Foxboro™ DCS

FBM227, 0 to 10 V DC, Contact/DC I/O Module with DPIDA and MDACT Support

PSS 41H-2S227

Product Specification

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www.schneider-electric.com

Legal Information

Overview

Some plant applications require fast control execution for either analog or discrete control. The FBM227 supports local execution of the Advanced PID algorithm or, separately, a tri-state discrete (e.g. raise/off/lower) output algorithm.

The FBM227 module provides signal conversion required to interface analog and digital electrical input/output signals from field sensors/actuators. It has four 0 to 10 V dc analog input channels and two 0 to 10 V dc analog output channels, all of which are individually isolated. For the digital I/O signals (on/off state), it has four digital input channels, isolated in two groups of two channels each, and four digital, pair isolated, output channels.

It executes either the Analog I/O or Digital I/O application program, and has support for MDACT or DPIDA control.

The configurable options for each analog program are Input Resolution, Fail-safe Configuration (Hold/Fallback) and Output Fail-safe Fallback Data. The configurable options for each digital program are Input Filter Time, Fail-safe Configuration, Fail-safe Fall Back and Sustained or Momentary Outputs.

If the Momentary Output configuration is selected, then Pulse Output Interval is also configurable.

Configurable options for inputs are exercised on a per module basis; those for outputs are exercised on a per channel basis.

Features

- Four 0-10 V analog input channels, used for either dc voltage measuring, or slidewire (position) sensing
- Two 0-10 V analog output channels, used for driving positioners, controllers or remote indicators
- Four 130 V dc digital input channels, used for either contact sensing, or dc voltage monitoring
- Four digital output channels, used for either 60 V dc output switching with an external source (e.g. to control powering of various external loads), or a 3-wire dc output switching with an internal 11 V dc source (e.g. to power external solid state relays or other similar devices)
- Support for DPIDA and MDACT control blocks
- Each pair of analog input or output channels is individually isolated from other channels and ground. Its digital channels have paired isolation from all other channels and ground
- Rugged design suitable for enclosure in Class G3 (harsh) environments

Standard Design

The FBM227 module has a rugged extruded aluminum exterior for physical protection of the circuits. Enclosures specially designed for mounting the Fieldbus Modules (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 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 communications with the FBM227 over the redundant 2 Mbps module Fieldbus used by the FBMs. The FBM227 module accepts communication from either path (A or B) of the redundant 2 Mbps fieldbus. If one path is unsuccessful or is switched off 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 FBM227 modules are described in *Termination Assemblies and Cables, page 13*.

Functional Specifications

Communications	Communicates with its associated FCM or FCP via the redundant 2 Mbps module Fieldbus.
Analog Signals	Input Functions: • Capacity: 4 independent channels • Configurable Specifications: See *Table 1* • Voltage Measuring: See *Figure 1* • Range (each channel): -0.2 to 10.2 V dc • Input Impedance: 10 Megohms nominal • Rated Mean Accuracy (each channel): ±0.025% of span • Slidewire (Position) Sensing: See *Figure 1* • Excitation Reference Voltage: 10 V dc ±2% • Excitation Reference Current: 10 mA (maximum) • Slidewire Resistance: 1 k Ω to 100 k Ω (nominal) Output Functions: • Capacity: 2 independent channels • Range (each channel): -0.2 to 10.2 V dc • Current (each channel): 2 mA (maximum) • Rated Mean Accuracy: ±0.05% of span • Settling Time: 150 ms maximum (to 1% of final value for 10 to 90% step change) • Linearity Error: ±0.025% of span • Resolution: 12 bits

Digital Signals	Input Functions: • Capacity: 4 independent channels • Filter Time: Configurable (4, 8, 16, or 32 ms) • Contact Sensor: See *Figure 3* ◦ Range (each channel): Contact open (off) or closed (on) ◦ Open-Circuit Voltage: 24 V dc ±10% ◦ Short-Circuit Current: 2.5 mA (maximum) ◦ ON-State Resistance: 1 k Ω (maximum) ◦ OFF-State Resistance: 100 k Ω (minimum) • Voltage Monitor: See *Figure 3* ◦ ON-State Voltage: 15 to 130 V dc ◦ OFF-State Voltage: 0 to 5 V dc ◦ Current: 2.2 mA (typical) at 5 to 130 V dc ◦ Source Resistance Limits (ON-State): 1 k Ω (maximum) at 15 V dc ◦ Source Resistance Limits (OFF-State) 100 k Ω (minimum) at 130 V dc Output Functions: • Capacity: 4 channels arranged in pairs

