Foxboro Evo™ Process Automation System



by Schneider Electric

Product Specifications

PSS 31H-2S245

FBM245, 0 to 20 mA I/O Module with HART® Support (Redundant)



A pair of FBM245 modules provide redundant and galvanically isolated communications channels. The four inputs and four outputs continue operation in the presence of a module fault and the operation continues through replacement of the suspect module. The channels are capable of communicating HART® messages and are electrically compatible with 4 to 20 mA signals.

OVERVIEW

A redundant pair of FBM245 modules perform the signal conversion required to interface electrical input/output signals from field sensors and actuators to the redundant module Fieldbus. Each module contains four 0 to 20 mA galvanically isolated analog input and output channels (eight total). They support any mix of standard 4 to 20 mA devices and HART devices as shown in Figure 1.

Each input channel accepts an analog sensor input such as a 4 to 20 mA transmitter or a self-powered

20 mA source. Each output channel drives an external load and produces a 0 to 20 mA output.

A redundant analog input and redundant analog output block in the Foxboro Evo[™] Control Software validates each input and output in conjunction with information to/from the module. When a failure is detected in one of the FBM245s, its output is driven to 0 mA, and the corresponding channel in the good module automatically continues supplying the proper current to the output current loop.

4 REDUNDANT ANALOG INPUTS - SINGLE TRANSMITTER 4 REDUNDANT ANALOG OUTPUTS - SINGLE VALVE



Figure 1. Redundant I/O Configurations

The configurable options for this program include Fail-Safe Action (Hold/Fallback), Analog Output Fail-Safe Fallback Data (on a per channel basis), Fieldbus Fail-Safe Enable, and Fieldbus Fail-Safe Delay Time.

FEATURES

Key features of the FBM245 module are:

- Four 0 to 20 mA analog input channels, used for a HART analog sensor input
- Four analog output channels, used to drive an external load and produce a 0 to 20 mA output
- Support for the HART universal commands necessary to interface the field device with the Foxboro Evo system. All channels are galvanically isolated
- Rugged design suitable for enclosure in harsh environments (Class G3) per ISA Standard S71.04.

- Termination Assemblies (TAs) for locally or remotely connecting field wiring to the FBM245
- Channels may be powered from sources internal to the Foxboro Evo system or from external sources.

PHYSICAL DESIGN

The FBM245 has a modular 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.

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 which accommodates up to 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 FBM245 module accepts 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 a DIN rail mounted termination assembly. The TA used

with the FBM245 modules is described in "TERMINATION ASSEMBLIES AND CABLES" on page 7.

FUNCTIONAL SPECIFICATIONS

Supported Hart Instrument Types

HART instruments compliant to Version 5, 6, or 7 of the HART specifications may be used.

Process I/O Communications

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

Input Channels

INPUT

4 isolated and independent redundant $\ensuremath{\mathsf{channels}}^{(1)}$

INPUT RANGE (EACH CHANNEL) 0 to 20.4 mA dc

ACCURACY

±0.075% of span

COMMUNICATION Via a redundant Fieldbus

INPUT CONNECTIONS

Two configurations (see Figure 2)



EXTERNALLY POWERED TRANSMITTER



Figure 2. Input Connections

⁽¹⁾ Redundant inputs pairs are connected by a common field I/O connector and therefore, are not isolated from each other.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Output Channels OUTPUT

4 isolated and independent redundant channels $^{\left(2\right) }$

OUTPUT RANGE (EACH CHANNEL) 0 to 20.4 mA dc

OUTPUT LOAD (MAXIMUM) 735 Ω

COMPLIANCE VOLTAGE

18.0 V nominal at 20 mA dc at I/O field terminals

ACCURACY

±0.05% of span (25°C) between 4-20 mA **OUTPUT TEMPERATURE COEFFICIENT**

100 ppm/°C

COMMUNICATION

Via a redundant Fieldbus

SETTLING TIME

100 ms to settle within a 1% band of steady state for a 10 to 90% input step change.

LINEARITY ERROR

 $\pm 0.05\%$ of span

RESOLUTION 12 bits

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.

Fastest Allowed ECB Block Period

100 msec - However, it is recommended that you refer to the *Sizing Guidelines and Excel Workbook* appropriate for your Control Processor to determine the optimal loading for a 100 msec Block Processing Cycle (BPC).

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.

⁽²⁾ Redundant output pairs are connected by a common field I/O connector and therefore, are not isolated from each other.

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 Table 1 on page 9.

