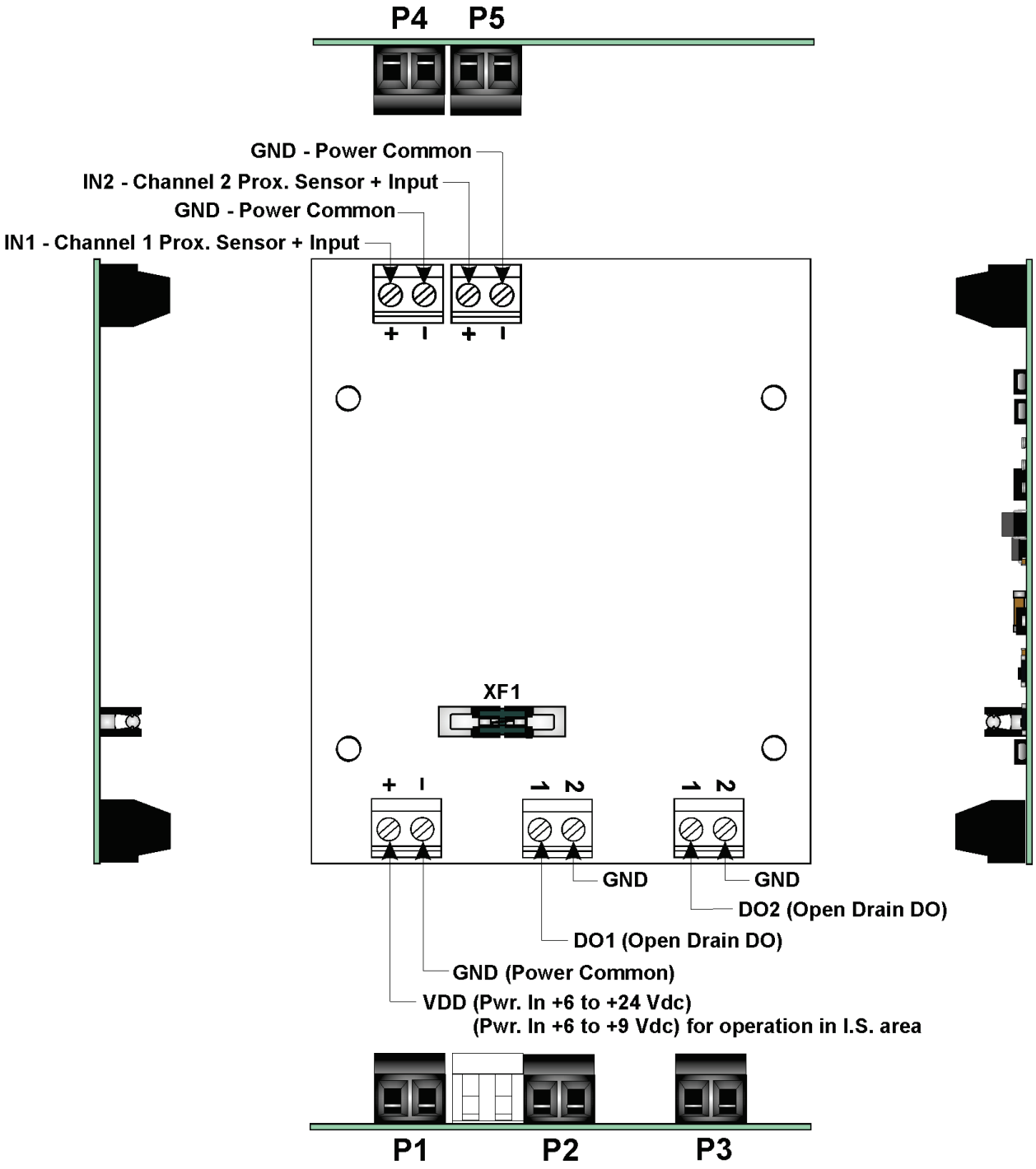

Figure 1-1. ControlWave ISProx Board Views & Component Identification Diagram

Table 1-2. Converted Prox. Signal Open Drain Digital Output Connector P2

P2 PIN #	SIGNAL NAME	DESCRIPTION	NOTES
1	DO1	Channel 1 Open Drain DO	Derived from Prox. Sensor 1
2	GND	Circuit Ground	

