FBM201/b/c/d Analog Input (0 to 20 mA, 0 to 100 mV, 0 to 5 V, 0 to 10 V dc) Interface Modules



The FBM201/b/c/d Analog Input Interface Modules provide eight dc current or dc voltage input channels.

FEATURES

Key features of the FBM201/b/c/d modules are:

- Eight channels for input of analog sensor signals:
  - 0 to 20 mA dc – FBM201
  - 0 to 100 mV dc – FBM201b
  - 0 to 5 V dc – FBM201c
  - 0 to 10 V dc – FBM201d
- Each analog input channel is galvanically isolated from other channels and ground
- 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 integration time and 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 FBM201/b/c/d modules
- Termination Assemblies for per channel internally and/or externally loop powered transmitters.

OVERVIEW

Each FBM201/b/c/d Analog Input Interface Module contains eight analog input channels, each channel accepting a 2-wire, dc input from an analog sensor such as a 4 to 20 mA or 0 to 5V transmitter, or a self-powered 20 mA source.

The modules perform the signal conversion required to interface the electrical input signals from the field sensors to the optionally redundant fieldbus.

When connected to the appropriate TAs, the FBM201 module provides functionality formerly provided by the 100 Series FBM I/O subsystem. TAs are available which support the functionality of the 100 Series FBM01 when the FBM01 is used with non-HART® devices.

COMPACT DESIGN

The FBM201/b/c/d modules have 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.

HIGH ACCURACY

For high accuracy, the modules incorporate sigma-delta data conversion on a per-channel basis, which can provide a new analog input reading every 25 ms, and a configurable integration period to remove any process noise and power-line frequency noise.

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.

EASY REMOVAL/REPLACEMENT

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

VISUAL INDICATORS

Light-emitting diodes (LEDs) incorporated into the front of the modules provide visual status indications of Fieldbus Module (FBM) functions.

MODULAR BASEPLATE MOUNTING

The modules mount on a modular baseplate (see Figure 1) which accommodates up to four or eight FBMs. 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.

FIELDBUS COMMUNICATION

A Fieldbus Communication Module or a Control Processor interfaces the redundant 2 Mbps module Fieldbus used by the FBMs. The FBM201/b/c/d modules accept communication from either path (A or B) of the redundant 2 Mbps fieldbus – should one path fail or be switched at the system level, the module continues communication over the active path.

TERMINATION ASSEMBLIES

Field I/O signals connect to the FBM subsystem via DIN rail mounted TAs (see Figure 1). The TAs used with the FBM201/b/c/d modules are described in “TERMINATION ASSEMBLIES AND CABLES” on page 8.

FUNCTIONAL SPECIFICATIONS

Process I/O Communications
Communicates with its associated FCM or FCP via the redundant 2 Mbps module Fieldbus.

Input Channels
8 isolated and independent channels

Input Range (each channel)
FBM201: 0 to 20 mA dc
FBM201b: 0 to 100 mV dc
FBM201c: 0 to 5 V dc
FBM201d: 0 to 10 V dc

Input Channels (8)

ANALOG ACCURACY (INCLUDES LINEARITY)
±0.03% of span
Accuracy temperature coefficient: ±50 ppm/ºC

FIELD DEVICE CABLING DISTANCE
Maximum distance of the field device from the FBM is a function of compliance voltage (22.8 V dc), wire resistance, and voltage drop at the field device.

INPUT CHANNEL IMPEDANCE
FBM201: 61.5 Ω nominal
FBM201b: 10 MΩ
FBM201c: 10 MΩ
FBM201d: 10 MΩ

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

INTEGRATION PERIOD
Software configurable.

COMMON MODE REJECTION
>100 db at 50 or 60 Hz

NORMAL MODE REJECTION
>95 db at 50 or 60 Hz

LOOP POWER SUPPLY PROTECTION
Each channel is channel-to-channel galvanically isolated, current limited, and voltage regulated. All analog inputs are limited by their design to less than 30 mA. If the current limit circuit shorted out, the current is limited to about 100mA.

Input Channel Isolation
Each channel is galvanically isolated from all other channels and earth (ground). The module/TA 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 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.

Power Requirements

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

CONSUMPTION
7 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, 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

ELECTROMAGNETIC COMPATIBILITY (CONT.)

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

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 [nL] 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 Table 1 on page 9.

