

**Compact FBM240, Redundant with Readback, Discrete Output and Discrete Input Module**



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

**OVERVIEW**

The Compact FBM240 is an 8 channel input and 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.

This module is part of the Compact 200 Series I/O subsystem described in *Compact 200 Series I/O Subsystem Overview* (PSS 31H-2COV).

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

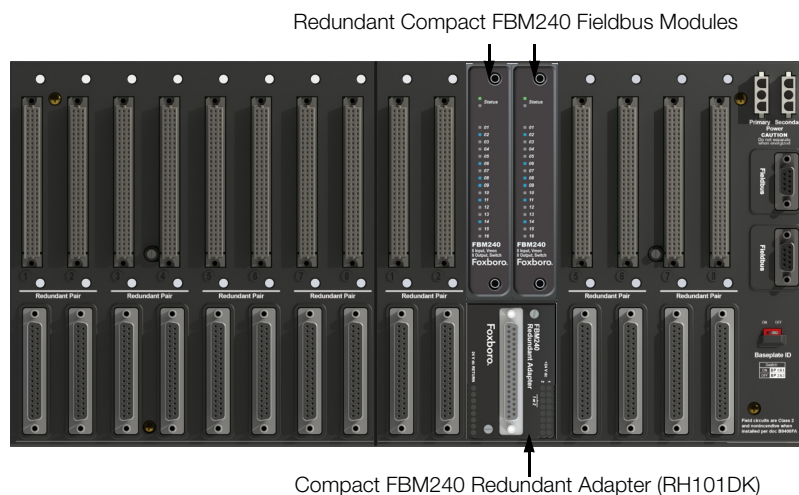


Figure 1. Compact FBM240 Redundant Module Configuration

## FEATURES

The key features of the Compact FBM240 are:

- ▶ Eight discrete outputs/Eight discrete voltage monitor inputs
- ▶ 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 Compact 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<sup>(1)</sup>:
  - 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.

## INTERNAL READBACK OF OUTPUT

The Compact 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 Compact FBM240. When external power is applied to the relay contact of each channel, the LED for that channel is ON when the

(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.

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 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
Compact 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)
Compact FBM240 with 5A relay	120 V ac (external power source)	120 V ac at 5 A Switch (external power source)
Compact 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 RH916AQ/RH916AR 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 Compact 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 Compact 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 Compact FBM240'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 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.

## **EASY REMOVAL/REPLACEMENT**

The module mounts on a Compact 200 Series baseplate. Two screws on the FBM secure the module to the baseplate.

Redundant modules must be located in adjacent positions on the baseplate, with the first module located in an odd-numbered position (for example, the positions labelled "3" and "4"). To achieve redundancy, a redundant adapter module is placed on the two adjacent baseplate termination cable connectors to provide termination for a single cable (see Figure 1). A single termination cable connects from the redundant adapter to the associated termination assembly (TA).

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

## **REDUNDANT MODULES IN FOXBORO EVO HMI**

The redundant pair of modules appear as two independent modules to system management software applications (such as System Manager, and System Manager/Display Handler (SMDH)). The functional redundancy for these modules is provided by their associated control blocks.

## **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 Compact 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.

## TERMINATION ASSEMBLIES

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

- ▶ RH917YF - 80 to 125 V dc at 5 A or 80 to 120 V ac at 10A
- ▶ RH917HU - 80 to 120 V ac at 5 A
- ▶ RH926SZ - 15 to 30 V dc at 5 A
- ▶ RH916AQ/RH916AR - 15 to 60 V dc voltage monitor and 2 A switch.

### NOTE

When the Compact 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 RH916AQ/AR passive TA provides fused 2A outputs and independent inputs for use with 15-60 V dc.

The redundant adapter connects the redundant FBM's 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 assemblies to be mounted as needed by plant design.

