EcoStruxure™

Foxboro™ DCS

FBM248, Current/Voltage Analog/Digital/Pulse I/O Configurable Module (Redundant)

PSS 41H-2S248

Product Specification

July 2020

Schneider Electric™

https://www.se.com

Legal Information

Features

- Eight redundant individually isolated channels (redundancy is achieved at the FBM level as FBM248s are configured as a redundant pair in Main/Tracker roles). These channels support:
  - HART Analog Input (AI)/Analog Output (AO) 4-20 mA
  - Analog input signal (4-20 mA) that complies with the NAMUR NE 43 standard signal range
  - 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
  - NAMUR dry contact sense 7.5 V dc, nominal/typical
  - Pulse count, frequency, acceleration and jerk, contact sense or voltage input
  - Discrete Output 24 V, 20 mA current or solid state switch output.
- Redundant modules increase reliability by means of Master and Tracker roles
- 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 FBM248’s I/O points
- Passive Termination Assemblies (TAs) - DIN rail mounted or 200 Series baseplate mounted - for locally or remotely connecting field wiring to the FBM248
- Optional baseplate-mounted TAs attach directly to a 200 Series baseplate, helping to eliminate the need for mounting a separate TA on a DIN rail for the redundant FBM248s, 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 FBM248, which supports a wide range of analog, digital, and pulse field I/O applications

Overview

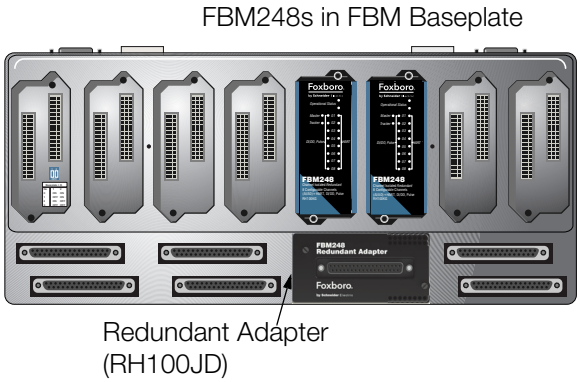
In many plant situations, the signal types associated with an installation are not well known until late in the project. The FBM248 provides the capability to accept a range of standard analog, discrete, and pulse inputs that are user selectable and changeable at the discretion of the engineer over redundant channels. The HART® input signals are electrically compatible with the standard 4 to 20 mA inputs.

The FBM248, Channel-Isolated Current/Voltage Analog/Digital/Pulse I/O Module (Redundant) contains eight redundant channels which can be individually configured for a range of analog, digital, and pulse field I/O signals.

A redundant pair of the modules combine to provide redundancy at the Fieldbus Module (FBM) level, with field I/O wired to one common termination assembly via a Redundant Adapter (RH100JD). In most configurations, each module independently attempts to hold the output(s) at its specified output value(s), and each independently reports its observed value of the inputs.

The FBM248 pair validate each input and output.

Figure 1 - Redundant FBM248s Attached to a Redundant Adapter



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

Three types of passive termination assemblies are available for the redundant FBM248:

- DIN rail mounted TA (RH924WW), similar to those used with the other 200 Series FBMs
- Compression Baseplate-mounted TA (RH100KR), which provides field I/O wiring support for redundant FBM248s in paired slots (that is, in positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8), as shown in Figure 2. This TA mounts directly onto the field I/O connectors on the 200 Series baseplate.
- Spring Cage Baseplate-mounted TA (RH101KA), which provides field I/O wiring support for redundant FBM248s in paired slots (that is, in positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8), as shown in Figure 3. This TA mounts directly onto the redundant adapter (RH100JD) which must be installed directly onto the field I/O connectors on the 200 Series baseplate.

