

Compact FBM247, Current/Voltage Analog/Digital/Pulse I/O Configurable Module



In many plant situations, the signal types associated with an installation are not well known until late in the project. The Compact FBM247 provides the capability to accept a range of standard analog, discrete, and pulse inputs that are user selectable and changeable at the discretion of the engineer. The HART® input signals are electrically compatible with the standard 4 to 20 mA inputs.

OVERVIEW

The Compact FBM247, Channel-Isolated Current/Voltage Analog/Digital/Pulse I/O Module contains eight channels which can be individually configured for a range of analog, digital and pulse field I/O signals. It is part of the Compact 200 Series I/O subsystem described in *Compact 200 Series I/O Subsystem Overview* (PSS 31H-2COV).

Each I/O channel is galvanically isolated from other channels and ground.

Two types of passive termination assemblies are available for the FBM247:

- ▶ DIN rail mounted TA, similar to those used with the other Compact 200 Series FBMs
- ▶ Baseplate-mounted Termination Assembly (TA) - mounts directly onto the field I/O connectors of the Compact 200 Series baseplate. This TA provide field I/O wiring support for a Compact FBM247 as shown in Figure 1.

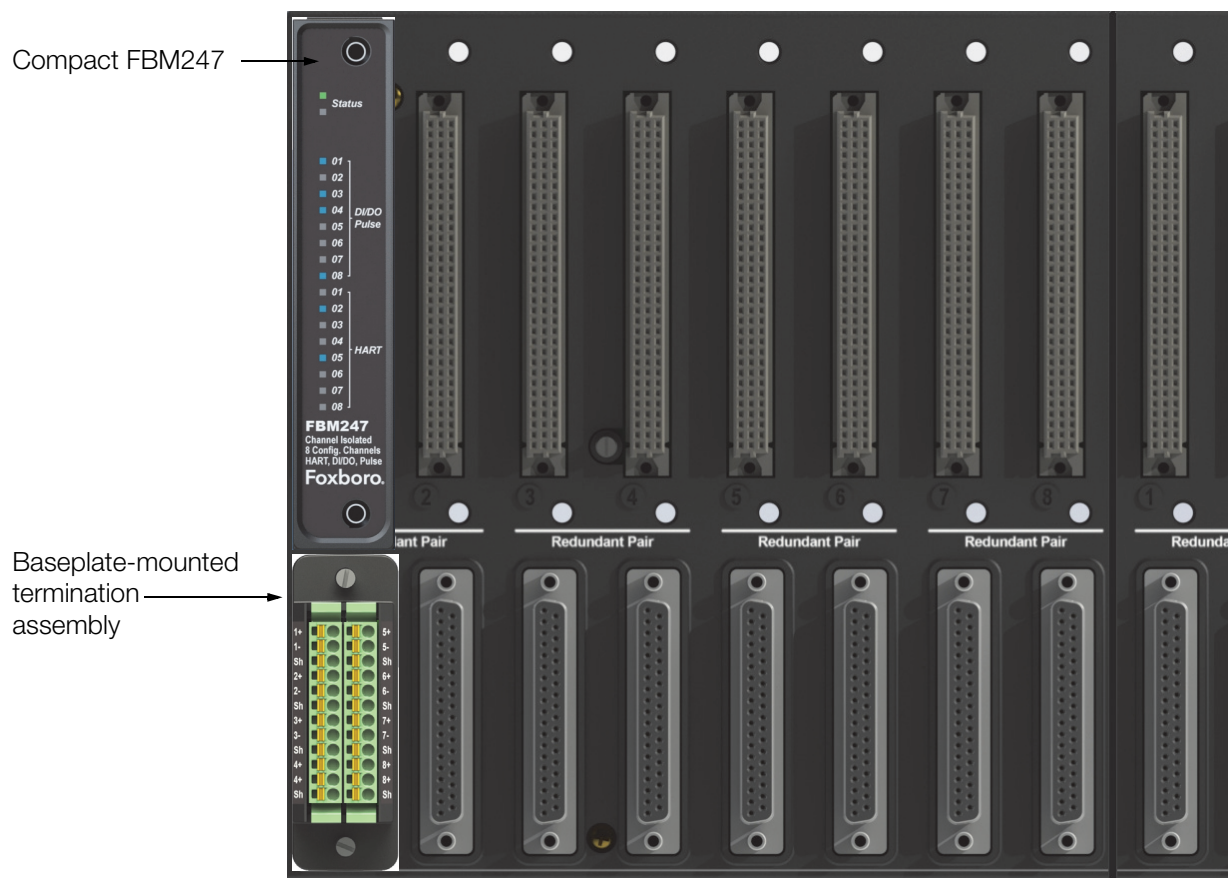


Figure 1. Baseplate-Mounted Termination Assembly

The Compact FBM247 can serve as a HART communications field device host, enabling the Foxboro Evo™ system to request and receive two digital messages per second from the field device. The message pass-through capability can be used to support HART universal, common practice, and device-specific commands, but not the burst communication mode. These commands are implemented using the Intelligent Field Device Configurator FoxCom™ and HART™ Protocols (IFDC — refer to PSS 21S-8A3 B3 for details) or PACTware (Process Automation Configuration Tool - refer to PSS 2A-1Z3 G for details).

The Compact FBM247 must be used with Foxboro Evo Control Core Services software, v9.2 or later.

When used with the baseplate-mounted TAs, there is no need for a separate termination or marshalling enclosure. When installed in G-Series system enclosures with baseplate-mounted TAs, the Compact FBM247 enables the G-Series system enclosure to support up to 192 FBMs and their associated Field Control Processors (FCP) from a single enclosure's footprint. Refer to *G-Series Enclosures Overview* (PSS 31H-2GOV) for a complete list of modules supported in the G-Series system enclosures.

