Foxboro™ DCS

Compact FBM238, Digital 24DI/8DO Module

PSS 41H-2C238

Product Specification

August 2019

Legal Information

Overview

Many plant situations, such as Motor Control Center controls, require several inputs for each output. The Compact FBM238 contains 24 discrete input and eight discrete output channels that are compatible with voltages and currents commonly found in industrial plants. An external power supply is used to energize the field circuits.

The Compact FBM238 24DI/8DO Module provides twenty-four digital inputs with eight digital output channels. Associated Termination Assemblies (TAs) provide for discrete nominal inputs of 30 V dc, 60 V dc, 120 V ac/125 V dc or 240 V ac and nominal outputs of 60 V dc, 120 V ac/125 V dc or 240 V ac. The module performs signal conversion required to interface the electrical input signals from the field sensors to the Module Fieldbus.

Depending on the type of I/O signal required, the TAs support current limiting devices, high voltage attenuation circuits, optical isolation and external power source connections.

Features

- 24 digital input channels, used for either contact sensing, or dc voltage monitoring
- 8 digital output channels, used for either dc output switching with an external source (e.g. to control powering of various external loads), or dc output switching with an internal source only (e.g. to power external solid state relays or other similar devices)
- Compact, rugged design suitable for enclosure in Class G3 (harsh) environments
- Supports discrete input signals at voltages of:
  - 30 V dc/60 V dc
  - 120 V ac/125 V dc
  - 240 V ac
- Supports output switching at voltages of:
  - 60 V dc
  - 120 V ac/125 V dc
  - 240 V ac
- Executes the programs for Digital I/O (ECB5), and Ladder Logic (ECB8)
- Various Termination Assemblies (TAs) provide for per-channel isolation and contain:
  - High voltage attenuation and optical isolation for inputs
  - External power connection for device excitation.
  - Output current limiting

Compact Design

The Compact FBM238’s design is narrower than the standard 200 Series 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.

Visual Indicators

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

Easy Removal/Replacement

The modules mount on a Compact 200 Series baseplate. Two screws on the FBM attach each module to the baseplate.

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

Fieldbus Communication

A Fieldbus Communications Module or a Control Processor interfaces to the 2 Mbps module Fieldbus used by the FBMs. The Compact FBM238 accepts communication from either path (A or B) of the 2 Mbps Fieldbus. If one path is unsuccessful or is switched at the system level, the module continues communication over the active path.

Modular Baseplate Mounting

The modules mount on a DIN rail mounted modular baseplate, which accommodates up to 16 compact FBMs. The baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for redundant fieldbus, redundant independent dc power, and termination cables.

Field I/O Signals

Field I/O signals connect to the FBM subsystem via DIN rail mounted TAs.

The TAs used with Compact FBM238 are described in *Termination Assemblies and Cables, page 10*.

Functional Specifications

I/O Channels	24 group isolated digital input channels and eight group isolated digital output channels
Filter/Debounce Time	Configurable (No Filtering, 4, 8, 16, or 32 ms)
Voltage Monitor (Compact FBM238 with feed through TA RH924VD)	• Input: 30 V dc maximum applied voltage • On-State Voltage: 15 to 30 V dc • Off-State Voltage: 0 to 5 V dc • Current: 2.3 mA maximum at 30 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
Contact Sense (Compact FBM238 with feed through TA RH924VG)	• Contact Supply: 24 V dc nominal (supplied by FBM through the TA) • Contact Current: 1.8 mA dc nominal • Source Resistance Limits: ◦ On-State: 1 k Ω (maximum) at 15 V dc ◦ Off-State: 100 k Ω (minimum) at 60 V dc
Output (Compact FBM238 with feed through TAs RH924VD or RH924VG)	• Applied Voltage: 60 V dc (maximum) • Load Current: 0.24 A dc maximum per channel 2.0 A dc maximum per TA • Inductive Loads: Outputs may require a protective diode or MOV connected across the load