Table 1-3. Converted Prox. Signal Open Drain Digital Output Connector P3

P3 PIN #	SIGNAL NAME	DESCRIPTION	NOTES
1	DO2	Channel 2 Open Drain DO	Derived from Prox. Sensor 2
2	GND	Circuit Ground	

Table 1-4. Proximity Sensor Input Interface Connector P4

P4 PIN #	SIGNAL NAME	DESCRIPTION	NOTES
1	IN1	Channel 1 Prox. Sensor + Input	Input from Inductive Sensor #1
2	GND	Power Common	PCB Common Ground

Table 1-5. Proximity Sensor Input Interface Connector P5

P5 PIN #	SIGNAL NAME	DESCRIPTION	NOTES
1	IN2	Channel 2 Prox. Sensor + Input	Input from Inductive Sensor #2
2	GND	Power Common	PCB Common Ground

- **Fuse XF1**

  The XF1 fuse (0.125A fast blow 2 x 7 mm) provides protection for the ISProx and associated field I/O. If an abnormal condition occurs in the ISProx circuitry, the XF1 blows and all current stops flowing. The ISProx also protects against field wiring short circuits.

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Chapter 2 – Installation

This chapter explains how to install ISProx boards into the ControlWave.

2.1 ISProx Mounting

ISProx Boards are either snap-track mounted (on edge) to the fabrication panel within a ControlWave EFM/GFC Plus housing or panel-mounted and glued to the inside of a ControlWave Corrector Instrument front cover. *Figure 2-1* provides ISProx PCB dimensions and *Figure 2-2* shows a snap-track mounted unit.