FEATURES

Key features of the Compact FBM247 are:

- ▶ Eight individual isolated channels to support:
 - HART Analog Input (AI)/Analog Output (AO) 4-20 mA
 - 0-20 mA AI/AO, non-HART
 - 0-10 V and 0-5 V AI, non-HART
 - Digital dry contact sense 24 V dc
 - Discrete voltage monitor, configurable 0 and 1 thresholds 0-10 V
 - NAMUR sensor discrete input - Signal level according to DIN EN 50227 (NAMUR):
 - “On” at 2.1 mA dc with short circuit detection at > 6 mA
 - “Off” at 1.2 mA dc with open detection at <0.25 mA
 - Pulse count, frequency, acceleration and jerk, contact sense or voltage input
 - Discrete Output 24 V, 20 mA current or solid state switch output.
- ▶ Compact, rugged design suitable for enclosures in Class G3 (harsh) environments
- ▶ Executes programs for Discrete Input, Pulse Count, Sequence of Events and Transient Data Recording with support for Sustained and Momentary Digital Outputs
- ▶ Enables higher utilization of I/O points in each enclosure - fewer points on each FBM are likely to be left unused due to the versatility of the Compact FBM247's I/O points
- ▶ Passive Termination Assembly (TA) - DIN rail mounted for locally or remotely connecting field wiring to the Compact FBM247
- ▶ Baseplate-mounted Termination Assembly (TA) attaches directly to a Compact 200 Series baseplate, eliminating the need for mounting a separate TA on a DIN rail for the Compact FBM247, and requiring space for the TA's cable in an enclosure.
- ▶ Enables sites to reduce the number of separate types of 200 Series FBMs maintained as spares, by replacing them with a single type of 200 Series FBM - the Compact FBM247, which supports a wide range of analog, digital and pulse field I/O applications.

HIGH ACCURACY

For high input accuracy, the module incorporates a 16-bit Sigma-Delta converter which can provide new analog input values for each channel every 100 milliseconds. For outputs, a 13-bit D/A is used.

COMPACT DESIGN

The Compact FBM247'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 Class G3 harsh environments per ISA Standard S71.04.

VISUAL INDICATORS

Light-emitting diodes (LEDs) incorporated into the front of the modules provide visual indication of the module operational status, and communication activity of the input/output channels.

