

**FBM202 Thermocouple/mV Input Module**



*The FBM202 Thermocouple/mV Input contains eight thermocouple input channels, and one isolated RTD reference junction compensation channel.*

**OVERVIEW**

The FBM202 Thermocouple/mV Input contains eight thermocouple input channels, and one isolated RTD reference junction compensation channel (for terminal temperature sensing). Each thermocouple/mV channel accepts standard thermocouples for various temperature ranges, and each provides thermocouple burnout detection (up-scale). The inputs are galvanically isolated from other channels and ground.

The module performs the signal conversion required to interface the electrical input signals from the field sensors to the optionally redundant Fieldbus. It executes an Analog Input application program, which provides integration time and Rate of Change Limits configurable options.

Two types of passive termination assemblies are available for the FBM202:

- ▶ DIN rail mounted TAs, similar to those used with the other 200 Series FBMs
- ▶ Baseplate-mounted TA, which mounts directly onto the field I/O connectors of the 200 Series

baseplate. These TAs provide field I/O wiring support for two FBM202s in paired slots (that is, in positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8), as shown in Figure 1.

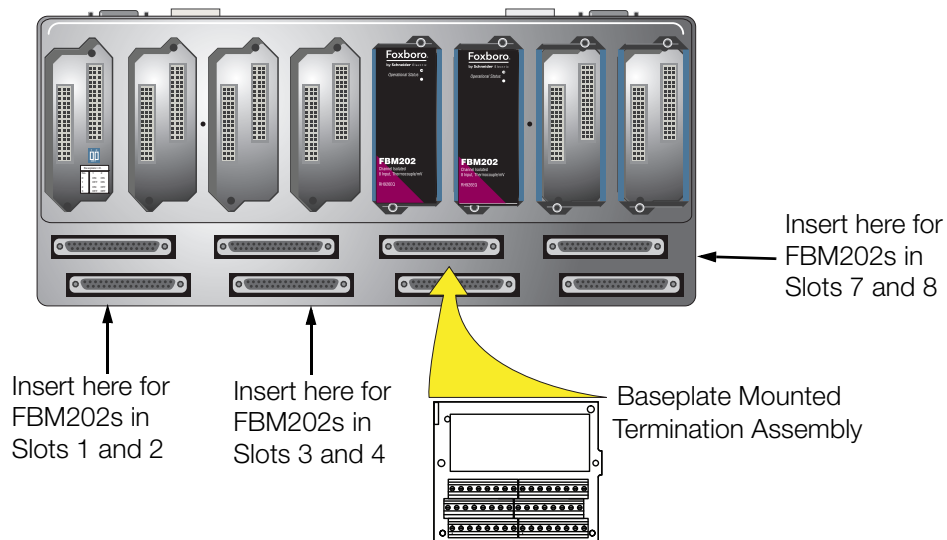


Figure 1. Baseplate-Mounted Termination Assembly

When connected to the appropriate TAs, the FBM202 module provides functionality formerly provided by the 100 Series FBM I/O subsystem. TAs are available which support the functionality of the 100 Series FBM02.

### FEATURES

Key features of the FBM202 are:

- ▶ Eight channels for input of thermocouple signals
- ▶ One isolated RTD reference junction compensation channel (for terminal temperature sensing)
- ▶ Each input channel is galvanically isolated

- ▶ Rugged design suitable for enclosure in Class G3 (harsh) environments
- ▶ Execution of an analog input application program that provides conversion time and configurable options for Rate of Change Limits
- ▶ High accuracy achieved by sigma-delta data conversions for each channel
- ▶ Termination Assemblies (TAs) for locally or remotely connecting field wiring to the FBM202

### HIGH ACCURACY

For high accuracy, the module incorporates Sigma-Delta data conversion on a per-channel basis, which can provide new analog input readings every 25 ms, and a configurable integration period to remove any process noise and power line frequencies.

Each time period, the FBM converts each analog input to a digital value, averages these values over the time period and provides the averaged value to the controller.

### STANDARD DESIGN

FBM202 has a rugged extruded aluminum exterior for physical protection of the circuits. Enclosures specially designed for mounting the FBMs provide various levels of environmental protection, up to harsh environments, per ISA Standard S71.04.

### VISUAL INDICATORS

Red and green light-emitting diodes (LEDs) incorporated into the front of the module provide visual status indications of the FBM operational status.

### EASY REMOVAL/REPLACEMENT

The module can be removed/replaced without removing field device termination cabling, power, or communications cabling.