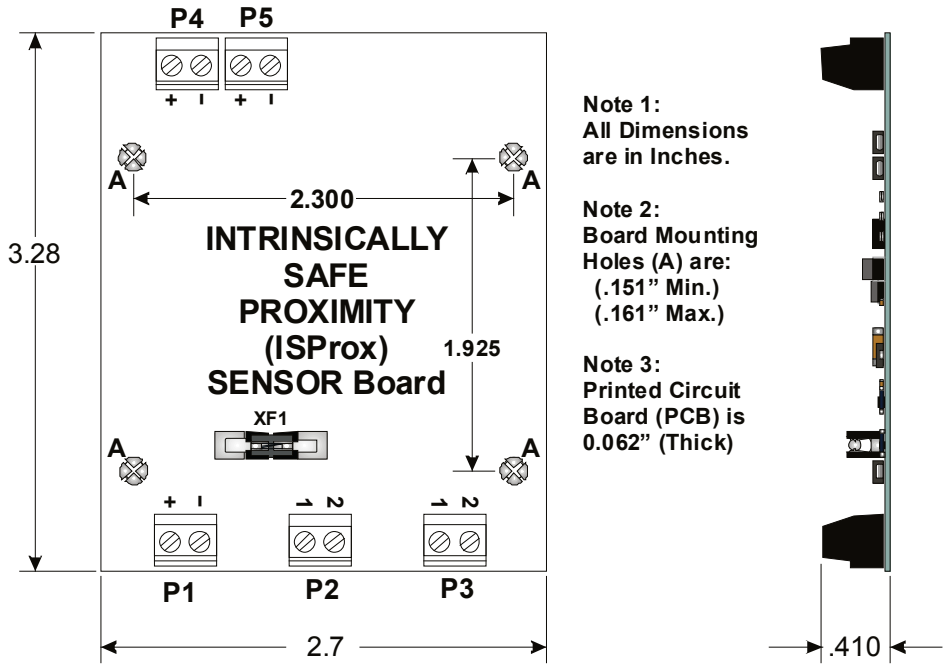


Figure 2-1. ControlWave ISProx Dimensions

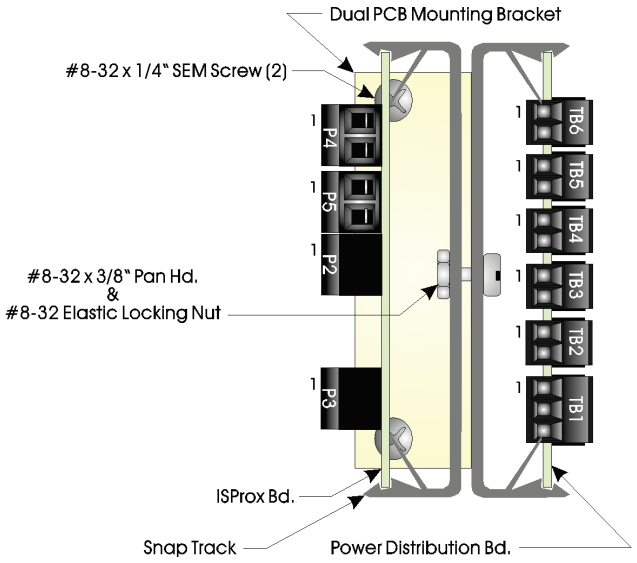


Figure 2-2. Example of Snap Track Mounted ISProx Board
(Shown mounted to the ControlWave EFM or GFC Plus Fabrication Panel)

2.2 ISProx Sensor Board Wiring

Terminal Blocks are equipped with compression-type terminals that accept a #16 AWG size wire. To make a connection, insert the wire's bared end (1/4" max.) into the clamp beneath the screw and then tighten the screw. ISProx terminal blocks function as follows:

- **P1**: Interface for ISProx PCB's bulk input power
  - P1-1 (VDD): +6 to +24 Vdc Bulk Power Input for Div. 2 Barrier Operation) (+6 to +9 Vdc for IS area)
  - P1-2 (GND): 6-24V Power Common/Return)
- **P2**:Interface for Open Drain DO #1 (Converted from Proximity Sensors)
  - P2-1 (DO1): Channel 1 Open Drain Digital Output
  - P2-2 (GND): Circuit Ground

Note: Use in conjunction with ground from P1-2, P4-2, or P5-2.

- **P3**: Interface for Open Drain DO #2 (Converted from Proximity Sensors)
  - P3-1 (DO2): Channel 2 Open Drain Digital Output
  - P3-2 (GND):Circuit Ground

Note: Use in conjunction with ground from P1-2, P4-2, or P5-2.

- **P4**: Interface for Input from Proximity Sensor #1
  - P4-1 (IN1): Input from Channel 1 Proximity Sensor
  - P4-2 (GND): Channel 1 Proximity Sensor Common Ground/Return

- **P5**: Interface for Input from Proximity Sensor #2
  - P5-1 (IN2): Input from Channel 2 Proximity Sensor
  - P5-2 (GND): Channel 2 Proximity Sensor Common Ground/Return

2.2.1 Field I/O Wiring

Figure 2-3 illustrates the two primary ISProx wirings.