Isolation	Input and output channels are group isolated from each other and earth (ground). For details, see *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). The module withstands, without damage, a potential of 600 V ac applied for one minute between the group isolated channels or between either set of group isolated channels and ground. **⚠⚠DANGER** **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH** 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. **Failure to follow these instructions will result in death or serious injury.**
Communication	Communicates with its associated FCM or FCP via the module Fieldbus
Power Requirements	• Input Voltage Range (Redundant): 24 V dc +5%, -10% • Module Consumption: 7 W (maximum) at 24 V dc • Module Heat Dissipation: 3 W (maximum) at 2 A total load and all inputs at 30 V dc
Calibration Requirements	Calibration of the module is not required.
Regulatory Compliance: Electromagnetic Compatibility (EMC):	• *European EMC Directive 2014/30/EU*: Meets EN 61326:2013 Class A Emissions and Industrial Immunity levels
Regulatory Compliance: Product Safety	• *Underwriters Laboratories (UL) for U.S. and Canada*: UL/UL-C listed as suitable for use in Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems. 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). For more information, see the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). • *European Low Voltage Directive 2014/35/EU and Explosive Atmospheres (ATEX) directive 2014/34/EU* ATEX (DEMKO) Ex nA IIC T4 Gc certified when connected as described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). For use in an enclosure suited for an ATEX Zone 2 classified area.
RoHS Compliance	Complies with European RoHS Directive 2011/65/EU, including amending Directives 2015/863 and 2017/2102.

Environmental Specifications

	Operating	Storage
Temperature	Compact FBM238: -20 to +60°C (-4 to +140°F)	-40 to +70°C (-40 to +158°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)
Vibration	7.5 m/s^2 (5 to 500 Hz)	
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.	

Physical Specifications

Mounting	• Module: The Compact FBM238 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 *Compact 200 Series 16-Slot Horizontal Baseplate* (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)
Weight	185 g (6.5 oz) 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 Assemblies	See *Dimensions - Nominal, page 21*
Part Numbers	• Compact FBM238: RH101GJ • Termination Assemblies, see: ◦ *Functional Specifications - Standard Termination Assemblies, page 11* ◦ *Functional Specifications - Main Termination Assemblies, page 12* ◦ *Functional Specifications - Expansion Termination Assemblies, page 17*

Termination Cables	• Cable Lengths: Up to 30 m (98 ft) • Cable Materials: Polyurethane or Low Smoke Zero Halogen (LSZH) • Termination Cable Type: ◦ Baseplate to Main TA: Type 4 - See *Table 2, page 20* ◦ Main TA to Expansion TA: Type 6 - See *Table 3, page 20* • Baseplate to Main TA Cable Connection: ◦ FBM Baseplate End: 37-pin D-subminiature ◦ Termination Assembly End: 37-pin D-subminiature • Main TA to Expansion TA Cable Connection: ◦ Main TA End: 25-pin D-subminiature ◦ Expansion TA End: 37-pin D-subminiature
Termination Assembly Construction	• Material: Polyamide Material, compression
Field Termination Connections	• Compression — Accepted Wiring Sizes: ◦ Solid/Stranded/AWG: 0.2 to 4 mm^2/0.2 to 2.5 mm^2/24 to 12 AWG ◦ Stranded with Ferrules: 0.2 to 2.5 mm^2 with or without plastic collar

Termination Assemblies and Cables

Field I/O signals connect to the FBM subsystem via DIN rail mounted termination assemblies (TAs). Multiple types of TAs are available with the Compact FBM238 to provide I/O signal connections, signal conditioning, optical isolation from signal surges and external power connections for field devices as required by the particular FBM. Since these features are built into the termination assemblies (where required), in most applications there is no need for additional termination equipment for field circuit functions such as circuit protection or signal conditioning (including fusing and power distribution).

