

I/A Series® Hardware

PSS 21H-2Z20 B4

FBM220/221 FOUNDATION™ fieldbus H1 Communication Interface Modules



FEATURES

Key features of the FBM220/221 modules are:

- ▶ Conforms to the FOUNDATION fieldbus specifications and supports all registered FOUNDATION fieldbus H1 field devices, allowing devices from various manufacturers to be used.
 - ▶ Provides support for all dynamic variables, which are used as connectable values in control strategies configured in the control station.
 - ▶ Upper-level application programs provide complete access to all variables in the field devices.
 - ▶ Integrate H1 device data into an I/A Series program format for consistent operator display of alarms, trends, and operator displays,
- independent of the protocol/communication bus used to bring them into the system.
 - ▶ Bus powering is a function of the type of field termination assembly. The typical non-intrinsic safety termination assembly contains power converters, which provide up to 300 mA of conditioned power to each H1 segment.
 - ▶ Provides a Link Active Scheduler (LAS) for each H1 segment.
 - ▶ The FBMs automatically detect and schedule all devices on the H1 segment, providing faster start-up and commissioning.
 - ▶ The FOUNDATION fieldbus segments conform to ANSI/ISA S-50, IEC 61158, and CENELEC EN 50170.

- ▶ The FBMs and termination assemblies are suitable for installation in Class1, Division 2 and Zone 2 locations.

OVERVIEW

The FOUNDATION fieldbus H1 Communication Interface Modules (FBM220/FBM221) provide an interface between FOUNDATION fieldbus field devices and the I/A Series system. FBM220 supports one H1 segment and FBM221 provides integration of four H1 channel isolated fieldbus segments.

The FOUNDATION fieldbus is a bi-directional, all digital communication bus designed for the integration of process measurement and control devices. The H1 bus is designed to be the digital alternative to the 4 to 20 mA standard. Using shielded twisted-pair wiring, field devices can be located up to 1900 m (6270 ft) from the FBM220/221 termination assembly.

FBM220/221 support the standard FOUNDATION fieldbus function blocks (AI, AO, DI, and DO), passing all block parameters to the I/A Series control station over the I/A Series high-speed redundant Ethernet fieldbus.

The H1 segments are isolated from the high-speed Ethernet fieldbus and from each other. Power is supplied to the field devices via the FBM termination assembly (TA).

As shown in Figure 1, the FBM220/221 communicate with the I/A Series control station via Fieldbus Communications Modules (FCMs) and the I/A Series Ethernet trunk fieldbus. (For additional information on this communication network, refer to the DIN Rail Mounted FBM Subsystem Overview PSS 21H-2W1 B3.) In addition to the configuration shown in Figure 1, several other approaches to field termination are possible, including those using intrinsic safety protective devices. Power to the H1 bus is always a function of the termination configuration.

INTELLIGENT FIELD DEVICE LINK MASTER

FBM220/221 acts as an intelligent field device link master, supporting the scheduling of devices on each of the H1 segments (one segment for FBM220, and four for FBM221). A publisher/subscriber relationship between the FBM220/221 and the H1 field devices guarantees that the communication in each segment will act in a deterministic fashion.

FBM220/221 receives digital messages from the field devices in engineering units. Analog inputs and outputs of connectable variables are collected and made available to the I/A Series system in IEEE 32-bit floating-point format. Security information (status of the AI and AO variables) is supplied, as is diagnostic information and message checking.

COMPACT, RUGGED DESIGN

FBM220/221 has a compact design, with a rugged extruded aluminum exterior for physical and electrical protection of the circuits. Enclosures specially designed for mounting of the FBMs provide various levels of environmental protection, up to harsh environments per ISA Standard S71.04.

The module can be removed/replaced without removing field device termination cabling, power, or communications cabling. It mounts on a baseplate, which accommodates up to eight FBMs. The baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for the FBMs, redundant independent dc power, and I/O cable connections.