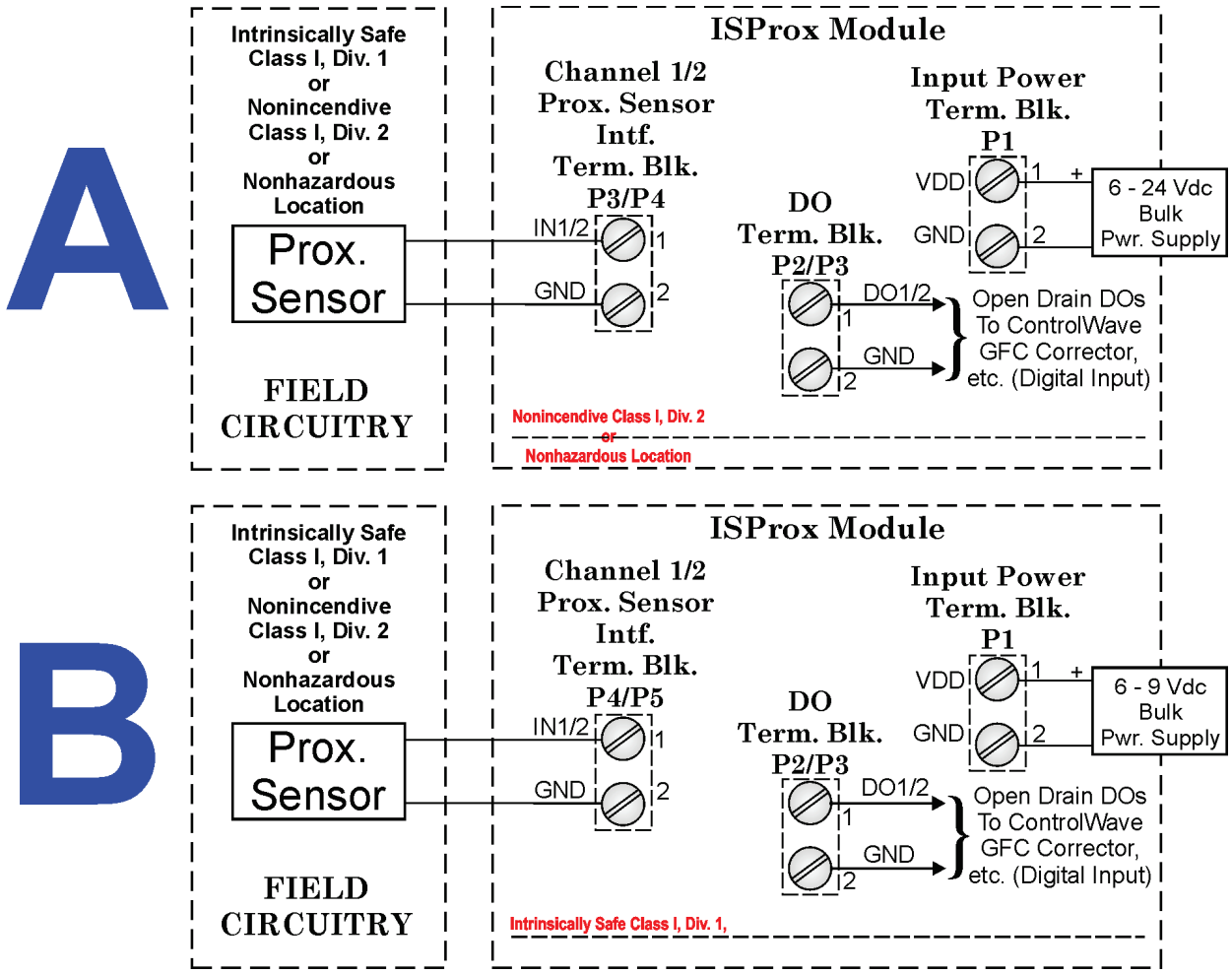


Figure 2-3. ISProx Wiring Diagram

ISProx wiring requirements depend on the following considerations:

- ISProx Site Environment
  - ISProx boards are suitable for installation where equipment must be certified for operation in either Nonincendive - Class I, Division 2 (Groups A, B, C & D) or Intrinsically Safe - Class I, Division 1 (Groups C & D) environments.
- Proximity Sensor Site Environment and ISProx Board Input
  - ISProx boards can be interfaced to inductive proximity sensors that match the ISProx Entity Parameters. These Proximity Sensors may be installed and operating in a non-hazardous

(unregulated) area or either Nonincendive - Class I, Division 2 (Groups A, B, C & D) or Intrinsically Safe - Class I, Division 1 (Groups C & D) environments.