## VISUAL INDICATORS

Red and green light-emitting diodes (LEDs) incorporated into the front of the modules provide visual status indications of Fieldbus Module (FBM) functions, as well as the discrete states of the individual output points.

## FUNCTIONAL SPECIFICATIONS

### I/O Channels

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

### Filter/Debounce Time<sup>(2)</sup>

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

### Voltage Monitor Function (with TA (RH916AQ/RH916AR))

#### 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  $\Omega$  (maximum) at 15 V dc

*Off-State*

100 k  $\Omega$  (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.

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 with TA RH916AR*

2 W (maximum) total for single module

4 W (maximum) total for redundant pair

*Module with TA RH926SZ*

7.6 W (maximum) total for single module

*Module with TA RH917YF*

15.2 W (maximum) total for single module

*Termination Assembly*

5 A relay (RH917HU or RH926SZ) - 7.6 W

10 A relay (RH917YF) - 15.2 W

#### HEAT DISSIPATION

*Module with TA RH916AR*

2 W (maximum) total for single module

4 W (maximum) total for redundant pair

*Module with TA RH926SZ*

7.6 W (maximum) total for single module

*Module with TA RH917YF*

15.2 W (maximum) total for single module

*Termination Assembly*

5 A relay (RH917HU or RH926SZ) - 7.6 W

10 A relay (RH917YF) - 15.2 W

### Calibration Requirements

Calibration of the module and termination assembly is not required.

(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 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)*

DEMKO 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).

### **MARINE CERTIFICATION**

ABS Type Approved and Bureau Veritas Marine certified for Environmental Category EC31.



ENVIRONMENTAL SPECIFICATIONS<sup>(3)</sup>

Operating

TEMPERATURE

*Compact FBM240*  
-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<sup>2</sup> (0.75 g) from 5 to 500 Hz

PHYSICAL SPECIFICATIONS

Mounting

MODULE

The Compact FBM240 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.  
Redundant modules must be located in odd and even adjacent positions on the baseplate (positions 1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10 (the second 1 and 2), 11 and 12 (the second 3 and 4), 13 and 14 (the second 5 and 6), or 15 and 16 (the second 7 and 8)). 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 styles including 32 mm (1.26 in) and 35 mm (1.38 in).

Weight

COMPACT FBM240

185 g (6.5 oz) approximate

TERMINATION ASSEMBLIES

5 A - 454 g (1 lb) approximate  
10 A - 908g (2 lb) approximate  
2 A - 363g (0.8 lb) approximate

Dimensions

COMPACT FBM240

*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 13 to page 16

(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)

Part Numbers

**COMPACT FBM240**

RH101DG

**TERMINATION ASSEMBLIES (EXTERNAL SOURCED) WITH READBACK**

RH917YF - 80 to 125 V dc at 5 A or  
80 to 120 V ac at 10A

RH917HU - 80 to 120 V ac at 5 A

RH926SZ - 15 to 30 V dc at 5 A

**TERMINATION ASSEMBLY (PASSIVE)**

RH916AQ/RH916AR - 15 to 60 V dc at 2 A

**REDUNDANT ADAPTER**

RH101DK

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**

*FBM Baseplate End*

37-pin D-subminiature

*Termination Assembly End*

37-pin D-subminiature

Construction - Termination Assembly

**MATERIAL**

Polyamide (PA) - Ring Lug

**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<sup>2</sup>/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 <sup>(a)</sup>	Type 4 LSZH <sup>(b)</sup>
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 +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	Single 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)

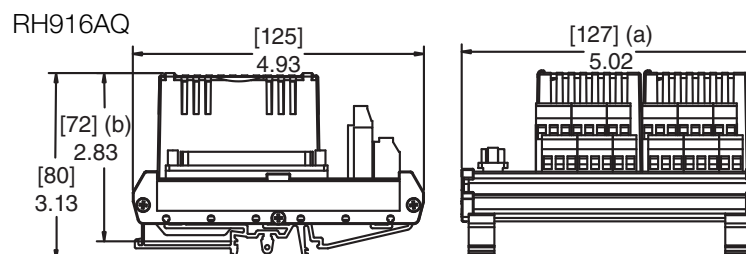
Table 3. Termination Assembly Relay (P0165CP) 10 A Contact Data