Their functionality varies depending on the type of I/O signal used on each channel:

- ▶ Red and green LEDs provide indication of the FBM operational status.
- ▶ Blue LEDs indicate HART communication activity for each channel.
- ▶ Blue LEDs are provided to indicate the On or Off state of the discrete input or output channels.

EASY REMOVAL/REPLACEMENT

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

The module can be removed/replaced without removing field device termination cabling, power, or communication cabling.

SEQUENCE OF EVENTS

The Sequence of Events (SOE) software package is used for acquisition, storage, display, and reporting of events associated with discrete input points in a control system. SOE, using the optional GPS based time synchronization capability, supports data acquisition across control processors at intervals of up to one millisecond, depending on the signal source.

Refer to *Sequence of Events* (PSS 31S-2SOE) to learn more about this package, and to *Time Synchronization Equipment* (PSS 31H-4C2), for a description of the optional time synchronization capability.

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 at the system level, the module continues communication over the active path.

TERMINATION ASSEMBLIES

Field I/O signals connect to the FBM subsystem via a DIN rail mounted or baseplate-mounted TA.

NOTE

A shield terminal connection (SH) is provided for each channel. The shield terminals are connected to the earth at the system power supply.

The TAs used with the Compact FBM247 are described in “TERMINATION ASSEMBLY AND CABLES” on page 10.

FUNCTIONAL SPECIFICATIONS

Supported HART Instrument Types

HART instruments compliant to Version 5, 6, or 7 of the HART specifications may be used.

Input/Output Channels

Eight I/O channels, each individually configurable as:

- ▶ HART 4-20 mA analog input or analog output
- ▶ (non-HART) 0-20 mA analog input or analog output
- ▶ (non-HART) 0-10 V and 0-5V analog input
- ▶ Digital dry contact sense 24 V dc
- ▶ NAMUR⁽¹⁾ sensor discrete input -
Signal level according to DIN EN 50227 (NAMUR)
 - "On" at 2.1 mA dc with short circuit detection at > 6 mA
 - "Off" at 1.2 mA dc with open detection at <0.25 mADigital voltage input, configurable 0 and 1 thresholds 0-10 V
- ▶ Pulse count, frequency, acceleration or jerk, contact sense or voltage input
- ▶ Digital output 24 V, 20 mA current or switch

Discrete inputs have configurable current or voltage thresholds when not in SOE mode.

Channel types are independently configurable without taking the module or other channels off-line.

Each channel is isolated and independent.

Input/Output Channels Specifications

INPUT RANGES

Voltage

-0.2564 to 10 V dc or -0.1282 to 5 V dc
(0.0 V = 1600 raw counts)

Current

0 to 20 mA dc

Pulse Count

0 to 65535 with rollover to zero

Frequency

10 Hz to 25000 Hz.

INPUT OVER-RANGE CAPABILITY

Voltage

10.2 V dc or 5.1 V dc (65,535 counts), 30 V without damage

Current

20.4 mA dc (65,280 counts), 36 mA without damage

DIGITAL SOE OR PULSE ON LEVEL

Voltage

6 V dc min, 30 V dc max.

Current

2.1 mA dc min, 10 mA dc max. NAMUR compatible

DIGITAL SOE OR PULSE OFF LEVEL

Voltage

0 V dc min, 2 V dc max.

Current

0 mA dc min, 1.2 mA dc max. NAMUR compatible

MINIMUM PULSE ON TIME

16 microseconds

MINIMUM PULSE OFF TIME

16 microseconds

MINIMUM PULSE PERIOD

40 microseconds

INPUT ACCURACY

Analog Input

0.03% of span

Temperature Coefficient

50 PPM/Deg C

Pulse Rate

0.05% of reading

INPUT PULSE TOTALIZING

No missing pulses

ANALOG INPUT RESOLUTION

16 bits

PULSE COUNT RESOLUTION

Pulse Count

16 bits (integer)

Frequency

32 bits (integer)

(1) For intrinsically safe installations, an external barrier is required.