### FIELD BUS COMMUNICATION

A Fieldbus Communications Module or a Control Processor interfaces to the redundant 2 Mbps module Fieldbus used by the FBMs. The FBM 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.

### MODULAR BASEPLATE MOUNTING

The module mounts on a DIN rail mounted baseplate, which accommodates up to four or eight Fieldbus Modules. The Modular baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for redundant Fieldbus, redundant independent dc power, and termination cables.

### TERMINATION ASSEMBLIES

Field I/O signals connect to the FBM subsystem via a:

- ▶ DIN rail mounted TA, or
- ▶ Baseplate-mounted TA.

The TAs used with the FBM202 are described in “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” on page 8.

## FUNCTIONAL SPECIFICATIONS

### Input Channels

Eight isolated and independent thermocouple/mV input channels. One isolated reference junction temperature compensation channel.

### Input Range

-10.5 to +69.5 mV dc (-10.5 to +69.5 mV dc equals 0 to 64000 raw counts. Input of 71.419 mV equals 65535 raw counts (full range of module))

### Reference Junction

Reference junction temperature compensation is provided by a 4-wire 100 ohm platinum RTD (IEC 751, Class B) at the termination assembly.

### Accuracy

#### MILLIVOLT INPUT

$\pm 0.03\%$  of span ( $\pm 24 \mu\text{V}$ ) at  $25^\circ\text{C}$

#### RTD CHANNEL

$\pm 0.03\%$  of span

#### RTD REFERENCE JUNCTION CONFORMITY

$\pm 0.25^\circ\text{C}$

#### THERMOCOUPLE CONFORMITY

$\pm 0.25^\circ\text{C}$

#### ACCURACY TEMPERATURE COEFFICIENT

$\pm 50 \text{ ppm}/^\circ\text{C}$

#### RTD REFERENCE JUNCTION MEASUREMENT ACCURACY

$\pm 0.50^\circ\text{C}$  (When using the RTD internal to the Foxboro supplied termination assemblies)

#### DIFFERENTIAL INPUT IMPEDANCE

10 M $\Omega$

#### COMMON MODE VOLTAGE

Up to 30 V ac or 60 V dc

### Integration Period

Software configurable

### Input Open Circuit Voltage

250 mV dc through 10 M ohms (mV channels)

### Input Signal A/D Conversion

Each channel performs A/D signal conversion using an independent Sigma-Delta converter.

### Typical Thermocouple Types

B, E, J, K, N, R, S, T and other millivolt signals

### Thermocouple Burnout Detection

Full upscale value

### Input Channel Isolation

Each channel is galvanically isolated from all other channels and earth (ground). The module withstands, without damage, a potential of 600 V ac applied for one minute between any channel and ground, or between a given channel and any other channel.

### CAUTION

This does not imply that these channels are intended for permanent connection to hazardous voltage circuits. Connection of these channels to voltages greater than 30 V ac or 60 V dc violates electrical safety code requirements and may expose users to electric shock.

### Communication

Communicates with its associated FCM or FCP via the redundant 2Mbps module Fieldbus.

### Power Requirements

#### INPUT VOLTAGE RANGE (REDUNDANT)

24 V dc, +5%, -10%

#### CONSUMPTION

3 W (maximum)

#### HEAT DISSIPATION

3 W (maximum)

### Calibration Requirements

Calibration of the module and termination assembly is not required.

**FUNCTIONAL SPECIFICATIONS (CONTINUED)****Regulatory Compliance****ELECTROMAGNETIC COMPATIBILITY (EMC)**

European EMC Directive 2004/108/EC (Prior to April 20, 2016) and 2014/30/EU (Beginning April 20, 2016)

Meets: EN61326-1:2013 Class A Emissions and Industrial Immunity Levels

**RoHS COMPLIANCE**

Complies with European RoHS Directive 2011/65/EU

**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 when connected to specified Foxboro Evo processor modules as described in the *Standard and Compact 200 Series 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 *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).

*European Low Voltage Directive 2006/95/EC (Prior to April 20, 2016) and 2014/35/EU (Beginning April 20, 2016) and Explosive Atmospheres (ATEX) directive 94/9/EC (Prior to April 20, 2016) and 2014/34/EU (Beginning April 20, 2016)*

DEMKO certified as Ex nA IIC T4 for use in certified Zone 2 enclosure when connected to specified I/A Series processor modules as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).

Also see, "Certification for Termination Assemblies" on page 9.

**MARINE CERTIFICATION**

ABS Type Approved and Bureau Veritas Marine certified for Environmental Category EC31.

