# Foxboro Evo™ Process Automation System Hardware

**Product Specifications**

Foxboro® by Schneider Electric

**PSS 31H-2S204**

## FBM204, 0 to 20 mA I/O Module




*The FBM204, 0 to 20 mA Input/Output contains four 20 mA dc analog input channels and four 20 mA dc analog output channels.*

## OVERVIEW

The FBM204, 0 to 20 mA Input/Output module contains four 0 to 20 mA dc analog input channels and four 0 to 20 mA dc analog output channels. 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 inputs/outputs are galvanically isolated from other channels and ground.

The FBM204 performs the signal conversion required to interface the electrical input/output signals from the field sensors to the optionally redundant fieldbus.

The FBM204 executes the Analog I/O application program, which provides the following configurable options: Conversion Time, Fail-Safe Configuration (Hold/Fallback), and Analog Output Fail-Safe Fallback Data (on a per channel basis). When used with I/A Series® software v8.6 to v8.8 or Foxboro Evo™ Control Core Services software v9.0 or later, the FBM may instead execute a distributed PIDA (DPIDA) application program to provide a fast control loop running in it.

The FBM204 is electrically compatible with standard HART signals.

## FEATURES

The key features of the FBM204 are:

- Four 20 mA dc analog input channels
- Four 20 mA dc analog output channels
- Each input and output channel is galvanically isolated
- Rugged design suitable for enclosure in Class G3 (harsh) environments
- Execution of an analog I/O 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 FBM204
- TA for use with Output Bypass Station to maintain outputs during maintenance operations
- 3-tier termination assembly for per channel internally and/or externally loop powered transmitters.
- Support for DPIDA control blocks.

## HIGH ACCURACY

For high accuracy, the module incorporates Sigma-Delta data conversion on a per channel basis, which provides new analog input readings every 25 ms, and a configurable integration period to remove any process and/or electromagnetic noise.

## STANDARD DESIGN

FBM204 has 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

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

## EASY REMOVAL/REPLACEMENT

The module can be removed/replaced without removing field device termination cabling, or 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 Modular 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 DIN rail mounted TAs. The TAs used with the FBM204 are described in “TERMINATION ASSEMBLIES AND CABLES” on page 6.

## FUNCTIONAL SPECIFICATIONS

### Input/Output Channels
Four 20 mA dc analog input channels, and four 20 mA dc analog output channels. Each channel is isolated and independent.

### Input/Output Range (each channel)
0 to 20.4 mA dc

### Input Channels (Four) - Specifications

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

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

**INPUT CHANNEL IMPEDANCE**
61.5 Ω nominal

**INTEGRATION PERIOD**
Software configurable

**COMMON MODE REJECTION**
>100 db at 50 or 60 Hz

**NORMAL MODE REJECTION**
>95 db at 50 or 60 Hz

**FIELD DEVICE CABLING DISTANCE**
Maximum distance of the field device from the FBM is a function of compliance voltage (20.2 V dc at 20.4 mA input), wire gauge, and voltage drop at the field device.

**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 shorts out, the current is limited to about 100mA.

### Output Channels (Four) - Specifications

**ACCURACY - ANALOG (INCLUDES LINEARITY)**
±0.03% of Span
Accuracy temperature coefficient: ±50 ppm/°C

**OUTPUT LOAD**
750 Ω maximum

**OUTPUT PROCESSING DELAY**
30 ms maximum

**RESOLUTION**
13 bits

**FIELD DEVICE CABLING DISTANCE**
Maximum distance of the field device from the FBM is a function of compliance voltage (19.6 V dc at 20.4 mA input), wire gauge, and voltage drop at the field device.

**LOOP POWER SUPPLY PROTECTION**
Each channel is channel-to-channel galvanically isolated, current limited, and voltage regulated. All analog outputs are limited by their design to about 25 mA. If the output FET shorts, the output current could increase up to 35 mA. In normal operation the FBM outputs a constant current into a 0 to 750 ohm load.

**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 as an “input device” to the FBM204, a 200 ohm in-line resistor (assembly part number RH902VY (supersedes P0902VY)) must be added in series with the transmitter.

