# Foxboro Evo™ Process Automation System

## Product Specifications

Foxboro by Schneider Electric

**PSS 31H-2Z28**

# FBM228 FOUNDATION™ fieldbus Module for Control in the Field Applications


*Redundant FBM228s, shown above mounted with fault-tolerant FCP280 Field Control Processors, provide a redundant interface to FOUNDATION™ fieldbus H1 devices for Foxboro Evo™ control stations such as the FCP280, FCP270 or the ZCP270 Z-Form Control Processors.*

## OVERVIEW

The FOUNDATION fieldbus Redundant Module (FBM228) provides a reliable, high-capacity interface between FOUNDATION fieldbus devices and the Foxboro Evo system. The FBM228, which can be used in single or redundant configurations, supports four H1 Links for a maximum of 64 fieldbus devices.

The H1 fieldbus is a bi-directional, all digital communication bus designed for the integration of process measurement and control devices. The H1 bus provides all the benefits of the traditional 4 to 20 mA standard, while providing greater data access to both control and system health information.

FOUNDATION fieldbus enables you to take full advantage of intelligent field devices, resulting in access to device maintenance information, reduced equipment and wiring costs, and a wider selection of suppliers due to interoperability.

The FBM228 connects the H1 field devices to the versatile and robust Foxboro Evo control system, where control resources include support for all FOUNDATION fieldbus device blocks either with the universal FOUNDATION fieldbus block (UNIVFF) or one of the following dedicated function blocks:

| | | |
|---|---|---|
| AI | AO | DI |
| DO | MAI | MAO |
| MDI | MDI | PID. |

The FBM228 enables the control station to access any block parameter in any H1 device. With FOUNDATION fieldbus blocks, parameters in the H1 device are dynamically updated in the control station memory and are connectable to all other blocks in the station, thus allowing easy construction of control loops that contain H1 function blocks and control station blocks.

With the FBM228 and InFusion v2.0 or later software (including the Foxboro Control Software (FCS) v3.0 to v4.x and Foxboro Evo Control Software v5.0 or later), for each control loop you have a choice of locating the PID block in the field device or in the host control station. Complex strategies can be subdivided so that faster secondary loops consisting of AI, PID and AO device blocks run in the field, while the primary PID loop and other complex blocks run in the host system.

The FBM228 also supports an enhanced DCI block set that enables the control station to access block parameters in an H1 device. The parameters specified by offset.subindex are the parameters in resource, transducer, and function blocks. These DCI blocks can be used, for example, to source device diagnostic information for the development of maintenance and alarm strategies.

The blocks include:

- BIN for binary input
- IIN for integer values
- RIN for real input
- ROUT for real output
- PAKIN for bit-enumerated parameters
- STRIN for string data.

## FEATURES

Key features of the FBM228:

- Conforms to the FOUNDATION fieldbus specifications and supports all FOUNDATION fieldbus H1 field devices registered to the Interoperability Test Kit (ITK) 4.6 or greater.
- Provides support for standard FF Views 1, 2, and 4 which include presentation of dynamic block parameters that may be used as connectable values in control strategies configured in the control station.
- Provides all applications operating on Control Core Services workstations access to block parameters in the field devices.
- Enables the development of an integrated control database that seamlessly connects H1 function blocks and control station function blocks. The database is built using the graphical control strategy diagram in the Foxboro Evo Control Editors.
- Supports control in the host and control in the field loops.
- Can be installed as a redundant pair providing maximum uptime, with fully redundant communications between the FBM228 and fault-tolerant control processors.