Figure 2 - Baseplate-Mounted Termination Assembly (RH100KR) for FBM248 Pair

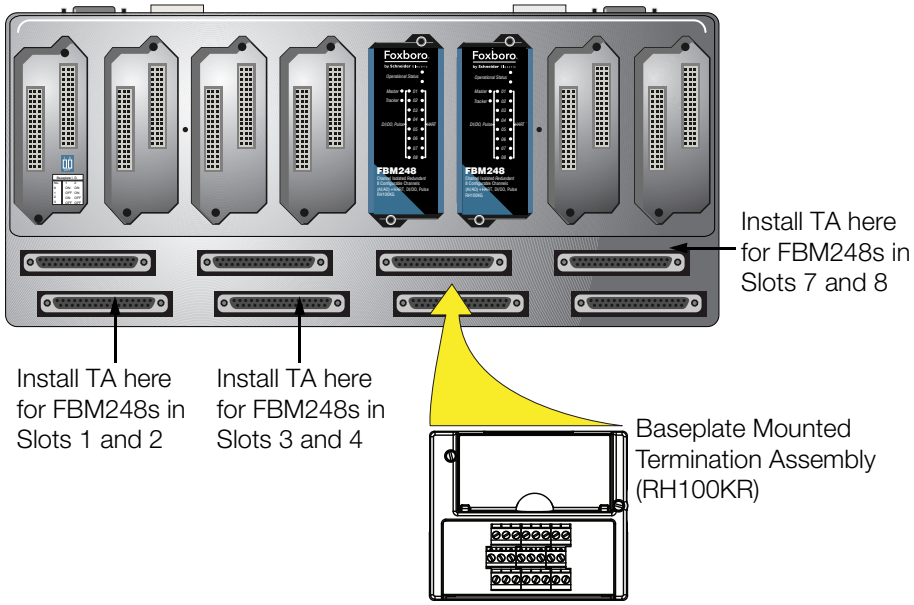
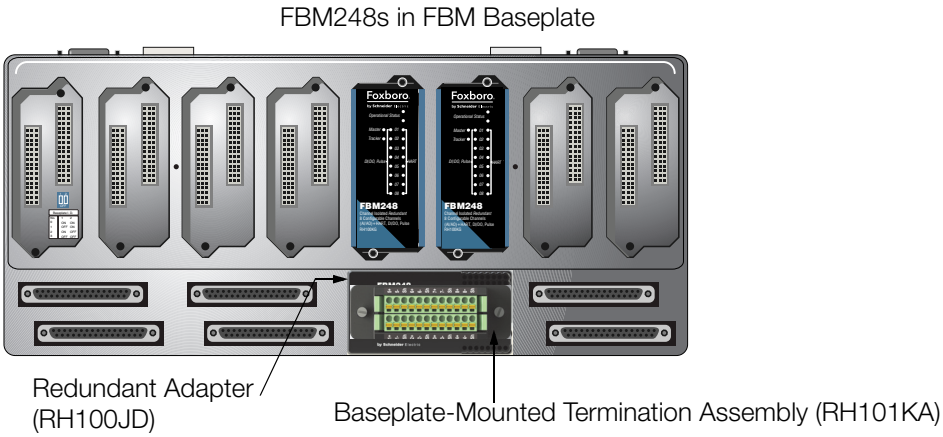


Figure 3 - Baseplate-Mounted Termination Assembly (RH101KA) for FBM248 Pair



The FBM248 can serve as a HART communications field device host, enabling 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 using the Foxboro DCS Field Device Expert for HART or PACTware. For details, see *Field Device Expert for HART Devices Control and I/O* (PSS 41S-10FDMHRT) or *Model PC50 Field Device Tool for Use with Intelligent Field Devices* (PSS 2A-1Z3 G).

The FBM248 must be used with Foxboro DCS Control Core Services software v9.3 or later. Use ICC or Control Software to configure FBM248s. This FBM type is not supported by IACC.

