

**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 FBM227 supports local execution of the Advanced PID algorithm or, separately, a tri-state discrete (e.g. raise/off/lower) output algorithm.*

**OVERVIEW**

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

Key features of the FBM227 module 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 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 earth (ground). Its digital channels have paired isolation from all other channels and earth (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 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 communicates 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 – 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 FBM227 modules are described in “TERMINATION ASSEMBLIES AND CABLES” on page 8.

## 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)

$\pm 0.025\%$  of span

##### Slidewire (Position) Sensing

See Figure 1 (Analog Input Configurations)

##### Excitation Reference Voltage

10 V DC  $\pm 2\%$

##### Excitation Reference Current

10 mA (maximum)

##### Slidewire Resistance

1 k  $\Omega$  to 100 k  $\Omega$  (nominal)

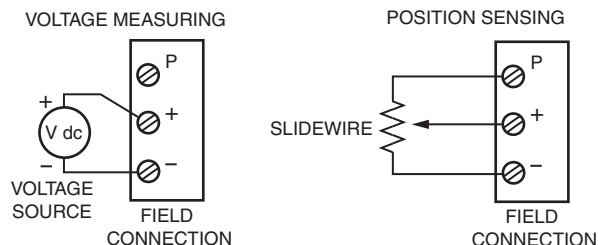


Figure 1. Analog Input Configurations

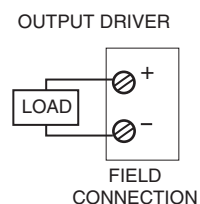


Figure 2. Analog Output Configuration

Table 1. Configurable Specifications for Analog Input Channels

| Conversion Time<br>(Seconds) | Settling Time <sup>(a)</sup><br>(Seconds) | Linearity Error <sup>(b)</sup><br>(% of Range) | Resolution<br>(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* $\pm 0.05\%$  of span*Settling Time*

150 ms maximum (to 1% of final value for 10 to 90% step change)

*Linearity Error* $\pm 0.025\%$  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  $\pm 10\%$ *Short-Circuit Current*

2.5 mA (maximum)

*ON-State Resistance*1 k  $\Omega$  (maximum)*OFF-State Resistance*100 k  $\Omega$  (minimum)**INPUT FUNCTIONS (CONTINUED)***Voltage Monitor*

See Figure (Digital Input Configurations)

*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

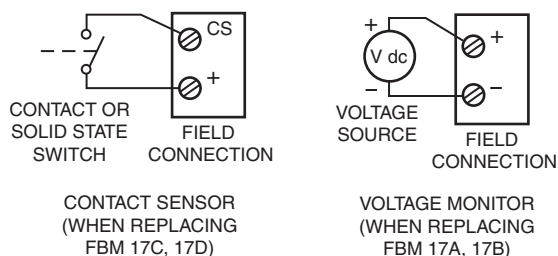
*Source Resistance Limits (ON-State)*1 k  $\Omega$  (maximum) at 15 V DC*Source Resistance Limits (OFF-State)*100 k  $\Omega$  (minimum) at 130 V DC

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*

0.5 A (maximum)

*Shorted-Load Duration*

Indefinite (duty cycle current limit on overload)

*ON-State Current Limit*

0.75 A (typical)

*OFF-State Leakage Current @ 60 V*< 100  $\mu$ A (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  $\pm 2$  V DC

Source Resistance

660  $\Omega$  (nominal)

Shorted-Output (ON-State) Duration

Indefinite

OFF-State Leakage Current @ 11 V

< 50  $\mu$ A (typical)

100  $\mu$ A (maximum)

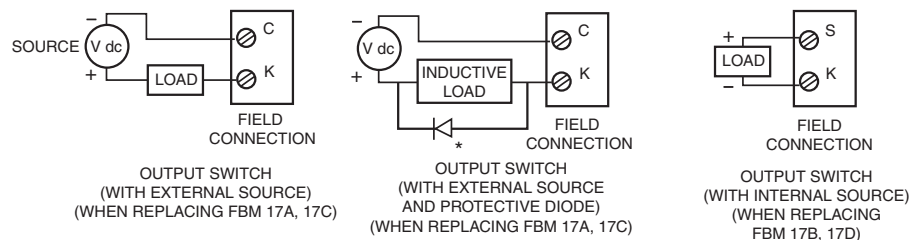


Figure 4. Digital Output Configurations

### 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<sup>(1)</sup> (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.

(1) 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 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)*

DEMCO 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).

## ENVIRONMENTAL SPECIFICATIONS<sup>(2)</sup>

### Operating

#### TEMPERATURE

*FBM227*

-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/S<sup>2</sup> (0.75 g) from 5 to 500 Hz

## PHYSICAL SPECIFICATIONS

### Mounting

#### FBM227

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. Refer to *Standard 200 Series Modular 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

#### FBM227

284 g (10 oz) approximate

#### TERMINATION ASSEMBLY

*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 Assembly

See page 11

### Part Numbers

#### FBM227

RH927AC (supersedes P0927AC)

#### TERMINATION ASSEMBLIES

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” on page 9

(2) 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

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” 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 FBM227 modules.

## FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES

| FBM Type | Input Signal                                                                                                                                                                                                                                                      | TA Part Number <sup>(a)</sup>   | Termination Type <sup>(b)</sup> | TA Cable Type <sup>(c)</sup> | TA Certification Type <sup>(d)</sup> |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------|------------------------------|--------------------------------------|
|          |                                                                                                                                                                                                                                                                   | PA                              |                                 |                              |                                      |
| 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<br><br>Two channel isolated analog output channels, 0 to 10 V DC, plus four digital outputs (60 V DC), pair isolated | RH924DB<br>(supersedes P0924DB) | C                               | 4                            | 1, 2                                 |

(a) PA is polyamide rated from -20 to +70°C (-4 to +158°F).

(b) C = TA with compression 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 <sup>(a)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 [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 200 Series FBMs and field circuits meeting entity parameter constraints specified in <i>Standard and Compact 200 Series Subsystem User's Guide</i> (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 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 *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA) and the conditions stated in UL and DEMKO reports.

**Table 3. Cable Types and Part Numbers**

| <b>Cable Length<br/>m (ft)</b> | <b>Type 4<br/>P/PVC<sup>(a)</sup></b> | <b>TYPE 4<br/>LSZH<sup>(b)</sup></b> |
|--------------------------------|---------------------------------------|--------------------------------------|
| 0.5 (1.6)                      | RH916FG<br>(supersedes P0916FG)       | RH928BA<br>(supersedes P0928BA)      |
| 1.0 (3.2)                      | RH916FH<br>(supersedes P0916FH)       | RH928BB<br>(supersedes P0928BB)      |
| 2.0 (6.6)                      | RH931RQ<br>(supersedes P0931RQ)       | RH928BC<br>(supersedes P0928BC)      |
| 3.0 (9.8)                      | RH916FJ<br>(supersedes P0916FJ)       | RH928BD<br>(supersedes P0928BD)      |
| 5.0 (16.4)                     | RH916FK<br>(supersedes P0916FK)       | RH928BE<br>(supersedes P0928BE)      |
| 10.0 (32.8)                    | RH916FL<br>(supersedes P0916FL)       | RH928BF<br>(supersedes P0928BF)      |
| 15.0 (49.2)                    | RH916FM<br>(supersedes P0916FM)       | RH928BG<br>(supersedes P0928BG)      |
| 20.0 (65.6)                    | RH916FN<br>(supersedes P0916FM)       | RH928BH<br>(supersedes P0928BH)      |
| 25.0 (82.0)                    | RH916FP<br>(supersedes P0916FP)       | RH928BJ<br>(supersedes P0928BJ)      |
| 30.0 (98.4)                    | RH916FQ<br>(supersedes P0916FQ)       | RH928BK<br>(supersedes P0928BK)      |

(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**

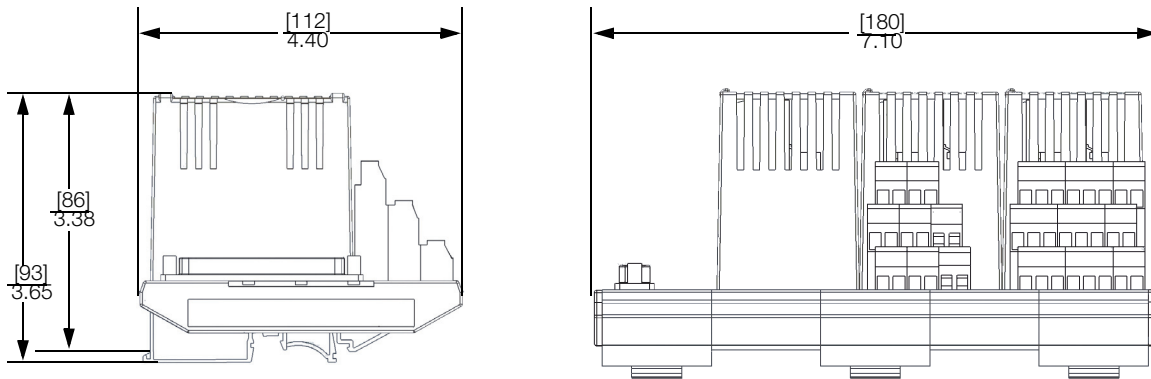
When an FBM227 is used to replace the 100 Series FBM17, it may use any of the appropriate termination assemblies listed above for the FBM227's field I/O wiring. Alternatively, in a system upgrade, the FBM227 receives field wiring through a Termination

Assembly Adapter (TAA) instead of a termination assembly. This is discussed in *Termination Assembly Adapter Modules for 100 Series Upgrade* (PSS 31H-2W4).

## DIMENSIONS – NOMINAL

[mm]  
in

Compression TA: RH924DB (supersedes P0924DB)



## RELATED PRODUCT SPECIFICATION SHEETS (PSS)

| PSS Number       | Description                                                     |
|------------------|-----------------------------------------------------------------|
| PSS 31H-2SOV     | Standard 200 Series Subsystem Overview                          |
| PSS 31H-2W100    | 100 Series Fieldbus Module Upgrade Subsystem Overview           |
| PSS 31H-2CERTS   | Standard and Compact 200 Series I/O - Agency Certifications     |
| PSS 31H-2W4      | Termination Assembly Adapter Modules for 100 Series Upgrade     |
| PSS 31H-2SBASPLT | Standard 200 Series Baseplates                                  |
| PSS 31H-2W8      | 100 Series Conversion Mounting Structures                       |
| PSS 21S-3CP270IC | Control Processor 270 (CP270) Integrated Control Software       |
| PSS 31S-3FCPICS  | Field Control Processor 280 (CP280) Integrated Control Software |