- Integrates H1 device data into a Foxboro Evo format for consistent operator display of alarms, trends, and operator displays that are independent of the protocol/communication bus used to bring them into the system.
- Compatible with a variety of power conditioning devices from Foxboro® and third-party manufacturers. Bus powering is a function of the type of field termination assembly. The typical non-intrinsic safety termination assembly contains power converters that provide from 300 mA to 1 A of conditioned power to each H1 Link (see "POWER OPTIONS" on page 3).
- Provides a Link Active Scheduler (LAS) for each H1 Link.
- Supports use of Link Master devices as backup LAS on H1 segments.
- The FBM automatically detects and schedules all devices on each H1 Link, providing faster start-up, commissioning, and device replacement.
- The FOUNDATION fieldbus links conform to ANSI/ISA S-50, IEC 61158, and CENELEC EN 50170.
- The FBMs are suitable for installation in Class 1, Division 2, and Zone 2 locations.

## CONTROL STATIONS

The FBM228 provides the interface to H1 devices for either the DIN rail mounted FCP270 Field Control Processor or the rack mounted ZCP270 Z–Form Control Processor. When deployed for use with an FCP270 (as shown in Figure 2), the module is installed in the same baseplate or in an adjacent baseplate, and communicates with the control station over a 2 Mbps Fieldbus. The FCP270, in turn, is connected over a 100 Mbps switched network to other control stations, supervisory applications, system management stations, and other Foxboro Evo control resources.

With the optionally redundant FBM228, a highly available system can be configured, including:

- A redundant FBM228
- Fault-tolerant control processors
- Redundant communications between the CP and FBMs
- Redundant power conditioners and power supplies.

When the control station is a ZCP270, the FBM228s are installed in a 200 Series FBM system consisting of a Fieldbus Communications Module 100 (FCM100), the FBM228, and other FBM types.

The subsystem is connected to the ZCP270 via a 100 Mbps Ethernet network. For additional information on this communication network, refer to the *Standard 200 Series Subsystem Overview* (PSS 31H-2SOV).

## POWER OPTIONS

Power to the H1 bus is always a function of the selected power conditioners. To allow customers' preferences in cabinet design and hazardous area configurations, the Foxboro Evo system FOUNDATION fieldbus is designed to let customers select power conditioners from the many different solutions available on the market.

Figure 1 illustrates an integrated baseplate solution jointly developed with Pepperl+Fuchs that mounts two FBM228 modules plus up to eight P&F power conditioners. Lower installed costs, more than 80% fewer manual connections, and improved reliability result from 52 pairs of built in connections that distribute bulk power, link the FBM228 modules and the power conditioners to the H1 segments, and tie together power conditioner alarm contacts.

- The FBTA-228-BPFB-R-4R is used with a redundant pair of FBM228 modules, plus a redundant pair of power conditioners for each of the four H1 segments.
- The FBTA-228-BPFB-8 is used with two non-redundant FBM228 modules, plus a non-redundant power conditioner for each of the 8 H1 segments.

The two P&F power conditioner choices include:

- The passive HD2-FBCL-1.500
- The galvanically isolating HD2-FBPS-1.500.

Figure 2 illustrates a typical generic setup usable for any third-party power conditioners in either redundant or non-redundant configurations. A T1 termination cable (see Table 1 on page 12 for cable types and lengths) and a passive termination assembly (p/n P0922VC) provide the connection between the baseplate and the power conditioning modules. The third party modules are then connected using standard H1 practices with respect to power conditioning, distances, bus termination, and safety certifications.

Example power conditioning options include:

- Pepperl+Fuchs® KLD2-PC-1.1 IEC
- Relcom® FPS-1 redundant power system with terminators
- Fieldbus Intrinsically Safe Concept (FISCO) power conditioners from Pepperl+Fuchs and MTL
- Entity Concept intrinsically safe power conditioners from Pepperl+Fuchs and MTL
- Fieldbus Non-Incendive Concept (FNICO) power conditioners from Pepperl+Fuchs and MTL.

For hazardous area configurations, an alternative to using Entity, FISCO, or FNICO power conditioners is to use general purpose power conditioners in combination with a wiring block having built in field barriers for intrinsic safety.