	• Output Switch (with external source): See *Figure 4* ◦ Applied Voltage: 60 V dc (maximum) ◦ Load Current: 0.5 A (maximum) ◦ Shorten-Load Duration: Indefinite (duty cycle current limit on overload) ◦ ON-State Current Limit: 0.75 A (typical) ◦ OFF-State Leakage Current @ 60 V dc: < 100 µA (typical) 200 mA (maximum) ◦ Inductive Loads: Require a protective diode connected across the load (see Figure 4 diagram with protective diode). Diode must be capable of conducting maximum expected load current and have a voltage rating greater than 1.3 times the supply voltage. • Output Switch (with internal source): See *Figure 4* ◦ Output Voltage (no load): 11 V dc ±2 V dc ◦ Source Resistance: 660 Ω (nominal) ◦ Shorted-Output (ON-State) Duration: Indefinite ◦ OFF-State Leakage Current @ 11 V dc: < 50 µA (typical) 100 µA (maximum)
Isolation Channel	The FBM's analog channels are channel isolated from all other channels and earth (ground). The FBM's digital channels are isolated in pairs from all other channels and earth (ground). The module/TA withstands, without damage, a potential of 600 V ac on the analog channels or 1250 V ac on the digital channels applied for one minute between any channel and ground, or between a given channel and any other channel. Within the digital channel pairs, each of the two channels shares a common power supply and return. **⚠⚠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.**

	⚠⚠DANGER **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH** Digital inputs are isolated in pairs (e.g., channels 1 and 2 are isolated from channels 3 and 4). When inputs are used with hazardous voltages (greater than 60 V dc), both channels of a pair must be used with hazardous voltages. Hazardous and nonhazardous voltages must not be mixed within a channel pair. **Failure to follow these instructions will result in death or serious injury.**
Power Requirements	• Input Voltage Range (Redundant): 24 V dc +5%, -10% • Consumption (Maximum): 7 W • Heat Dissipation (Maximum): 3 W
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
Regulatory Compliance: 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 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 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 processor modules as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).
RoHS Compliance	Complies with European RoHS Directive 2011/65/EU, including amending Directives 2015/863 and 2017/2102.

Figure 1 - Analog Input Configurations

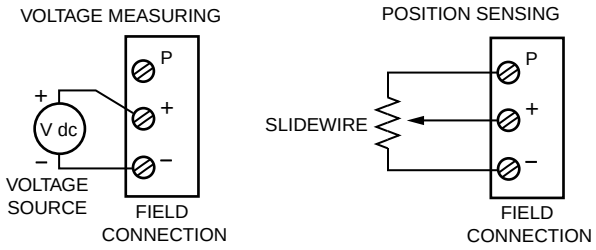


Figure 2 - Analog Output Configuration

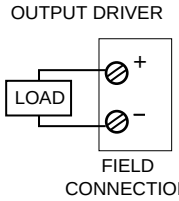


Figure 3 - Digital Input Configurations

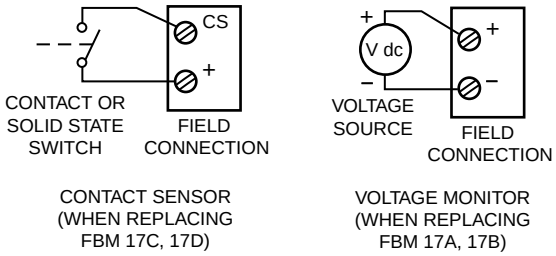


Figure 4 - Digital Output Configurations

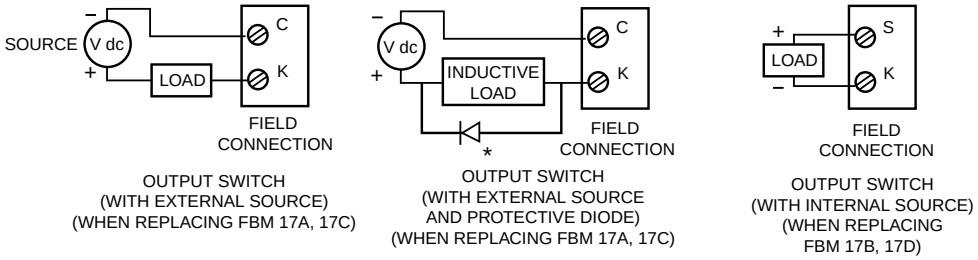


Table 1 - Configurable Specifications for Analog Input Channels

Conversion Time (Seconds)	Setting Time[a] (Seconds)	Linearity Error[b] (% of Range)	Resolution (Bits)
0.1	0.3	0.013	12
0.2	0.5	0.008	13
0.5	1.1	0.005	14
1.0	2.1	0.005	15

[a] Output value settles within a 1% band of steady state for a 10 to 90% input step change.

[b] Monotonic (signal used for Fieldbus communications either increases or remains the same for increasing analog input signals).

Environmental Specifications

	Operating	Storage
Temperature	• FBM227: –20 to +70°C (-4 to +158°F) • Termination Assembly – PA: -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 (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.	

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 type of enclosure to be used.