Light-emitting diodes (LEDs) incorporated into the front of the module provide visual indication of the Fieldbus Module operational status, as well as the communication activity of the individual H1 segments.

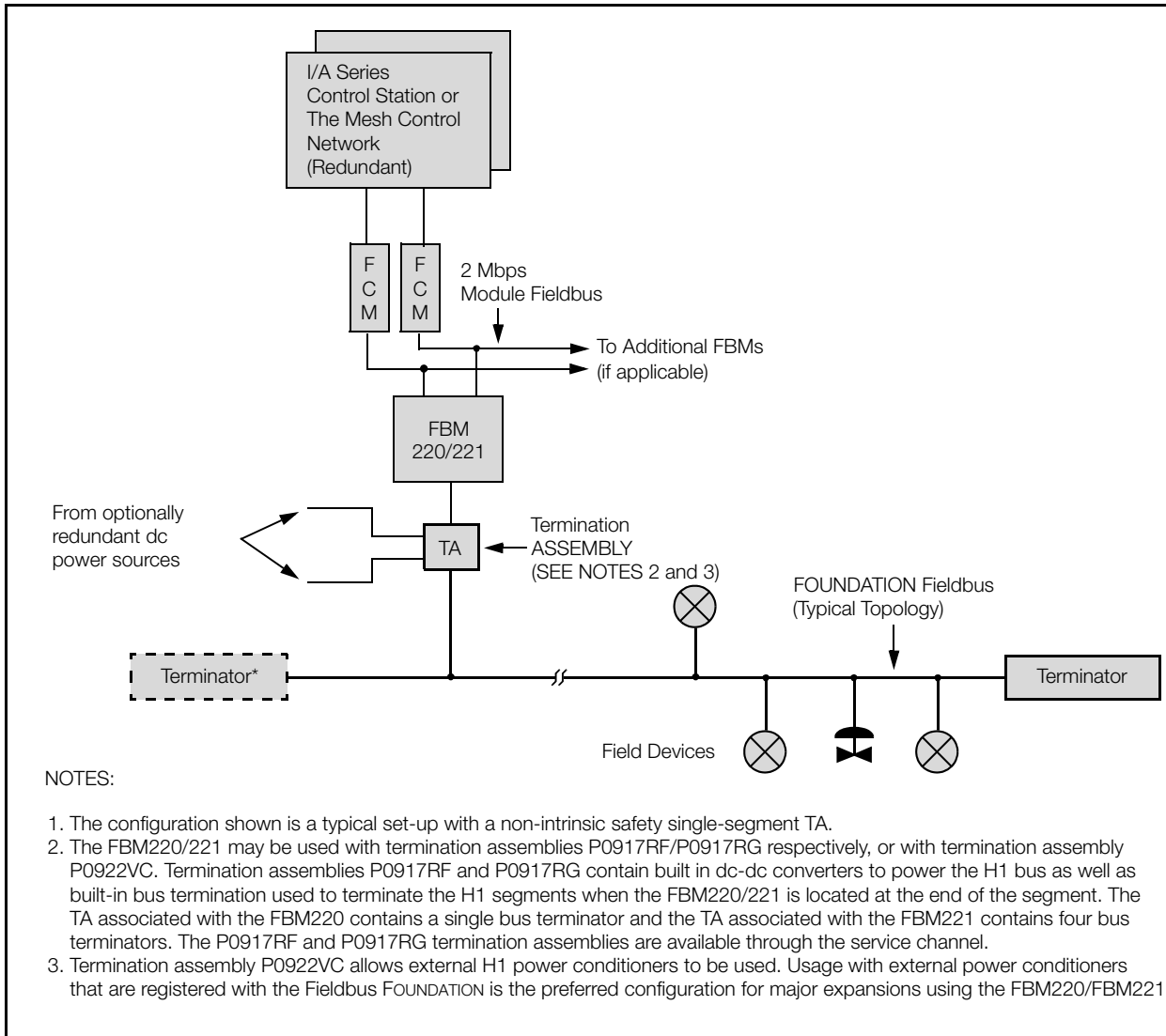


Figure 1. FBM220/221 used in a Typical Network Configuration

I/A SERIES FIELDBUS COMMUNICATION

Communication with the I/A Series control station is via an optionally redundant fieldbus. A Fieldbus Communication Module (FCM) or a Control Processor interfaces to the redundant 2 Mbps Module Fieldbus used by the FBMs. FBM220/221 accepts communication from either path (A or B) of the 2 Mbps Fieldbus — should one path fail or be switched at the system level, the module continues communication over the active path.

