Foxboro™ DCS

Compact FBM204, 0 to 20 mA I/O Module

PSS 41H-2C204

Product Specification

August **2019**

Legal Information

Overview

The Compact FBM204, 0 to 20 mA Input/Output Interface contains four 20 mA dc analog input channels and four 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. It is part of the Compact 200 Series I/O subsystem described in *Compact 200 Series I/O Subsystem Overview* (PSS 41H-2COV).

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

The Compact 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). The Fieldbus Module (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

- Four 20 mA dc analog input channels
- Four 20 mA dc analog output channels
- Each input and output channel is galvanically isolated
- Compact, 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 Compact 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 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 FBM204'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

Red and green light-emitting diodes (LEDs) incorporated into the front of the modules provide visual status indications of FBM functions.

Easy Removal/Replacement

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

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

Modular Baseplate Mounting

The modules mount on a DIN rail mounted modular baseplate, which accommodates up to 16 compact FBMs. The 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 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. If one path is unsuccessful or is 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 FBM204 are described in *Termination Assemblies and Cables, page 11*.

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 (nominal)
Input Channels (Four)	• 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)	• Accuracy (Includes Linearity): ±0.03% of span • Accuracy Temperature Coefficient: ±50 ppm/ºC • 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 Compact FBM204, a 200 ohm in-line resistor (assembly part number RH902VY (supersedes P0902VY)) must be added in series with the transmitter.
Communication	Communicates with its associated control processor through the redundant 2 Mbps module fieldbus.
Input Channel Isolation	Each channel is galvanically isolated from all other channels and 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. **⚠⚠DANGER** **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH** 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. **Failure to follow these instructions will result in death or serious injury.**
Calibration Requirements	Calibration of the module and termination assembly is not required.
Power Requirements	• Input Voltage Range (Redundant): 24 V dc +5%, -10% • Consumption: 7 W • Heat Dissipation: 3.5 W

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
Product Safety	• *Underwriters Laboratories (UL) for U.S. and Canada*: UL/UL-C listed as suitable for use in UL/ULC listed Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems when connected to specified Foxboro DCS processor modules. 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). For more information, see *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 processor modules as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). **NOTE:** ATEX (DEMKO) Certification does not apply to Termination Assembly RH917QW. See *Certification for Termination Assemblies, page 12*.
RoHS Compliance	Complies with European RoHS Directive 2011/65/EU, including amending Directives 2015/863 and 2017/2102.

Environmental Specifications

	Operating	Storage
Temperature	• Module: -20 to +60°C (-4 to +140°F) • Termination Assembly: ◦ PVC (See the **NOTICE** below): -20 to +50°C (-4 to +122°F) ◦ Polyamide: -20 to +70°C (-4 to +158°F)	-40 to +70°C (-40 to +158°F)
Relative Humidity	5 to 95% (noncondensing)	5 to 95% (noncondensing)
Altitude	-300 to +3,000 m (-1,000 to +10,000 ft)	-300 to +12,000 m (-1,000 to +40,000 ft)
Vibration	7.5 m/s^2 from 5 to 500 Hz	
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.	

NOTICE

POTENTIAL EQUIPMENT DAMAGE

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

Failure to follow these instructions can result in equipment damage.

NOTE: 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) that describes the specific type of enclosure that is to be used.

Physical Specifications

Mounting	• Compact FBM204: The Compact FBM204 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 41H-2C200) for details. • Termination Assemblies: 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 Type(Approximate)*: 159 g (0.35 lb, approximate) ◦ *Ring Lug Type (Approximate)*: 204 g (0.45 lb, approximate)
Dimensions - Compact FBM204	• 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)
Dimensions - Termination Assemblies	Refer to *Dimensions - Nominal, page 14*.
Part Numbers	• Compact FBM204: RH101DD • Termination Assemblies: See *Functional Specifications - Termination Assemblies, page 12*.
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 1 — Refer to *Termination Cable Types and Part Numbers, page 13*. • Cable Connection: ◦ *FBM Baseplate End*: 37-pin D-subminiature ◦ *Termination Assembly End*: 25-pin D-subminiature

Construction - Termination Assembly	Material: • Compression: PVC, Polyamide (PA) • Ring Lug: PVC
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 Compact FBM204 module are available in the following forms:

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

Each Compact FBM204 Termination Assembly and its associated termination cable provide feedthrough connection between four 3-wire analog input channels and four 3-wire analog output channels, and the Compact FBM204, 0 to 20 mA I/O module.

Termination Assembly (RH917QW) includes built-in bypass jacks for each output channel. Jacks accept a bypass plug from the Output Bypass Station (Foxboro part number 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 using 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 as needed by plant design. See *Table 2* for a list of termination cables used with the TAs for the Compact FBM204 module.

