

## **Compact FBM211, 0 to 20 mA Input Module**



*The Compact FBM211, 0 to 20 mA Input Interface Module contains sixteen 20 mA dc analog input channels.*

### **OVERVIEW**

The Compact FBM211, 0 to 20 mA Input Interface Module contains sixteen 20 mA dc analog input channels, each channel accepting a 2-wire analog sensor input such as a 4 to 20 mA transmitter or a self-powered 20 mA source. The input channels are galvanically isolated from ground and module logic. The module performs the signal conversion required to interface the electrical input signals from the field sensors to the FCP or ZCP.

It is part of the Compact 200 Series I/O subsystem described in *Compact 200 Series I/O Subsystem Overview* (PSS 31H-2COV).

The Compact FBM211 executes an analog input application program, which provides configurable options for Conversion Time and Rate of Change Limits.

### **FEATURES**

Key features of the Compact FBM211 are:

- ▶ Sixteen 20 mA dc analog input channels
- ▶ Each group of eight input channels is group 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 Compact FBM211
- ▶ Termination Assemblies for external or FBM powered transmitters.

### **HIGH ACCURACY**

For high accuracy, the module incorporates a multiplexed Sigma-Delta converter shared by all channels, which can provide new analog input readings every 100 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**

The Compact FBM211's design is narrower than the standard 200 Series FBMs. It has a rugged Acrylonitrile Butadiene Styrene (ABS) 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**

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

### **EASY REMOVAL/REPLACEMENT**

The module mounts on a Compact 200 Series baseplate. Two screws on the FBM secure the module to the baseplate.

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

### **FIELDBUS COMMUNICATION**

A Fieldbus Communications Module or a Control Processor interfaces to the redundant 2 Mbps module Fieldbus used by the FBMs. The Compact FBM211 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.

### **TERMINATION ASSEMBLIES**

Field I/O signals connect to the FBM subsystem via DIN rail mounted TAs. The TAs used with the Compact FBM211 are described in "TERMINATION ASSEMBLIES AND CABLES" on page 6.

## FUNCTIONAL SPECIFICATIONS

### Input

16 group isolated and independent channels

### Input Range (each channel)

0 to 20.4 mA dc (each channel current limited to 33 mA)

### Accuracy (includes linearity)

$\pm 0.03\%$  of span

Accuracy temperature coefficient:  $\pm 50$  ppm/ $^{\circ}$  C

### Input Signal A/D Conversion

Each channel performs A/D signal conversion using a multiplexed Sigma-Delta converter.

### Integration Period

Software configurable

### Common Mode Rejection

$>100$  db at 50 or 60 Hz

### Normal Mode Rejection

$>35$  db at 50 or 60 Hz

### Input Channel Impedance

61.9  $\Omega$  nominal

### Field Device Cabling Distance

Maximum distance of the field device from the FBM is a function of compliance voltage (23 V for internal power), wire gauge, and voltage drop at the field device.

### Loop Power Supply Protection

Each channel is current limited and voltage regulated when used with TA RH916BT or P0916BU that limits short circuit current to 35 mA. If the current limit circuit shorts out, the current is limited to about 385 mA.

### HART® Protocol Compatibility

The channels meet the impedance requirements for a HART High Impedance Device and can be used in a HART loop without interfering with the HART signals between the field device and a Hand-Held Communicator (HHC).

If a FoxCom or HART transmitter is used with Compact FBM211, a 200 ohm in-line resistor (assembly part number RH902VY (supersedes P0902VY)) must be added in series with the transmitter.

### Input Channel Isolation

The channels are not galvanically isolated from each other, but are galvanically isolated from ground and module logic. Group isolated inputs use the FBM subsystem power supply for field power.

The module withstands, without damage, a potential of 600 V ac applied for one minute between the group isolated channels 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.