FOUNDATION fieldbus TECHNOLOGY

The FOUNDATION fieldbus is an all-digital, serial, two-way communication system which interconnects field devices, such as transmitters, actuators, and controllers. It is a Local Area Network (LAN) with built-in capability to distribute control application across the network. This technology consists of the Physical Layer, the Communication Stack, and the User Application Blocks.

Physical Layer

The FBM220/221 conforms to IEC 61158-2 and ISA S50.02 Physical Layer Standards as referenced to define, as a minimum, the signaling and electrical properties of a fieldbus device's Physical Layer interface. In this regard, the properties of the FBM220/221 are:

- ▶ Polarity independence

- ▶ Open-circuit voltage level of 35 V dc maximum
- ▶ Support of general-purpose H1 devices, and intrinsically safe H1 devices through third-party safety barriers.

FOUNDATION fieldbus TOPOLOGIES

A basic FOUNDATION fieldbus topology is shown in Figure 1. Numerous other types of topologies can be employed (refer to document AG-140, *FOUNDATION fieldbus Application Guide, 31.25 kbits/s Wiring and Installation*).

TERMINATION ASSEMBLIES AND CABLES

Field I/O signals connect to the FBM subsystem via DIN rail mounted termination assemblies (TAs). The TAs used with the FBM220/221 are described in “TERMINATION ASSEMBLIES AND CABLES” on page 10.

FBM220/221 H1 POWERING CAPABILITIES

Table 1 lists the characteristics of FBM220/ 221 support of a FOUNDATION fieldbus segment.

Table 1. FBM220/221 H1 Powering Capabilities

Parameter	Bus Powered, Intrinsically Safe	Bus Powered, General Purpose ^(a)	Separately Powered
Intrinsically Safe	Yes	No	No
Maximum Bus Power	75 or 110 mA at 24 V dc	300 mA at 30 Vdc	None
Number of Devices ^(b)	2 to 6	2 to 12	2 to 16

(a) Powered via a Foxboro termination assembly (TA).

(b) The number of devices on a fieldbus link varies depending on factors such as the power consumption of each device, type of cable used, use of repeaters, and so forth.

FUNCTIONAL SPECIFICATIONS

FOUNDATION fieldbus Communications

INTERFACE

FBM220 – 1 isolated H1 segment

FBM221 – 4 isolated H1 segments

H1 BUS CHARACTERISTICS

General

Non-redundant, multi-drop communications bus operating at 31.25 kbps. Topology is the bus/tree type. Each FBM220/221 (and associated H1 segment) has its own Link Active Scheduler (LAS).

Maximum Allowable Bus Length⁽¹⁾

1900 m (6270 ft). This includes the trunk length and all spur lengths

Maximum Allowable Spur Length, Single Device per Spur⁽²⁾

120 m (396 ft), 1 to 12 devices on fieldbus
90 m (297 ft), 13 to 14 devices on fieldbus
60 m (198 ft), 15 to 18 devices on fieldbus
30 m (99 ft), 19 to 24 devices on fieldbus
1 m (3.3 ft), 25 to 32 devices on fieldbus

Maximum Cable Length, FBM220/221 to TA

30 m (99 ft)

Maximum Number of Devices on fieldbus

For FBM220, the maximum number of devices is 16. For FBM221, the maximum number of devices is 32 (8 per port). These numbers may vary depending on factors such as the power consumption of each device, type of cable used, use of repeaters, and so forth. Consult the Physical Layer Specifications for details.