The DIN rail mounted termination assemblies connect to the FBM subsystem baseplate by means of removable termination cables. The cables are available in a variety of lengths, up to 30 meters (98 feet), allowing the termination assemblies to be mounted in either the enclosure or in an adjacent enclosure. See *Table 2, page 20* and *Table 3, page 20* for termination cable part numbers and specifications.

Discrete Inputs/Outputs

Various termination assemblies are available to support the interfacing of field signals to the low level FBM I/O circuits. Active termination assemblies support input/output signal conditioning for the FBM as well as channel isolation. The signal conditioning circuits are located on daughter boards that are mounted under the component covers of the termination assemblies. To condition signals, these termination assemblies provide optical isolation, current limiting, voltage attenuation and optional terminal blocks to connect externally supplied excitation voltage.

Functional Specifications - Standard Termination Assemblies

FBM Type	Input Signal	Output Signal	TA Part Number[a] PA	Termination Type[b]	BP to TA Cable Type[c]	TA Cert. Type [d]
Compact FBM238	24 channel, Voltage Monitor, external source 30 V dc maximum applied voltage Logic Zero – 0 to 5 V dc Logic One – 15 to 30 V dc 2.2 mA typical at 30 V dc 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	8 channel output switch, external source 60 V dc maximum voltage 0.25 A maximum current 2.0 A maximum current per FBM 0.25 mA maximum off-state leakage current 0.4 A over-current fuse	RH924VD	C	4	1, 2, 4
Compact FBM238	24 channel, Contact Sense, internal source 24 V dc nominal open circuit voltage 7 mA nominal maximum current 2.2 mA typical at 30 V dc 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	8 channel output switch, external source 60 V dc maximum voltage 0.25 A maximum current 2.0 A maximum current per FBM 0.25 mA maximum off-state leakage current 0.4 A over-current fuse	RH924VG	C	4	1, 2, 4

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

[b] C = TA with compression terminals, RL = TA with ring lug terminals.

[c] See *Table 2, page 20* for cable part numbers and specifications.

[d] See *Table 1, page 19* Termination Assembly certification definitions.

Functional Specifications - Main Termination Assemblies

FBM Type	Input Signal	Output Signal	TA Part Number PA[a]	Term. Type[b]	BP to TA Cable Type[c]	TA Cert. Type [d]
Compact FBM238	When replacing a main FBM09A/B: Voltage Monitor external source 130 V dc Maximum voltage Logic Zero: 0 to 5 V dc Logic One: 15 to 130 V dc 2.2 mA typical 5 to 130 V dc 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance When replacing a main FBM09C/D: Contact sense internal source 24 V dc ±10% Open circuit voltage 2.5 mA maximum short circuit current 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM09A/C: Output Switch external source 60 V dc Maximum voltage 0.5 V maximum voltage drop @ 0.5 A 0.5 A maximum current 0.75 A current limit Shorted load duration: indefinite (duty-cycle limited) 1.0 mA maximum off-state leakage When replacing a main FBM09B/D: output switch internal source 11 V dc ±2 V Open circuit voltage Source resistance 680 Ω nominal Shorted load duration: indefinite 0.5 mA maximum off-state leakage	RH924HE	C	4	1, 2, 4

Compact FBM238	When replacing a main FBM10: Voltage Monitor, external source 132 V ac Maximum voltage Logic Zero: 0 to 20 V ac Logic One: 79 to 132 V ac 2.2 mA typical 20 to 132 V ac 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM10: Output Switch external source 132 V ac Maximum voltage 0.4 V maximum voltage drop @ 1 A 2 A maximum current per channel 12 A maximum current per TA 3 A current limit 24 A surge current limit for 10 msec Shorted load duration: indefinite (duty-cycle limited) 3 mA maximum off-state leakage	RH924HG	C	4	1, 4
Compact FBM238	When replacing a main FBM11: Voltage Monitor 264 V ac Maximum voltage Logic Zero: 0 to 40 V ac Logic One: 164 to 264 V ac 2.2 mA typical 40 to 264 V ac 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM11: Output Switch external source 264 V ac Maximum voltage 0.6 V maximum voltage drop @ 0.5 A 1 A maximum current per channel 7 A maximum current per TA 1.5 A current limit 12 A surge current limit for 10 msec Shorted load duration: indefinite (duty-cycle limited) 2.5 mA maximum off-state leakage	RH924HJ	C	4	1