- ISProx Board Output Interface
  - ISProx boards functionally interface the output of a proximity sensor to one or two ControlWave EFM/GFC/Corrector digital inputs (DIs) or counter inputs (HSC). ISProx functionally provides one of the following I/O interfaces:
    - Intrinsically Safe Barrier installation and interface (Class I, Div. 1) between a proximity sensor (in an Intrinsically Safe area) and DI/HSC associated with a ControlWave EFM/GFC/Corrector that is situated in either a Nonhazardous or Nonincendive (Class I, Div.2) environment (see Figure 2.3A).
    - Intrinsically Safe barrier interface between a proximity sensor (in an Intrinsically Safe area) and DI/HSC associated with a ControlWave EFM/GFC/Corrector that is situated in an Intrinsically Safe (Class I, Div. 1) environment (see Figure 2.3B).
    - Nonhazardous or Nonincendive (Class I, Div.2) installation and Nonincendive barrier interface between a proximity sensor (in a Nonhazardous or Nonincendive area) and DI/HSC associated with a ControlWave EFM/GFC/Corrector that is situated in either a Nonhazardous or Nonincendive (Class I, Div.2) environment (see Figure 2.3A).

Chapter 3 – Specifications

This chapter details the specifications for the ISProx board.

3.1 Operating Specifications

Function: In addition to being intrinsically safe, ISProx can serve as an intrinsically safe barrier between up to two IS devices and up to two ControlWave EFM/GFC/Corrector Digital Inputs (DIs) or Counter Inputs (HSCs) in a Div. 2 installation.

Power Requirements:

- **Div. II Applications**
  6Vdc to 24Vdc @ 3.5mA (average current) including prox. sensors
- **Div. I IS Applications**
  6Vdc to 9Vdc @ 3.5mA (average current) including proximity sensors

Fusing: Field Replaceable 0.125A Fast Blow (2 x 7 mm) Fuse

Surge Susceptibility: Field connected circuits are designed to meet the requirements of IEC 1000-4-5 Class 3 Environment for surge withstanding capability

Terminations: Fixed, maximum wire size is 16 gauge

3.2 Environmental Specifications

Temperature:

- **Operating Range:** -40° to +85°C (-40° to 185°F)
- **Storage Range:** -40°to +100°C (-40° to 212°F)

Relative Humidity: 15% to 95% (Non-condensing)

Vibration: 1g for 10-500 Hz on any axis per SAMA PMC-31-1 without damage or impairment.

RFI Susceptibility: 3V/meter – 150 kHz to 80 MHz

3.3 Connectors

Terminal Block P1:
For Division II installations, 2-Pin P1 terminal block accommodates input power from a bulk DC (+6 to +24V). For Division I installations, 2-pin P1 terminal block accommodates input power from a bulk DC (+6 V DC to +9V DC).

Terminal Blocks P2 & P3:
2-Pin P2 & P3 terminal blocks provide open drain digital outputs (DO1 & DO2) that are derived from the Proximity Sensor inputs (IN1 & IN2).

Terminal Block P4:
2-Pin P4 terminal block accommodates interfaces to the input from proximity sensor #1 (IN1).

Terminal Block P5:
2-Pin P5 terminal block accommodates interfaces to the input from proximity sensor #2 (IN2).