Maximum Number of Point Connects

The maximum number of point connects for FBM220 is 24⁽³⁾; the maximum number of point connects for FBM221 is 64 total per FBM, or 16 per port⁽³⁾.

FBM220/221 CHANNEL ISOLATION

Each channel is galvanically isolated and referenced to ground. The module can withstand, without damage, a potential of 600 V ac applied for one minute between any channel and earth (ground).

CAUTION

This does not imply that these channels are intended for permanent connection to voltages of these levels. Exceeding the limits for input voltages, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.

Conformance to FOUNDATION fieldbus Standards

FOUNDATION fieldbus topologies and communications are in accordance with specifications presented in the following documents:

- Fieldbus Standard for Use in Industrial Control Systems, Part 2: Physical Layer Specifications and Service Definition, ISA S50.02-1992
- International Standard for Use in Industrial Control Systems, Part 2: Physical Layer Specifications and Service Definition, IEC 61158-2 (1993) Digital data communications for measurement and control
- Fieldbus for use in industrial control systems, Part 3: Data Link Service Definition, and Part 4: Data Link Protocol Specification, 61158 DIS, IEC SC65C/WG6 - ISA SP50, 1994-1998
- FOUNDATION fieldbus Specifications, Fieldbus FOUNDATION, 1994-1998

(1) Maximum cable length (trunk plus spurs) is based on the use of #18 AWG (0.8 mm²) shielded twisted-pair cable.

(2) Minimum spur length is 1 m (3.3 ft). Devices must be close-coupled to the wire (within 1 meter).

(3) Each analog or discrete output requires two point connects, one for the output and one for the readback.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

I/A Series Fieldbus Communication

FBM220/221 communicates with its associated FCM or FCP via the redundant 2 Mbps Module Fieldbus.

Bus Power Supply

Bus powering is a function of the type of field termination assembly. The typical non-intrinsic safety termination assembly contains power converters, which provide up to 300 mA of conditioned power to each H1 segment.

H1 Device Function Blocks Supported

The following H1 device function blocks are supported for use with the FBM220/221 and the I/A Series system: AI, AO, DI, DO.

FBM220/221 Power Requirements

INPUT VOLTAGE RANGE (REDUNDANT)

24 V dc +5%, -10%

CONSUMPTION

FBM220

3.5 W (maximum)

FBM221

4.0 W (maximum)

HEAT DISSIPATION

FBM220

3.5 W (maximum)

FBM221

4.0 W (maximum)

Termination Assembly Power Requirements⁽⁴⁾

H1 BUS POWER SUPPLIED VIA DC-TO-DC CONVERTER(S) IN TA

30 V dc \pm 6% at 300 mA, per channel

INPUT VOLTAGE TO TA (OPTIONALLY REDUNDANT)

24 V dc +5%, -10%

CONSUMPTION

11.5 W maximum per channel

DISSIPATION

2.5 W maximum per channel

OUTPUT POWER

9 W maximum per channel

Signal Connections

Signal connections to the FOUNDATION fieldbus are made via a termination assembly (TA).

Regulatory Compliance

ELECTROMAGNETIC COMPATIBILITY (EMC)

European EMC Directive 89/336/EEC

Meets: EN 50081-2 Emission standard

EN 50082-2 Immunity standard

EN 61326 Annex A (Industrial Levels)

CISPR 11, Industrial Scientific and Medical (ISM) Radio-frequency Equipment - Electromagnetic Disturbance Characteristics - Limits and Methods of Measurement

Meets: Class A Limits

IEC 61000-4-2 ESD Immunity

Contact 4 kV, air 8 kV

IEC 61000-4-3 Radiated Field Immunity

10 V/m at 80 to 1000 MHz

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity

2 kV on I/O, V dc power and communication lines

IEC 61000-4-5 Surge Immunity

2kV on ac and dc power lines; 1kV on I/O and communications lines

IEC 61000-4-6 Immunity to Conducted Disturbances induced by Radio-frequency Fields

10 V (rms) at 150 kHz to 80 MHz on I/O, V dc power and communication lines

IEC 61000-4-8 Power Frequency Magnetic Field Immunity

30 A/m at 50 and 60 Hz

(4) For P0917RF and P0917RG only.