When used with the baseplate-mounted TAs, there is no need for a separate termination or marshalling enclosure. When installed in K-Series or equivalent system enclosures with baseplate-mounted TAs, the redundant FBM248s enable the system enclosure to support up to 96 FBMs and their associated Field Control Processor 280s (FCP280s) from a single enclosure's footprint. See *G-Series Enclosures Overview* (PSS 41H-2GOV), *K-Series Enclosures Overview* (PSS 41H-2KOV), or equivalent PSS for a complete list of modules supported in the system enclosures.

The FBM248 is electrically compatible with standard HART signals.

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.

High Reliability

The redundancy of the module pair, coupled with the high coverage of detected faults, provides a very high subsystem availability time.

Standard Design

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 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
- Yellow LEDs indicate HART communication activity for each channel
- Yellow LEDs are provided to indicate the On or Off state of the discrete input or output channels and to indicate the Master/Tracker status of each FBM248 in the pair

Easy Removal/Replacement

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

Sequence of Events

The Foxboro DCS 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.

See *Sequence of Events* (PSS 31S-2SOE) to learn more about this package, and see *Time Synchronization Equipment* (PSS 41H-4TIMESNC) for a description of the optional time synchronization capability.

Fieldbus Communication

A Control Processor interfaces to the redundant 2 Mbps module Fieldbus used by the FBMs. The redundant FBM248s accept 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 module mounts on a modular baseplate, which accommodates up to eight 200 Series FBMs. The modular baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for a redundant 2 Mbps HDLC module Fieldbus, redundant independent DC power, and termination cables or baseplate-mounted TAs.

Redundant modules must be located in adjacent positions on the baseplate (positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8). To achieve the redundancy, a redundant adapter module is placed on the two adjacent baseplate termination cable connectors to provide a single termination cable connection (see Figure 1, page 4). A single termination cable connects from the redundant adapter to the associated termination assembly (TA).

To system configurator applications and monitoring through SMON and Foxboro DCS System Manager, the redundant pair are displayed as a single module. The functional redundancy is provided by the FBM248 pair, not the control blocks.

Termination Assemblies

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

The TAs used with the FBM248 are described in Termination Assemblies and Cables, page 15.

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 • HART or 4-20 mA analog input with NAMUR NE 43 support • (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[a] 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 Digital 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 offline. Each channel is isolated and independent. **NOTE:** Redundant pairs (input or output) are connected together by a common field I/O connector and therefore are not isolated from each other.
Input/Output Channels Specifications	See Input/Output Channels Specifications, page 10.
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. **⚠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. **Failure to follow these instructions can result in injury or equipment damage.**
Communication	Communicates with its associated Foxboro DCS FCP280 via the redundant 2 Mbps module Fieldbus.

Power Requirements	• Input Voltage Range (Single or Redundant): 24 V dc +5%, -10% • Consumption (Maximum): 10 W total for module in Single mode 14 W total for redundant pair • Heat Dissipation (Maximum): 8.2 W total for module in Single mode 14.1 W total for redundant pair
Calibration Requirements	Calibration of the module and termination assembly is not required.
Regulatory Compliance: Electromagnetic Compatibility (EMC)	• *European EMC Directive 2014/30/EU*: Meets EN61326:2013 Class A Emissions and Industrial Immunity Levels
Regulatory Compliance: Product Safety	• *Underwriters Laboratories (UL) for U.S. and Canada*: Module can be used in UL/UL-C listed Division 2 enclosure based systems. The FBMs are UL listed as Class I, Division 2, Groups A-D and G; Division 2 hazardous locations when connected to field devices and wiring meeting entity parameter constraints specified in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA). I/O circuits also meet the requirements for Class 2 as defined in Article 725 of the National Electrical Code (NFPA) and Section 16 of the Canadian Electrical Code (CSA C22.1). Class 2 compliance applies only when field circuits are module powered. The UL/UL-C listing requires that the 24 V dc power source for the module is from a Foxboro power supply that is UL/UL-C recognized (to UL 60950) as having a Safety Extra Low Voltage (SELV) output. • *European Low Voltage Directive 2014/35/EU and Explosive Atmospheres (ATEX) directive 2014/34/EU*: Module can be used in certified Zone 2 enclosure based systems. The modules (Without Safety Barriers) are DEMKO certified as "Ex nA IIC T4 Gc", for use in Zone 2, Group IIC, potentially explosive atmospheres when connected to field devices and wiring meeting entity parameter constraints described in the *Standard and Compact 200 Series Subsystem User's Guide* (B0400FA).
RoHS Compliance	Complies with European RoHS Directive 2011/65/EU, including amending Directives 2015/863 and 2017/2102.
Calibration Requirements	Calibration of the module and termination assembly is not required.

