Foxboro Evo™ Process Automation System

Product Specifications

Foxboro®

by Schneider Electric

PSS 31H-2C227

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

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

OVERVIEW

The Compact FBM227 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

Key features of the Compact FBM227 are:

- 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 circuits (with its associated termination assembly), each supporting a 30 V dc digital input channel, used for either contact sensing, or dc voltage monitoring Four digital output channels, used for either 60 V dc output(1) 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 earth (ground). Its digital channels have paired isolation from all other channels and earth (ground)
- Compact, rugged design suitable for enclosure in Class G3 (harsh) environments.

COMPACT DESIGN

The Compact FBM227'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.

EASY REMOVAL/REPLACEMENT

The modules mount on a Compact 200 Series baseplate. Two screws on the FBM secure each module to the baseplate.

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.

FIELDBUS COMMUNICATION

A Fieldbus Communication Module or a Control Processor communicates with the Compact FBM227 over the redundant 2 Mbps module Fieldbus used by the FBMs. The Compact FBM227 accepts communication from either path (A or B) of the redundant 2 Mbps fieldbus – should one path fail or be 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 Compact FBM227 modules are described in "TERMINATION ASSEMBLIES AND CABLES" on page 8.

(1) 60 V dc digital output circuit is in the termination assembly.

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 (Analog Input Configurations)
Range (each channel)
-0.2 to 10.2 V dc
Input Impedance
10Meg Ohms nominal
Rated Mean Accuracy (each channel)
±0.025% of span
Slidewire (Position) Sensing
See Figure 1 (Analog Input Configurations)
Excitation Reference Voltage
10 V dc ±2%
Excitation Reference Current
10 mA (maximum)
Slidewire Resistance
1 k Ω to 100 k Ω (nominal)

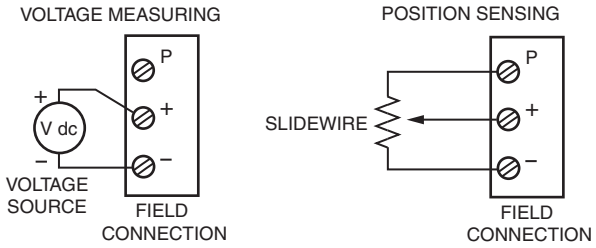


Figure 1. Analog Input Configurations

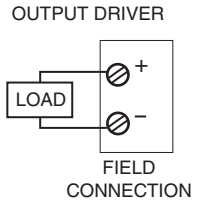


Figure 2. Analog Output Configuration

Table 1. Configurable Specifications for Analog Input Channels

Conversion Time (Seconds)	Settling 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).

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Analog Signals (Cont.)

OUTPUT FUNCTIONS (Output Drivers)

See Figure 2 (Analog Output Configuration)

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 channels arranged in pairs

Filter Time
Configurable (4, 8, 16, or 32 ms)

Contact Sensor
See Figure (Digital Input Configurations)

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)

INPUT FUNCTIONS (CONTINUED)

Voltage Monitor
See Figure (Digital Input Configurations)

ON-State Voltage
15 to 30 V dc (15 to 130 V dc in the TA)

OFF-State Voltage
0 to 5 V dc

Current
2.2 mA (typical) at 30 V dc (5 to 130 V dc in the TA)

Source Resistance Limits (ON-State)
1 k Ω (maximum) at 15 V dc

Source Resistance Limits (OFF-State)
100 k Ω (minimum) at 30 V dc (130 V dc in the TA)

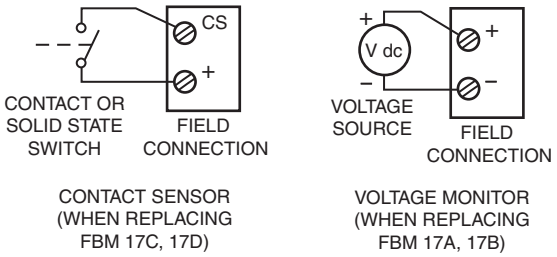


Figure 3. Digital Input Configurations

OUTPUT FUNCTIONS

Capacity
4 channels arranged in pairs

Output Switch (with external source)
See Figure 4 (Digital Output Configurations)

Applied Voltage
60 V dc (maximum)

Load Current
0.25 A (maximum)

OFF-State Leakage Current @ 60 V
< 100 µA (typical)
200 mA (maximum)

FUNCTIONAL SPECIFICATIONS (CONTINUED)

OUTPUT FUNCTIONS (Continued)

Capacity (Continued)

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 (Digital Output Configurations)

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

< 50 µA (typical)

100 µA (maximum)

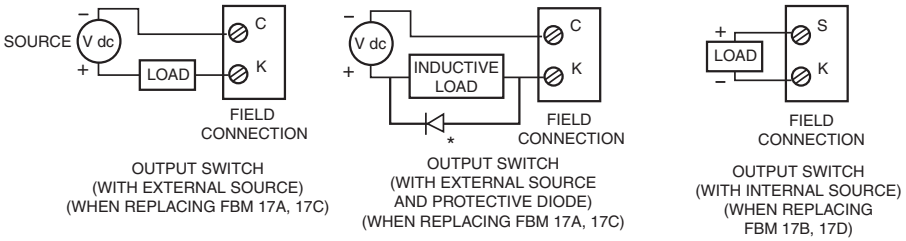


Figure 4. Digital Output Configurations

Input Channel Isolation

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(2) (see notes below) 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.

CAUTION

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.

