

Compact FBM207/b/c Voltage Monitor/Contact Sense Input Interface Modules



Discrete inputs can be sensed across all the usual voltage levels found in industrial facilities. The Compact FBM207/b/c Voltage Monitor/Contact Sense Input Interface Modules use one of the several termination assemblies to match to the externally powered voltage level.

OVERVIEW

The Compact FBM207/b/c Voltage Monitor/Contact Sense Input Interface Module functions as a 16-channel dc voltage monitor (FBM207) or 16-channel contact sensor for 24 V dc inputs (FBM207b) or 48 V dc inputs (FBM207c). Each channel accepts a 2-wire input from a dc voltage source (FBM207) or pair of contacts or solid state switches (FBM207b/FBM207c). Associated termination assemblies (TAs) support discrete input signals at voltages of 60 V dc, 120 V ac/125 V dc, or 240 V ac.

For voltages higher than 60 V dc, the TAs have additional signal conditioning hardware that provides voltage attenuation and optical isolation.

It is part of the Compact 200 Series I/O subsystem described in *Compact 200 Series I/O Subsystem Overview* (Reference 1). (See Table 3, "Reference Documents," on page 15 at the end of this document.)

The module is available in three distinct types, and each type with its associated TA supports discrete inputs as shown below:

Compact FBM207	Provides voltage monitoring at: –60 V dc –120 V ac/125 V dc –240 V ac Provides switch inputs with: –External 120 V ac/125 V dc –External 240 V ac
Compact FBM207b	24 V dc Contact Sense
Compact FBM207c	48 V dc Contact Sense

Each discrete input is galvanically isolated from other channels and ground, and group isolated when used with external excitation.

The modules perform signal conversion required to interface electrical input signals from field sensors to the redundant module Fieldbus. In addition, they may execute programs for Discrete Input, Ladder Logic, Pulse Count, and Sequence of Events, with configurable options of input filter time.

The modules can be used as a single unit, or as a redundant pair. When used as a redundant pair, the modules combine to provide redundancy at the FBM level, with field input signals received from one common termination assembly through a redundant adapter affixed to the Compact FBMs' baseplate. The input current for redundant modules is doubled. A redundant digital input block in the Foxboro Evo™ control software validates each input in conjunction with information to/from the module, and selects the input with the higher quality for processing in the control strategy.

A redundant contact input function block, CINR, is used for each pair of inputs. The CINR block handles input reads and initialization logic for the redundant channels. On each execution cycle of the CINR block, identical reads are queried from each module, fully exercising the fieldbus and the logic circuitry of each module.

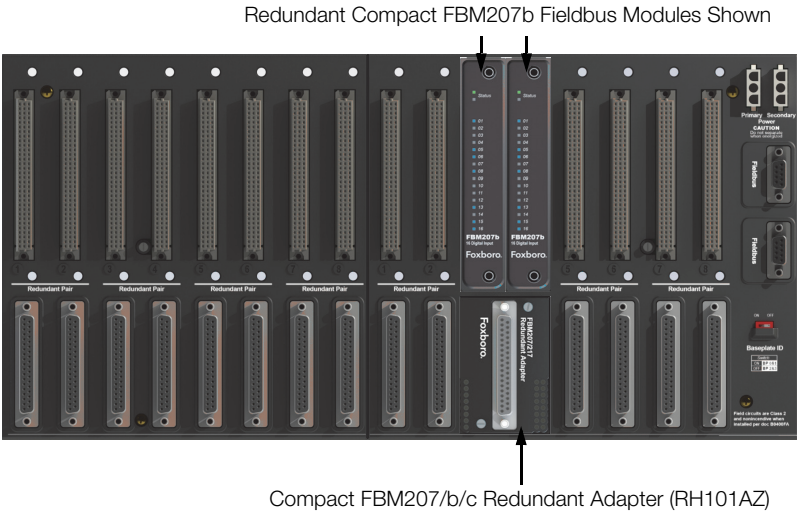


Figure 1. Compact FBM207/b/c Redundant Module Configuration

FEATURES

Key features of the Compact FBM207/b/c are:

- ▶ FBM207 supports sixteen discrete input signals at voltages of:
 - 15 to 60 V dc - voltage monitoring
 - 120 V ac/125 V dc - voltage monitoring or switch inputs
 - 240 V ac - voltage monitoring or switch inputs
- ▶ FBM207b/c support sixteen discrete inputs:
 - FBM207b - 24 V dc contact sense
 - FBM207c - 48 V dc contact sense
- ▶ Each input is galvanically isolated, and group isolated with external excitation.
- ▶ Single or redundant modules
- ▶ Compact, rugged design suitable for enclosures in Class G3 (harsh) environments
- ▶ Executes programs for Discrete Input, Ladder Logic, Pulse Count, and Sequence of Events with configurable Input Filter Time option
- ▶ Termination Assemblies (TAs) for locally or remotely connecting field wiring to the Compact FBM207/b/c
- ▶ Termination Assemblies for per channel internally loop powered devices

COMPACT DESIGN

The Compact FBM207/b/c's design is narrower than the standard 200 Series FBMs, with 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 harsh environments (Class G3), per ISA Standard S71.04.

VISUAL INDICATORS

Light-emitting diodes (LEDs) incorporated into the front of the module provide visual indication of the module's operational status, as well as the discrete states of the individual input points.

EASY REMOVAL/REPLACEMENT

The modules mount on a Compact 200 Series baseplate which is either DIN rail mounted or rack mounted horizontally, and includes signal connectors for redundant Fieldbus, redundant independent dc power, and termination cables. Two screws on each FBM secure the module to the Compact 200 Series 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.

SEQUENCE OF EVENTS

The Sequence of Events (SOE) software package is used to acquire, store, display, and report events associated with a contact's change of state. System time is distributed to the FBM and the state change is marked with a precision of one millisecond. The contact signal may be passed through a debounce filter of variable period. System time is usually set by an optional master timekeeper receiving GPS time signals. This permits multiple control processors to be synchronized in time and therefore provide a consistent time basis for post-event analysis.

Refer to *Sequence of Events* (Reference 2) to learn more about this package, and to *Time Synchronization Equipment* (Reference 3) for a description of the optional time synchronization capability. Also, for more information, refer to the section on "Timestamp Accuracy and Precision of SOE Data" in *Time Synchronization User's Guide* (B0700AQ).

FIELDBUS COMMUNICATION

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

OVERCURRENT PROTECTION

Field power, for contacts or solid-state switches, is current limited.

TERMINATION ASSEMBLIES (TA)

Field I/O signals connect to the FBM subsystem via 200 Series TAs. The TAs used with the Compact FBM207/b/c are described in "TERMINATION ASSEMBLIES AND CABLES" on page 9.

FUNCTIONAL SPECIFICATIONS

Communication

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

Input

16 isolated and independent channels

Accuracy

Pulse Count

No missing pulses for pulse rate 0 to 250 Hz

Filter/Debounce Time

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

Voltage Monitor Function - Input

INPUT

Logic One, On-State Voltage: 15 to 60 V dc

Logic Zero, Off-State Voltage: 0 to 5 V dc

Current: 1.4 mA (typical) at 5 to 60 V dc

SOURCE RESISTANCE LIMITS

Logic One, On-State: 1 k Ω (maximum) at 15 V dc

Logic Zero, Off-State: 100 k Ω (minimum) at 60 V dc

Contact Sensor Function - Input

RANGE (EACH CHANNEL)

Contact open (off) or closed (on)

OPEN-CIRCUIT VOLTAGE

Compact FBM207b

24 V dc $\pm 15\%$

Compact FBM207c

48V dc $\pm 15\%$

SHORT-CIRCUIT CURRENT

3.2 mA (typical)

LOGIC ONE, ON-STATE RESISTANCE

1.0 k Ω (maximum)

LOGIC ZERO, OFF-STATE RESISTANCE

100 k Ω (minimum)

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Isolation

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

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.

Power Requirements

INPUT VOLTAGE RANGE (REDUNDANT)

24 V dc +5%, -10%

CONSUMPTION (MAXIMUM)

5 W

HEAT DISSIPATION (MAXIMUM)

5 W

Loop Power Supply Protection

Current limited at 3.2 mA (typical)

Field Terminations Functional Specifications

Refer to "TERMINATION ASSEMBLIES AND CABLES" on page 9.

Calibration Requirements

Calibration of the module and termination assembly is not required.

