



Foxboro™ DCS

Compact FBM214E, 16 Channel HART® Communication Input Interface Module

PSS 41H-2C214E

Product Specification

May 2020



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Overview

The Compact FBM214e HART Communication Module contains 16 input channels. It supports any mix of standard 4 to 20 mA devices and HART devices (signals are electronically compatible and complies with NAMUR NE43 standards), and is part of the Compact 200 Series I/O subsystem, as described in *Compact 200 Series I/O Subsystem Overview* (PSS 41H-2COV).

The Compact FBM214e can serve as a HART communications field device host, enabling the EcoStruxure™ Foxboro™ DCS 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 it cannot support the burst communication mode. These commands are implemented by the Foxboro DCS Field Device Expert for HART. For details, see *Field Device Expert for HART Devices Control and I/O* (PSS 41S-10FDMHRT).

The FBM214e provides a common isolated power supply to power all 16 channels when connected to Internal Power Termination Assembly.

Features

- 16 analog input channels, each accepting one of the following inputs:
 - Analog input signal that complies with the NAMUR NE43 standard signal range
 - Standard 4 to 20 mA analog sensor signal
 - Digital HART Frequency Shift Keying (FSK) signal superimposed on a 4 to 20 mA analog input signal
- FSK modem dedicated to each input channel for bi-directional digital communications with a HART field device
- Analog to digital conversion of each of the 4 to 20 mA input signals from the HART devices
- Support for the HART universal commands necessary to interface the field device with the Foxboro DCS database
- The channels are not galvanically isolated from each other, but are galvanically isolated (both optical and transformer isolation) as a group from the ground and module logic
- Compact, rugged design suitable for enclosure in Class G3 (harsh) environments
- High accuracy achieved by sigma-delta analog-to-digital conversions for each channel
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- Termination Assembly (TA) for locally or remotely connecting field wiring to the FBM214e. Two types of Termination Assemblies are available:
 - Group Isolated Internal Power TA
 - Group Isolated External Power TA

Compact Design

The Compact 200 Series Fieldbus Modules design is narrower than the standard Foxboro DCS 200 Fieldbus Modules (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 harsh environments per ISA Standard S71.04.

High Accuracy

For high accuracy, the module incorporates a Sigma-Delta analog-to-digital converter shared by all channels, which can provide new analog input readings every 100 milliseconds.

Visual Indicators

Light-emitting diodes (LEDs) incorporated into the front of the module provide visual indication of the module's operational status, and communication activity on the channels.

Easy Removal/Replacement

The module mounts 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 the FBM fix the module to the Compact 200 Series baseplate.

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

Fieldbus Communication

A Fieldbus Communication Module or a Control Processor interfaces the redundant 2 Mbps module Fieldbus used by the FBMs.

The Compact FBM214e module accepts communication from either path (A or B) of the redundant 2 Mbps fieldbus. If one path is unsuccessful or is switched off at the system level, the module continues communication over the active path.

The use of an external power supply common to two or more loops requires a Cable Balun Module to maintain communication signal line balance.

Termination Assemblies

Field input signals connect to the FBM subsystem via DIN rail mounted TAs. The TA used with the Compact FBM214e is described in **Termination Assemblies and Cables**. For more information, see [Termination Assemblies and Cables](#), page 12.

Configuration Tools

The Compact FBM214e provides sufficient loop resistance to allow use of the HART Hand-Held Terminal.