FUNCTIONAL SPECIFICATIONS (CONTINUED)**PRODUCT SAFETY*****Underwriters Laboratories (UL) for U.S. and Canada***

UL/UL-C listed as suitable for use in UL/UL-C listed Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems. These modules are also UL and UL-C listed as associated apparatus for supplying non-incendive communication circuits for Class I, Groups A-D hazardous locations when connected to specified I/A Series® processor modules as described in the *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA). Communications circuits also meet the requirements for Class 2 as defined in Article 725 of the National Electrical Code (NFPA No.70) and Section 16 of the Canadian Electrical Code (CSA C22.1). Conditions for use are as specified in the *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA).

European Low Voltage Directive 73/23/EEC and Explosive Atmospheres (ATEX) directive 94/9/EC

CENELEC (DEMKO) certified as EEx nA IIC T4 for use in CENELEC certified Zone 2 enclosure certified as associated apparatus for supplying non-incendive field circuits for Zone 2, Group IIC, potentially explosive atmospheres when connected to specified I/A Series processor modules as described in the *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA).

ENVIRONMENTAL SPECIFICATIONS⁽⁵⁾

Operating

TEMPERATURE

Module

-20 to +70°C (-4 to +158°F)

Termination Assembly

-20 to +50°C (-4 to +122°F)

RELATIVE HUMIDITY

5 to 95% (noncondensing)

ALTITUDE

-300 to +3,000 m (-1,000 to +10,000 ft)

Storage

TEMPERATURE

Module

-40 to +70°C (-40 to +158°F)

Termination Assembly

-40 to +80°C (-40 to +176°F)

RELATIVE HUMIDITY

5 to 95% (noncondensing)

ALTITUDE

-300 to +12,000 m (-1,000 to +40,000 ft)

Contamination

Suitable for use in Class G3 (Harsh) environments as defined in ISA Standard S71.04, based on exposure testing according to EIA Standard 364-65, Class III.

(5) The environmental limits of this module may be enhanced by the type of enclosure containing the module. {Refer to the applicable Product Specification Sheet (PSS) which describes the specific type of enclosure that is to be used.}

PHYSICAL SPECIFICATIONS

Mounting

MODULE

FBM220/221 mounts on a baseplate. The baseplate can be mounted horizontally or vertically on a DIN rail, or mounted horizontally in a 19-inch rack using a mounting kit. Refer to PSS 21H-2W6 B4 for details.

Termination Assembly

TERMINATION ASSEMBLY

The TA accommodates multiple DIN styles including 32 mm (1.26) and 35 mm (1.38 in) rails.

Mass

MODULE

284 g (10 oz) approximate

TERMINATION ASSEMBLY

332 g (10.7 oz) approximate

Dimensions - Module

HEIGHT

102 mm (4 in)

114 mm (4.5 in) including mounting lugs

WIDTH

45 mm (1.75 in)

DEPTH

104 mm (4.11 in)

Dimensions - Termination Assembly

Refer to page 13 and page 14.

Part Numbers

FBM220 MODULE

P0917HA

FBM221 MODULE

P0917HB

TERMINATION ASSEMBLIES

FBM220

P0917RF - 1 channel

FBM221

P0917RG - 4 channels

Termination Cables

CABLE LENGTHS

Up to 30 m (98 ft).