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Input/Output Channels Specifications (Cont.)**INPUT UPDATE RATE***Analog*

25 milliseconds, 10 milliseconds in TDR mode

Pulse count and frequency

10 or 25 milliseconds depending upon integration time setting

Digital SOE update rate

1 millisecond

ANALOG AND PULSE INPUT INTEGRATION TIME

100, 200, 500 and 1000 milliseconds, software configurable on a per FBM basis

FASTEST ALLOWED ECB BLOCK PERIOD

100 msec

INPUT SIGNAL A/D CONVERSION

Each channel performs A/D signal conversion using an independent Sigma-Delta converter

INPUT CHANNEL IMPEDANCE*Voltage Input*

10 M Ohm nominal

Current Input

With External Loop Supply

200 Ohm nominal

With Internal Loop Supply

250 Ohm nominal

INPUT CURRENT LIMIT

30 mA nominal

MAXIMUM OUTPUT CURRENT

20.4 mA

MAXIMUM OUTPUT LOAD IN OUTPUT MODE WHEN FBM PROVIDES POWER

750 Ohms when using FBM power

ANALOG OUTPUT ACCURACY

0.05% of span (0.1 to 20 mA)

Temperature Coefficient

50 PPM/Deg C

ANALOG OUTPUT RESOLUTION

13 bits

ANALOG OUTPUT NON-LINEARITY

Non-linearity is included in the accuracy specification.

ANALOG OUTPUT PROCESSING DELAY

30 milliseconds maximum

FIELD DEVICE CABLING DISTANCE

For current I/O Channels, maximum distance of the field device from the FBM is a function of compliance voltage (20 V dc @ 20.4 mA input), wire gauge, and voltage required at the field device.

LOOP POWER SUPPLY PROTECTION

Loop power is channel-to-channel galvanically isolated and current limited.

HART® PROTOCOL COMPATIBILITY

The channels meet the impedance requirements for a HART high Impedance Device and can be used in a HART loop without interfering with the HART signals between the field device and a Hand-Held Communicator (HHC).

Input/Output Channel 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. See CAUTION below.

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.

Communication

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

FUNCTIONAL SPECIFICATIONS (CONTINUED)

Power Requirements

INPUT VOLTAGE RANGE

24 V dc +5%, -10%

CONSUMPTION (MAXIMUM)

9.4 W

HEAT DISSIPATION (MAXIMUM)

6.8 W

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

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).

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE

Module

-20 to +60°C (-4 to +140°F)

Termination Assembly

Polyamide (PA)

-20 to +70°C (-4 to +158°F)

RELATIVE HUMIDITY

5 to 95% (noncondensing)

ALTITUDE

-300 to +3000 m (-1000 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 (-1000 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

COMPACT FBM247

The Compact FBM247 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.

Refer to *Compact 200 Series 16-Slot Horizontal Baseplate* (PSS 31H-2C200) for details.

TERMINATION ASSEMBLY

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

The baseplate-mounted TA mounts on the one field I/O connectors associated with its Compact FBM247 on a Compact 200 Series baseplate.

Weight

COMPACT FBM247

185 g (6.5 oz) approximate

TERMINATION ASSEMBLY

DIN Rail Mounted TA

170 g (0.37 lb, approximate)

Baseplate-Mounted TA

100 g (0.22 lb, approximate)

Dimensions

COMPACT FBM247

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

Refer to page 13.

Part Numbers

COMPACT FBM247

RH101EY

TERMINATION ASSEMBLIES

See "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLY" on page 10.

Termination Cables

CABLE LENGTHS

Up to 30 m (98 ft)

CABLE MATERIALS

Polyurethane or Low Smoke Zero Halogen (LSZH)

TERMINATION CABLE TYPE

Type 1 – See Table 2 on page 12.

CABLE CONNECTION – TA TO BASEPLATE

FBM Baseplate End

37-pin D-subminiature

Termination Assembly End

25-pin D-subminiature

Field Termination Connections

DIN RAIL TA COMPRESSION-TYPE 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

BASEPLATE MOUNTED TA COMPRESSION - ACCEPTED WIRING SIZES

Solid/Stranded/AWG

0.2 to 1.5 mm²/0.2 to 1.5 mm²/24 to 16 AWG

Stranded with Ferrules

0.25 to 0.75 mm² with plastic collar

0.25 to 1.5mm² without plastic collar

TERMINATION ASSEMBLY AND CABLES

Field I/O signals connect to the FBM subsystem via a DIN rail mounted termination assembly (TA) or baseplate mounted termination assembly (BTA).