Load	Single 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

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

Compression Termination Assembly, 2 A Fused Switch



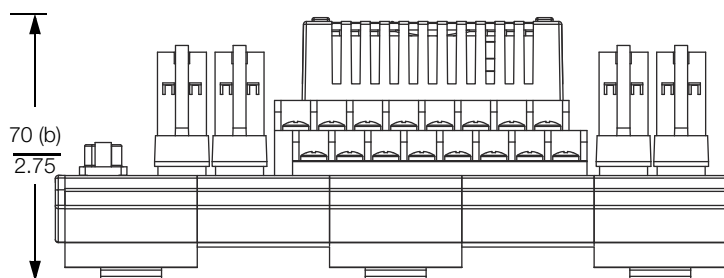
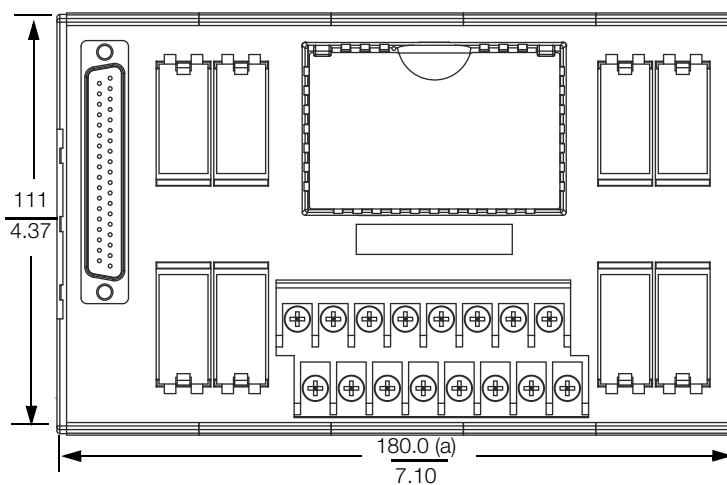
- (a) Overall width – for determining DIN rail loading.  
(b) Height above DIN rail (add to DIN rail height for total).