Physical Specifications

Mounting	• Module: The FBM227 mounts 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. See *Standard 200 Series Modular Baseplates* (PSS 41H-2SBASPLT) or *100 Series Conversion Mounting Structures* (PSS 41H-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	• FBM227: 284 g (10 oz) approximate • Termination Assemblies: ◦ Compression: 181 g (0.40 lb, approximate)
Dimensions - FBM227	• 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	See *Dimensions - Nominal, page 16*
Part Numbers	• FBM227: RH927AC • Termination Assemblies: See *Functional Specifications - Termination Assemblies, page 14*
Termination Cables	• Cable Lengths: Up to 30 m (98 ft) • Cable Materials: Polyurethane or Low Smoke Zero Halogen (LSZH) • Termination Cable Type: Type 4 - See *Table 3* • Cable Connection: ◦ FBM Baseplate End: 37-pin male D-subminiature ◦ Termination Assembly End: 37-pin D-subminiature

Termination Assembly Construction	• Material: Polyamide (PA), compression PA, ring lug
Field Termination Connections	• Compression-Type 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

Termination Assemblies and Cables

Field signals connect to the FBM subsystem via DIN rail mounted Termination Assemblies. TAs for the FBM227 module are available in the following forms:

- Compression screw type using Polyamide (PA) material

See *Functional Specifications - Termination Assemblies, page 14* for a list of TAs used with the FBM227 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 3* for a list of termination cables used with the TAs for the FBM227 modules.

Functional Specifications - Termination Assemblies

FBM Type	Input Signal	TA Part Number PA[a]	Termination Type[b]	TA Cable Type[c]	TA Cert.[d]
FBM227	Four channel isolated analog input channels, 0 to 10 V dc plus four digital inputs (130 V dc), isolated into two groups of two channels each Two channel isolated analog output channels, 0 to 10 V dc, plus four digital outputs (60 V dc), pair isolated	RH924DB	C	4	1, 2

[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 3* for cable part numbers and specifications.

[d] See *Table 2* for Termination Assembly certification definitions.

Table 2 - Certifications 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 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 DIN rail mounted FBMs and field circuits meeting entity parameter constraints specified in *Standard and Compact 200 Series Subsystem User's Guide* (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

[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.

Table 3 - Cable Types (Baseplate to Main TA Cables) and Part Numbers

Cable Length m (ft)	Type 4 P/PVC[a]	Type 4 LSZH[b]
0.5 (1.6)	RH916FG	RH928BA
1.0 (3.2)	RH916FH	RH928BB
2.0 (6.6)	RH931RQ	RH928BC
3.0 (9.8)	RH916FJ	RH928BD
5.0 (16.4)	RH916FK	RH928BE
10.0 (32.8)	RH916FL	RH928BF
15.0 (49.2)	RH916FM	RH928BG
20.0 (65.6)	RH916FN	RH928BH
25.0 (82.0)	RH916FP	RH928BJ
30.0 (98.4)	RH916FQ	RH928BK

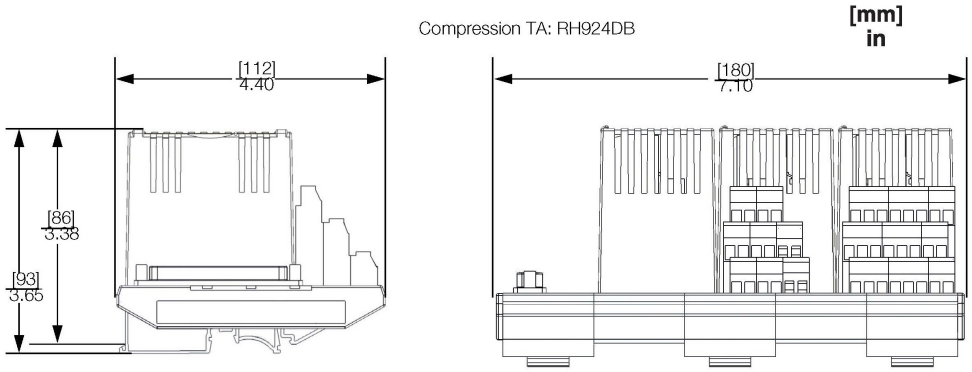
[a] P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. PVC is rated from -20 to +50°C (-4 to 122°F).

[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).

Use of Termination Assemblies in 100 Series Upgrade Subsystem

When an FBM227 is used to replace the 100 Series FBM17, it may use any of the appropriate termination assemblies listed above for the FBM227's field I/O wiring. Alternatively, in a system upgrade, the FBM227 receives 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 41H-2W4).

Dimensions - Nominal



Related Product Documents

Document Number	Description
PSS 41H-2SOV	*Standard 200 Series Subsystem Overview*
B0400FA	*Standard and Compact 200 Series Subsystem User's Guide*
PSS 41H-2W100	*100 Series Fieldbus Module Upgrade Subsystem Overview*
PSS 41H-2CERTS	*Standard and Compact 200 Series I/O - Agency Certifications*
PSS 41H-2W4	*Termination Assembly Adapter Modules for 100 Series Upgrade*
PSS 41H-2SBASPLT	*Standard 200 Series Baseplates*
PSS 41H-2W8	*100 Series Conversion Mounting Structures*
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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