[a] For intrinsically safe installations, an external barrier is required.

Input/Output Channels Specifications

Input Ranges	• Voltage: -0.25 to 10 V dc or -0.12 to 5 V dc (0.0 V = 1,600 raw counts) • Current: 0 to 20 mA dc • Pulse Count: 0 to 65,535 with rollover to zero • Frequency: 10 Hz to 25,000 Hz
Input Over-Range Capability	• Voltage: 10.2 V dc or 5.1 V dc (65,248 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, 1.8 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: 0.075% of span • Temperature Coefficient: 50 PPM/Deg C • Pulse Rate: 0.05% of reading
Analog Input Resolution	16 bits
Pulse Count Resolution	• Pulse Count: 16 bits (integer) • Frequency: 32 bits (integer)

Input Update Rate	• Analog: 25 milliseconds, unsettled raw samples are available at an update rate of 10 msec as inputs to the Foxboro Transient Data Recorder (TDR) • 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 1,000 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: 300 kΩ nominal • Current Input: ◦ With External Loop Supply: 300 Ω nominal ◦ With Internal Loop Supply: 250 Ω nominal
Input Current Limit	32 mA nominal
Maximum Output Current	20.4 mA
Maximum Output Load in Output Mode when FBM Provides Power	750 Ω when using FBM power
Analog Output Accuracy	0.075% 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 (19 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).

Environmental Specifications

	Operating Conditions	Storage Conditions
Temperature	• Module: -20 to +70°C (-4 to +158°F) • Termination Assembly - PA: ◦ Polyamide (PA): -20 to +70°C (-4 to +158°F) ◦ Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS): -20 to +70°C (-4 to +158°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 (5 to 500 Hz)	

Physical Specifications

Mounting	• Module: FBM248 mounts on a 200 Series baseplate. The baseplate can be mounted on a DIN rail (horizontally or vertically), or horizontally on a 19-inch rack using a mounting kit. Redundant modules must be located in adjacent positions on the baseplate (positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8). See *Standard 200 Series Baseplates* (PSS 41H-2SBASPLT) for details. • Termination Assembly: The DIN rail mounted TA (RH924WW) 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 (RH100KR) mounts on the two field I/O connectors associated with its two FBM248s on a 200 Series baseplate.
Weight	• Module: 373 g (12 oz) approximate • Termination Assembly: ◦ DIN Rail Mounted TA: 170 g (0.37 lb, approximate) ◦ Baseplate Mounted TA: 245 g (0.57 lb, approximate)
Dimensions: Module	• Height: 102 mm (4 in) or 114 mm (4.5 in) including mounting lugs • Width: 45 mm (1.75 in) • Depth: 104 mm (4.11 in)
Dimensions: Termination Assemblies	See Dimensions - Nominal, page 18.
Part Numbers	• FBM248 Module: RH100KG • Termination Assemblies: See Functional Specifications - Termination Assemblies, page 16 • Redundant Adapter: RH100JD • Baseplate-Mounted TA: RH100KR

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, page 17 • 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 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 Baseplate Mounted TA Compression Accepted Wiring Sizes: • Solid/Stranded/AWG: 0.2 to 1.5 mm 2 /0.2 to 1.5 mm 2 /24 to 16 AWG • Stranded with Ferrules: 0.25 to 0.75 mm^2 with plastic collar 0.25 to 1.5 mm^2 without plastic collar

Termination Assemblies and Cables

Field I/O signals connect to the FBM subsystem via DIN rail mounted or baseplate mounted termination assemblies (TAs).