### Communication

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

### Power Requirements

#### INPUT VOLTAGE RANGE (REDUNDANT)

24 V dc  $+5\%$ ,  $-10\%$

#### CONSUMPTION

3.5 W (External Power)

11 W (Internal Power)

#### HEAT DISSIPATION

3 W

### 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).

### MARINE CERTIFICATION

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

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

Operating

TEMPERATURE

*Compact FBM211*  
-20 to +60°C (-4 to +140°F)  
*Termination Assembly - PVC<sup>(2)</sup>*  
-20 to +50°C (-4 to +122°F)  
*Termination Assembly - 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 +85°C (-40 to +185°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 SPECIFICATIONS

Mounting

MODULE

The Compact FBM211 mounts on a Compact 200 Series 16-slot horizontal baseplate. The baseplate can be mounted on a horizontal DIN rail, or horizontally on a 19-inch rack using a mounting kit.

Refer to *Compact 200 Series 16-Slot Horizontal Baseplate* (PSS 31H-2C200) 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).

Weight

MODULE

185 g (6.5 oz) approximate

TERMINATION ASSEMBLIES

*Compression*  
272 g (0.60 lb, approximate)  
*Ring Lug*  
363 g (0.80 lb, approximate)

Dimensions

COMPACT FBM201

*Height*  
130 mm (5.12 in)  
*Width*  
25 mm (0.98 in)  
*Depth*  
150 mm (5.9 in) - Including baseplate connectors, 139 mm (5.46 in)

TERMINATION ASSEMBLY

Refer to page 9.

Part Numbers

COMPACT FBM211

RH101DE

TERMINATION ASSEMBLIES

See "FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES" on page 7.

(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.]  
(2) Do not use this termination assembly when the temperature specification exceeds +50°C (122°F).

## PHYSICAL SPECIFICATIONS (CONTINUED)

### Termination Cables

#### CABLE LENGTHS

Up to 30 m (98 ft)

#### CABLE MATERIALS

Polyurethane outer jacket over semi-rigid PVC primary conductor insulation (P/PVC)

Low Smoke Zero Halogen (LSZH)

#### TERMINATION CABLE TYPE

Type 4 - Refer to Table 2.

#### CABLE CONNECTION

*FBM Baseplate End*

37-pin D-subminiature

*Termination Assembly End*

37-pin D-subminiature

### Construction - Termination Assembly

#### MATERIAL

*Compression*

PVC

*Ring Lug*

PVC

#### TERMINAL BLOCKS

Inputs - 2 tiers, 16 positions

### Field Termination Connections

#### COMPRESSION - 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

#### 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 termination assemblies, which are **electrically passive**. TAs for the Compact FBM211 module are available in the following forms:

- ▶ Compression screw type using Polyvinyl Chloride (PVC) material
- ▶ Ring lug type using PVC material.

Each Compact FBM211 Termination Assembly and its associated termination cable provide feedthrough connection between sixteen 2-wire analog input signals and the Compact FBM211.

Loop power is provided to the field devices by a customer-supplied external dc power supply or by the FBM auxiliary +24 V dc power supply depending on the TA selected.

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 assemblies to be mounted as needed by plant design. See Table 2 for a list of termination cables used with the TAs for the Compact FBM211.

## FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES

FBM Type	Input Signal	TA Part Number <sup>(a)</sup>		Termination Type <sup>(b)</sup>	TA Cable Type <sup>(c)</sup>	TA Certification Type <sup>(d)</sup>
		PVC	PA			
Compact FBM211	Loop power is provided to the field devices by a customer-supplied external dc power supply.	RH916JT (supersedes P0916JT) P0916PQ		C RL	4	1,2
Compact FBM211	Loop power is provided to the field devices by the FBM auxiliary +24 V dc power supply.	P0916BU	RH916BT (supersedes P0916BT)	C RL	4	1,4

(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.

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

**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 Ex nA 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 200 Series FBMs and field circuits meeting entity parameter constraints specified in <i>Standard and Compact 200 Series Subsystem User's Guide</i> (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.
Type 4	All field circuits are Class 2 limited energy (60 V dc, 30 V ac, 100 VA or less) if customer-supplied equipment meets Class 2 limits.

