

FBM244, 0 to 20 mA I/O Interface Module with HART® Support



The FBM244 0 to 20 mA I/O Interface Module with HART® support provides four input and four output communication channels for analog field signals.

FEATURES

Key features of the FBM244 module are:

- ▶ Four 0 to 20 mA analog input channels, used for a HART analog sensor input such as a 4 to 20 mA transmitter or a self-powered 20 mA source
 - ▶ 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 I/A Series® system database
- Both inputs and outputs are galvanically isolated

- ▶ Compact, rugged design suitable for enclosure in Class G3 (harsh) environments
- ▶ Termination Assemblies (TAs) for locally or remotely connecting field wiring to the FBM244
- ▶ Termination Assemblies for per channel internally and/or externally loop powered transmitters.

OVERVIEW

The FBM244 module contains four 0 to 20 mA galvanically isolated analog input and output channels (eight total). The FBM244 supports any mix of standard 4 to 20 mA devices and HART devices.

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. The module performs the signal conversion required to interface the electrical input/output signals from the field sensors and actuators to the redundant Fieldbus.

This module executes the analog I/O application program. The configurable options for this program are Fail-Safe Configuration (Hold/Fallback), Analog Output Fail-Safe Fallback Data, (on a per channel basis), Fieldbus Switching Enable and Fieldbus Switching Time. The module does not provide DPIDA support.

When connected to the appropriate TAs, the FBM244 module provides functionality formerly provided by the 100 Series FBM I/O subsystem. TAs are available which support the functionality of the 100 Series FBM04, when the FBM04 is used with HART devices.

COMPACT DESIGN

The FBM244 module 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.

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 or conversion mounting structure 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 FBM244 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 ASSEMBLY

Field I/O signals connect to the FBM subsystem via a DIN rail mounted termination assembly. The TA used with the FBM244 modules is described in “TERMINATION ASSEMBLIES AND CABLES” on page 6.

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 channels

INPUT RANGE (EACH CHANNEL)

0 to 20.4 mA dc

ACCURACY

$\pm 0.03\%$ of span

COMMUNICATION

Via a redundant Fieldbus

INPUT CONNECTIONS

Two configurations (see Figure 1)

Output Channels

OUTPUT

4 isolated and independent channels

OUTPUT RANGE (EACH CHANNEL)

0 to 20.4 mA dc

OUTPUT LOAD (MAXIMUM)

735 Ω

COMPLIANCE VOLTAGE

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

ACCURACY

$\pm 0.05\%$ 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.

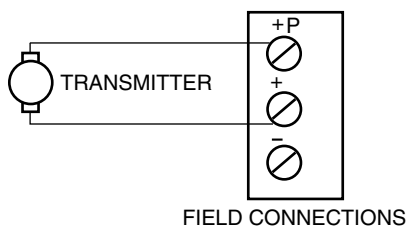
LINEARITY ERROR

$\pm 0.025\%$ of span (monotonic)

RESOLUTION

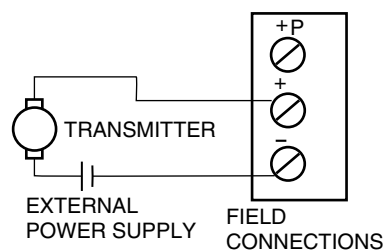
12 bits

MODULE-POWERED TRANSMITTER



INPUT COMPLIANCE VOLTAGE
22 VOLTS MINIMUM AT 20 mA

EXTERNALLY POWERED TRANSMITTER



INPUT RESISTANCE 50 Ω

Figure 1. Input Connections

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.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

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.

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

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 7.

ENVIRONMENTAL SPECIFICATIONS⁽¹⁾

Operating

TEMPERATURE

FBM244

-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/S² (0.75 g) from 5 to 500 Hz

PHYSICAL SPECIFICATIONS

Mounting

FBM244

The modules mount on a modular baseplate or a 100 Series conversion mounting structure. 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

FBM244

284 g (10 oz) approximate

TERMINATION ASSEMBLY

181 g (0.40 lb) approximate

Dimensions – FBM244

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 9

Part Numbers

FBM244

P0927AK

TERMINATION ASSEMBLIES

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” on page 6

(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

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 8

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 TA for the FBM244 module is available as a compression screw type using Polyamide (PA) material.

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” below for the TA used with the FBM244 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 TA for the FBM244 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			
FBM244	Four input and four output channels, 4 to 20 mA analog signal, from HART devices		P0924QU, P0924QZ ^(e)	C	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.

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

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 <i>DIN Rail Mounted 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 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. Cable 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.

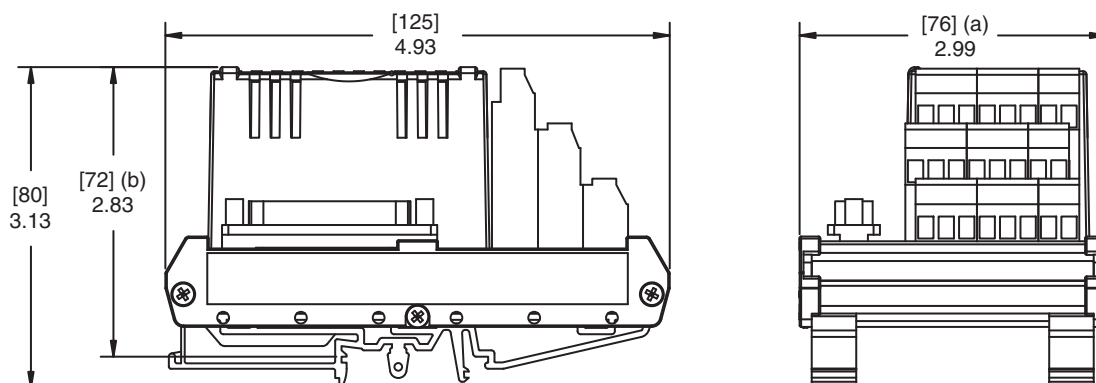
Upgrade Use of Termination Assemblies

When an FBM244 is used to replace the 100 Series FBM04, it may use any of the appropriate termination assemblies listed above for the FBM244's field I/O wiring. Alternatively, the FBM244 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

TERMINATION ASSEMBLY - Compression - P0924QU, 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 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