3.4 Part Numbers

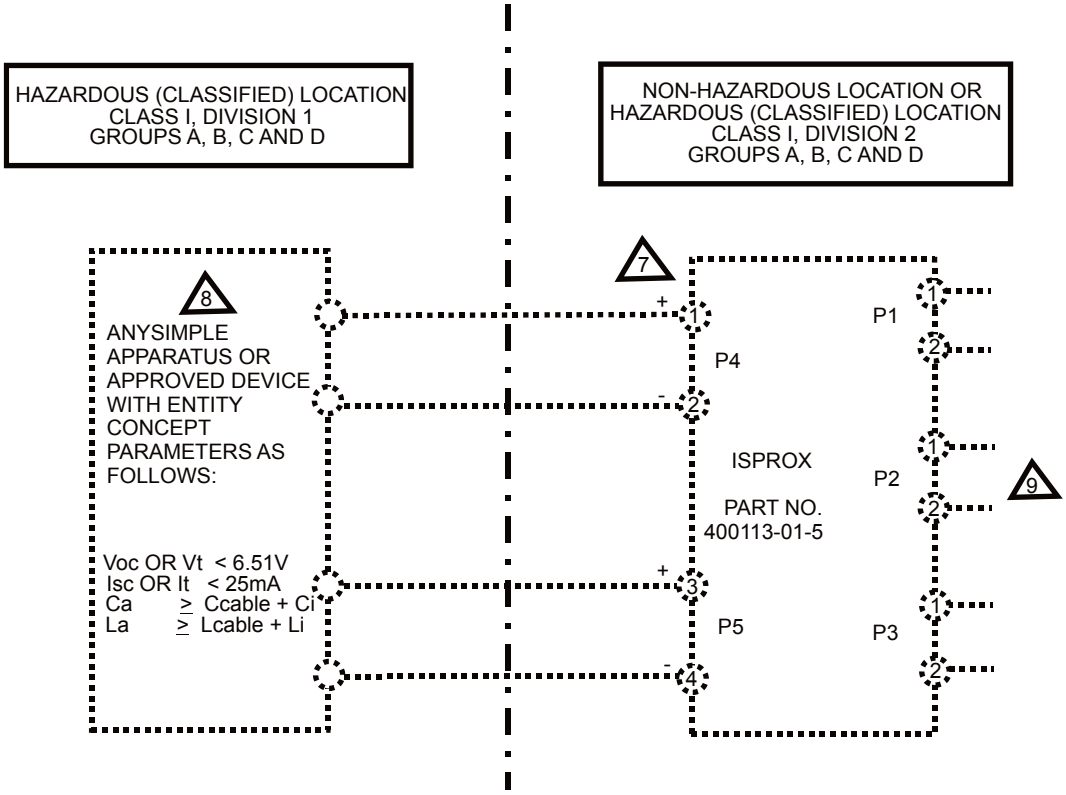
400113-01-5 ISProx Board

3.5 Dimensions

Dimensions are provided in *Figure 1-2*.

Appendix A – Control Drawings

Barrier Control



TERMINALS	LOAD PARAMETER			
	Voc (V)	Isc (mA)	Ca (μF) AB/C/D	La (mH) AB/C/D
P4	6.51	25	2/7/18	30/120/270
P5	6.51	25	2/7/18	30/120/270

NOTES:

1. WHERE MULTIPLE CIRCUITS EXTEND FROM THE SAME PIECE OF INTRINSICALLY SAFE EQUIPMENT, THEY MUST BE INSTALLED IN SEPARATE CABLES OR IN ONE CABLE HAVING SUITABLE INSULATION. REFER TO INSTRUMENTATION, SYSTEMS AND AUTOMATION SOCIETY (ISA) RECOMMENDED PRACTICE ISA RP12.6 FOR INSTALLING INTRINSICALLY SAFE EQUIPMENT.
2. BARRIERS MAY BE IN A DIVISION 2 OR ZONE 2 LOCATION IF SO APPROVED.
3. BARRIER OUTPUT CURRENT MUST BE LIMITED BY A RESISTOR SUCH THAT THE OUTPUT VOLTAGE – CURRENT PLOT IS A STRAIGHT LINE DRAWN BETWEEN OPEN CIRCUIT VOLTAGE AND SHORT CIRCUIT CURRENT.

