

FBM240, Redundant with Readback, Discrete Output Interface Module



The FBM240 has eight discrete channel isolated outputs with readback to verify that each discrete output has changed to the requested state.

FEATURES

The key features of the FBM240 are:

- ▶ Eight discrete outputs
- ▶ Eight discrete inputs readback the voltage across the relay contacts. Set the channel BAD, if the state of the contact disagrees with the state of the corresponding output channel
- ▶ Monitors each FBM output and sets the output channel BAD if the output is in the wrong state
- ▶ Single or redundant module
- ▶ Termination Assemblies (TAs) for locally or remotely connecting field wiring to the FBM240
- ▶ Supports discrete relay outputs capable of switching:
 - 10 A at 80 to 120 V ac, or
 - 5 A at 80 to 125 V dc, or
 - 5 A at 15 to 30 V dc, or
 - 5 A at 80 to 120 V ac

- ▶ Supports channel-isolated discrete I/O⁽¹⁾:
 - 15-60 V dc @ 2 A, fused outputs
 - 15-60 V dc inputs
- ▶ A failure in redundant module:
 - marks failed channel BAD
 - allows the corresponding channel in the good module to automatically continue to drive the discrete outputs.

OVERVIEW

The FBM240 is an 8 channel output Fieldbus Module (FBM) available as a single or redundant module. A redundant pair of the modules combine to provide redundancy at the FBM level, with field I/O wired to one common termination assembly (see Figure 1). Each module independently holds the output(s) at its specified output value(s), and each independently reads back its observed value of the output.

A redundant contact output block in the control software validates each output in conjunction with information to/from the module.

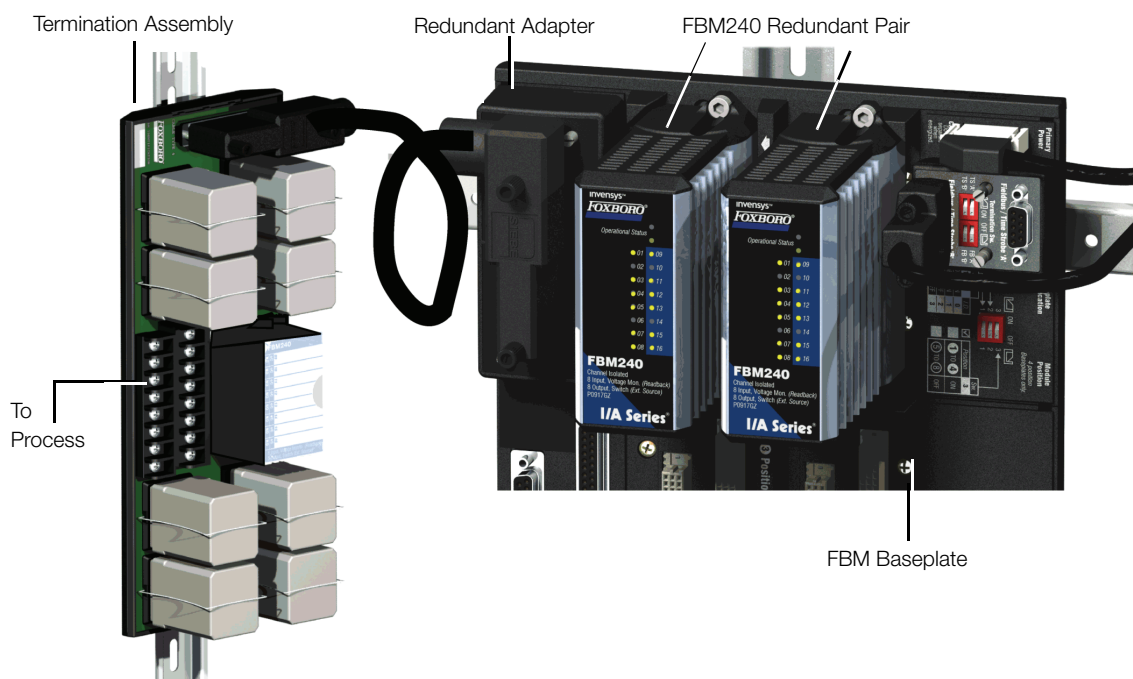


Figure 1. FBM240 Redundant I/O Configuration

(1) Support for this termination assembly and the new Fail-Safe configuration options described in "FAIL-SAFE" on page 4 require version 1.40N or later firmware.