The number of devices on the bus may be limited by the choice of powering arrangement and other factors such as desired macrocycle times and loop design. The following table indicates the typical bus power availability for various methods:

| | |
|---|---|
| General Purpose Power Conditioners<br>(Refer to vendor specifications) | Up to 1 A @ 30 V dc |
| FISCO Power Conditioners | 100 mA @ 24 V dc |
| Entity Concept Power Conditioners | 70 mA @ 24 V dc |

## INTELLIGENT FIELD DEVICE LINK MASTER

The FBM228 acts as an intelligent field device link master, scheduling devices on each H1 Link. A publisher/subscriber relationship between the FBM and the H1 field device guarantees that the communication in each link acts in a deterministic fashion.

The FBM228 receives digital messages from the field devices in engineering units. Published device data is communicated with each macrocycle, and dynamic data views are regularly updated to the control processor. All device data is accessible for diagnostics software and other applications.

## REDUNDANT OPERATION

The FBM228 extends the uptime benefits of the Fault Tolerant Foxboro Evo architecture from the control station to the termination assembly. When configured as a redundant pair, the FBM228s operate in a master/tracker relationship, with one module providing the interface and scheduling the connected H1 devices, and the other tracking the master. If there is an operating fault in the master, the two modules automatically switch roles with no

interruption in service. The role switch includes transfer of the link active scheduling functions so there is no interruption in service, and thus, no need for configuring link backup functions within the devices.

A failed module can be removed from the baseplate and replaced with no interruption in service.

## COMPACT, RUGGED DESIGN

The FBM228 has a compact design, with a rugged extruded aluminum exterior for physical and electrical protection of the circuits. Enclosures specially designed for mounting of FBMs provide various levels of environmental protection, up to harsh environments per ISA Standard S71.04.

The module can be removed and replaced without removing field device termination, power, or communications cabling. It mounts on a variety of baseplates, which accommodate 2, 4, or 8 modules. 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, its current role as either master or tracker in a redundant pair, and the communication activity on each H1 Link.

## FBM228 ELECTRICAL INTERFACE

The FBM228 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 FBM228 are:

- Polarity independence
- Open-circuit voltage level of 35 V dc maximum
- Support of non-intrinsically safe H1 devices, and intrinsically safe H1 devices through third-party safety barriers.

## FOUNDATION fieldbus TOPOLOGIES

A basic FOUNDATION fieldbus topology is shown in Figure 2, however, numerous other topologies can be employed. Refer to FF documents AG-181, *FOUNDATION™ fieldbus System Engineering Guidelines, and AG-140 FOUNDATION™ fieldbus Wiring and Installation 31.25 kbits/s, Voltage Mode, Wire Medium Application Guide* (www.fieldbus.org).