Functional Specifications

Field Device Channels	<ul style="list-style-type: none"> • Supported Hart Instruments HART instruments compliant to Version 5, 6, or 7 of the HART specifications may be used. • Interface 16 Input channels • Communication to the Device Point-to-point, master/slave, asynchronous, halfduplex, at 1200 baud. • Detected Error Checking Parity on each byte, and one CRC check byte on each message. • Speed 2 messages per second • Fastest Allowed ECB Block Period 100 msec - However, it is recommended that you refer to the <i>Sizing Guidelines and Excel Workbook</i> appropriate for your Control Processor to determine the optimal loading for a 100 msec Block Processing Cycle (BPC). • Maximum Distance (FBM214e to Field Device) Meets HART FSK physical layer specification HCF_SPEC-54, Revision 8.1 [up to 3030 m (10000 ft)]. NOTE: The maximum allowable distance decreases when the loop is operated through an intrinsic safety barrier. The maximum distance of the field device from the FBM is a function of compliance voltage, wire gauge and voltage drop at the device. • Internal Loop Supply Compliance Voltage at Termination Assembly 18.5 V dc minimum at 20.5 mA • Current Inputs <ul style="list-style-type: none"> ◦ <i>Input Range:</i> 0 - 20.5 mA, NAMUR NE43 compliance ◦ <i>Sense Resistor:</i> 59 Ω nominal ◦ <i>Total Input Resistance:</i> 280 Ω nominal ◦ <i>Accuracy (Includes Nonlinearity):</i> ±0.03% of full scale ◦ <i>Temperature Coefficient:</i> 50 ppm/°C ◦ <i>Resolution:</i> 15 bits ◦ <i>Update Rate:</i> 100 ms ◦ <i>Integration Time:</i> 500 ms ◦ <i>Common Mode Rejection:</i> >70 db at 50 or 60 Hz ◦ <i>Normal Mode Rejection:</i>
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	<p>>35 db at 50 or 60 Hz</p> <ul style="list-style-type: none"> • Input Resistance Including Termination Assembly <ul style="list-style-type: none"> ◦ Group Isolated External Power TA: 279 Ω ◦ Group Isolated Internal Power TA: 298 Ω • Loop Power Supply Protection: For Compact FBM214e, the channels are galvanically group isolated and current limited. All input loop supplies are limited by design to less than 33 mA. • FBM Internal Power For Field Device 24 V dc ±15% common power supply for all channels. Loop load limited to one device per channel. • System Software Requires Foxboro DCS Control Core Services v9.5 or later. • Isolation The channels are not galvanically isolated from each other, but are galvanically isolated (both optical and transformer isolation) as a group from the ground and module logic. The module withstands, without damage, a potential of 600 V ac applied for one minute between the group-isolated channels and ground. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;"> DANGER</p> <p style="text-align: center;">HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH</p> <p>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.</p> <p style="text-align: center;">Failure to follow these instructions will result in death or serious injury.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTICE</p> <p style="text-align: center;">POTENTIAL DATA LOSS</p> <p>The detected Field Device Malfunction and HART communication failure is not shown as an alarm in System Manager and FoxView. However, the associated status alerts are shown in Device Diagnosis Status (DIAG). You can use Maintenance Response Center (MRC) to view these device conditions.</p> <p style="text-align: center;">Failure to follow these instructions can result in equipment damage.</p> </div>
<p>Fieldbus Communication</p>	<p>Communicates with FCP280 via the redundant 2 Mbps module Fieldbus.</p>
<p>Power Requirements</p>	<ul style="list-style-type: none"> • Input Voltage Range (Redundant) 24 V dc +5% -10% • Consumption 15 W (maximum) • Heat Dissipation 8 W (maximum)
<p>Regulatory Compliance: Electromagnetic Compatibility (EMC)</p>	<ul style="list-style-type: none"> • <i>European EMC Directive 2014/30/EU</i>: Meets: EN61326-1:2013 Class A Emissions and Industrial Immunity Levels

<p>Regulatory Compliance: Product Safety (FBM and Cable Balun)</p>	<ul style="list-style-type: none"> • <i>Underwriters Laboratories (UL) for U.S. and Canada:</i> UL/UL-C listed as suitable for use in UL/ULC listed Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems when connected to specified Foxboro DCS processor modules as described in the <i>Standard and Compact 200 Series Subsystem User's Guide</i> (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 <i>Standard and Compact 200 Series Subsystem User's Guide</i> (B0400FA). • <i>European Low Voltage Directive 2014/35/ EU and Explosive Atmospheres (ATEX) directive and 2014/34/EU:</i> 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 <i>Standard and Compact 200 Series Subsystem User's Guide</i> (B0400FA). Also, for more information, see <i>Certification for Termination Assemblies</i>, page 14.
<p>RoHS Compliance</p>	<p>Complies with European RoHS Directive 2011/65/EU</p>
<p>China RoHS Compliance</p>	<p>Compliant</p>
<p>California Prop 65 RoHS Compliance</p>	<p>Compliant</p>
<p>Calibration Requirements</p>	<p>Calibration of the module or termination assembly is not required</p>

Environmental Specifications

	Operating	Storage
Temperature	<ul style="list-style-type: none"> • <i>Module</i> -20 to +60°C (-4 to +140°F) • <i>Termination Assembly</i> -20 to +60°C (-4 to +140°F) 	-40 to +85°C (-40 to +185°F)
Relative Humidity	5 to 95% (noncondensing)	5 to 95% (noncondensing)
Altitude	-300 to +3,000 m (-1,000 to +10,000 ft)	-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 (0.75g) from 5 to 500 Hz	

NOTE: The environmental limits of this module may be enhanced by the type of enclosure containing the module. For more information, see the applicable Product Specification Sheet (PSS) that describes the type of enclosure to be used.