**ENVIRONMENTAL SPECIFICATIONS<sup>(1)</sup>**

**Operating**

**TEMPERATURE**

*Module*

-20 to +70°C (-4 to +158°F)

*Termination Assembly - PA and PC/ABS*

-20 to +70°C (-4 to +158°F)

**RELATIVE HUMIDITY**

5 to 95% (noncondensing)

**ALTITUDE**

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

**Storage**

**TEMPERATURE**

-40 to +70°C (-40 to +158°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.

**Vibration**

0.75 m/S<sup>2</sup> (5 to 500 Hz)

**PHYSICAL SPECIFICATION**

**Mounting**

**MODULE**

FBM202 mounts on a baseplate. The baseplate can be mounted on a DIN rail (horizontally or vertically), or horizontally on a 19-inch rack using a mounting kit. Alternatively, FBM202 mounts on a 100 Series conversion mounting structure.

Refer to *Standard 200 Series Baseplates* (PSS 31H-2SBASPLT) or *100 Series Conversion Mounting Structures* (PSS 31H-2W8) for details.

**TERMINATION ASSEMBLY**

The DIN rail mounted TA mounts on a DIN rail and accommodates multiple DIN rail styles including 32 mm (1.26 in) and 35 mm 1.38 in) The baseplate-mounted TA mounts on the two field I/O connectors associated with its two FBM202s on a 200 Series baseplate.

**Weight**

**MODULE**

284 g (10 oz) approximate

**Weight (Cont.)**

**TERMINATION ASSEMBLIES**

*Compression (Approximate)*

(For DIN Rail Mounted TAs) 159 g (0.35 lb)

(For Baseplate Mounted TAs) 245 g (0.57 lb)

*Ring Lug*

204 g (0.45 lb)

**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 Assemblies**

Refer to page 10.

**Part Numbers**

**FBM202 MODULE**

RH926EQ (supersedes P0926EQ)

**TERMINATION ASSEMBLIES**

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” on page 8.

(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 SPECIFICATION (CONTINUED)

### Termination Cables

#### CABLE LENGTHS

Up to 30 m (98 ft)

#### CABLE MATERIALS

Polyurethane or Low Smoke Zero Halogen (LSZH)

#### TERMINATION CABLE TYPE

Type 2 - Refer to Table 2.

#### CABLE CONNECTION

*FBM Baseplate End*

37-pin D-subminiature

*Termination Assembly End*

25-pin D-subminiature

### Construction - Termination Assembly

#### MATERIAL

*DIN Rail Mounted TAs*

Polyamide (PA), compression and ring lug

*Baseplate-Mounted TAs*

Polycarbonate/Acrylonitrile Butadiene

Styrene (PC/ABS), compression

### Field Termination Connections

#### DIN RAIL TA COMPRESSION-TYPE ACCEPTED WIRING SIZES

*Solid/Stranded/AWG*

0.2 to 4 mm<sup>2</sup>/0.2 to 2.5 mm<sup>2</sup>/24 to 12 AWG

*Stranded with Ferrules*

0.2 to 2.5 mm<sup>2</sup> with or without plastic collar

#### BASEPLATE MOUNTED TA COMPRESSION - ACCEPTED WIRING SIZES

*Solid/Stranded/AWG*

0.2 to 1.5 mm<sup>2</sup>/0.2 to 1.5 mm<sup>2</sup>/24 to 16

AWG

*Stranded with Ferrules*

0.25 to 0.75 mm<sup>2</sup> with plastic collar

0.25 to 1.5mm<sup>2</sup> without plastic collar

#### RING-LUG - ACCEPTED WIRING SIZES

#6 size connectors (0.375 in (9.5 mm))

0.5 to 4 mm<sup>2</sup>/22 AWG to 12 AWG

## TERMINATION ASSEMBLIES AND CABLES

Field I/O signals connect to the FBM subsystem via DIN rail mounted or baseplate mounted termination assemblies (TAs). Both these types of TAs are electrically passive. The TAs for the FBM202 are available in the following forms:

- ▶ Compression screw type (DIN rail mounted) using Polyamide (PA) material
- ▶ Compression screw type (baseplate mounted) using Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS)
- ▶ Ring lug type (DIN rail mounted) using Polyamide (PA) material

Each DIN rail mounted TA and its associated termination cable provides a feedthrough connection between eight 2-wire thermocouple/mV analog input signals and an FBM202 Thermocouple/mV Input Module. Each baseplate mounted TA provides a

feedthrough connection between sixteen 2-wire thermocouple/mV analog input signals and two FBM202 Thermocouple/mV Input Modules.