Compact FBM238	When replacing a main FBM26A: Voltage Monitor, external source 150 V dc Maximum voltage Logic Zero: 0 to 10 V dc Logic One: 33 to 150 V dc 2.5 mA typical 10 to 150 V dc 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM26A: Output Switch external source 150 V dc Maximum voltage 0.4 V maximum voltage drop @ 1 A 2 A maximum current per channel 12 A maximum current per TA 2.3 A current limit 20 A surge current limit, 20 ms Shorted load duration: indefinite (duty-cycle limited) 2 mA maximum off-state leakage	RH924HU	C	4	1, 2, 4
Compact FBM238	When replacing a main FBM26B: Contact Sense internal source 48 V dc nominal open circuit voltage 2.5 mA ±20% short circuit current 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM26B: Output Switch external source 150 V dc Maximum voltage 0.4 V maximum voltage drop @ 1 A 2 A maximum current per channel 12 A maximum current per TA 2.3 A current limit 20 A surge current limit, 20 ms Shorted load duration: indefinite (duty-cycle limited) 2 mA maximum off-state leakage	RH924HV	C	4	1, 2, 4

Compact FBM238	When replacing a main FBM26C: Contact Sense external source on channel 1 150 V dc Maximum voltage Logic Zero: 0 to 10 V dc Logic One: 33 to 150 V dc 2.5 mA typical 10 to 150 V dc 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM26C: Output Switch external source 150 V dc Maximum voltage 0.4 V maximum voltage drop @ 1 A 2 A maximum current per channel 12 A maximum current per TA 2.3 A current limit 20 A surge current limit, 20 ms Shorted load duration: indefinite (duty-cycle limited) 2 mA maximum off-state leakage	RH924HW	C	4	1, 2, 4

Compact FBM238	When replacing a main FBM41A: Voltage Monitor external source 60 V dc Maximum voltage Logic Zero: 0 to 5 V dc Logic One: 15 to 60 V dc 6 mA maximum input current 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance When replacing a main FBM41C: Contact sense internal source 24 V dc ±20% Open circuit voltage 5 mA maximum short circuit current 1 k Ω Maximum On-state resistance 100 k Ω Minimum Off-state resistance	When replacing a main FBM41A/C: Output Switch external source 60 V dc Maximum voltage 0.4 V maximum voltage drop @ 1 A 2.25 A maximum current 12 A maximum current per TA 10 A surge current limit for 20 msec maximum Shorted load duration: indefinite (duty-cycle limited) 0.5 mA maximum off-state leakage	RH924JA	C	4	1, 2, 4

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

[b] C = TA with compression terminals; RL = TA with ring lug terminals.

[c] See *Table 2, page 20* for cable part numbers and specifications.

[d] See *Table 1, page 19* for Termination Assembly certification definitions.

