Foxboro Evo™ Process Automation System Hardware

Product Specifications

Foxboro® by Schneider Electric

PSS 31H-2Z40

FBM240, Redundant with Readback, Discrete Output Module

Critical control circuits require knowledge that the actual contact output state is matched to the demanded state. The FBM240 provides both redundancy to maintain control integrity in the presence of a fault as well as readback of the output state for comparison with the demanded state.

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 Foxboro Evo™ Control Software validates each output in conjunction with information to/from the module.

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.

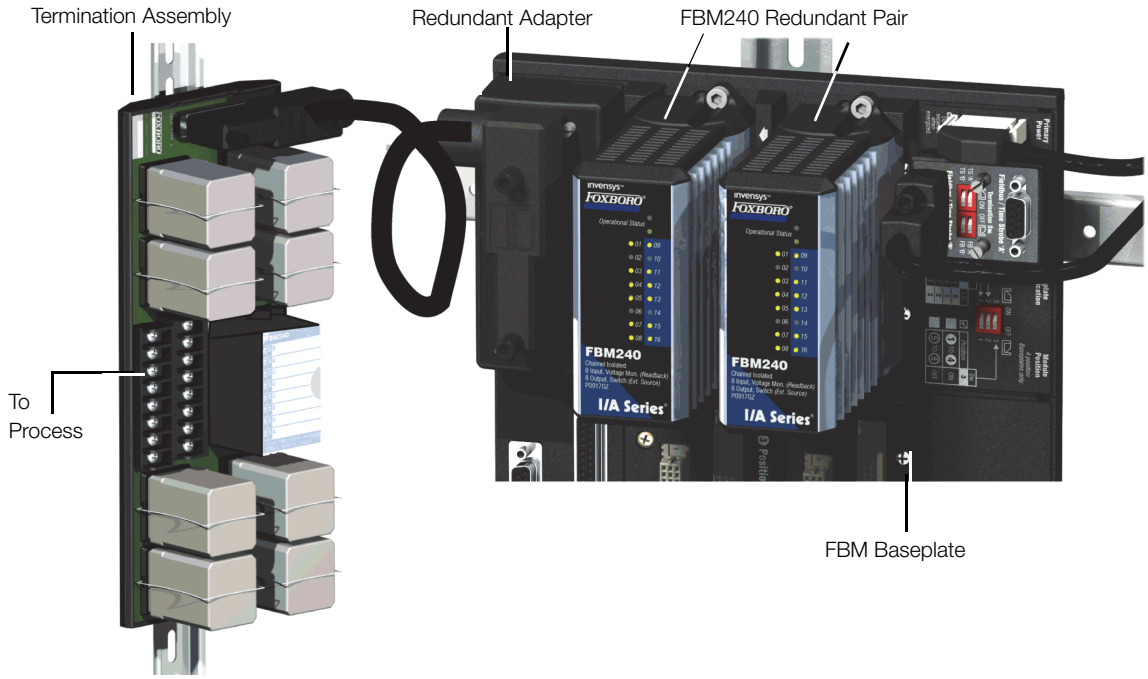


Figure 1. FBM240 Redundant I/O Configuration

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.

(1) Support for this termination assembly and the new Fail-Safe configuration options described in “FAIL-SAFE” on page 3 require version 1.40N or later firmware.

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 Foxboro Evo 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 P0916AQ/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
- P0916AQ/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 P0916AQ/AR 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 (P0916AQ/AR))

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 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 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 Foxboro Evo processor modules as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).

FUNCTIONAL SPECIFICATIONS (CONTINUED)

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 Foxboro Evo processor modules as described in the *Standard and Compact 200 Series 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 Foxboro Evo processor modules as described in the *Standard and Compact 200 Series 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/S^2 (0.75 g) from 5 to 500 Hz

(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

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 31H-2SBASEPLT 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).

Weight

FBM240 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 16

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)
P0916AQ/P0916AR - 15 to 60 V dc at 2 A

REDUNDANT ADAPTER
P0927BM

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 mm^2/22 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)

PHYSICAL SPECIFICATIONS (CONTINUED)

Table 1. Cables Types and Part Numbers

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

(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).