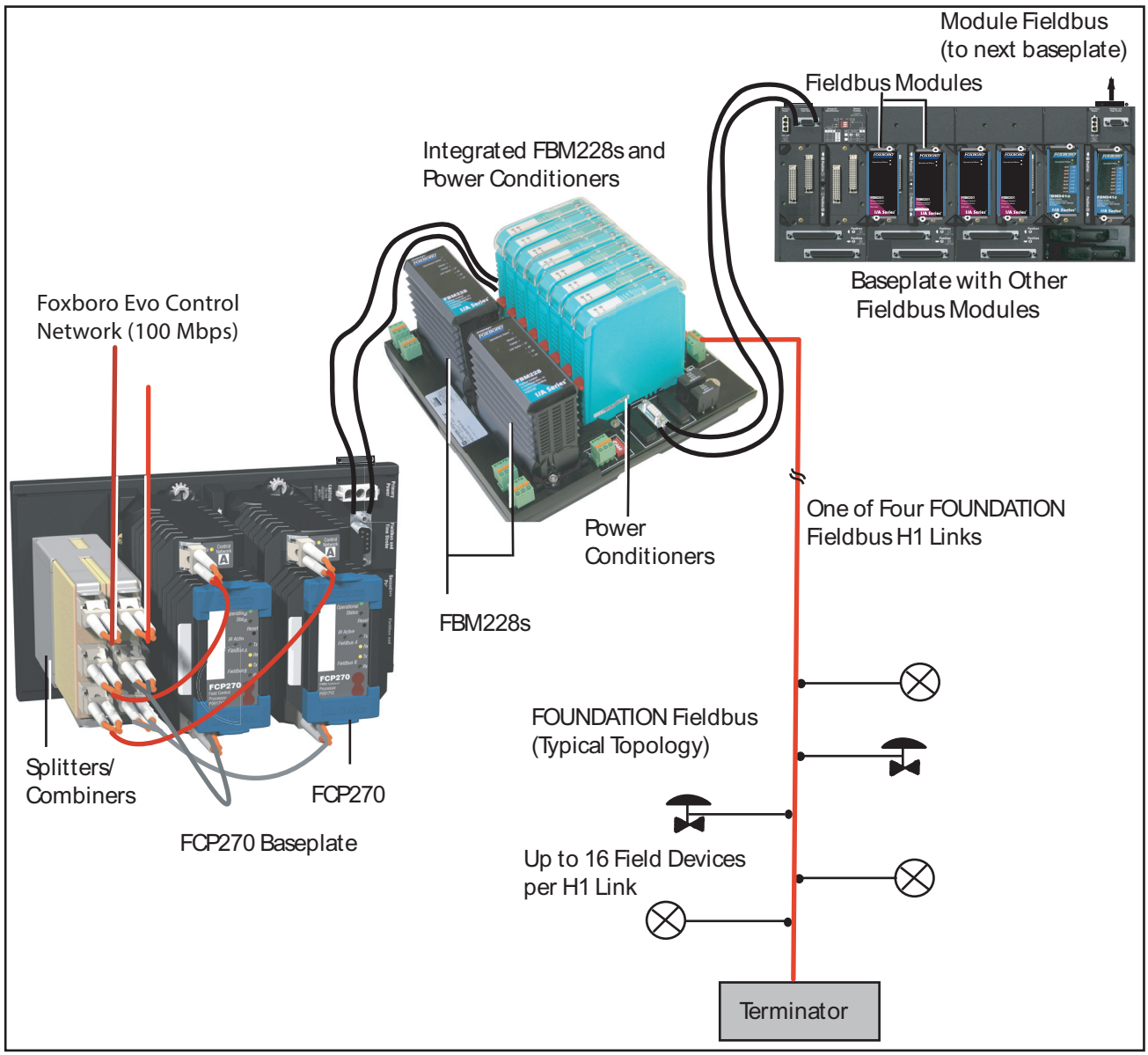


*Figure 1. Integrated FBM228s and Power Conditioners*

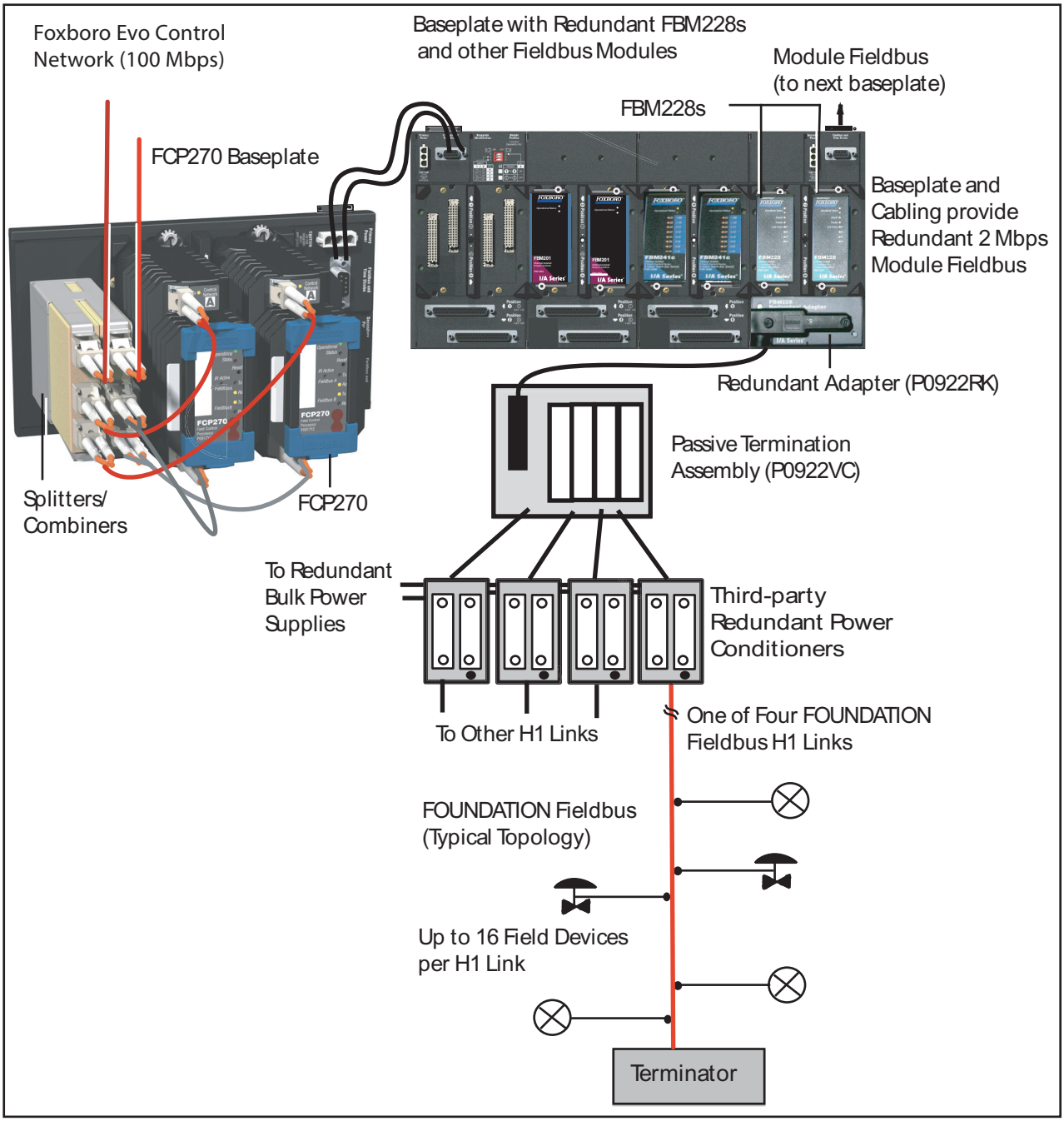


*Figure 2. Generic Connection of FBM228 Power Conditioners*

## FUNCTIONAL SPECIFICATIONS

### FOUNDATION fieldbus Communications

#### INTERFACE

Four isolated H1 Links

#### H1 BUS CHARACTERISTICS

*General*

Non-redundant multi-drop communications bus operating at 31.25 kbps. Topology is the bus/tree type. Each FBM228 (and associated H1 Link) has its own Link Active Scheduler (LAS).

*Maximum Allowable Bus Length and Maximum Allowable Spur Length, Single Device per Spur*

Refer to document AG-181, *Foundation™ fieldbus System Engineering Guidelines.*

*Maximum Cable Length, FBM228 to Terminator Assembly*

30 m (99 ft)

*Maximum Number of Devices on fieldbus*

64 devices per module with a maximum of 16 devices per H1 Link. Maximums also vary according to such factors as the power consumption of each device, the type of cable used, and the use of repeaters. Consult FOUNDATION fieldbus Physical Layer Specifications for details.

*Maximum Number of Points*

128 publisher/subscriber block connections and 128 client/server block connections per FBM, 32 of each type per H1 Link.
Total capacity is affected by the update period of client/server access to device block parameters and by the configured macrocycle.
Update period is separately configured for each block.