ENVIRONMENTAL SPECIFICATIONS(1)

Operating

TEMPERATURE

FBM201/b/c/d
-20 to +70°C (-4 to +158°F)
Termination Assembly
PVC
-20 to +50°C (-4 to +122°F)
PA
-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

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

PHYSICAL SPECIFICATIONS

Mounting

FBM201/b/c/d

The modules mount on a modular 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, the modules mount 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 TA mounts on a DIN rail and accommodates multiple DIN rail styles including 32 mm (1.26 in) and 35 mm 1.38 in).

Mass

FBM201/b/c/d

284 g (10 oz) approximate

TERMINATION ASSEMBLY

Compression
181 g (0.40 lb) approximate
Ring Lug
249 g (0.55 lb) approximate

Dimensions – FBM201/b/c/d

HEIGHT

102 mm (4 in)
114 mm (4.5 in) with mounting lugs

WIDTH

45 mm (1.75 in)

DEPTH

104 mm (4.11 in)

Dimensions – Termination Assembly

See page 12

Part Numbers

FBM201

P0914SQ

FBM201b

P0922YH

FBM201c

P0922YJ

FBM201d

P0922YK

(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 (CONTINUED)

Part Numbers (Cont.)

TERMINATION ASSEMBLIES
See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" on page 8

Termination Cables

CABLE LENGTHS
Up to 30 m (98 ft)

CABLE MATERIALS
Polyurethane or Low Smoke Zero Halogen (LSZH)

TERMINATION CABLE TYPE
Type 1 – See Table 2 on page 10

BASEPLATE TO MAIN TA CABLE CONNECTION

FBM Baseplate End
37-pin D-subminiature

Termination Assembly End
25-pin D-subminiature

Construction – Termination Assembly

MATERIAL
Polyvinyl Chloride (PVC), compression
Polyamide (PA), compression
PVC, ring lug
PA, ring lug

Field Termination Connections

COMPRESSION-TYPE 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 TYPE 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 input signals connect to the FBM subsystem via DIN rail mounted Termination Assemblies, which are electrically passive (see Figure 1). TAs for the FBM201/b/c/d modules are available in the following forms:

- Compression screw type using Polyamide (PA) material
- Compression screw type using Polyvinyl Chloride (PVC) material
- Ring lug type using Polyamide (PA) material
- Ring lug type using Polyvinyl Chloride (PVC) material

See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" on page 8 for a list of TAs used with the FBM201/b/c/d modules.

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 FBM201/b/c/d modules.

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			
FBM201	8 channels, 0 to 20 mA dc, passive feedthrough with FBM201 channel isolation	P0916AA P0916AB	P0916XG P0917JK	C RL	1	1, 2
FBM201b	8 channels, 0 to 100 mV dc, passive feedthrough with FBM201b channel isolation		P0922ZM	C	1	1, 2
FBM201c	8 channels, 0 to 5 V dc, passive feedthrough with FBM201c channel isolation		P0922ZN	C	1	1, 2
FBM201d	8 channels, 0 to 10 V dc, passive feedthrough with FBM201d channel isolation		P0922ZP P0926SQ	C RL	1	1, 2

(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 specifications.
(d) See Table 1 for Termination Assembly certification definitions.

Table 1. Certification for Termination Assemblies

Type	Certification[a]
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 [nL] IIC T4 for use in Zone 2 potentially explosive atmospheres.
Type 2	TAs are UL/UL-C listed as associated apparatus for supplying non-incendive field circuits Class I; Groups A-D; Division 2 hazardous locations when connected to specified DIN rail mounted FBMs and field circuits meeting entity parameter constraints specified in *DIN Rail Mounted Subsystem User's Guide* (B0400FA). They are also CENELEC (DEMKO) certified as associated apparatus for supplying field circuits for Group IIC, Zone 2 potentially explosive atmospheres. Field circuits are also Class 2 limited energy (60 V dc, 30 V ac, 100 VA or less) if customer-supplied equipment meets Class 2 limits.

(a) All TAs are UL/UL-C listed to comply with applicable ordinary location safety standards for fire and shock hazards. Hazardous location types comply with ATEX directive for II 3 G use. They also comply with the requirements of the European Low Voltage Directive. All listings/certifications require installation and use within the constraints specified in DIN Rail Mounted Subsystem User's Guide (B0400FA) and the conditions stated in UL and DEMKO reports.

Table 2. Cables 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.
(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 FBM201 is used to replace the 100 Series FBM01, it may use any of the appropriate termination assemblies listed above for the FBM01's field I/O wiring. Alternatively, the FBM201 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).