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

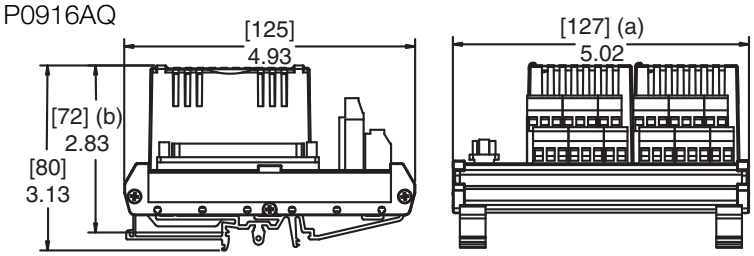
Load	1-Pole Type	
	Resistive Load (p.f. = 1)	**Inductive Load (p.f. = 0.4) (L/R = 7 ms)**
Rated load	10 A at 250 V ac 13A, 1/3 HP at 120 V ac 13A, ½ HP at 277 V ac 10 A at 150 V dc	7.5 A at 120 V ac 4 A at 125 V dc
Contact material	0.187 silver cadmium oxide, gold flashed	
Carry current	13 A @ 250 V 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

mm
in

Compression Termination Assembly, 2 A Fused Switch

P0916AQ



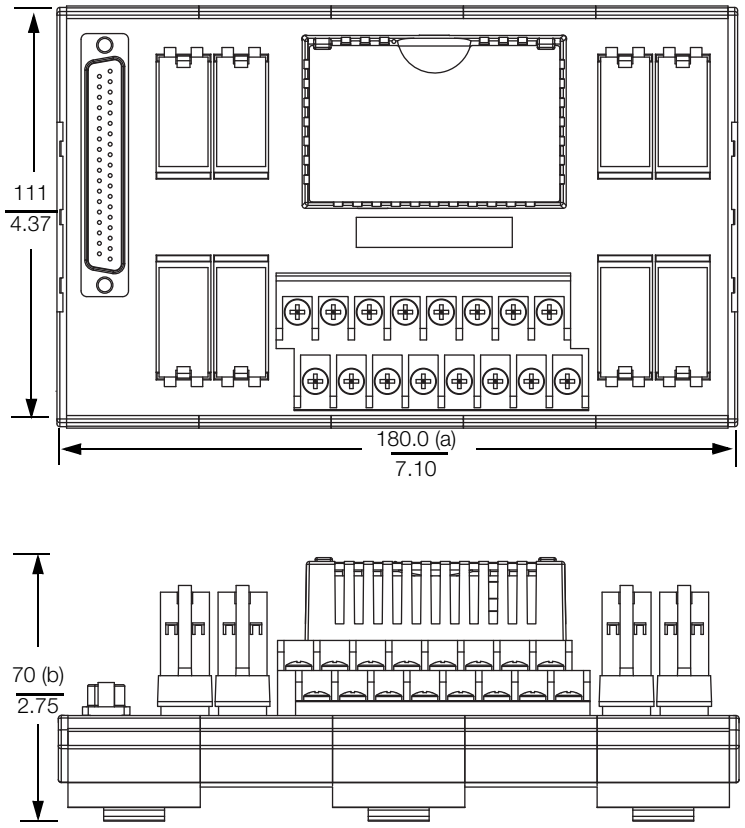
(a) Overall width – for determining DIN rail loading.
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