Physical Specifications

Mounting	<ul style="list-style-type: none"> • Module: The Compact FBM214e 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. See <i>Compact 200 Series 16-Slot Horizontal Baseplate</i> (PSS 41H-2C200) 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	<ul style="list-style-type: none"> • Module: 227 g (0.5 lb) approximate • Termination Assembly: <ul style="list-style-type: none"> ◦ Group Isolated External Power <ul style="list-style-type: none"> – 340g(0.75lb) approximate ◦ Group Isolated Internal Power <ul style="list-style-type: none"> – 272g(0.60lb) approximate
Dimensions - Module	<ul style="list-style-type: none"> • 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 Assemblies	For more information, see <i>Dimensions - Nominal</i> , page 16.
Part Numbers	<ul style="list-style-type: none"> • Compact FBM214e Module RH101RP • Termination Assemblies For more information, see <i>Functional Specifications - Termination Assemblies</i>, page 14.

Termination Cables	<ul style="list-style-type: none">• Cable Lengths Up to 30 m (98 ft)• Cable Materials Polyurethane or Low Smoke Zero Halogen (LSZH)• Termination Cable Type Type 4 — For more information, see <i>Cable Types and Part Numbers - Type 4</i>, page 15.• Cable Connection — TA<ul style="list-style-type: none">◦ <i>FBM Baseplate End</i> 37-pin D-subminiature◦ Termination Assembly End 37-pin D-subminiature
Field Termination Connections	<ul style="list-style-type: none">• Compression—Type Accepted Wiring Sizes<ul style="list-style-type: none">◦ <i>Solid/Stranded/AWG</i> 0.2 to 4 mm²/0.2 to 2.5 mm²/24 to 12 AWG◦ <i>Stranded with Ferrules</i> 0.2 to 2.5 mm² with or without plastic collar

Termination Assemblies and Cables

Field input signals connect to the Compact 200 Series I/O subsystem via DIN rail mounted Termination Assemblies. The TA for the Compact FBM214e module is available in Polyamide (PA) material with compression screw terminations.

For more information, see [Functional Specifications - Termination Assemblies](#), page 14 for the TAs used with the Compact FBM214e.

A removable termination cable connects the DIN rail mounted TA to the FBM via a field connector on the baseplate in which the FBM is installed. Termination cables are available in these 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. For more information, see [Cable Types and Part Numbers - Type 4](#), page 15 for a list of termination cables used with the TAs for the Compact FBM214e.