Functional Specifications - Expansion Termination Assemblies

FBM Type	I/O Signal	TA Part Number PA[a]	Termination Type[b]	Main TA to Exp. TA Cable Type[c]	TA Cert.[d]
Compact FBM238	When replacing an expansion FBM12A/B (16 input voltage monitor/ contact sense), connect this TA to the main TA. Input specifications are the same as for TA RH924HE above, in *Functional Specifications - Main Termination Assemblies*.	RH924HB	C	6	1, 2, 4
Compact FBM238	When replacing an expansion FBM13 (16 input 120 V ac voltage monitor), connect this TA to the main TA. Input specifications are the same as for TA RH924HG above, in *Functional Specifications - Main Termination Assemblies*.	RH924HD	C	6	1, 4
Compact FBM238	When replacing an expansion FBM21 (16 input 240 V ac voltage monitor), connect this TA to the main TA. Input specifications are the same as for TA RH924HJ above, in *Functional Specifications - Main Termination Assemblies*.	RH924HM	C	6	1
Compact FBM238	When replacing an expansion FBM25A (16 input 125 V dc voltage monitor), connect this TA to the main TA. Input specifications are the same as for TA RH924HU above, in *Functional Specifications - Main Termination Assemblies*.	RH924HR	C	6	1, 2, 4
Compact FBM238	When replacing an expansion FBM25B (16 input contact sense (internal source)), connect this TA to the main TA. Input specifications are the same as for TA RH924HV above, in *Functional Specifications - Main Termination Assemblies*.	RH924HS	C	6	1, 2, 4

Compact FBM238	When replacing an expansion FBM25C (16 input contact sense (external source)), connect this TA to the main TA. Input specifications are the same as for TA RH924HW above, in *Functional Specifications - Main Termination Assemblies*.	RH924HT	C	6	1, 2, 4

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

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

(c) See *Table 2, page 20* for cable part numbers and specifications.

(d) See *Table 1, page 19* for Termination Assembly certification definitions.

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 for use in Zone 2 potentially explosive atmospheres.
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 *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). They are also 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
Type 4	All field circuits are Class 2 limited energy (60 V dc, 30 V ac, 100 VA or less) if customer-supplied equipment meets Class 2 limits.
Type 5	The TA and its field circuitry are for use in only ordinary (non-hazardous) locations.

Table 2 - Cable Types (Baseplate to Main TA Cables) and Part Numbers

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

[a] P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. PVC is rated from -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).

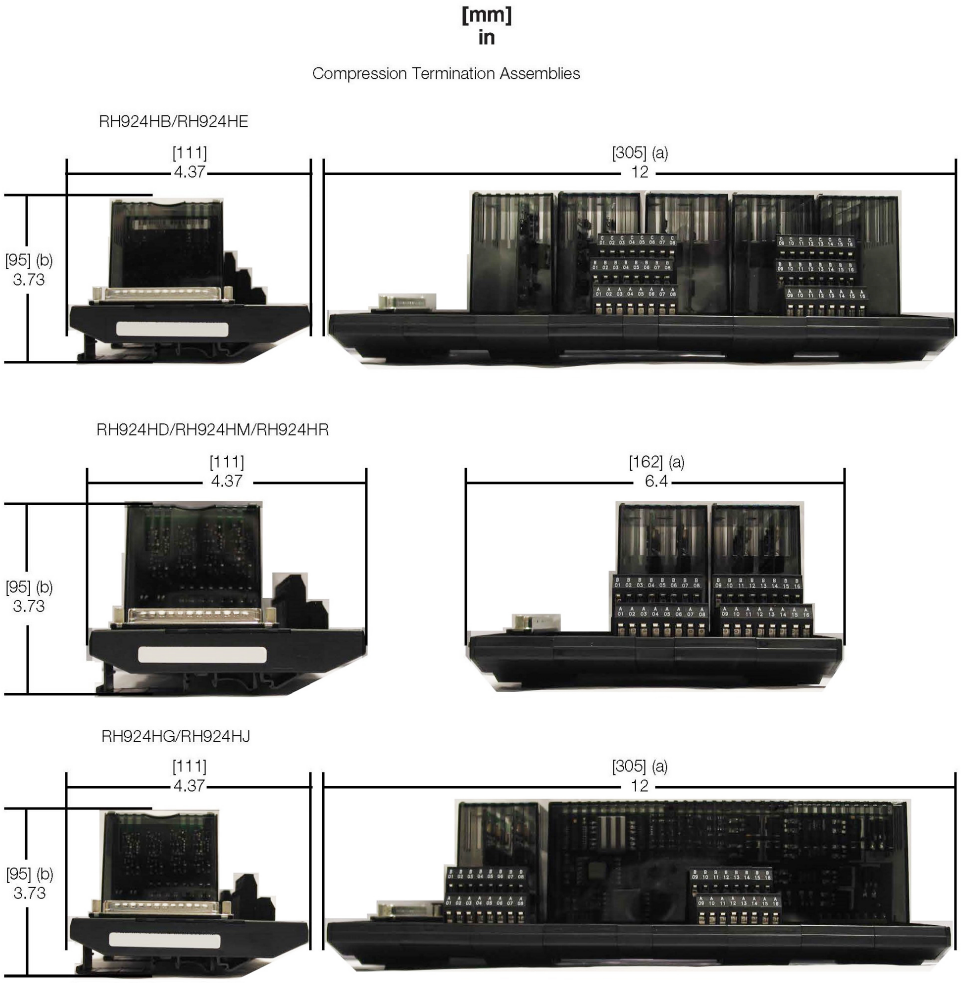
Table 3 - Cable Types (Main TA to Expansion TA Cables) and Part Numbers