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 - LOW VOLTAGE INPUTS

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). (Reference 4). For use in an enclosure suited for an ATEX Zone 2 classified area.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

PRODUCT SAFETY - TERMINATION ASSEMBLIES WITH HIGH VOLTAGE INPUTS

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).
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

Operating Conditions

TEMPERATURE

FBM207/b/c

-20 to + 60°C (-4 to +140°F)

Termination Assembly - PA

-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 Conditions

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/s² from 5 to 500 Hz

PHYSICAL SPECIFICATIONS

Mounting

MODULE

The Compact FBM207/b/c 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* (Reference 5) 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

MODULE

185 g (6.5 oz) approximate

TERMINATION ASSEMBLY - COMPRESSION

127 mm (5.02 in) – 272 g (0.60 lb, approximate)

146 mm (5.75 in) – 317 g (0.7 lb, approximate)

TERMINATION ASSEMBLY - RING LUG

198 mm (7.78 in) – 400 g (0.90 lb, approximate)

216 mm (8.51 in) – 440 g (1.0 lb, approximate)

Dimensions - Module

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)

Dimensions - Termination Assembly

COMPRESSION SCREW

Refer to page 13.

RING LUG

Refer to page 14.

Part Numbers

COMPACT FBM207 MODULE

RH101GC

COMPACT FBM207b MODULE

RH101AF

COMPACT FBM207c MODULE

RH101GD

TERMINATION ASSEMBLIES

Refer to "TERMINATION ASSEMBLIES AND CABLES" on page 9.

REDUNDANT ADAPTER

RH101AZ

Termination Cables

CABLE LENGTHS

Up to 30 m (98 ft)

CABLE MATERIALS

PVC or Low Smoke Zero Halogen (LSZH)

TERMINATION CABLE TYPE

Type 4 or Type 4H - Refer to Table 2

CABLE CONNECTION

37-pin male D-subminiature

Construction - Termination Assembly

MATERIAL

Polyamide (PA), compression

Polyamide (PA), ring lug

FAMILY GROUP COLOR

Dark blue - discrete

TERMINAL BLOCKS

Inputs - 2 tiers, 16 positions

Excitation - 2 tiers, 4 positions

Field Termination Connections

COMPRESSION - ACCEPTED WIRING SIZES

Solid/Stranded/AWG

0.2 to 4 mm²/0.2 to 2.5 mm²/24 to 12 AWG

Stranded with Ferrules

0.2 to 2.5 mm² with or without plastic collar

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 ASSEMBLIES AND CABLES

General Description

Field I/O signals connect to the FBM subsystem via DIN rail mounted termination assemblies (TAs). Multiple types of TAs are available with FBMs to provide pass-thru I/O signal connections.

The termination assembly can be used with a single Compact FBM207/b/c or with a redundant pair (two Compact FBM207/b/cs).

The DIN rail mounted termination assemblies connect to the FBM subsystem baseplate by means of removable termination cables. When used with a redundant module pair, the termination assembly is connected to the baseplate using a Compact FBM207/b/c redundant adapter (RH101AZ). The DIN rail mounted TAs connect to the redundant adapter by means of a removable termination cable.

The cables for both single and redundant configurations are available in a variety of lengths, up to 30 meters (98 feet), allowing the termination assemblies to be mounted as needed by plant design. Refer to Table 2 on page 12 for termination cable part numbers and specifications.

Discrete Inputs

Termination assemblies with discrete inputs for the FBM207 support sixteen 2-wire discrete input signals at passive low voltage levels of less than 60 V dc and active high voltage levels of 125 V dc, 120 V ac, or 240 V ac. Active termination assemblies support input signal conditioning for FBMs. To condition signals, these termination assemblies may provide optical isolation, current limiting, noise reduction, voltage attenuation, or optional terminal blocks to connect externally supplied excitation voltage.

Termination assemblies with discrete contact sense inputs support sixteen 2-wire discrete input signals at passive low voltage levels of +24 V dc for the FBM207b and +48 V dc for the FBM207c.

Low Voltage Discrete Inputs

The low voltage inputs (less than 60 V dc) use passive termination assemblies. Inputs for FBM207 are voltage monitor types. Voltage monitor inputs require an external field voltage source.

Contact sense inputs use the FBM +24 V dc or +48 V dc supplied to all input channels on the assembly, to wet field contacts.

A load may not be required for proper operation of the input channels. A diode may be required for a dc inductive load only.

FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES

FBM Type	Input Signal	TA Part No.(a)	Termination Type(b)	TA Cable Type(c)	TA Certification Type(d)
		PA			
Compact FBM207	16 channel, voltage monitor (external source) 15 to 60 V dc FBM207 channel isolation	RH916XN(e)	C	4	1,2
		P0917JR(e)	RL		
Compact FBM207	16 channel, voltage monitor 120 V ac or 125 V dc Logic Zero 0 to 20 V ac; 0 to 20 V dc Logic One 80 to 132 V ac; 75 to 150 V dc Input Current for Logic One; 2 mA typical FBM207 channel isolation	RH916XP(e)	C	4	1
		P0917JS(e)	RL		
Compact FBM207	16 channel, voltage monitor 240 V ac Logic Zero 0 to 40 V ac Logic One 160 to 280 V ac Input Current for Logic One; 1.6 mA maximum FBM207 channel isolation	RH916PH	C	4	1
Compact FBM207	16 channel, voltage monitor 120 V ac or 125 V dc with external excitation Logic Zero 0 to 20 V ac; 0 to 20 V dc Logic One 80 to 132 V ac; 75 to 150 V dc Input Current for Logic One; 2 mA typical Group isolation provided by termination assembly	RH916PK	C	4	1
		P0917JT(e)	RL		

FUNCTIONAL SPECIFICATIONS - TERMINATION ASSEMBLIES (CONTINUED)

FBM Type	Input Signal	TA Part No. ^(a)	Termination Type ^(b)	TA Cable Type ^(c)	TA Certification Type ^(d)
		PA			
Compact FBM207	16 channel, voltage monitor 240 V ac with external excitation Logic Zero 0 to 40 V ac Logic One 160 to 280 V ac Input Current for Logic One; 1.6 mA maximum Group isolation provided by termination assembly	RH916PM	C	4	1
Compact FBM207b	16 channel, contact sense 24 V dc contact wetting from FBM207b FBM207b channel isolation	RH916XT ^(e)	C	4	1, 2
Compact FBM207c	16 channel, contact sense 48 V dc contact wetting from FBM207c FBM207c channel isolation	RH917MG	C	4	1, 2
		P0917MJ ^(e)	RL		

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

(b) C= TA with compression terminals, RL = TA with ring lug terminals.

(c) See to Table 2 for cable part numbers and specifications.

(d) See to Table 1 Termination Assembly certification definitions.

Note: To avoid false tripping of ac type inputs, care should be taken in routing long wiring or bundled runs to minimize coupling from adjacent signals and/or noise from heavy equipment. When possible, dc excitation of input circuits is recommended for runs greater than 305 m (1000 ft).

(e) Polyamide RL supersedes the PVC RL, note this is not a RoHS part.

Table 1. Certifications for Termination Assemblies

Type	Certification
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 Ex nA IIC T4 Gc for use in Zone 2 potentially explosive atmospheres.
Type 2	TAs are UL/UL-C listed for supplying 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 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.

Table 2. Cable Types and Part Numbers

Length m (ft)	Type 4, 26 AWG^(a) P/PVC	Type 4 LSZH^(b)
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

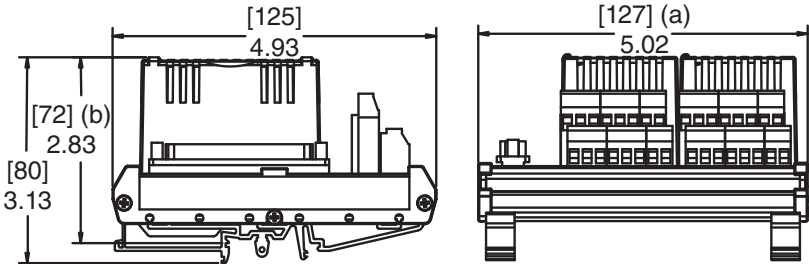
- (a) P/PVC cable assemblies polyurethane outer jacket and semi-rigid PVC primary conductor insulation temperature range: -20 to +70°C (-4 to 158°F)
- (b) Low smoke zero halogen or low smoke free of halogen (LSZH) is a material classification used for cable jacketing. LSZH is composed of thermoplastic 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)

DIMENSIONS—NOMINAL

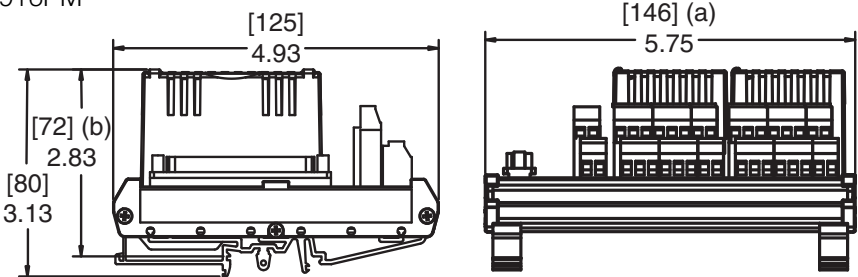
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Compression Termination Assemblies