CABLE MATERIALS

Polyurethane or Hypalon XLP

TERMINATION CABLE TYPE

Type 1 - Refer to Table 3

CABLE CONNECTION

Termination Assembly

25-pin male D-subminiature

Modular Baseplate

37-pin male D-subminiature

Termination Assembly Construction Material

MATERIAL

Polypropylene (PVC) Material, compression

FAMILY GROUP COLOR

Green - communication

TERMINAL BLOCKS

Inputs and Outputs - 3 tiers, 8 positions

Field Termination Connections

COMPRESSION-TYPE ACCEPTED WIRING SIZES

Solid/Stranded/AWG

0.2 to 4 mm²/0.2 to 2.5 mm²/24 to 12 AWG

Stranded with Ferrules

0.2 to 2.5 mm² with or without plastic collar

Indicators (mounted on front of module)

OPERATIONAL STATUS

Red and green light-emitting diodes (LEDs)

CHANNEL COMMUNICATION ACTIVITY

Amber LEDs, one per channel

TERMINATION ASSEMBLIES AND CABLES

Field I/O signals connect to the FBM subsystem via DIN rail mounted termination assemblies (TAs) (see Figure 2). The FBM220/221 may be used with termination assemblies P0917RF/P0917RG respectively, or with termination assembly P0922VC/P0922VS. Termination assemblies P0917RF and P0917RG contain built-in dc-dc converters to power the H1 bus as well as built-in bus termination used to terminate the H1 segments when the FBM220/221 is located at the end of the segment. The TA associated with the FBM220 contains a single bus terminator and the TA associated with the FBM221 contains 4. The P0917RF and P0917RG termination assemblies are mature products available through the service channel.

Termination assemblies P0922VC and P0922VS allow external H1 power conditioners to be used. Usage with external power conditioners that are registered with the Fieldbus Foundation is the preferred configuration for major expansions using the FBM220/FBM221.

If the P0917RF or P0917RG termination assembly is used, its dc-to-dc converter receives 24 V dc power from an optionally redundant external power source. This power source can be one of the existing supplies which power the FBM baseplates, or a user supplied power supply. The 24 V dc power is converted to isolated 30 V dc power (at 300 mA) for powering the Foundation fieldbus field devices. Individual switch(es) on the TA provide on/off control of the power to each of the H1 bus segment(s).

The bus terminator(s) in the TA are used when the FBM220/221 is located at the end point on the Foundation fieldbus segment(s). Individual switch(es) on the TA provide for bus terminator selection (in or out) for each H1 segment.

H1 FOUNDATION fieldbus signal connections are made to two connection terminals for each cable connection to allow for both mid-bus and end-bus cabling configurations.

Power connections for redundant 24 V dc power sources are marked Primary and Secondary on the label. (Redundancy control is provided internal to the TA, by diode OR-ring of the two 24 V inputs.) Extra line and neutral connection terminals are provided to allow for possible daisy-chaining of power connections, or for the possibility of using additional power supplies for load sharing.

TAs are available in Polypropylene (PVC) material.

The DIN rail mounted TAs connect to the FBMS by means of a removable termination cable. The cable is available in a variety of lengths, up to 30 meters (98 feet), allowing the TA to be mounted in either the enclosure or in an adjacent enclosure. Termination cables (refer to Table 3) are available in the following materials:

- ▶ Polyurethane
- ▶ Hypalon® XLP (fire retardant)