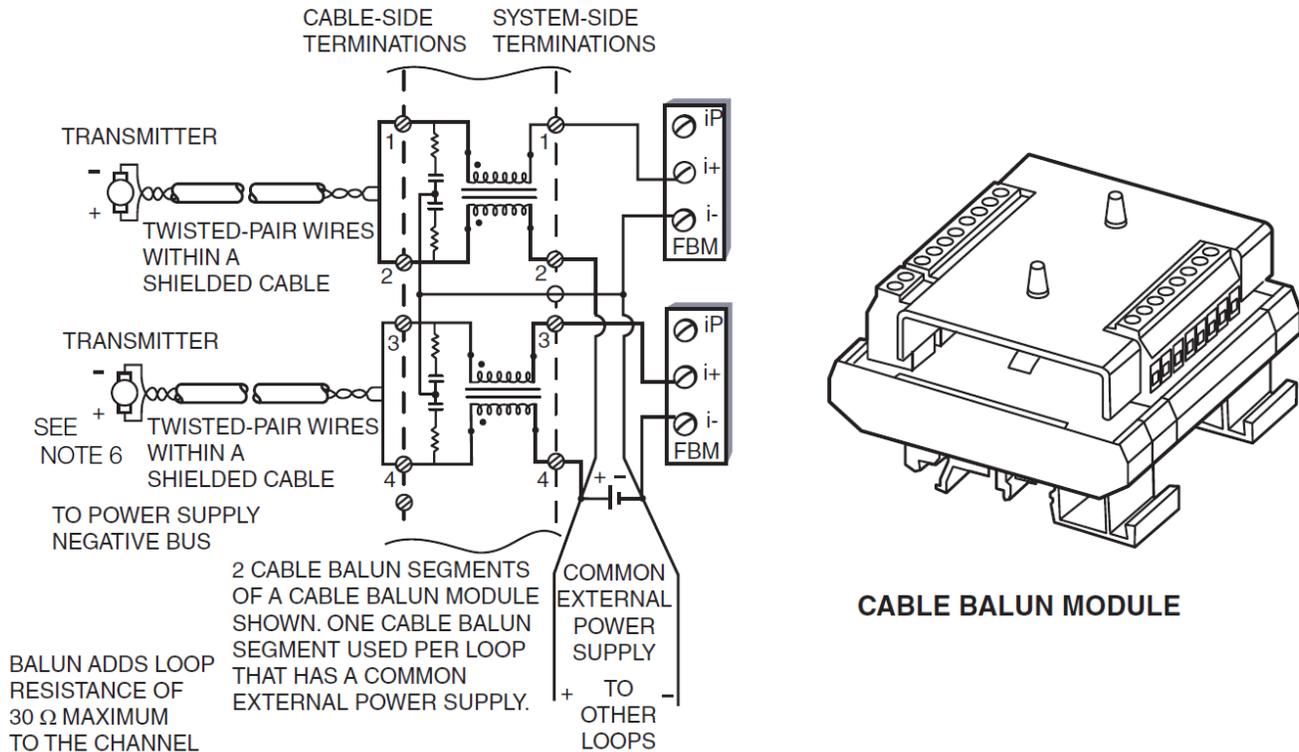
Cable Balun Module

The Cable Balun module is used to maintain digital communication line balance for HART Transmitter to FBM loops that are powered from a common external power supply. This powering effectively connects one line of each loop together. Without the Baluns, the common connection at the external power supply would cause near end crosstalk at the system end of the loop. Loops using FBM internal power source do not require Baluns.

The Cable Balun module contains multiple Baluns. One Balun segment is interconnected in each externally powered loop.(for more information see the figure "Cable Balun Module"). There is one Cable Balun module for four channels.

Table 1 - Cable Balun Module

Module Model	Module Part No.	No. of Baluns in the Module
CBM-4	RH903SV	4

Figure 1 - Cable Balun Module**NOTES:**

- For detailed information on balun use and installation, see “Using the Cable Balun Module with Intelligent Transmitters” in *System Equipment Installation* (B0193AC).
- Cable balun used only when multiple loops are connected to a common power supply. The FBM negative terminals connect directly to the minus (-) terminal of the power supply. The balun system side negative (-) terminals (2, 4, 6, and 8) connect to the power supply positive terminals when there are 4 (maximum) power loops.
- For hazardous environments, install an intrinsic safety barrier such as an MTL 787S+ between the balun wiring to limit the amount of energy in the wiring.
- A user-supplied capacitor can be installed across the external power supply(ies) to shunt ac power.
- The external power supply can be redundant power supplies in parallel.
- For this transmitter connection, use twisted-pair wiring inside a shielded cable with the shield grounded at the Foxboro DCS end.

Functional Specifications - Termination Assemblies

FBM Type	Input Signal	TA Part Number	Termination Type	TA Cable Type	TA Certification Type
		PA ^(a)	Type ^(b)	Type ^(c)	Type ^(d)
Compact FBM214e Module	16 input channels, 4 to 20 mA analog signal, alone or with HART signal superimposed Loop power is provided to the field devices by a customer-supplied external dc power supply	RH101RT	C	4	1,2
	16 input channels, 4 to 20 mA analog signal, alone or with HART signal superimposed Loop power is provided to the field devices by the FBM auxiliary +24 V DC power supply	RH101RY			

(a) PA is polyamide rated from -20 to +60°C (-4 to +140°F)
 (b) C = TA with compression terminals; RL = TA with ring lug terminals
 (c) For more information, see *Cable Types and Part Numbers - Type 4*, page 15 for cable part numbers.
 (d) For more information, see table “Certification for Termination Assemblies”

Table 2 - Certification for Termination Assemblies

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 CENELEC (DEMKO) certified Ex nA IIC T4 for use in Zone 2 potentially explosive atmospheres.
Type 2	Type 2 TAs are UL/UL-C listed as associated apparatus for supplying non-incendive field circuits Class I; Groups A-D; Division 2 hazardous locations when connected to specified DIN rail mounted 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 CENELEC (DEMKO) certified as associated apparatus 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.