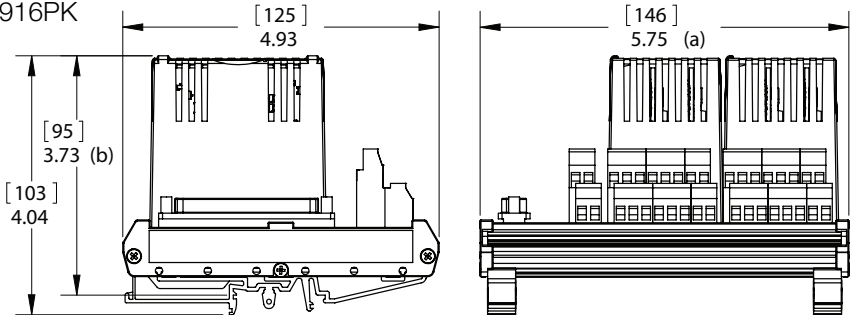
RH916XN¹, RH916XT¹, RH916XP¹, RH916PH, RH917MG¹



RH916PM



RH916PK



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

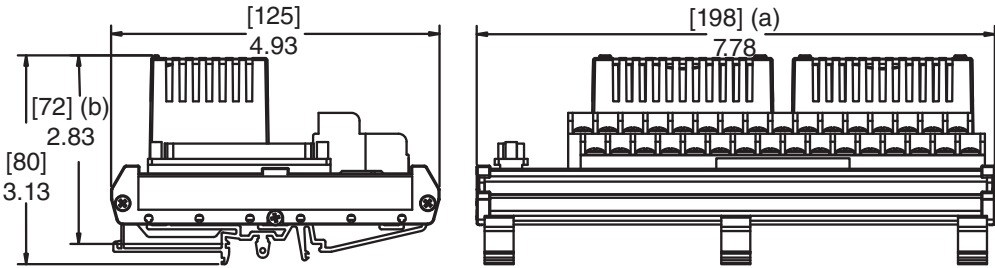
¹Dimensions may be slightly smaller.

DIMENSIONS-NOMINAL (CONTINUED)

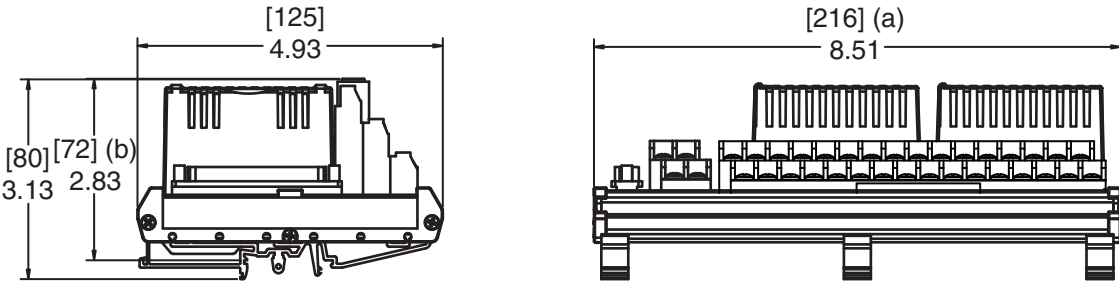
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Ring Lug Termination Assemblies

P0917JS¹, P0917JR¹, P0917MJ¹



P0917JT¹



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

¹Dimensions may be slightly smaller.

RELATED PRODUCT DOCUMENTS

Table 3. Reference Documents

Reference	Document Number	Description
1	PSS 31H-2COV B3	Compact 200 Series I/O Subsystem Overview
2	PSS 31S-2SOE	Sequence of Events
3	PSS 31H-4C2	Time Synchronization Equipment
4	B0400FA	Standard and Compact 200 Series Subsystem User's Guide
5	PSS 31H-2C200	Compact 200 Series 16-Slot Horizontal Baseplate

Table 4. Other Related Documents

Document Number	Description
PSS 31H-2CERTS	Standard and Compact 200 Series I/O, Agency Certifications
PSS 31H-2C480 B4	Compact Power Supply - FPS480-24
PSS 31S-3B3	Field Control Processor 280 (FCP280) Integrated Control Software
PSS 21S-3B2 B3	Control Processor 270 (CP270) Integrated Control Software



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