READBACK

The FBM240 has 8 internal readback channels, one per each output channel, used to verify that the output has changed to the requested state. These channels read the voltage across the relay contacts on the relay termination assemblies. The states of these channels are displayed on LEDs on the front panel of the FBM240. When external power is applied to the relay contact of each channel, the LED for that channel is ON when the relay contact is CLOSED, and OFF when the relay contact is OPEN. If the state of the contact disagrees with the state of the corresponding output channel, the channel is marked BAD.

The FBM also monitors each of its eight outputs and sets the corresponding output channel BAD if the output is in the wrong state.

If the channel or input power is marked BAD, the CP presents that information to the I/A Series® system for display as a System Management alarm and as a control block alarm.

The relay termination assemblies (TAs) are available with a 5 A or a 10 A relay per channel and support the following discrete outputs:

FBM	Contact Readback	Outputs
FBM240 with 10A relay	120 V ac, or 125 V dc (external power source)	120 V ac at 10 A, or 125 V dc at 5 A Switch (external power source)
FBM240 with 5A relay	120 V ac (external power source)	120 V ac at 5 A Switch (external power source)
FBM240 with 5A relay	30 V dc (external power source)	30 V dc at 5 A Switch (external power source)

Each discrete output is galvanically isolated from other channels and ground.

When used with the P0916AR termination assembly, each of the I/O channels is galvanically isolated from all other channels and ground and the outputs are fused to protect them from overload. Configuration options allow the inputs to be used independently of the outputs with this termination assembly. The eight voltage monitor inputs and switch outputs operate at 15 to 60 V dc.

REDUNDANT OUTPUTS

A redundant contact output function block, COUTR, is used for each redundant pair of outputs. The COUTR block handles output writes and initialization logic for the redundant channels. On each write of the COUTR block, identical output writes are sent to both modules, fully exercising the Fieldbus and the logic circuitry of each module. You can select a sustained output that follows the block input or a pulsed output with a selectable pulse width.

When a failure is detected in one of the modules, its output is marked bad and the corresponding channel in the good module automatically continues to drive the discrete outputs.

Each output channel drives an externally powered load. Power for each FBM240 module is diode OR'd together in the redundant adapter to assure redundant power. The microprocessor of each module executes the digital output application program, plus diagnostic routines that validate the health of the FBM.

FAIL-SAFE

Configurable options for output safety include:

- ▶ Digital Output Fail-Safe Fallback Data - specifies the channel fallback value (0 or 1) for each of the eight digital outputs
- ▶ Mask option - determines which of the eight digital outputs hold its current value and which outputs assume the fallback values
- ▶ Fieldbus Fail-Safe Delay Time - length of time the FBM waits for a communication from the CP before entering a communications fail.

Redundant Modules

For redundant modules, the Fail-Safe Fallback Data and mask options are configurable. An additional option is provided so that the module data will fall back to zero (0) when the module is put off-line for maintenance functions so that it will not interfere with the remaining module which is still on-line.

The FBM240 requires version 1.40N or later firmware to support this feature.

Single Modules

For single modules the Fail-Safe Fallback Data and Mask options are configurable.

COMPACT DESIGN

The 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 G3 harsh environments, per ISA Standard S71.04.

HIGH RELIABILITY

The redundancy of the module pair, coupled with the high coverage of faults, provides a very high subsystem availability time.

The module performs signal conversion required to interface electrical input signals from field sensors to the optionally redundant Fieldbus. It executes the Discrete I/O program, with the following configurable options: Input Filter Time, Fail-Safe Configuration, and Sustained or Momentary Outputs. If the Momentary Output configuration is selected, then Pulse Output Interval is also configurable.

When redundant, either module may be replaced without upsetting field input or output signals to the good module. The module can be removed/replaced without removing field device termination cabling, power, or communications cabling.

FIELDBUS COMMUNICATION

The Fieldbus Communications Module (FCM) or the Field Control Processor (FCP) interfaces to the redundant 2 Mbps module Fieldbus used by the FBMs. The FBM240 accepts communication from either path of the redundant 2 Mbps Fieldbus - should one path fail or be switched at the system level, the module continues communication over the active path.