The DIN rail mounted TAs for the Compact FBM247 are available in Polyamide (PA) material with compression screw terminations.

The baseplate mounted TA for the Compact FBM247 is available in Acrylonitrile Butadiene Styrene (ABS) material with spring cage screw terminations.

See the following “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLY” for the TAs used with the Compact FBM247.

The Compact FBM247 provides sufficient loop resistance to allow use of the HART Hand-Held Terminal, or *PC20 Intelligent Field Device Configurator* (PSS 2A-1Z3 E).

A removable termination cable connects the TA to the FBM via a field connector on the baseplate in which the FBM is installed. Termination cables are available in the following materials:

- ▶ Polyurethane
- ▶ Low Smoke Zero Halogen (LSZH).

Termination cables are available in a variety of lengths, up to 30 meters (98 feet), allowing the Termination Assembly to be mounted in either the enclosure or in an adjacent enclosure. See Table 2 for a list of termination cables used with the TAs for the Compact FBM247.

FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLY

FBM Type	Input/Output Signal	TA Part Number		Termination	TA Cable	TA Certification
		PA ^(a)	PC/ABS ^(b)	Type ^(c)	Type ^(d)	Type ^(e)
Compact FBM247	8 configurable I/O channels, voltage or current, analog or digital. Analog 4 to 20 mA I/O may also have the HART signal superimposed.	RH924WW/ P0924WW		C	1	1, 2
Compact FBM247	8 configurable I/O channels, voltage or current, analog or digital. Analog 4 to 20 mA I/O may also have the HART signal superimposed.		RH101KA	Spring Cage (SC) (Baseplate mounted)	n/a	1, 2

(a) PA is Polyamide rated from -20 to +70°C (-4 to +158°F).

(b) ABS is Acrylonitrile Butadiene Styrene (PC/ABS) rated from -20 to +70°C (-4 to +158°F).

(c) C = TA with compression terminals.

SC = TA with spring cage terminals

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

(e) See Table 1 for Termination Assembly certification definitions.

Table 1. Certification for Termination Assembly

Type	Certification ^(a)
Type 1	TAs are UL/UL-C listed as suitable for use in Class I; Groups A-D; Division 2 temperature code T4 hazardous locations. They are 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 limits.
Type 4	All field circuits are NEC/CEC Class 2 limited energy if customer-supplied equipment meets Class 2 limits.

(a) All TAs are UL/UL-C listed to comply with applicable ordinary location safety standards for fire and shock hazards. Hazardous location types comply with ATEX directive for II 3 G use. They also comply with the requirements of the European Low Voltage Directive. All listings/certifications require installation and use within the constraints specified in *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA) and the conditions stated in UL and DEMKO reports.

Table 2. Cables Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC (a)	Type 1 LSZH (b)
0.5 (1.6)	RH100BY	RH100BC
1.0 (3.2)	RH100BZ	RH100BD
1.4 (4.9)	RH100EP	RH100EL
2.0 (6.6)	RH100CA	RH100BE
3.0 (9.8)	RH100CB	RH100BF
5.0 (16.4)	RH100CC	RH100BG
10.0 (32.8)	RH100CD	RH100BH
15.0 (49.2)	RH100CE	RH100BJ
20.0 (65.6)	RH100CF	RH100BK
25.0 (82.0)	RH100CG	RH100BL
30.0 (98.4)	RH100CH	RH100BM

(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. Temperature range: -20 to +70°C (-4 to +158°F).