(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 3 - Cable Types and Part Numbers - Type 4

Cable Length m (ft)	Type 4 P/PVC^(a)	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
<p>^(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation.</p> <p>^(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)</p>		

Dimensions - Nominal

Figure 2 - Compression Termination Assembly — RH101RT

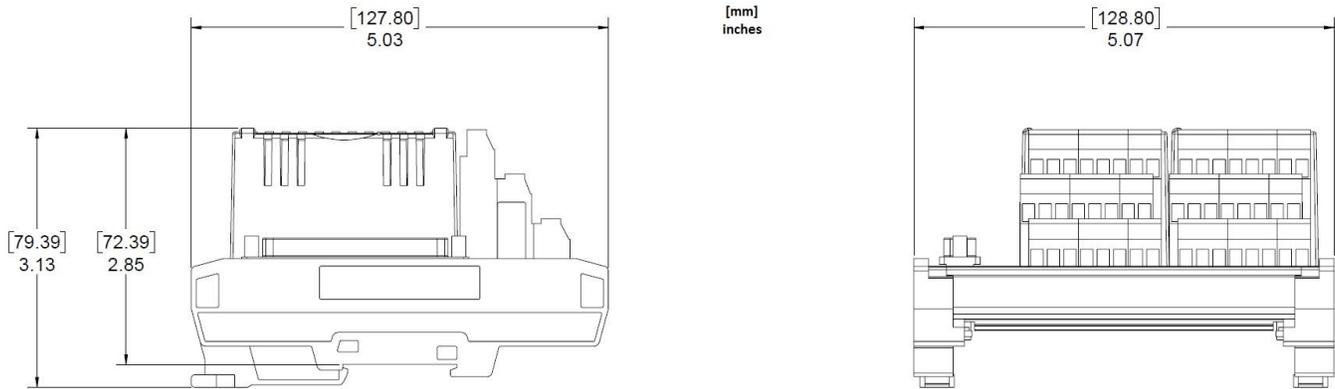
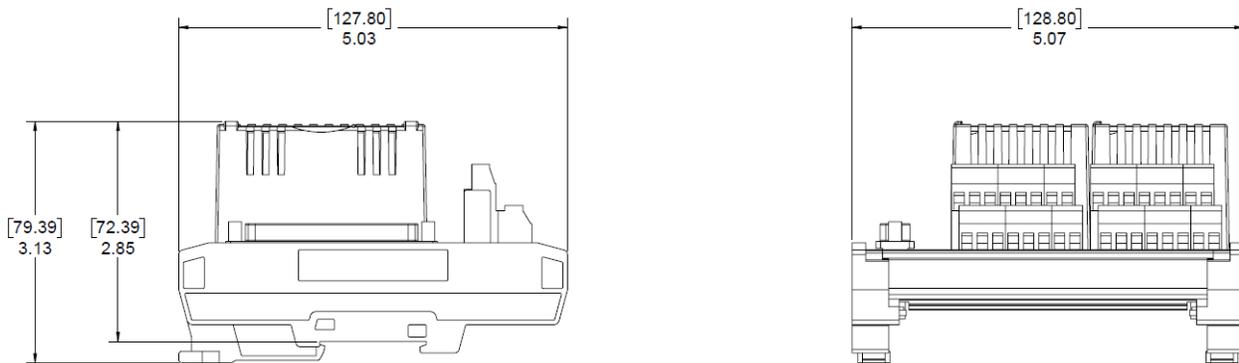


Figure 3 - Compression Termination Assembly — RH101RY



NOTE:

- (a) Overall width to determine the DIN rail loading.
- (b) For the total height of the module, add the height above DIN rail to the DIN rail height.

Related Documents

Document Number	Description
PSS 41H-2COV	<i>Compact 200 Series I/O Subsystem Overview</i>
PSS 41S-10FDMHRT	<i>Field Device Expert for HART Devices Control and I/O</i>
PSS 41H-2C200	<i>Compact 200 Series 16-Slot Horizontal Baseplate</i>
B0400FA	<i>Standard and Compact 200 Series Subsystem User's Guide</i>
B0193AC	<i>System Equipment Installation</i>
PSS 41H-2CERTS	<i>Standard and Compact 200 Series I/O, Agency Certifications</i>
PSS 41H-2C480	<i>Compact Power Supply - FPS480-24</i>
PSS 41S-3FCPICS	<i>Field Control Processor 280 (FCP280) Integrated Control Software</i>
B0400FF	<i>HART Communication Interface Modules User's Guide</i>

 **WARNING:** This product can expose you to chemicals including lead and lead compounds, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.p65warnings.ca.gov/.

Schneider Electric Systems USA, Inc.
38 Neponset Avenue
Foxboro, Massachusetts 02035-2037
United States of America

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

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PSS 41H-2C214E, Rev B