FBM202, Thermocouple/mV Input Interface Module

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

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
- Compact, 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.

OVERVIEW

The FBM202 Thermocouple/mV Input Interface 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.

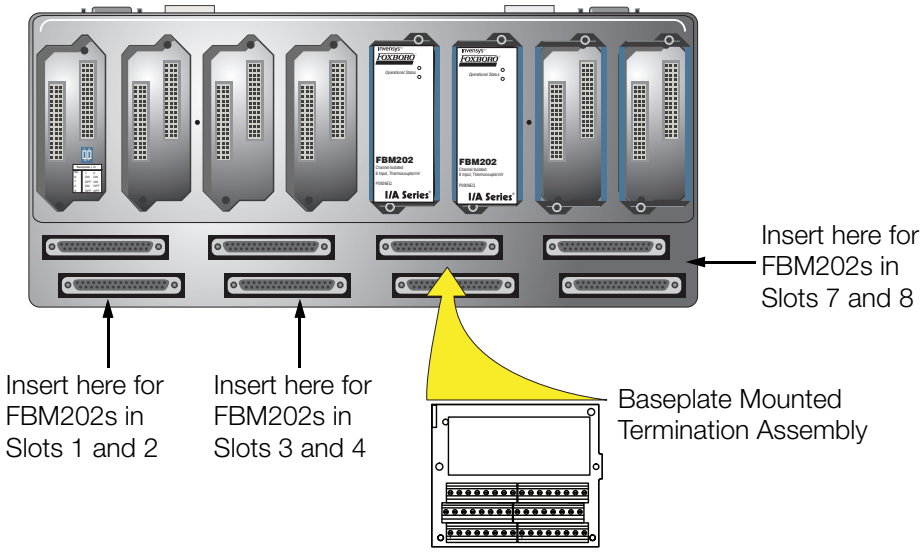


Figure 1. Baseplate-Mounted Termination Assembly

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.

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.

COMPACT DESIGN

FBM202 has a compact design, with 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.

FIELDBUS 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
±0.03% of span (±27 μV) at 25°C

RTD CHANNEL
±0.03% of span

RTD REFERENCE JUNCTION CONFORMITY
±0.25°C

THERMOCOUPLE CONFORMITY
±0.25°C

ACCURACY TEMPERATURE COEFFICIENT
±50 ppm/°C

RTD REFERENCE JUNCTION MEASUREMENT ACCURACY
±0.50°C (When using the RTD internal to the Foxboro supplied termination assemblies)

DIFFERENTIAL INPUT IMPEDANCE
10 MΩ

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 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

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). Also see, "Certification for Termination Assemblies" on page 8.

ENVIRONMENTAL SPECIFICATIONS(1)

Operating

TEMPERATURE

Module
-20 to +70°C (-4 to +158°F)
Termination Assembly
PVC
-20 to +50°C (-4 to +122°F)
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^2 (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 *DIN Rail Mounted Modular Baseplates* (PSS 21H-2W6 B4) or *100 Series Conversion Mounting Structures* (PSS 21H-2W8 B4) 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.

Mass

MODULE

284 g (10 oz) approximate

Mass (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

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
Poly Vinyl Chloride (PVC), compression and ring lug
Polyamide (PA), compression and ring lug

Baseplate-Mounted TAs
Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS), compression

Field Termination Connections

COMPRESSION - ACCEPTED WIRING SIZES

Solid/Stranded/AWG
0.2 to 4 mm^2/0.2 to 2.5 mm^2/24 to 12 AWG

Stranded with Ferrules
0.2 to 2.5 mm^2 with or without plastic collar

RING-LUG - ACCEPTED WIRING SIZES
#6 size connectors (0.375 in (9.5 mm))
0.5 to 4 mm^2/22 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 Poly Vinyl Chloride (PVC) or Polyamide (PA) material
- Compression screw type (baseplate mounted) using Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS)
- Ring lug type (DIN rail mounted) using Polyvinyl Chloride (PVC) 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 Interface Module. Each baseplate mounted TA provides a feedthrough connection between sixteen 2-wire thermocouple/mV analog input signals and two FBM202 Thermocouple/mV Input Interface 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]
		PVC	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)	P0916AC P0916AD	P0916XH P0917JL		C RL	2	1
	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)			P0928CN	C Baseplate-mounted)	n/a	1

(a) PVC is polyvinyl chloride rated from -20 to +50°C (-4 to +122°F); 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 CENELEC (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[b]	Type 2 H/XLPE [c]
0.5 (1.6)	P0916DU	P0928AL	P0916VK
1.0 (3.2)	P0916DV	P0928AM	P0916VL
2.0 (6.6)	P0931RN	P0928AN	P0931RS
3.0 (9.8)	P0916DW	P0928AP	P0916VM
5.0 (16.4)	P0916DX	P0928AQ	P0916VN
10.0 (32.8)	P0916DY	P0928AR	P0916VP
15.0 (49.2)	P0916DZ	P0928AS	P0916VQ
20.0 (65.6)	P0916EA	P0928AT	P0916VR
25.0 (82.0)	P0916EB	P0928AU	P0916VS
30.0 (98.4)	P0916EC	P0928AV	P0916VT

