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

The FBM227 0 to 10 V dc, Contact/dc Input/Output Interface Module with DPIDA and MDACT support provides four 0 to 10 V dc analog input channels and two 0 to 10 V dc analog output channels, as well as four digital input channels, isolated in two groups of two channels each, and four digital output channels.

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).

- Compact, rugged design suitable for enclosure in Class G3 (harsh) environments.

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.

When connected to the appropriate TAs, the FBM227 module provides functionality formerly RS-485 provided by the 100 Series FBM I/O subsystem. TAs are available which support the functionality of the 100 Series FBM17A/B/C/D.

COMPACT DESIGN

The FBM227 module has a compact design, with 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 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 – 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)
±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)

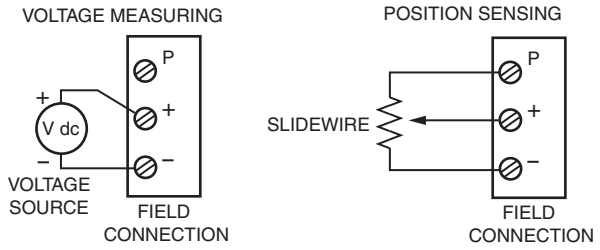


Figure 1. Analog Input Configurations

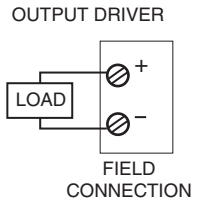


Figure 2. Analog Output Configuration

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 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

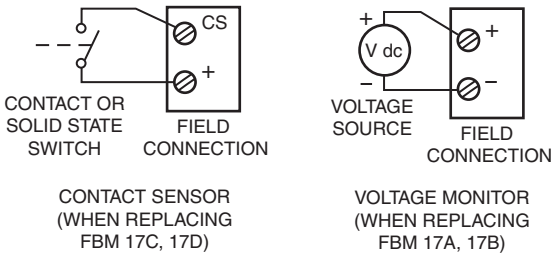


Figure 3. Digital Input Configurations

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 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)

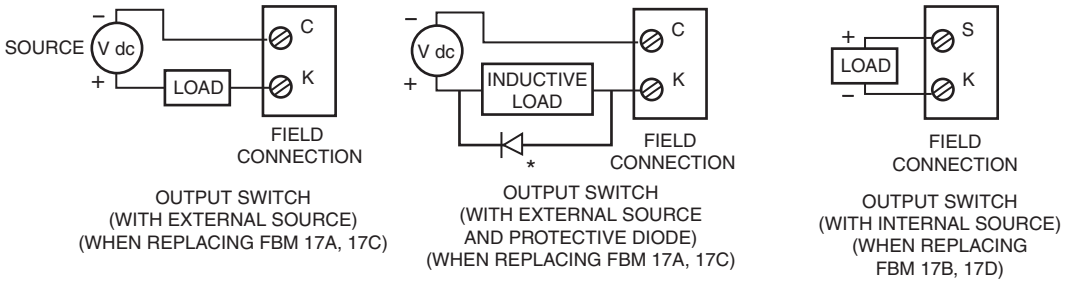


Figure 4. Digital Output Configurations

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(1) (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 89/336/EEC

Meets: EN 50081-2 Emission standard
EN 50082-2 Immunity standard
EN 61326 Annex A (Industrial Levels)

CISPR 11, Industrial Scientific and Medical (ISM) Radio-frequency Equipment - Electromagnetic Disturbance Characteristics - Limits and Methods of Measurement

Meets Class A Limits

IEC 61000-4-2 ESD Immunity

Contact 4 kV, air 8 kV

IEC 61000-4-3 Radiated Field Immunity

10 V/m at 80 to 1000 MHz

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity

2 kV on I/O, dc power and communication lines

IEC 61000-4-5 Surge Immunity

2kV on ac and dc power lines; 1kV on I/O and communications lines

ELECTROMAGNETIC COMPATIBILITY (CONT.)

IEC 61000-4-6 Immunity to Conducted Disturbances Induced by Radio frequency Fields

10 V (rms) at 150 kHz to 80 MHz on I/O, dc power and communication lines

IEC 61000-4-8 Power Frequency Magnetic Field Immunity

30 A/m at 50 and 60 Hz

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. These modules are also UL and UL-C listed as associated apparatus for supplying non-incendive communication circuits for Class I, Groups A-D hazardous locations when connected to specified I/A Series® processor modules as described in the *I/A Series DIN Rail Mounted 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 *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA).

European Low Voltage Directive 73/23/EEC and Explosive Atmospheres (ATEX) directive 94/9/EC

CENELEC (DEMKO) certified as EEx nA [nL] IIC T4 for use in CENELEC certified Zone 2 enclosure certified as associated apparatus for supplying non-incendive field circuits for Zone 2, Group IIC, potentially explosive atmospheres when connected to specified I/A Series processor modules as described in the I/A Series *DIN Rail Mounted Subsystem User's Guide* (B0400FA). Also, see Table 2 on page 9.

ENVIRONMENTAL SPECIFICATIONS(2)

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^2 (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 *DIN Rail Mounted Modular Baseplates* (PSS 21H-2W6 B4) or *100 Series Conversion Mounting Structures* (PSS 21H-2W8 B4) 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).

Mass

FBM227

284 g (10 oz) approximate

TERMINATION ASSEMBLY

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

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
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 FBM227 module 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 FBM227 modules.

FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES

FBM Type	Input Signal	TA Part Number[a]		Termination Type[b]	TA Cable Type[c]	TA Certification Type[d]
		PVC	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 Two channel isolated analog output channels, 0 to 10 V dc, plus four digital outputs (60 V dc), pair isolated		P0924DB P0924JY	C RL	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 CENELEC (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 DIN rail mounted FBMs and field circuits meeting entity parameter constraints specified in *DIN Rail Mounted Subsystem User's Guide* (B0400FA). They are also CENELEC (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 DIN Rail Mounted Subsystem User's Guide (B0400FA) and the conditions stated in UL and DEMKO reports.

Table 3. Cable Types and Part Numbers

Cable Length m (ft)	Type 4 P/PVC[a]	TYPE 4 LSZH[b]	Type 4 H/XLPE[c]
0.5 (1.6)	P0916FG	P0928BA	P0916WD
1.0 (3.2)	P0916FH	P0928BB	P0916WE
2.0 (6.6)	P0931RQ	P0928BC	P0931RU
3.0 (9.8)	P0916FJ	P0928BD	P0916WF
5.0 (16.4)	P0916FK	P0928BE	P0916WG
10.0 (32.8)	P0916FL	P0928BF	P0916WH
15.0 (49.2)	P0916FM	P0928BG	P0916WJ
20.0 (65.6)	P0916FN	P0928BH	P0916WK
25.0 (82.0)	P0916FP	P0928BJ	P0916WL
30.0 (98.4)	P0916FQ	P0928BK	P0916WM

(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).
(c) H/XLPE is Hypalon outer jacket and XLPE (cross-linked polyethylene) primary conductor insulation. H/XLPE is rated from -40 to +90°C (-40 to 194°F). Hypalon cables are no longer available for purchase.

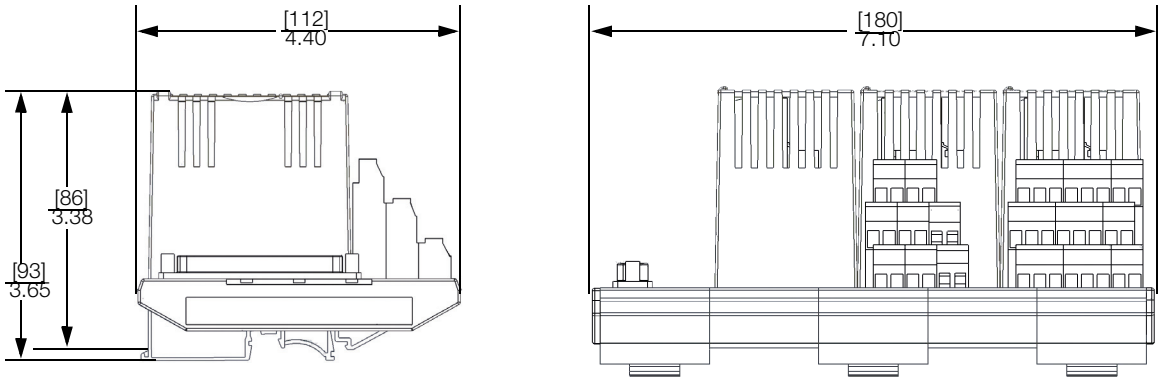
Use of Termination Assemblies in 100 Series Upgrade Subsystem

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 21H-2W4 B4).

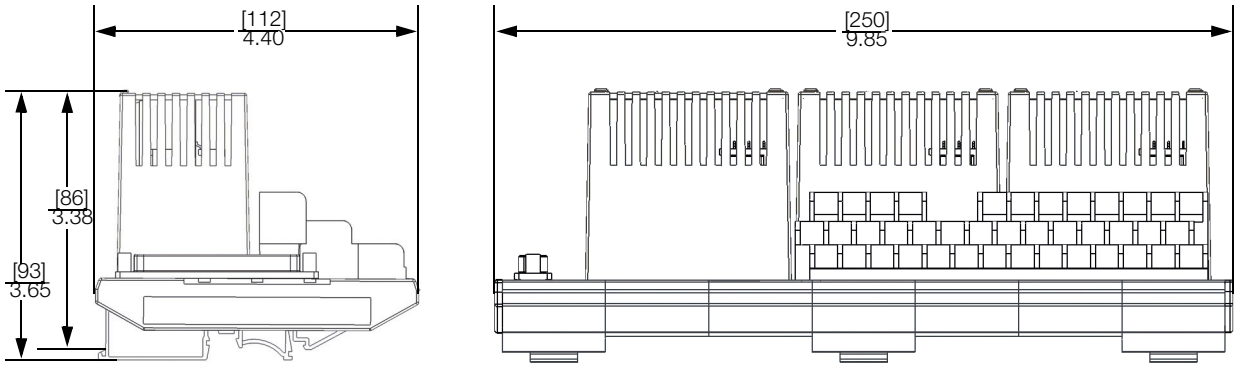
DIMENSIONS – NOMINAL

[mm]
in

Compression TA: P0924DB



Ring Lug TA: P0924JY



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

RELATED PRODUCT SPECIFICATION SHEETS (PSS)

PSS Number	Description
PSS 21H-2W1 B3	DIN Rail Mounted FBM Subsystem Overview
PSS 21H-2W1 B4	100 Series Fieldbus Module Upgrade Subsystem Overview
PSS 21H-2W2 B3	DIN Rail Mounted FBM Equipment, Agency Certification
PSS 21H-2W4 B4	Termination Assembly Adapter Modules for 100 Series Upgrade
PSS 21H-2W6 B4	DIN Rail Mounted Modular Baseplates
PSS 21H-2W8 B4	100 Series Conversion Mounting Structures
PSS 21S-3B2 B3	Control Processor 270 (CP270) Integrated Control Software

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