MARINE CERTIFICATION

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

ENVIRONMENTAL SPECIFICATIONS⁽³⁾

Operating

TEMPERATURE

FBM245 -20 to +70°C (-4 to +158°F) *Termination Assembly* -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

⁽³⁾ 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

Mounting

FBM245

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. Refer to *Standard 200 Series Baseplates* (PSS 31H-2SBASPLT) 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

FBM245

284 g (10 oz) approximate **TERMINATION ASSEMBLY** 181 g (0.40 lb) approximate

Dimensions – FBM245

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 Assembly See page 11

Part Numbers

FBM245

RH927AL (supersedes P0927AL)

TERMINATION ASSEMBLIES

See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" on page 8

REDUNDANT ADAPTER

RH924DU (supersedes P0924DU)

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 9

CABLE CONNECTION

FBM Baseplate End 37-pin D-subminiature *Termination Assembly End* 25-pin D-subminiature

Construction – Termination Assembly

MATERIAL

Polyamide (PA), compression

Field Termination Connections COMPRESSION-TYPE ACCEPTED WIRING

SIZES

Solid/Stranded/AWG 0.2 to 4 mm²/0.2 to 2.5 mm²/24 to 12 AWG Stranded with Ferrules 0.2 to 2.5 mm² with or without plastic collar

TERMINATION ASSEMBLIES AND CABLES

Field input signals connect to the FBM subsystem via DIN rail mounted Termination Assemblies.

The redundant adapter connects the redundant FBMs baseplate input/output connectors together. The redundant adapter provides a single termination connection to a single TA.

The TA for the FBM245 module is available as a compression screw type using Polyamide (PA) material.

See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" on page 8 for the TA used with the FBM245 modules. The DIN rail mounted TAs connect to the redundant adapter by means of a removable termination cable. The cable is available in a variety of lengths, up to 30 meters (98 feet), allowing the TA to be mounted in either the enclosure or in an adjacent enclosure. Termination cables are available in the following materials:

- Polyurethane
- Low Smoke Zero Halogen (LSZH).

See Table 2 for a list of termination cables used with the TA for the FBM245 modules.

		TA Part Number ^(a)	Termination	TA Cable	TA
FBM Туре	Input Signal	PA	Type ^(b)	Type(^(c)	Type ^(d)
FBM245	Four input and four output channels, 4 to 20 mA analog signal, from HART devices	RH924QU (supersedes P0924QU) RH924QZ ^(e) (supersedes P0924QZ)	С	1	1, 2

FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES

(a) PA is polyamide rated from -20 to +70°C (-4 to +158°F).

(b) C = TA with compression terminals.

(c) See Table 2 for cable part numbers and specifications.

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

(e) RH924QZ (supersedes P0924QZ) has four output bypass jacks. It is not suitable for use in any hazardous locations - ordinary locations only.

Туре	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 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 200 Series FBMs and field circuits meeting entity parameter constraints specified in <i>Standard and</i> <i>Compact 200 Series Subsystem User's Guide</i> (B0400FA). They are also 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.

Table 1. Certification for Termination Assemblies

(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 *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA) and the conditions stated in UL and DEMKO reports.

C	1	1
Cable Length m (ft)	Type 1 P/PVC ^(a)	Type 1 LSZH ^(b)
0.5 (1.6)	RH916DA	RH928AA
	(supersedes P0916DA)	(supersedes P0928AA)
1.0 (3.2)	RH916DB	RH928AB
	(supersedes P0916DB)	(supersedes P0928AB)
2.0 (6.6)	RH931RM	RH928AC
	(supersedes P0931RM)	(supersedes P0928AC)
3.0 (9.8)	RH916DC	RH928AD
	(supersedes P0916DC)	(supersedes P0928AD)
5.0 (16.4)	RH916DD	RH928AE
	(supersedes P0916DD)	(supersedes P0928AE)
10.0 (32.8)	RH916DE	RH928AF
	(supersedes P0916DE)	(supersedes P0928AF)
15.0 (49.2)	RH916DF	RH928AG
	(supersedes P0916DF)	(supersedes P0928AG)

Table 2. Cable Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC ^(a)	Type 1 LSZH ^(b)
20.0 (65.6)	RH916DG (supersedes P0916DG)	RH928AH (supersedes P0928AH)
25.0 (82.0)	RH916DH (supersedes P0916DH)	RH928AJ (supersedes P0928AJ)
30.0 (98.4)	RH916DJ (supersedes P0916DJ)	RH928AK (supersedes P0928AK)

Table 2. Cable Types and Part Numbers (Continued)

(a) P/PVC is polyure thane 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

When a redundant FBM245 is used to replace the 100 Series FBM05, it may use any of the appropriate termination assemblies listed above for the FBM245's field I/O wiring.

DIMENSIONS – NOMINAL

[mm] in

TERMINATION ASSEMBLY - Compression RH924QU (supersedes P0924QU), RH924QZ (supersedes P0924QZ)





(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 Certifications
PSS 31H-2SBASPLT	Standard 200 Series Baseplates
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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