Reference junction temperature compensation is provided by an isolated resistance temperature detector (RTD) that is integral to the termination assembly. The baseplate mounted TA contains an RTD for each FBM202.

See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" on page 8 for a list of TAs used with the FBM202 module.

A removable termination cable connects the DIN rail mounted TA to the FBM via a field connector on the baseplate in which the FBM is installed. Termination cables are available in the following materials:

- ▶ Polyurethane
- ▶ Low Smoke Zero Halogen (LSZH).

Termination cables are available in a variety of lengths, up to 30 meters (98 feet), allowing the termination assembly to be mounted in either the enclosure or in an adjacent enclosure. See Table 2 for a list of termination cables used with the TAs for the FBM202 module.

**FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES**

FBM Type	Input Signal	TA Part Number (a)		Termination Type(b)	TA Cable Type (c)	TA Certification Type (d)
		PA	PC/ABS(e)			
FBM202	Eight isolated and independent thermocouple/mV channels, passive feedthrough with FBM202 channel isolation with one 4-wire 100 ohm platinum RTD (IEC 751, Class B)	RH916XH (supersedes P0916AC P0916XH)		C	2	1
		P0917JL (supersedes P0916AD)		RL		
	Two sets of eight isolated and independent thermocouple/mV channels, passive feedthrough with FBM202 channel isolation with one 4-wire 100 ohm platinum RTD (IEC 751, Class B)		RH928CN (supersedes P0928CN)	C Baseplate -mounted)	n/a	1

(a) PA is polyamide rated from -20 to +70°C (-4 to +158°F).  
 (b) C = TA with compression terminals; RL = TA with ring lug terminals.  
 (c) See Table 2 for cable part numbers and length.  
 (d) See Table 1 for Termination Assembly certification definitions.  
 (e) PC/ABS is Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS) rated from -20 to +70°C (-4 to +158°F).



Table 1. Certification 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 DEMKO certified EEx nA IIC T4 for use in Zone 2 potentially explosive atmospheres.

Table 2. Cables Types and Part Numbers

Cable Length m (ft)	Type 2 P/PVC (a)	Type 2 LSZH <sup>(b)</sup>
0.5 (1.6)	RH916DU (supersedes P0916DU)	RH928AL (supersedes P0928AL)
1.0 (3.2)	RH916DV (supersedes P0916DV)	RH928AM (supersedes P0928AM)
2.0 (6.6)	RH931RN (supersedes P0931RN)	RH928AN (supersedes P0928AN)
3.0 (9.8)	RH916DW (supersedes P0916DW)	RH928AP (supersedes P0928AP)
5.0 (16.4)	RH916DX (supersedes P0916DX)	RH928AQ (supersedes P0928AQ)
10.0 (32.8)	RH916DY (supersedes P0916DY)	RH928AR (supersedes P0928AR)
15.0 (49.2)	RH916DZ (supersedes P0916DZ)	RH928AS (supersedes P0928AS)
20.0 (65.6)	RH916EA (supersedes P0916EA)	RH928AT (supersedes P0928AT)
25.0 (82.0)	RH916EB (supersedes P0916EB)	RH928AU (supersedes P0928AU)
30.0 (98.4)	RH916EC (supersedes P0916EC)	RH928AV (supersedes P0928AV)

(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) 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)

**Use of Termination Assemblies in 100 Series Upgrade Subsystem**

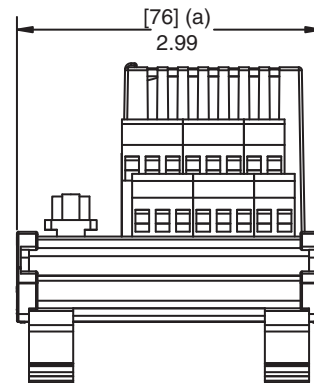
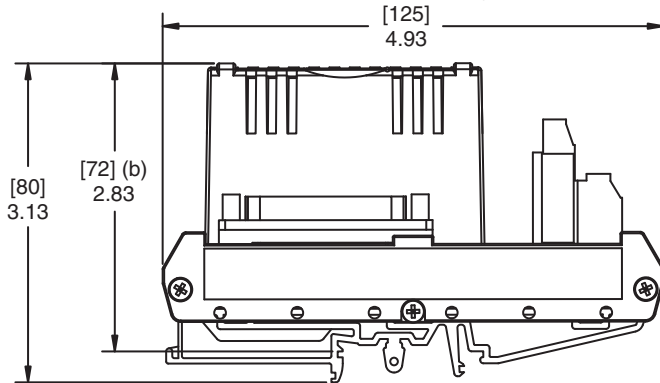
When an FBM202 is used to replace the 100 Series FBM02, it may use any of the appropriate termination assemblies listed above for the FBM02's field I/O