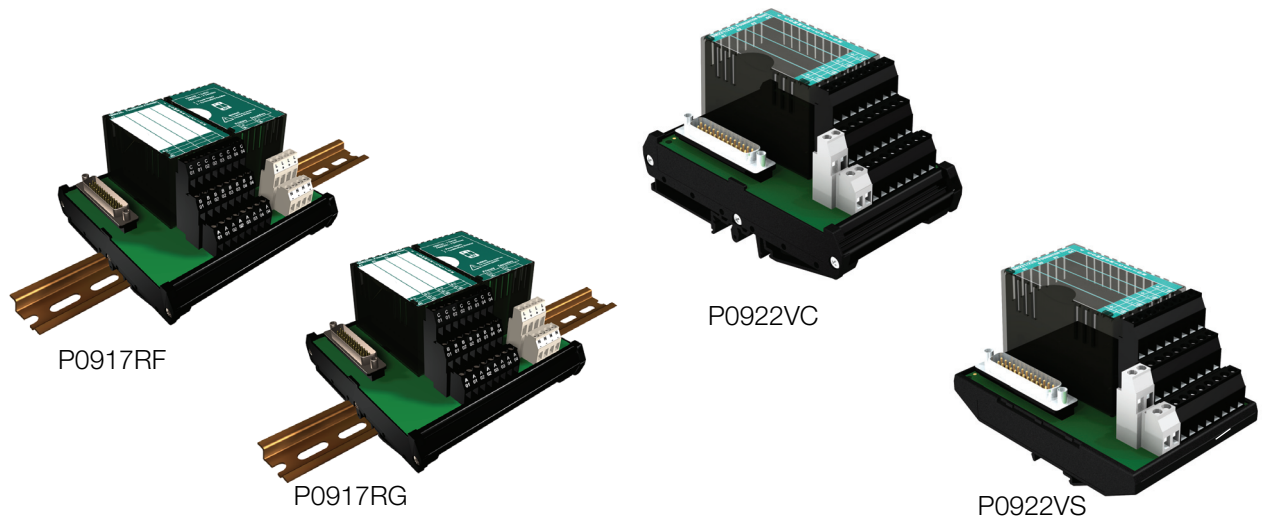


Figure 2. FBM220/221 Termination Assemblies

FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES

FBM Type	Input/Output Signal	TA Part No.(a)		Termination Type (b)	TA Cable Type (c)	TA Certification Type (d)
		PVC	PA			
FBM220	One I/O channel	P0917RF or	P0922VS	C	1	1
		P0922VC		C	1	1
FBM221	Four I/O channels	P0917RG or	P0922VS	C	1	1
		P0922VC		C	1	1

(a) PVC is polyvinyl chloride rated from -20 to +50°C (-4 to 122°F), PA is polyimide rated from -20 to +70°C (-4 to +158°F).

(b) C = TA with compression terminals.

(c) Refer to Table 3 for cable part numbers and specifications.

(d) Refer to Table 2 Termination Assembly certification definitions.

Table 2. Certifications for Termination Assemblies

Type	Certification
Type 1	TAs are UL/UL-C listed as suitable for use in Class I; Groups A-D; Division 2 temperature code T4 hazardous locations. They are CENELEC (DEMKO) certified EEx nA IIC T4 for use in Zone 2 potentially explosive atmospheres.

Table 3. Termination Cable Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC (a)	Type 1 H/XLPE (b)	Cable Length m (ft)	Type 1 P/PVC (a)	Type 1 H/XLPE (b)
0.5 (1.6)	P0916DA	P0916VA	10.0 (32.8)	P0916DE	P0916VE
1.0 (3.2)	P0916DB	P0916VB	15.0 (49.2)	P0916DF	P0916VF
2.0 (6.6)	P0931RM	P0931RR	20.0 (65.6)	P0916DG	P0916VG
3.0 (9.8)	P0916DC	P0916VC	25.0 (82.0)	P0916DH	P0916VH
5.0 (16.4)	P0916DD	P0916VD	30.0 (98.4)	P0916DJ	P0916VJ

(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation.

Temperature range: -20 to +80°C (-4 to +176°F).

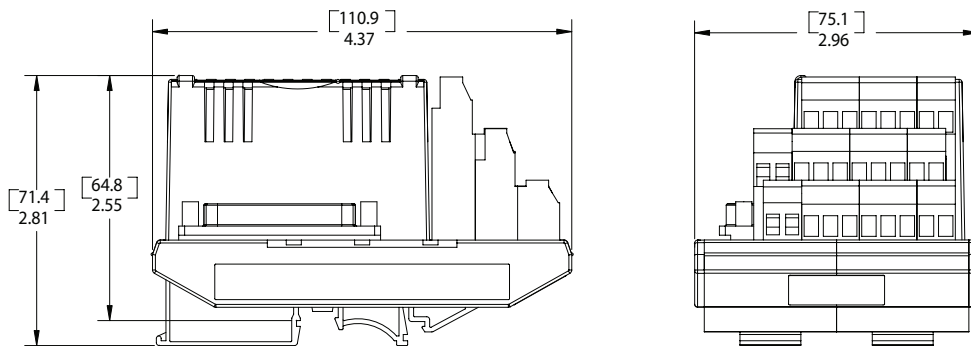
(b) H/XLPE is Hypalon outer jacket and XLPE (cross-linked polyethylene) primary conductor insulation.