(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)

(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

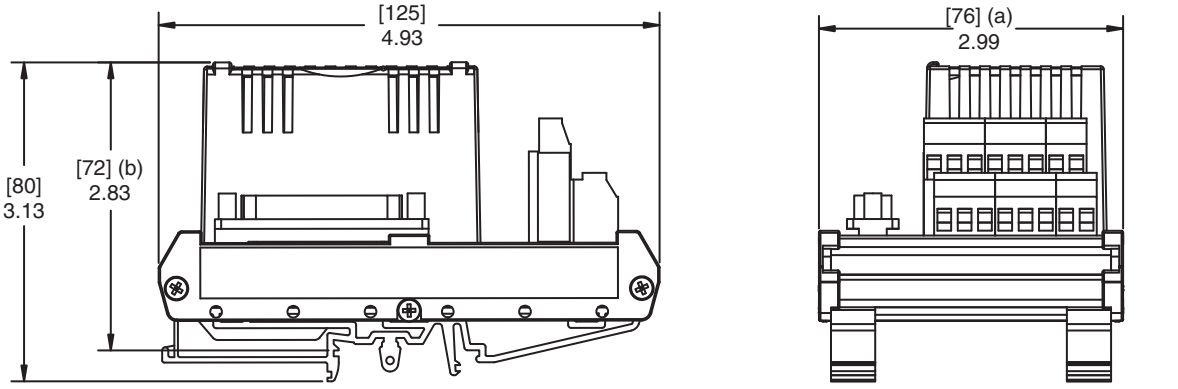
Use of Termination Assemblies in 100 Series Upgrade Subsystem

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 21H-2W4 B4).

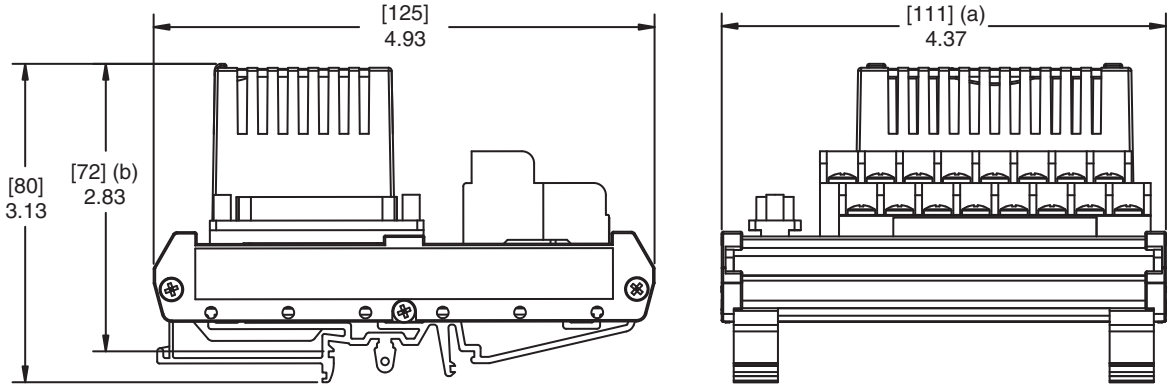
DIMENSIONS – NOMINAL

[mm]
in

Compression Termination Assembly



Ring Lug Termination Assembly

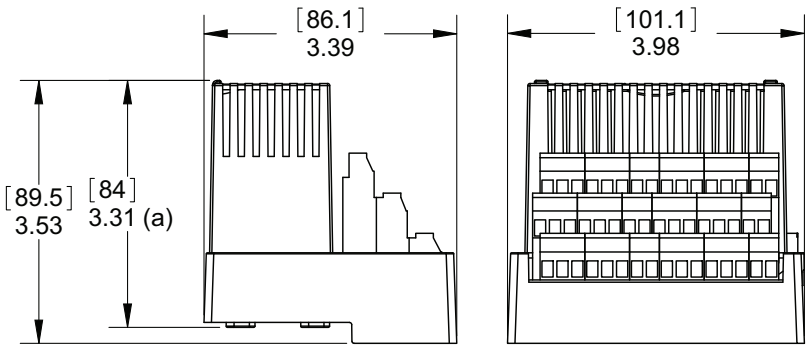


(a) Overall width – for determining DIN rail loading.
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

[mm]
in
Baseplate Mounted Termination Assemblies

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 21H-2W1 B3	DIN Rail Mounted FBM Subsystem Overview
PSS 21H-2W1 B4	100 Series Fieldbus Module Upgrade Subsystem Overview
PSS 21H-2W2 B3	DIN Rail Mounted FBM Equipment, Agency Certification
PSS 21H-2W4 B4	Termination Assembly Adapter Modules for 100 Series Upgrade
PSS 21H-2W6 B4	DIN Rail Mounted Modular Baseplates
PSS 21H-2W8 B4	100 Series Conversion Mounting Structures
PSS 21S-3B2 B3	Control Processor 270 (CP270) Integrated Control Software

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