Table 2. Cables Types and Part Numbers

Cable Length m (ft)	Type 4 P/PVC <sup>(a)</sup>	Type 4 LSZH <sup>(b)</sup>
0.5 (1.6)	RH100CJ	RH100BN
1.0 (3.2)	RH100CK	RH100BP
1.5 (4.9)	RH100EQ	RH100EN
2.0 (6.6)	RH100CL	RH100BQ
3.0 (9.8)	RH100CM	RH100BR
5.0 (16.4)	RH100CN	RH100BS
10.0 (32.8)	RH100CP	RH100BT
15.0 (49.2)	RH100CQ	RH100BU
20.0 (65.6)	RH100CR	RH100BV
25.0 (82.0)	RH100CS	RH100BW
30.0 (98.4)	RH100CT	RH100BX

(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. PVC is rated from -20 to +50°C (-4 to 122°F).

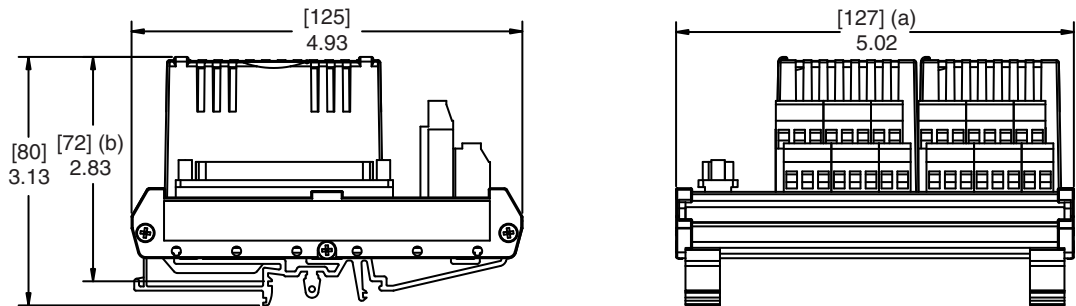
(b) Low smoke zero halogen or low smoke free of halogen (LSZH) is a material classification used for cable jacketing. LSZH is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogen when exposed to high sources of heat. Temperature range; -40 to +105°C (-40 to +221°F)



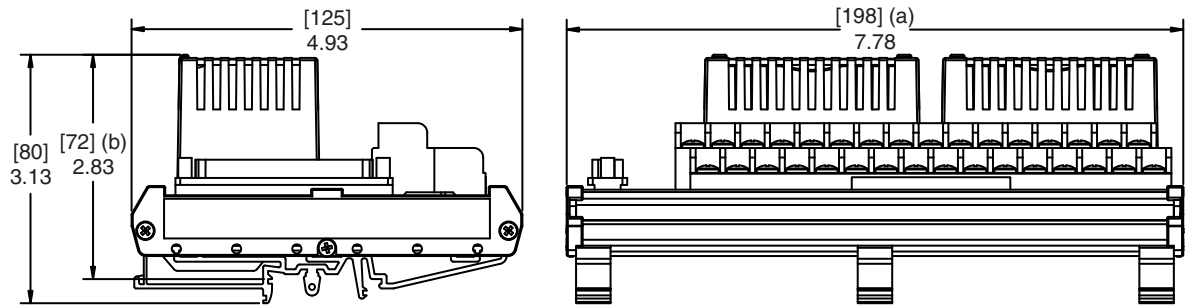
**DIMENSIONS – NOMINAL**

[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).

**RELATED PRODUCT DOCUMENTS****Table 3. Other Related Documents**

<b>PSS Number</b>	<b>Description</b>
PSS 31H-2COV	Compact 200 Series I/O Subsystem Overview
B0400FA	Standard and Compact 200 Series Subsystem User's Guide
PSS 31H-2C200	Compact 200 Series 16-Slot Horizontal Baseplate
PSS 31H-2CERTS	Standard and Compact 200 Series I/O, Agency Certifications
PSS 31H-2C480 B4	Compact Power Supply - FPS480-24
PSS 31S-3FCPICS	Field Control Processor 280 (FCP280) Integrated Control Software
PSS 21S-3CP270IC	Control Processor 270 (CP270) Integrated Control Software



**Foxboro**  
**by Schneider Electric**

Invensys Systems, Inc.  
38 Neponset Avenue  
Foxborough, MA 02035-2037  
United States of America  
[www.schneider-electric.com](http://www.schneider-electric.com)

Global Customer Support  
Inside U.S.: 1-866-746-6477  
Outside U.S.: 1-508-549-2424  
Website: <https://support.ips.invensys.com>

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