MODULAR BASEPLATE MOUNTING

The FBM240 module mounts on a DIN rail mounted Modular Baseplate, which accommodates up to four or eight Fieldbus Modules. The Modular Baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for the redundant Module Fieldbus, redundant independent dc power, and termination cables.

Redundant modules must be located in odd and even adjacent positions on the baseplate (positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8). To achieve the redundancy, a redundant adapter module is placed on the two adjacent baseplate termination cable connectors to provide a single termination cable connection (see Figure 1).

To system configurator applications and to other systems monitoring through SMON, System Manager, and SMDH, redundant FBM240s appear to be separate, nonredundant modules. The functional redundancy for these modules is provided by their associated control blocks.

TERMINATION ASSEMBLIES

Field I/O signals connect to the FBM subsystem via DIN rail mounted termination assemblies (TAs). The TAs used with the FBM240 provide:

- ▶ output signal connection points
- ▶ external power connection point
- ▶ 5 A unsealed relay or a 10 A unsealed relay for each output
- ▶ 15-60 V dc switch and voltage monitor inputs

The relay TAs have a high voltage input circuit that monitors the voltage across the contacts of each output relay. Monitor circuits are located on daughter card assemblies mounted on the TAs. There are two daughter cards per TA, each with four monitor circuits. The TAs are:

- ▶ P0917YF - 80 to 125 V dc at 5 A or 80 to 120 V ac at 10A
- ▶ P0917HU - 80 to 120 V ac at 5 A
- ▶ P0926SZ - 15 to 30 V dc at 5 A
- ▶ P0916AR - 15 to 60 V dc voltage monitor and 2 A switch.

NOTE

When the FBM240 output opens, the TA contacts still apply current to the circuit due to the TA's readback circuitry, as described in Table 2 and Table 3, "Consumption" in "Functional Specifications" and "Termination Assembly Switching Relays" in "Physical Specifications" below.

The P0916AR passive TA provides fused 2A outputs and independent inputs for use with 15-60 V dc.

The redundant adapter connects the redundant FBMs baseplate connectors together. The redundant adapter provides a single termination connection to a single TA.

The DIN rail mounted termination assemblies connect to the redundant adapter by means of a removable termination cable. The cable is available in a variety of lengths, up to 30 meters (98 feet), allowing the termination assembly to be mounted in either the same enclosure or in an adjacent enclosure.

FUNCTIONAL SPECIFICATIONS

I/O Channels

Eight input and eight output channels. Each channel is isolated and independent from the other channels.

Filter/Debounce Time⁽²⁾

Configurable (No Filtering, 4, 8, 16, or 32 ms)

Voltage Monitor Function (with TA (P0916AR))

INPUT

On-State Voltage

15 to 60 V dc

Off-State Voltage

0 to 5 V dc

Current

(Single module) 1.4 mA (typical) at

5 to 60 V dc

(Redundant modules) 2.8 mA (typical) at

5 to 60 V dc

SOURCE RESISTANCE LIMITS

On-State

1 k Ω (maximum) at 15 V dc

Off-State

100 k Ω (minimum) at 60 V dc

Output Switch with External Source

APPLIED VOLTAGE

60 V dc (maximum)

LOAD CURRENT

2.0 A (maximum)

OFF-STATE LEAKAGE CURRENT

0.1 mA (maximum)

Inductive Loads

TA output may require a protective diode or metal oxide varistor (MOV) connected across the inductive load.

I/O Channel Isolation

Each channel is galvanically isolated from all other channels and earth (ground). The TA/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.

I/O Channel Isolation (Cont.)

When used with a relay TA, the input and output channels are not isolated from each other, but are isolated as an I/O pair.

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.

Process I/O Communications

Communicates with its associated FCM or FCP via the redundant 2 Mbps module Fieldbus

Power Requirements

INPUT VOLTAGE RANGE (REDUNDANT)

24 V dc +5%, -10%

CONSUMPTION

Module

5 W (maximum) total for redundant pair

Termination Assembly

5 A relay (P0917HU or P0926SZ) - 7.6 W

10 A relay (P0917YF) - 15.2 W

HEAT DISSIPATION

Module

5 W (maximum) total for redundant pair

Termination Assembly

5 A relay (P0917HU or P0926SZ) - 7.6 W

10 A relay (P0917YF) - 15.2 W

(2) Digital filtering available for 200 Series FBM or competitive migration modules with version 1.25H or later firmware.