Temperature range; -40 to +90°C (-40 to +194°F).

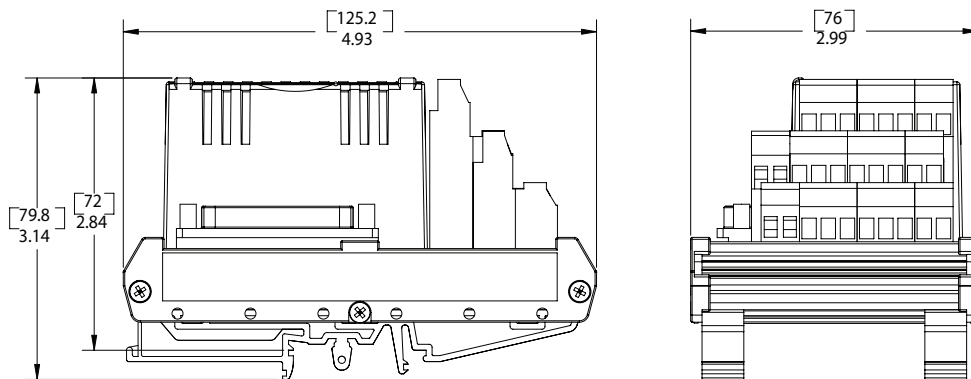
DIMENSIONS - NOMINAL

$\frac{\text{mm}}{\text{in}}$

Termination Assembly P0922VS



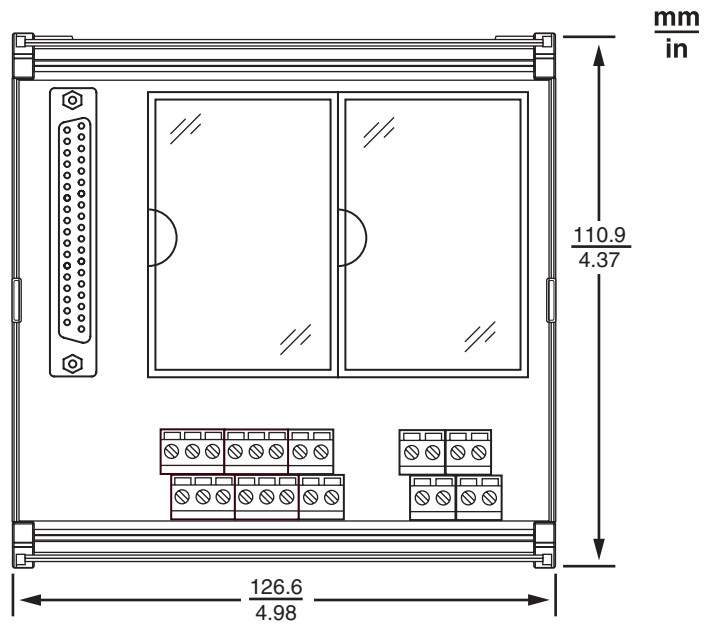
Termination Assembly P0922VC



DIMENSIONS - NOMINAL

$\frac{\text{mm}}{\text{in}}$

Termination Assembly P0917RF and P0917RG



RELATED PRODUCT SPECIFICATION SHEETS

PSS Number	Description
PSS 21H-2W1 B3	DIN Rail Mounted FBM Subsystem Overview
PSS 21H-2W2 B3	DIN Rail Mounted FBM Equipment, Agency Certifications
PSS 21H-2W6 B4	DIN Rail Mounted Modular Baseplates



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