### Input/Output 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. See CAUTION below.

**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.

## FUNCTIONAL SPECIFICATIONS (CONTINUED)

### Power Requirements

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

**CONSUMPTION (MAXIMUM)**
7 W (maximum)

**HEAT DISSIPATION (MAXIMUM)**
3.5 W (maximum)

### Calibration Requirements

Calibration of the module and termination assembly is not required.

### 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 7.

**NOTE**
DEMKO Certification does not apply to Termination Assembly RH917QW (supersedes P0917QW). See Table 1 on page 7.

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

## ENVIRONMENTAL SPECIFICATIONS(1)

### Operating Conditions

**TEMPERATURE**

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

**RELATIVE HUMIDITY**
5 to 95% (noncondensing

**ALTITUDE**
-300 to +3000 m (-1000 to +10 000 ft)

### Storage Conditions

**TEMPERATURE**
-40 to +70°C (-40 to +158°F)

**RELATIVE HUMIDITY**
5 to 95% (noncondensing)

**ALTITUDE**
-300 to +12 000 m (-1000 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 $m/s^2$ (5 to 500 Hz)

## PHYSICAL SPECIFICATIONS

### Mounting

**MODULE**
FBM204 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, FBM204 mounts on a 100 Series conversion mounting structure. Refer to *Standard 200 Series Baseplates* (PSS 31H-2SBASPLT) or *100 Series Conversion Mounting Structures* (PSS 31H-2W8) 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**
284 g (10 oz) approximate

**TERMINATION ASSEMBLIES**

*Compression*
159 g (0.35 lb, approximate)
*Ring Lug*
204 g (0.45 lb, approximate)

### 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 9

### Part Numbers

**FBM204 MODULE**
RH914SY (supersedes P0914SY)

**TERMINATION ASSEMBLIES**
See “FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES” on page 7.

(1) The environment ranges can be extended by the type of enclosure containing the module. Refer to the Product Specification Sheet (PSS) applicable to the enclosure that is to be used.

## PHYSICAL SPECIFICATIONS (CONTINUED)

### Termination Cables

**CABLE LENGTHS**
Up to 30 m (98 ft)

**CABLE MATERIALS**
Polyurethane or Low Smoke Zero Halogen (LSZH)

**TERMINATION CABLE TYPE**
Type 1 - Refer to Table 2

*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 - 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 termination assemblies, which are electrically passive. TAs for the FBM204 module are available in the following forms:

- Compression screw type using Polyamide (PA) material

Each FBM204 Termination Assembly and its associated termination cable provide feedthrough connection between four 2-wire analog input signals and four 2-wire analog output signals, and the FBM204, 0 to 20 mA I/O Module.

Termination Assembly (RH917QW (supersedes P0917QW)) includes built-in bypass jacks for each output channel. Jacks accept a bypass plug from the Foxboro Evo Output Bypass Station (Foxboro® P/N P0900HJ) or other external 20 mA sources. This option should be considered for applications where maintaining output during maintenance operations is desired.

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 FBM204 module.

## FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES

| FBM Type | Input | | Output | | TA Part No.(a) | Termination Type(b) | TA Cable Type(c) | TA Cert. Type (d) |
|---|---|---|---|---|---|---|---|---|
| | Qty. | Signal | Qty. | Signal | PA | | | |
| FBM204 | 4 | 0 to 20 mA | 4 | 0 to 20 mA | RH916XK (supersedes P0916AG, P0916XK) | C | 1 | 1 |
| | | | | | P0916AH | RL | | |
| FBM204 | 4 | 0 to 20 mA | 4 | 0 to 20 mA | RH917QW (supersedes P0917QW) | C | 1 | 4,5 |

(a) 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 |
|---|---|
| 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 IIC T4 for use in Zone 2 potentially explosive atmospheres. |
| 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. |
| Type 5 | The TA and its field circuitry are for use in only ordinary (non-hazardous) locations. |

### Table 2. Cables Types and Part Numbers

| Cable Length m (ft) | Type 1 P/PVC (a) | Type 1 LSZH (b) |
|---|---|---|
| 0.5 (1.6) | RH916DA (supersedes P0916DA) | RH928AA (supersedes P0928AA |
| 1.0 (3.2) | RH916DB (supersedes P0916DB) | RH928AB (supersedes P0928AB) |