wiring. Alternatively, the FBM202 can accept this field wiring through a Termination Assembly Adapter (TAA) instead of a termination assembly. This is discussed in *Termination Assembly Adapter Modules for 100 Series Upgrade* (PSS 31H-2W4).

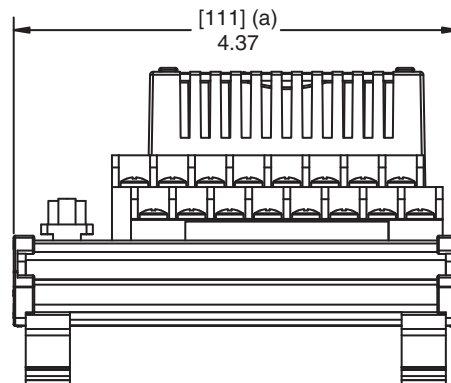
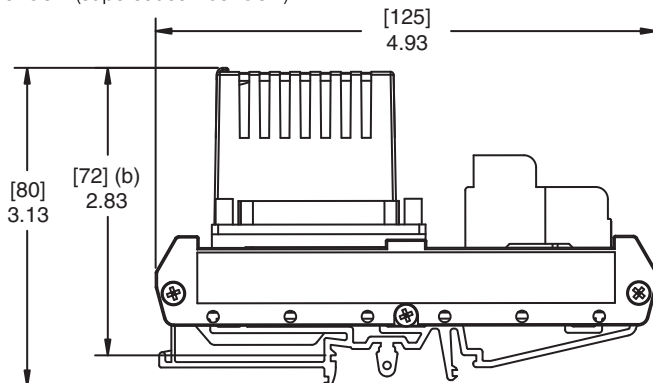
**DIMENSIONS – NOMINAL**

[mm]  
in

RH916XH (supersedes P0916XH, P0916AC) Compression Termination Assembly



RH928CN (supersedes P0928CN) Ring Lug Termination Assembly



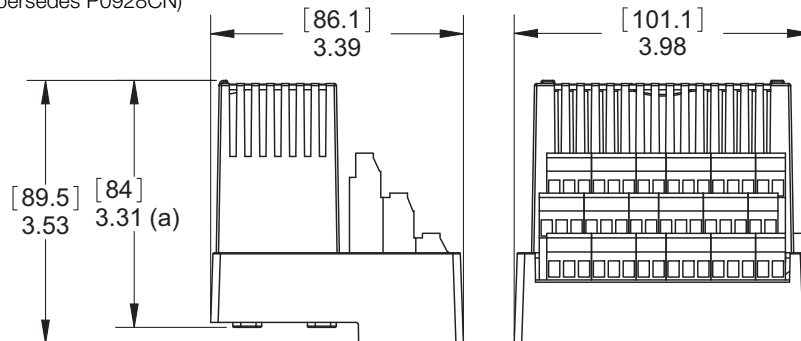
(a) Overall width – for determining DIN rail loading.  
(b) Height above DIN rail (add to DIN rail height for total).

**DIMENSIONS – NOMINAL (CONTINUED)**

[mm]  
in

Baseplate Mounted Termination Assemblies

RH928CN (supersedes P0928CN)



- (a) Overall width – for determining DIN rail loading.
- (b) Height above DIN rail (add to DIN rail height for total).

**RELATED PRODUCT SPECIFICATION SHEETS (PSS)**

PSS Number	Description
PSS 31H-2SOV	Standard 200 Series Subsystem Overview
PSS 31H-2W100	100 Series Fieldbus Module Upgrade Subsystem Overview
PSS 31H-2CERTS	Standard and Compact 200 Series I/O - Agency Certification
PSS 31H-2W4	Termination Assembly Adapter Modules for 100 Series Upgrade
PSS 31H-2SBASPLT	Standard 200 Series Baseplates
PSS 31H-2W8	100 Series Conversion Mounting Structures
PSS 21S-3CP270IC	Control Processor 270 (CP270) Integrated Control Software
PSS 31S-3FCPICS	Field Control Processor 280 (CP280) Integrated Control Software



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