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) Within the digital channel pairs, each of the two channels shares a common power supply and return.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Regulatory Compliance

ELECTROMAGNETIC COMPATIBILITY (EMC)

European EMC Directive 2014/30/EU
EN 61326:2013 Class A Emissions and Industrial Immunity levels

RoHS COMPLIANCE

Complies with European RoHS Directive 2002/95/EC and Recast RoHS Directive 2011/65/EU.

PRODUCT SAFETY

Underwriters Laboratories (UL) for U.S. and Canada
UL/UL-C listed as suitable for use in Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems. 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 2014/35/EU and Explosive Atmospheres (ATEX) directive 2014/34/EU
ATEX (DEMKO) Ex nA IIC T4 Gc certified when connected as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). For use in an enclosure suited for an ATEX Zone 2 classified area.
Also, see Table 2 on page 9.

ENVIRONMENTAL SPECIFICATIONS(3)

Operating

TEMPERATURE

Compact FBM227
-20 to +60°C (-4 to +140°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 +85°C (-40 to +185°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

PHYSICAL SPECIFICATIONS

Mounting

COMPACT FBM227

The Compact FBM227 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 31H-2C200) 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

185 g (6.5 oz) approximate

TERMINATION ASSEMBLY

Compression
181 g (0.40 lb) approximate
Ring Lug
249 g (0.55 lb) approximate

Dimensions

COMPACT FBM227

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)

TERMINATION ASSEMBLY

See page 11

Part Numbers

COMPACT FBM227

RH101GH

TERMINATION ASSEMBLIES

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” on page 9

(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 (CONTINUED)

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 on page 10

CABLE CONNECTION

FBM Baseplate End
37-pin D-subminiature

Termination Assembly End
37-pin D-subminiature

Construction – Termination Assembly

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

RING-LUG TYPE 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 signals connect to the FBM subsystem via DIN rail mounted Termination Assemblies. TAs for the Compact FBM227 are available in the following forms:

- Compression screw type using Polyamide (PA) material
- Ring lug type using Polyamide (PA) material

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” below 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 Compact FBM227s.

FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES

FBM Type	Input Signal	TA Part Number (a) PA	Termination Type(b)	TA Cable Type((c)	TA Certification Type(d)
Compact 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, 0.5 A), 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. 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 DEMKO certified Ex nA IIC T4 Gc for use in Zone 2 potentially explosive atmospheres.
Type 2	TAs are UL/UL-C listed for supplying 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 *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). They are also DEMKO certified 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. Termination Cable Types and Part Numbers - Type 4

Cable Length m (ft)	Type 4 P/PVC[a]	Type 4 LSZH[b]
0.5 (1.6)	RH100CJ	RH100BN
1.0 (3.2)	RH100CK	RH100BP
1.5 (4.9)	RH100EQ	RH100EN
2.0 (6.6)	RH100CL	RH100BQ
3.0 (9.8)	RH100CM	RH100BR
5.0 (16.4)	RH100CN	RH100BS
10.0 (32.8)	RH100CP	RH100BT
15.0 (49.2)	RH100CQ	RH100BU
20.0 (65.6)	RH100CR	RH100BV
25.0 (82.0)	RH100CS	RH100BW
30.0 (98.4)	RH100CT	RH100BX

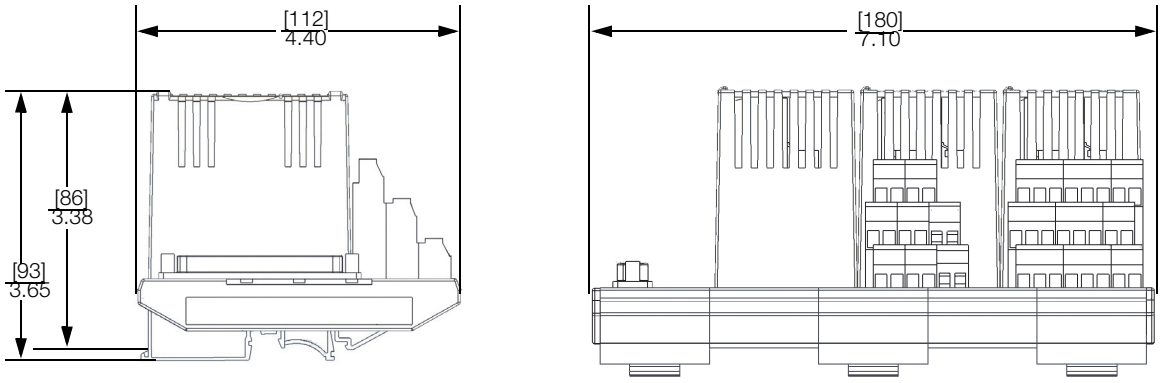
(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. PVC is rated from -20 to +70°C (-4 to 158°F).

(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

[mm]
in

Compression TA: RH924DB



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

RELATED PRODUCT DOCUMENTS

Table 4. Other Related Documents

PSS Number	Description
PSS 31H-2COV	Compact 200 Series I/O Subsystem Overview
B0400FA	Standard and Compact 200 Series Subsystem User's Guide
PSS 31H-2C200	Compact 200 Series 16-Slot Horizontal Baseplate
PSS 31H-2SOV	Standard 200 Series Subsystem Overview
PSS 31H-2CERTS	Standard and Compact 200 Series I/O - Agency Certifications
PSS 31H-2C480 B4	Compact Power Supply - FPS480-24
PSS 31S-3FCPICS	Field Control Processor 280 (FCP280) Integrated Control Software
PSS 21S-3CP270ICS	Control Processor 270 (CP270) Integrated Control Software

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