Table 2. Cables Types and Part Numbers (Continued)

| Cable Length m (ft) | Type 1 P/PVC [a] | Type 1 LSZH [b] |
|---|---|---|
| 2.0 (6.6) | RH931RM (supersedes P0931RM) | RH928AC (supersedes P0928AC) |
| 3.0 (9.8) | RH916DC (supersedes P0916DC) | RH928AD (supersedes P0928AD) |
| 5.0 (16.4) | RH916DD (supersedes P0916DD) | RH928AE (supersedes P0928AE) |
| 10.0 (32.8) | RH916DE (supersedes P0916DE) | RH928AF (supersedes P0928AF) |
| 15.0 (49.2) | RH916DF (supersedes P0916DF) | RH928AG (supersedes P0928AG) |
| 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) |

(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)

## Use of Termination Assemblies in 100 Series Upgrade Subsystem

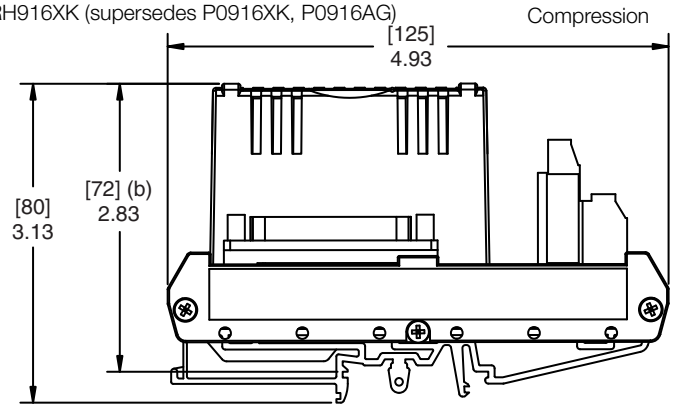
When an FBM204 is used to replace the 100 Series FBM04, it may use any of the appropriate termination assemblies listed above for the FBM04's field I/O wiring. Alternatively, the FBM204 can accept this field wiring through a Termination Assembly Adapter (TAA) instead of a termination assembly. This is discussed in *Termination Assembly Adapter Modules for 100 Series Upgrade* (PSS 31H-2W4).

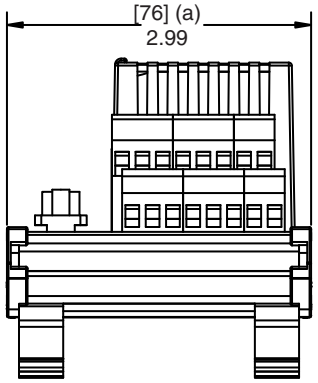
## DIMENSIONS–NOMINAL

mm
in

RH916XK (supersedes P0916XK, P0916AG)

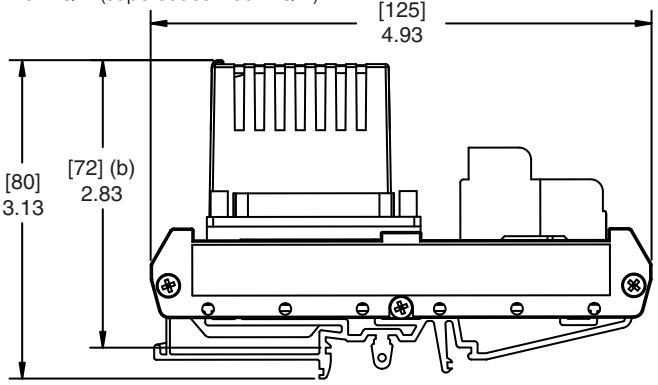
Compression

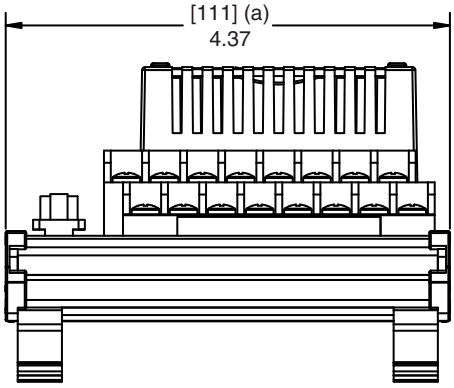



RH917QW (supersedes P0917QW)

Ring Lug




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