4. SELECTED BARRIERS MUST BE THIRD PARTY APPROVED AS PROVIDING INTRINSICALLY SAFE CIRCUITS FOR THE APPLICATION, AND HAVE Voc or Vt NOT EXCEEDING Vmax or Uo NOT EXCEEDING Ui, Isc OR It NOT EXCEEDING Imax OR Io NOT EXCEEDING Ii, AND THE Po OF THE BARRIER MUST BE LESS THAN OR EQUAL TO THE Pmax OR Pi OF THE INTRINSICALLYSAFE EQUIPMENT, AS SHOWN IN TABLE 1.

5. CAPACITANCE AND INDUCTANCE OF THE FIELD WIRING FROM THE INTRINSICALLY SAFE EQUIPMENT TO THE BARRIER SHOULD BE CALCULATED AND SHOULD BE INCLUDED IN THE SYSTEM CALCULATIONS AS SHOWN IN TABLE 1. CABLE CAPACITANCE (Ccable) PLUS INTRINSICALLY SAFE EQUIPMENT CAPACITANCE (Ci) MUST BE LESS THAN THE MARKED CAPACITANCE (Ca OR Co) SHOWN ON ANY BARRIER USED. THE SAME APPLIES FOR THE INDUCTANCE (Lc, Li, AND La OR Lo RESPECTIVELY). WHERE THE CABLE CAPACITANCE AND INDUCTANCE PER FOOT ARE NOT KNOWN, THE FOLLOWING VALUES SHALL BE USED: Cc=60 pF/ft., Lc=0.2 µH/ft.

TABLE 1:

I.S. EQUIPMENT		BARRIER
V max	≥	Voc (OR Vt)
I max	≥	Isc (OR It)
P max	≥	Po
Ci + Ccable	≤	Ca
Li + Lcable	≤	La

IF Po OF THE BARRIER IS NOT KNOWN, IT MAY BE CALCULATED USING THE FORMULA: Po = (Voc * Isc) / 4 = (Uo – Io) / 4

6. BARRIERS MUST BE INSTALLED IN ACCORDANCE WITH BARRIER MANUFACTURER'S CONTROL DRAWING AND ARTICLE 504 OF THE NATIONAL ELECTRICAL CODE, ANSI/NFPA 70, FOR INSTALLATION IN THE UNITED STATES, OR SECTION 18 OF THE CANADIAN ELECTRICAL CODE FOR INSTALLATIONS IN CANADA.

7. INSTALLATION MUST BE IN ACCORDANCE WITH NEC (NFPA 70, ARTICLE 504) AND ANSI / ISA-RP12.6.

8. SIMPLE APPARATUS IS DEFINED AS A DEVICE THAT WILL NEITHER GENERATE NOR STORE MORE THAN 1.2V, 0.1A, 20uJ OR 25 mW.

9. BARRIERS SHALL NOT BE CONNECTED TO ANY DEVICE THAT USES OR GENERATES IN EXCESS OF 24 VDC UNLESS IT IS ADEQUATELY ISOLATED FROM THE BARRIER.