Cable Length m (ft)	Type 6 P/PVC[a]	Type 6 LSZH[b]
0.75 (2.5)	RH924CK	RH928CQ

[a] P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. PVC is rated from -20 to +70°C (-4 to 158°F). These cables are no longer available for purchase.

[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

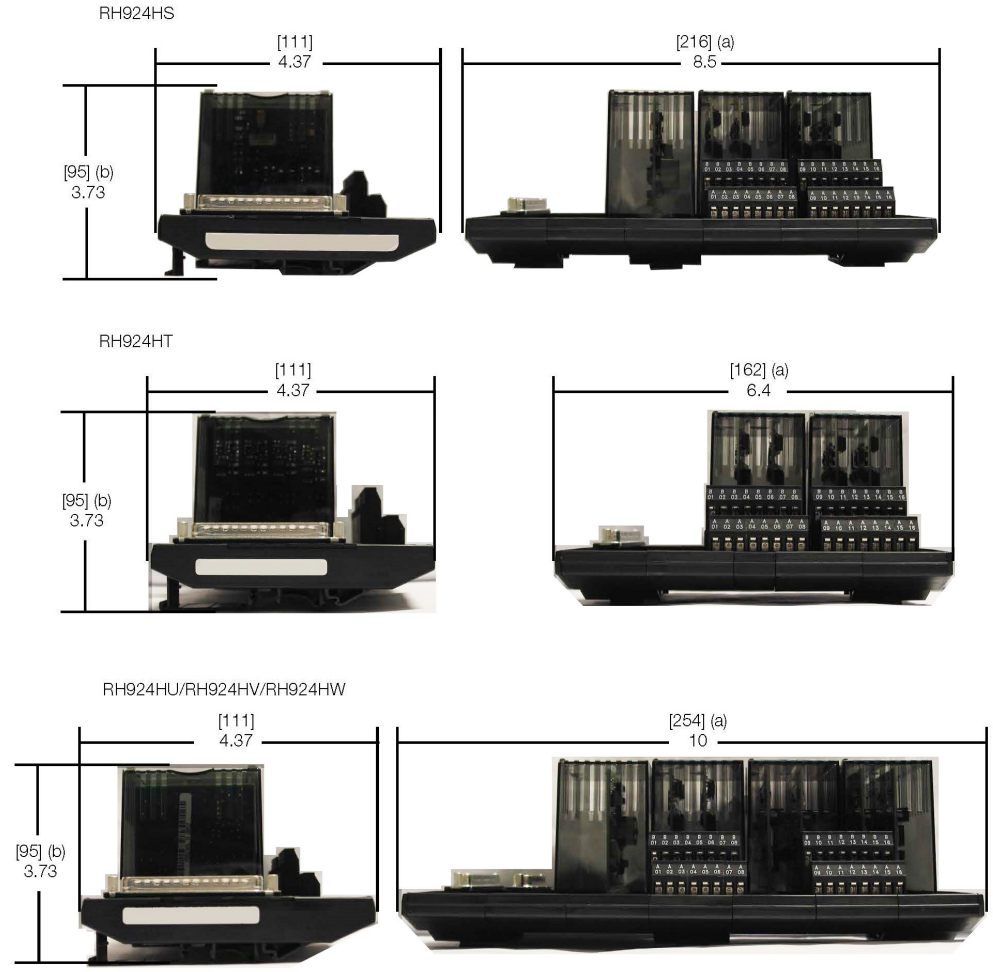


(a) Overall width — for determining DIN rail loading.

(b) Height above DIN rail (add to DIN rail height for total).

[mm]
in

Compression Termination Assemblies

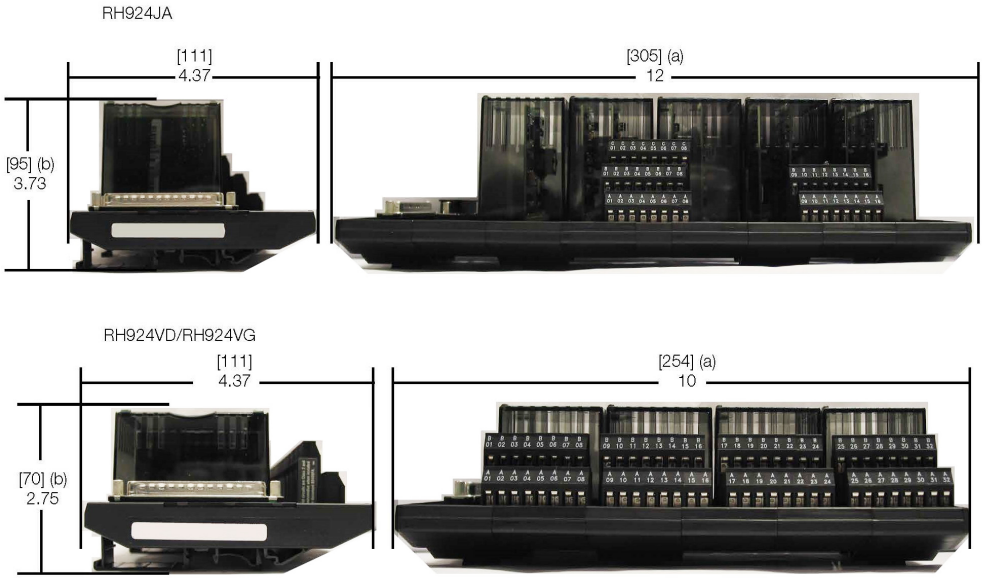


(a) Overall width — for determining DIN rail loading.

(b) Height above DIN rail (add to DIN rail height for total).

[mm]
in

Compression Termination Assemblies



(a) Overall width — for determining DIN rail loading.

(b) Height above DIN rail (add to DIN rail height for total).

Related Product Documents

Document Number	Description
PSS 41H-2COV	*Compact 200 Series I/O Subsystem Overview*
B0400FA	*Standard and Compact 200 Series Subsystem User's Guide*
PSS 41H-2C200	*Compact 200 Series 16-Slot Horizontal Baseplate*
PSS 41H-2SOV	*Standard 200 Series Subsystem Overview*
PSS 41H-2CERTS	*Standard and Compact 200 Series I/O - Agency Certifications*
PSS 41H-2C480	*Compact Power Supply - FPS480-24*
PSS 41S-3FCPICS	*Field Control Processor 280 (FCP280) Integrated Control Software*

⚠ **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/.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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