mm
in

Ring-Lug Termination Assembly, 5 A Relays

P0917HU, P0926SZ



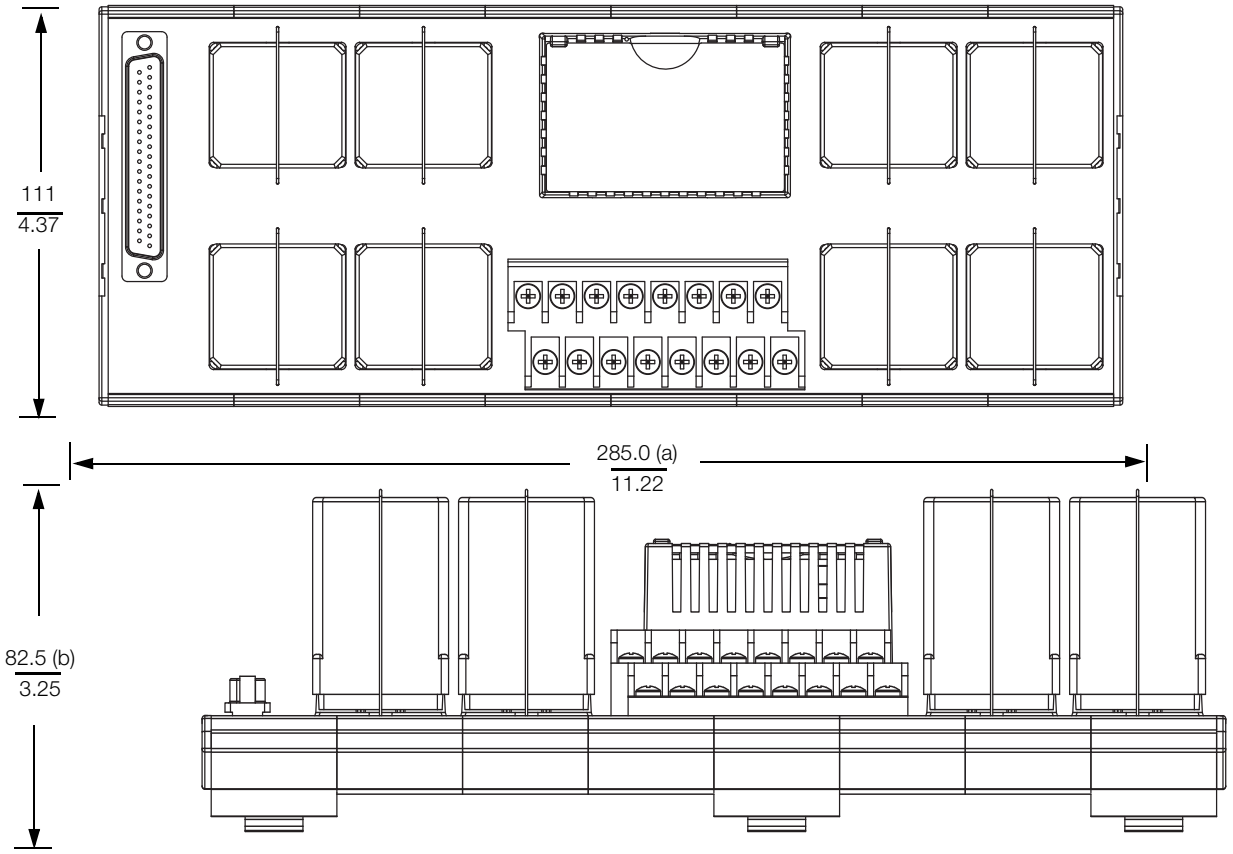
(a) Overall width – for determining DIN rail loading.
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

mm
in

Ring Lug Termination Assembly, 10 A Relays

P0917YF



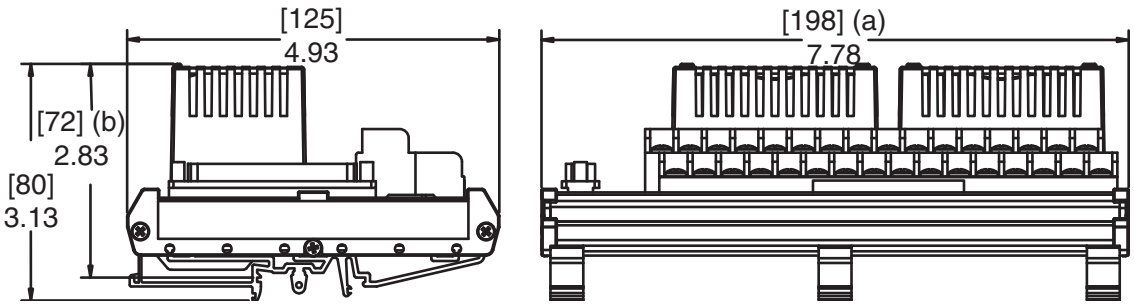
(a) Overall width – for determining DIN rail loading.
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

mm
in

Ring Lug Termination Assembly, 2 A Fused Switch

P0916AR



(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 31H-2S200	Standard 200 Series Subsystem Overview
PSS 31H-2CERTS	Standard and Compact 200 Series I/O - Agency Certifications
PSS 31H-2SBASEPLT	Standard 200 Series Baseplates

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