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, V 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

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, V dc power and communication lines

IEC 61000-4-8 Power Frequency Magnetic Field Immunity

30 A/m at 50 and 60 Hz

PRODUCT SAFETY - FBM240 MODULE

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).

PRODUCT SAFETY - FBM240 MODULE (CONT.)

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 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).

PRODUCT SAFETY - TERMINATION ASSEMBLY

Underwriters Laboratories (UL) for U.S. and Canada

UL/UL-C listed as suitable for use in ordinary locations and compliant with UL 3121, First Edition, and Canadian Standard, C22.2

No.1010.1-92 when connected to specified I/A Series processor modules as described in the *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA).

European Low Voltage Directive 73/23/EEC Certified for use in ordinary locations and compliant with IEC 61010 when connected to specified I/A Series processor modules as described in the *I/A Series DIN Rail Mounted Subsystem User's Guide* (B0400FA).

Calibration Requirements

Calibration of the module and termination assembly is not required.

ENVIRONMENTAL SPECIFICATIONS⁽³⁾

Operating

TEMPERATURE

FBM240

-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/S² (0.75 g) from 5 to 500 Hz

PHYSICAL SPECIFICATIONS

Mounting

MODULE

The FBM240 mounts on a Modular Baseplate. The Modular Baseplate can be mounted on a DIN rail (horizontally or vertically), or horizontally on a 19-inch rack using a mounting kit. Redundant modules must be located in odd and even adjacent positions on the baseplate (positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8). See PSS 21H-2W6 B4 for details.

TERMINATION ASSEMBLY

The TA mounts on a DIN rail and accommodates multiple DIN styles including 32 mm (1.26 in) and 35 mm (1.38 in).

Mass

FBM 240 MODULE -

284 g (10 oz) approximate (each module)

TERMINATION ASSEMBLIES

5 A - 454 g (1 lb) approximate

10 A - 908g (2 lb) approximate

2 A - 363g (0.8 lb) approximate

Dimensions - Module

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 page 13 to page 15

Part Numbers

FBM240 MODULE

P0917GZ

TERMINATION ASSEMBLIES (EXTERNAL SOURCED) WITH READBACK

P0917YF - 80 to 125 V dc at 5 A or

80 to 120 V ac at 10A

P0917HU - 80 to 120 V ac at 5 A

P0926SZ - 15 to 30 V dc at 5 A

TERMINATION ASSEMBLY (PASSIVE)

P0916AR - 15 to 60 V dc at 2 A

REDUNDANT ADAPTER

P0927BM

(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 - Refer to Table 1

CABLE CONNECTION

37-pin male D-subminiature

Construction - Termination Assembly

MATERIAL

Polyamide (PA) - Ring Lug

FAMILY GROUP COLOR

Dark Blue - Discrete

TERMINAL BLOCKS

Outputs - 2 tiers, 8 positions

I/O - 2 tiers, 16 positions

RING LUG - ACCEPTED WIRING SIZES

#6 size connectors (0.375 in (9.5 mm))

0.5 to 4 mm²/22 AWG to 12 AWG

Termination Assembly Switching Relays

ELECTRICAL SERVICE LIFE

100,000 operations at rated resistive load

5,000,000 operations at no load.

5 A RELAY

Type

Single-Pole, Single-Throw, Normally Open
(SPST_NO)

Switching Current

5 A at 30 V dc, 5 A at 80 to 120 V ac (see
Table 2)

10 A RELAY

Type

Single-Pole, Single-Throw, Normally Open
(SPST_NO)

Switching Current

5 A at 80 to 125 V dc, or 10 A at 80 to 120
V ac (see Table 3)

Table 1. Cables 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 +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).

(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.

PHYSICAL SPECIFICATIONS (CONTINUED)

Table 2. Termination Assembly Relay (P0165CL) 5 A Contact Data

Load	1-Pole Type	
	Resistive Load (p.f. = 1)	Inductive Load (p.f. = 0.4) (L/R = 7 ms)
Rated load	5 A at 250 V ac 0.6 A at 125 V dc	2 A at 250 V ac 0.4 A at 125 V dc
Contact material	0.187 silver cadmium oxide, gold flashed	
Carry current	5 A @ 250 V ac (see Note); 5 A @ 30 V dc	
Maximum operating voltage	380 V ac, 125 V dc	
Maximum operating current	5 A (see Note)	
Maximum switching capacity	1250 VA, 150 W	500 VA, 90 W
Minimum permissible load	100 mA, 5 V dc	
Note: These specifications apply only to the relay. When used in the TA, they have been derated due to UL and temperature ratings.		