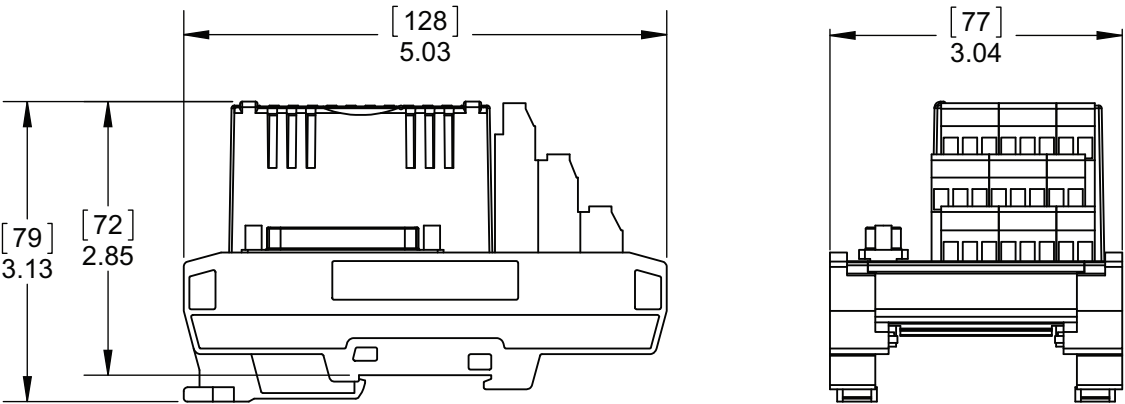
(b) Low smoke zero halogen or low smoke free of halogen (LSZH) is a material classification used for cable jacketing. LSZH is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogen when exposed to high sources of heat. Temperature range: -40 to +105°C (-40 to +221°F).

DIMENSIONS-NOMINAL

[mm]
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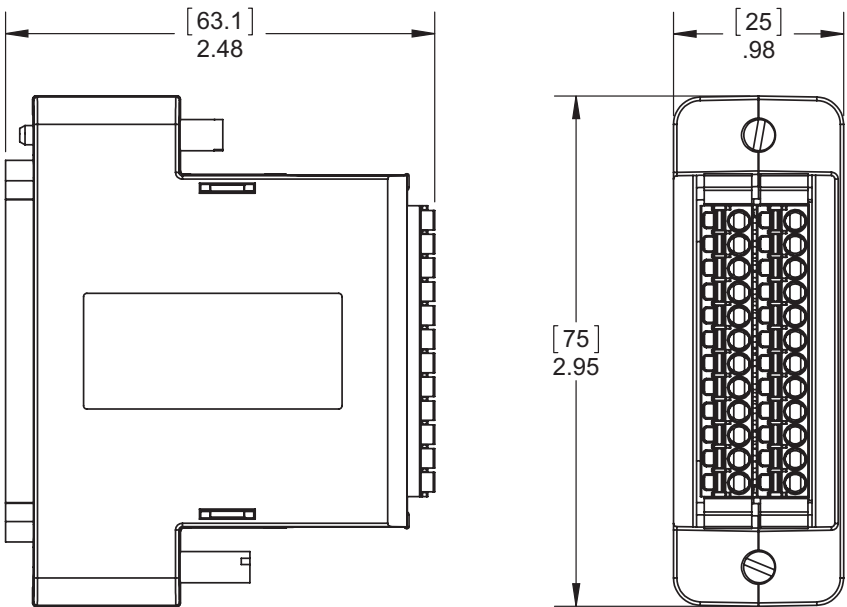
Compression Termination Assembly

RH924WW



Baseplate-Mounted Termination Assembly

RH101KA



- (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 Number	Description
PSS 31H-2COV	Compact 200 Series I/O Subsystem Overview
PSS 31H-2CERTS	Standard and Compact 200 Series I/O - Agency Certifications
PSS 31H-2C200	Compact 200 Series 16-Slot Horizontal Baseplate
PSS 31H-2GOV	G-Series Enclosures Overview
PSS 31H-4C2	Time Synchronization Equipment
PSS 31S-2SOE	Sequence of Events
PSS 31S-2TDRA	Transient Data Recorder and Analyzer
PSS 31S-3FCPICS	Field Control Processor 280 (FCP280) Integrated Control Software



Schneider Electric Systems USA, Inc.
38 Neponset Avenue
Foxborough, MA 02035-2037
United States of America
www.schneider-electric.com

Global Customer Support
<https://pasupport.schneider-electric.com>

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