**DIMENSIONS – NOMINAL (CONTINUED)**

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

Ring-Lug Termination Assembly, 5 A Relays

RH917HU, RH926SZ



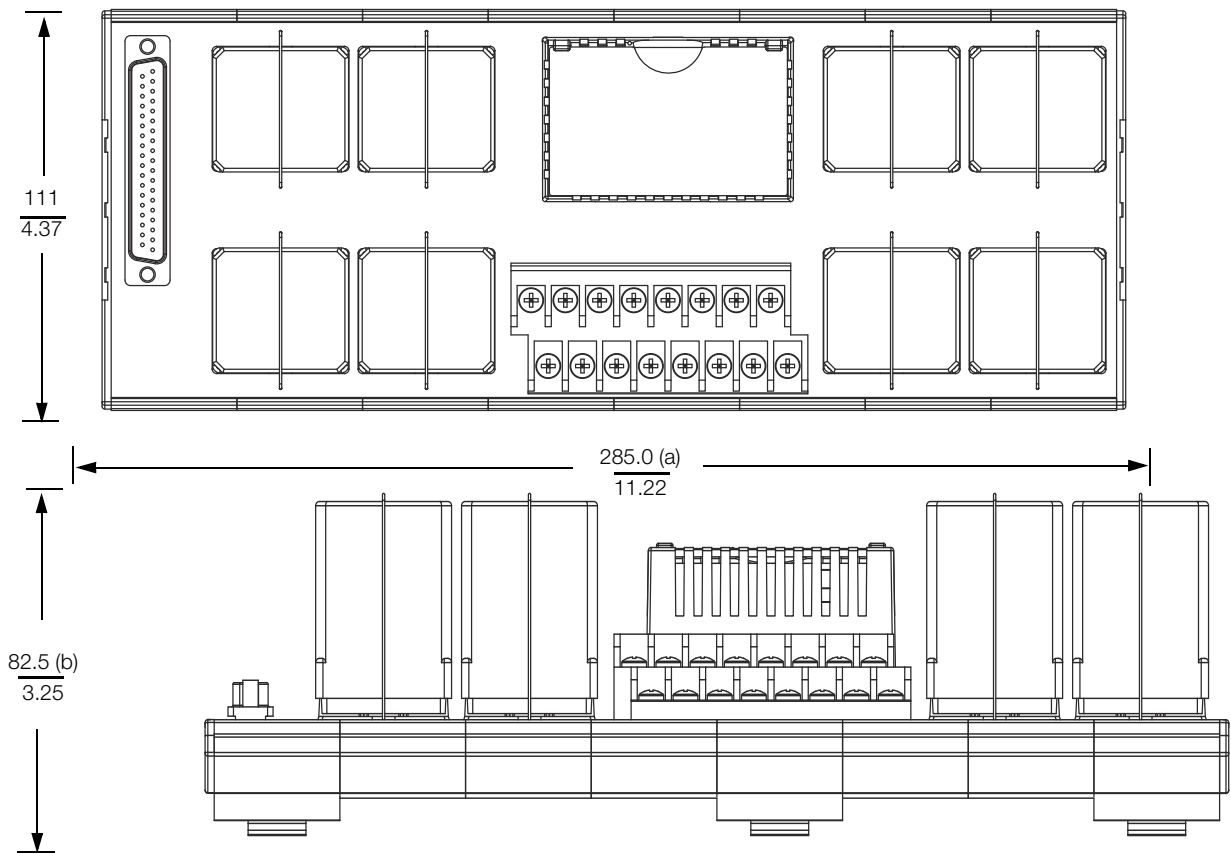
- (a) Overall width – for determining DIN rail loading.  
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS – NOMINAL (CONTINUED)

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

Ring Lug Termination Assembly, 10 A Relays

RH917YF

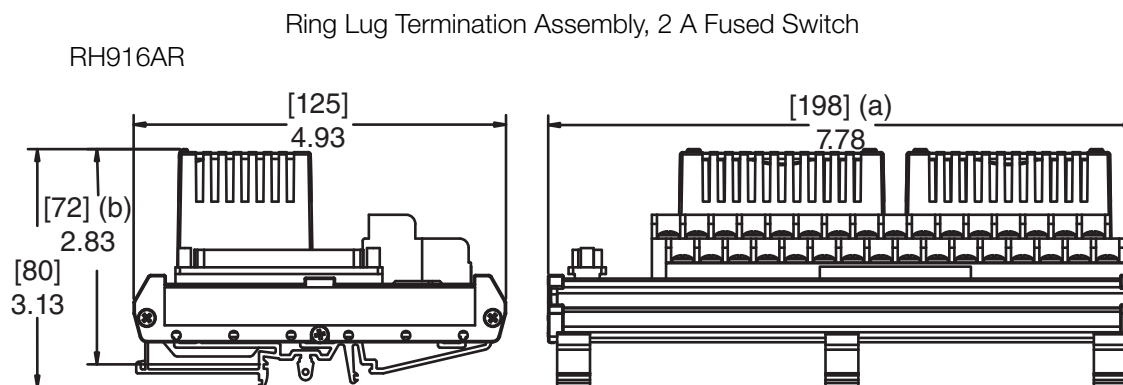


- (a) Overall width – for determining DIN rail loading.  
(b) Height above DIN rail (add to DIN rail height for total).



# 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 DOCUMENTS

**Table 4. Other Related Documents**

<b>PSS Number</b>	<b>Description</b>
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-2S200	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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