*Configurable Loop Macrocycle*

A minimum macrocycle time of 200 milliseconds is supported. It is automatically adjusted, if necessary, to achieve a 50% unscheduled time to support client/server communications on the H1 Link.

#### FBM228 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**

Exceeding input voltage limits, 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.

### Foxboro Evo Fieldbus Communication

The FBM228 communicates with its associated FCP270 or FCM100 via the Foxboro Evo 2 Mbps Module Fieldbus. The FCM and the Control station communicate via an Foxboro Evo 100 Mbps Ethernet trunk fieldbus.

## FUNCTIONAL SPECIFICATIONS (CONTINUED)

### Bus Power Supply

Bus powering is a function of the field termination assembly type. The FBM228 is compatible with various third-party power conditioners, both IS and non-IS.

### FBM228 Power Requirements

**INPUT VOLTAGE RANGE (REDUNDANT)**
24 V dc +5%, –10%

**CONSUMPTION**
5 W (maximum)

**HEAT DISSIPATION**
5 W (maximum)

### Signal Connections

See Figure 1 for the preferred approach of directly connecting the H1 segments to the baseplate. An alternative signal connection approach suitable when external power conditioners are used is shown in Figure 2.

### 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, 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, dc power and communication lines

*IEC 61000-4-8 Power Frequency Magnetic Field Immunity*
30 A/m at 50 and 60 Hz

**PRODUCT SAFETY**
European Low Voltage Directive 73/23/EEC

**SAFETY CERTIFICATION**
There are no direct customer field circuit connections to the FBMs. All connections are made to the associated termination assemblies. Safety certification information only applies when these modules are used with specified certified termination assemblies as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).

*Underwriters Laboratories (US and Canadian Certification)*
UL/UL-C listed as suitable for use in Class I, Groups A-D, Division 2, temperature code T4 enclosure based systems. For details of UL listing, refer to PSS 31H-2CERTS.

*CENELEC (DEMKO)*
CENELEC certified EEx nA IIC T4 for use in CENELEC certified Zone 2 enclosure based systems. For details of CENELEC certification, refer to PSS 31H-2CERTS.

**EUROPEAN UNION COMPLIANCE**
Meets all applicable European Union directives including the Explosive Atmospheres (ATEX) directive 94/9/EC, and bears the CE marking.

## ENVIRONMENTAL SPECIFICATIONS(1)

### Operating

#### TEMPERATURE

*FBM*
–20 to +70°C (–4 to +158°F)
*Termination Assembly (P0922VC)*
–20 to +50°C (–4 to +122°F)

#### RELATIVE HUMIDITY

5 to 95% (non-condensing)

#### ALTITUDE

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

### Contamination

Class G3 (Harsh) as defined in ISA Standard, S71.04.
Pollution degree 2 as defined in IEC 664-1.

### Vibration

7.5 m/S$^2$ (0.75 g) from 5 to 500 Hz

### Storage

#### TEMPERATURE

–40 to +70°C (–40 to +158°F)

#### RELATIVE HUMIDITY

5 to 95% (non-condensing)

#### ALTITUDE

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

(1) 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

### FBM

#### MOUNTING

The FBM228 mounts on a baseplate. The baseplate can be mounted on a DIN rail (horizontally or vertically), or horizontally mounted on a 19-inch rack using a mounting kit. Refer to PSS 31H-2SBASEPLT for details.

#### WEIGHT

284 g (10 oz) approximate (each module)

#### DIMENSIONS

*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)

#### INDICATORS (MOUNTED ON FRONT OF MODULE)

*Operational Status*
Red and green light-emitting diodes (LEDs).
*Role*
Amber LEDs indicating role of module as master or tracker.
*Channel Communication Activity*
Amber LEDs, one per channel.