PHYSICAL SPECIFICATIONS (CONTINUED)

Table 3. Termination Assembly Relay (P0165CP) 10 A Contact Data

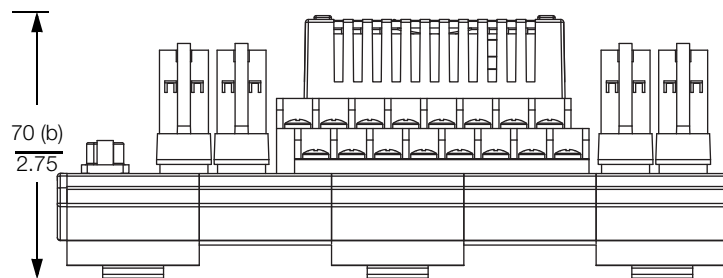
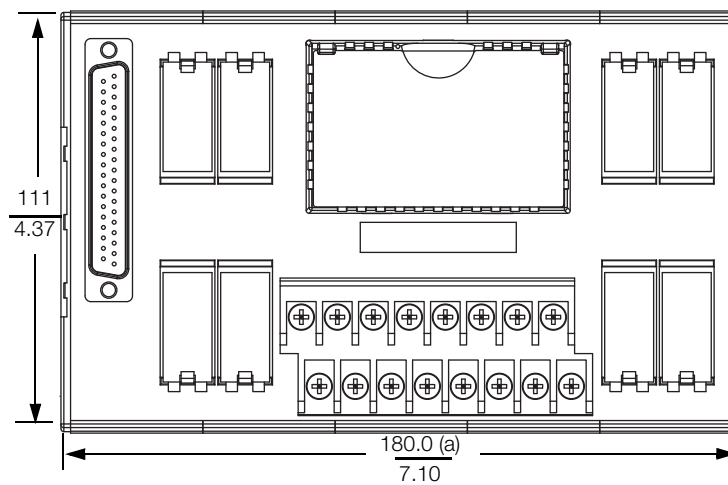
Load	1-Pole Type	
	Resistive Load (p.f. = 1)	Inductive Load (p.f. = 0.4) (L/R = 7 ms)
Rated load	10 A at 250 V ac 13A, 1/3 HP at 120 V ac 13A, 1/2 HP at 277 V ac 10 A at 150 V dc	7.5 A at 120 V ac 4 A at 125 V dc
Contact material	0.187 silver cadmium oxide, gold flashed	
Carry current	13 A @ 250 V ac (see Note); 10 A @150 V dc	
Maximum operating voltage	240 V ac, 150 V dc	
Maximum operating current	13 A (see Note)	
Maximum switching capacity	3250 VA, 364 W	2400 VA, 500 W
Minimum permissible load	130 mA, 5 V dc	
Note: These specifications apply only to the relay. When used in the TA, they have been derated due to UL and temperature ratings		