Functional Specifications - Termination Assemblies

FBM Type	Input		Output		TA Part No.[a]	TA Part No.[a]		Termination Type[b]	TA Cable Type[c]	TA Cert. Type[d]
	Qty	Signal	Qty	Signal	PVC	PA	PA with Bypass Jacks			
Compact FBM204	4	0 to 20 mA	4	0 to 20 mA	P0916-AH	RH916-XK		C RL	1	1
Compact FBM204	4	0 to 20 mA	4	0 to 20 mA			RH917-QW	C	1	4,5

[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.

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 Ex 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.
Type 5	The TA and its field circuitry are for use in only ordinary (non-hazardous) locations.

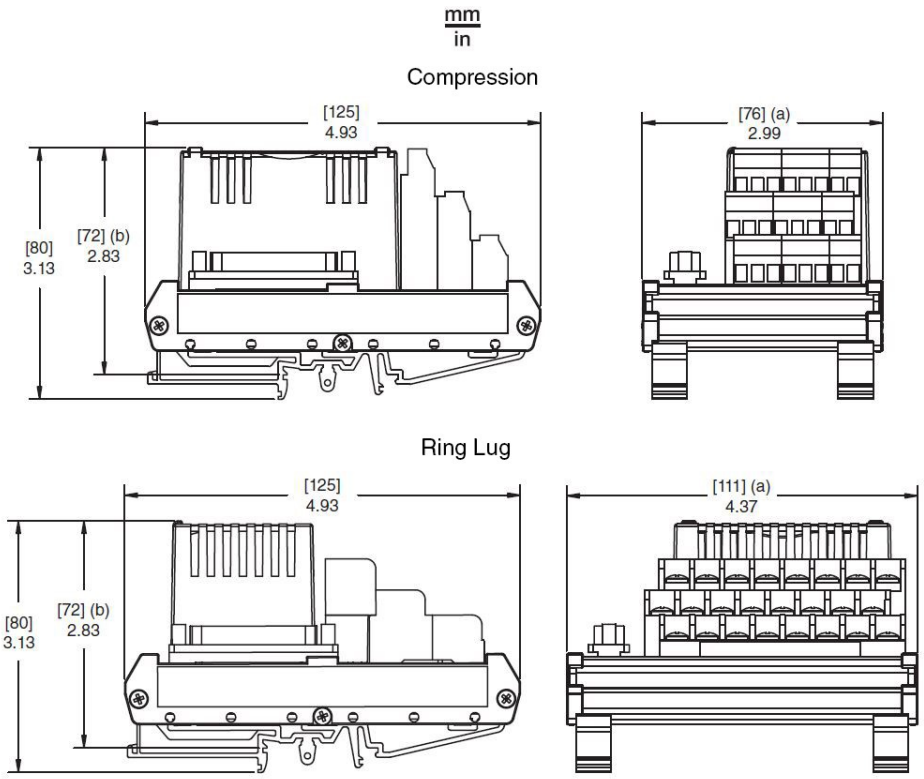
Termination Cable Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC[a]	Type 1 LSZH[b]
0.5 (1.6)	RH100BY	RH100BC
1.0 (3.2)	RH100BZ	RH100BD
1.5 (4.9)	RH100EP	RH100EL
2.0 (6.6)	RH100CA	RH100BE
3.0 (9.8)	RH100CB	RH100BF
5.0 (16.4)	RH100CC	RH100BG
10.0 (32.8)	RH100CD	RH100BH
15.0 (49.2)	RH100CE	RH100BJ
20.0 (65.6)	RH100CF	RH100BK
25.0 (82.0)	RH100CG	RH100BL
30.0 (98.4)	RH100CH	RH100BM

[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)

Dimensions - Nominal



(a) Overall width — for determining DIN rail loading.

(b) Height above DIN rail (add to DIN rail height for total).

Related Product Documents

Document Number	Description
PSS 41H-2COV	*Compact 200 Series I/O Subsystem Overview*
B0400FA	*Standard and Compact 200 Series Subsystem User's Guide*
PSS 41H-2C200	*Compact 200 Series 16-Slot Horizontal Baseplate*
PSS 41H-2SOV	*Standard 200 Series Subsystem Overview*
PSS 41H-2CERTS	*Standard and Compact 200 Series I/O - Agency Certifications*
PSS 41H-2C480	*Compact Power Supply - FPS480-24*
PSS 41H-1FCP280	*Field Control Processor 280 (FCP280)*
PSS 41S-3FCPICS	*Field Control Processor 280 (FCP280) Integrated Control Software*

WARNING: This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.p65warnings.ca.gov/.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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