IS Control

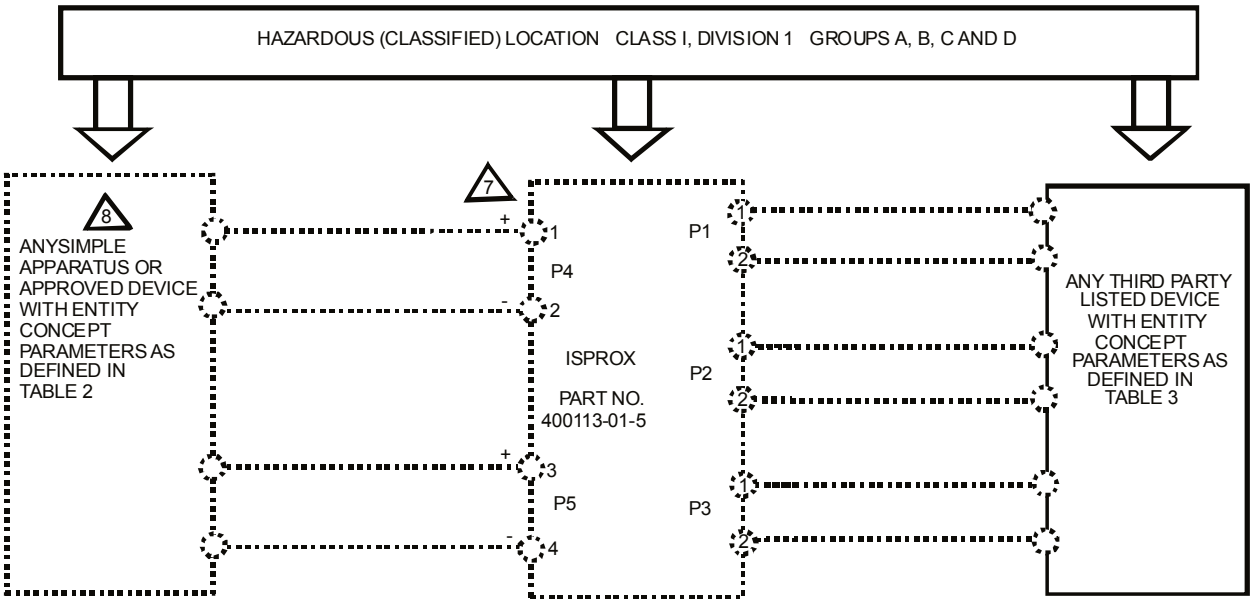


TABLE 2

TERMINALS	LOAD PARAMETER			
	Voc (V)	Isc (mA)	Ca (: F) AB/C/D	La (mH) AB/C/D
P4	6.51	25	2/7/18	30/120/270
P5	6.51	25	2/7/18	30/120/270

TABLE 3

TERMINALS	LOAD PARAMETER			
	Vmax (V)	Imax (mA)	Ci (: F)	Li (mH)
P1	8	125	1.63	0
P2	8	15	1.63	0
P3	8	15	1.63	0

NOTES:

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V max	≥	Voc (OR Vt)
I max	≥	Isc (OR It)
P max	≥	Po
Ci + Ccable	≤	Ca
Li + Lcable	≤	La

IF Po OF THE BARRIER IS NOT KNOWN, IT MAY BE CALCULATED USING THE FORMULA: Po = (Voc * Isc) / 4 = (Uo – Io) / 4

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For customer service and technical support,
visit www.emersonprocess.com/remote/support

Headquarters:
Emerson Process Management
Remote Automation Solutions
6005 Rogerdale Road
Houston, TX 77072 U.S.A.
T +1 281 879 2699 | F +1 281 988 4445
www.EmersonProcess.com/Remote

Europe:
Emerson Process Management
Remote Automation Solutions
Unit 8, Waterfront Business Park
Dudley Road, Brierley Hill
Dudley UK DY5 1LX
T +44 1384 487200 | F +44 1384 487258
www.EmersonProcess.com/Remote

North American/Latin America:
Emerson Process Management
Remote Automation Solutions
6005 Rogerdale Road
Houston TX USA 77072
T +1 281 879 2699 | F +1 281 988 4445
www.EmersonProcess.com/Remote

Middle East/Africa:
Emerson Process Management
Remote Automation Solutions
Emerson FZE
P.O. Box 17033
Jebel Ali Free Zone – South 2
Dubai U.A.E.
T +971 4 8118100 | F +971 4 8865465
www.EmersonProcess.com/Remote

Asia-Pacific:
Emerson Process Management
Remote Automation Solutions
1 Pandan Crescent
Singapore 128461
T +65 6777 8211| F +65 6777 0947
www.EmersonProcess.com/Remote