### Part Numbers

#### FBM228 MODULE

P0922QS

#### REDUNDANCY ADAPTER

P0922RK

### TERMINATION ASSEMBLY (P0922VC)

#### TYPE

Compression screw

#### CONSTRUCTION MATERIAL

PVC

#### WEIGHT

363 g (0.8 lb) approximate)

#### DIMENSIONS

See Figure 3.

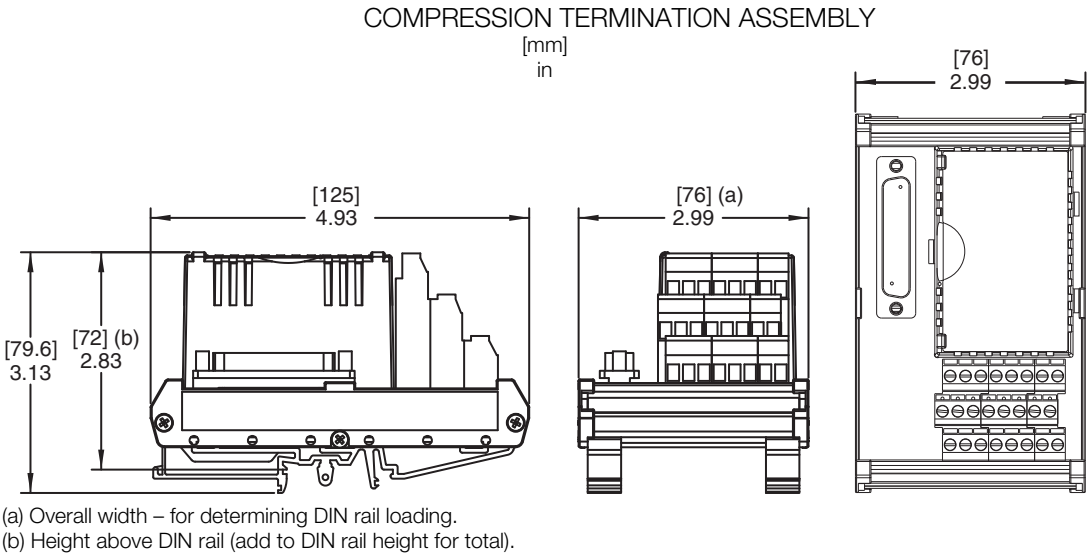


*Figure 3. Passive Termination Assembly (P0922VC) Dimensions (Nominal)*

Table 1. Termination Cable Types and Part Numbers

| Cable Length m (ft) | Type 1 P/PVC[a] | Type 1 LSZH [b] | Type 1 H/XLPE[c] |
|---|---|---|---|
| 0.5 (1.6) | P0916DA | P0928AA | P0916VA |
| 1.0 (3.2) | P0916DB | P0928AB | P0916VB |
| 2.0 (6.6) | P0931RM | P0928AC | P0931RR |
| 3.0 (9.8) | P0916DC | P0928AD | P0916VC |
| 5.0 (16.4) | P0916DD | P0928AE | P0916VD |
| 10.0 (32.8) | P0916DE | P0928AF | P0916VE |
| 15.0 (49.2) | P0916DF | P0928AG | P0916VF |
| 20.0 (65.6) | P0916DG | P0928AH | P0916VG |
| 25.0 (82.0) | P0916DH | P0928AJ | P0916VH |
| 30.0 (98.4) | P0916DJ | P0928AK | P0916VJ |

(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. Temperature rang: -20 to +80°C (-4 to +176°F).
(b) Low smoke zero halogen or low smoke free of halogen (LSZH) is a material classification used for cable jacketing. LSZH is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogen when exposed to high sources of heat. Temperature range: -40 to +105°C (-40 to +221°F)
(c) H/XLPE is Hypalon outer jacket and XLPE (cross-linked polyethylene) primary conductor insulation. Temperature range: -40 to +90°C (-40 to +194°F). Hypalon cables are no longer available for purchase.

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