DIMENSIONS – NOMINAL

$\frac{\text{mm}}{\text{in}}$

Ring-Lug Termination Assembly, 5 A Relays

P0917HU, P0926SZ



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

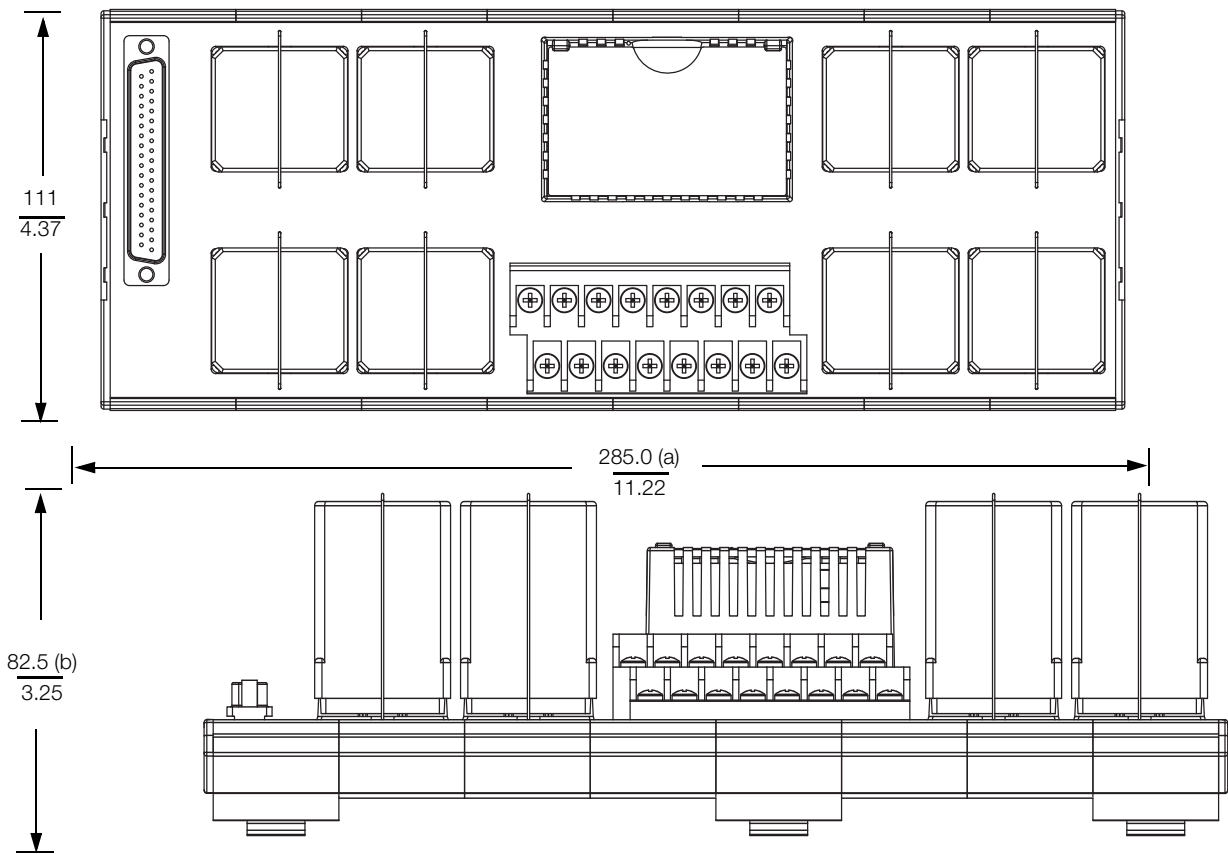
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

$\frac{\text{mm}}{\text{in}}$

Ring Lug Termination Assembly, 10 A Relays

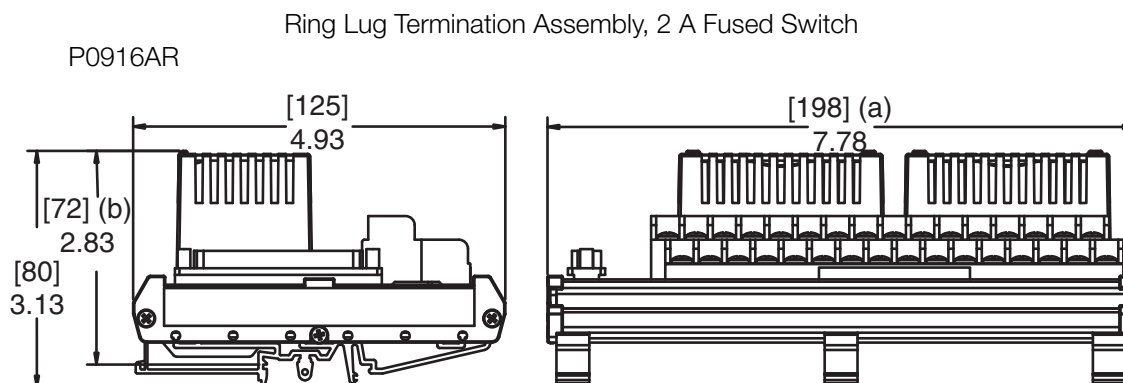
P0917YF



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

DIMENSIONS – NOMINAL (CONTINUED)

$\frac{\text{mm}}{\text{in}}$



- (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-2W2 B3	DIN Rail Mounted FBM Equipment, Agency Certifications
PSS 21H-2W6 B4	DIN Rail Mounted Modular Baseplates