For redundant FBM248 configurations, a redundant adapter (RH100JD) is required for connection between the FBM baseplate and the termination cable.

The DIN rail mounted TAs for the FBM248 are available in Polyamide (PA) material with compression screw terminations.

The baseplate mounted TA (RH100KR) for redundant FBM248s is available in Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS) material with compression screw terminations.

See Functional Specifications - Termination Assemblies, page 16 for the TAs used with the FBM248.

The FBM248 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 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 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, page 17 for a list of termination cables used with the DIN rail mounted TAs for the FBM248.

Functional Specifications - Termination Assemblies

FBM Type	Input/Output Signal	TA Part Number		Termination Type[c]	TA Cable Type[d]	TA Cert. Type[e]
		PA[a]	PC/ABS[b]			
FBM248	8 configurable I/O channels, voltage or current, analog or digital. Analog 4 to 20 mA I/O may also have the HART signal superim-posed.	RH924WW		C	1	1, 2
FBM248	8 configurable I/O channels, voltage or current, analog or digital. Analog 4 to 20 mA I/O may also have the HART signal superim-posed.		RH100KR	C (Baseplate-mounted)	N/A	1, 2

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

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

(c) C = TA with compression terminals.

(d) See Cable Types and Part Numbers, page 17 for cable part numbers and specifications.

(e) See Certifications for Termination Assemblies, page 17 for TA certification definitions.

Table 1 - Certifications 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 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 *Standard and Compact 200 Series Subsystem User's Guide* (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.
(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 - Cable Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC[a]	Type 2 LSZH[b]
0.5 (1.6)	RH916DA	RH928AA
1.0 (3.2)	RH916DB	RH928AB
2.0 (6.6)	RH931RM	RH928AC
3.0 (9.8)	RH916DC	RH928AD
5.0 (16.4)	RH916DD	RH928AE
10.0 (32.8)	RH916DE	RH928AF
15.0 (49.2)	RH916DF	RH928AG
20.0 (65.6)	RH916DG	RH928AH
25.0 (82.0)	RH916DH	RH928AJ
30.0 (98.4)	RH916DJ	RH928AK
(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. Temperature range: -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).		

Dimensions - Nominal

Figure 4 - DIN Rail Mounted Termination Assembly (RH924WW)

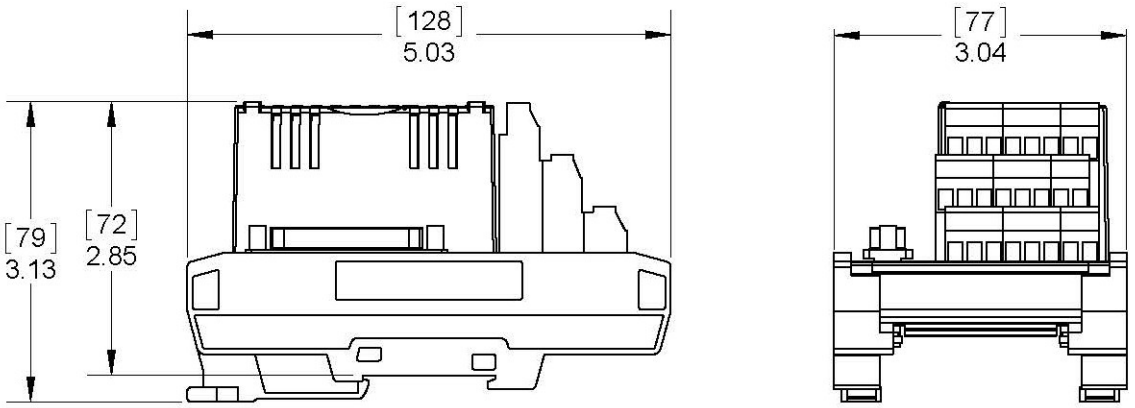
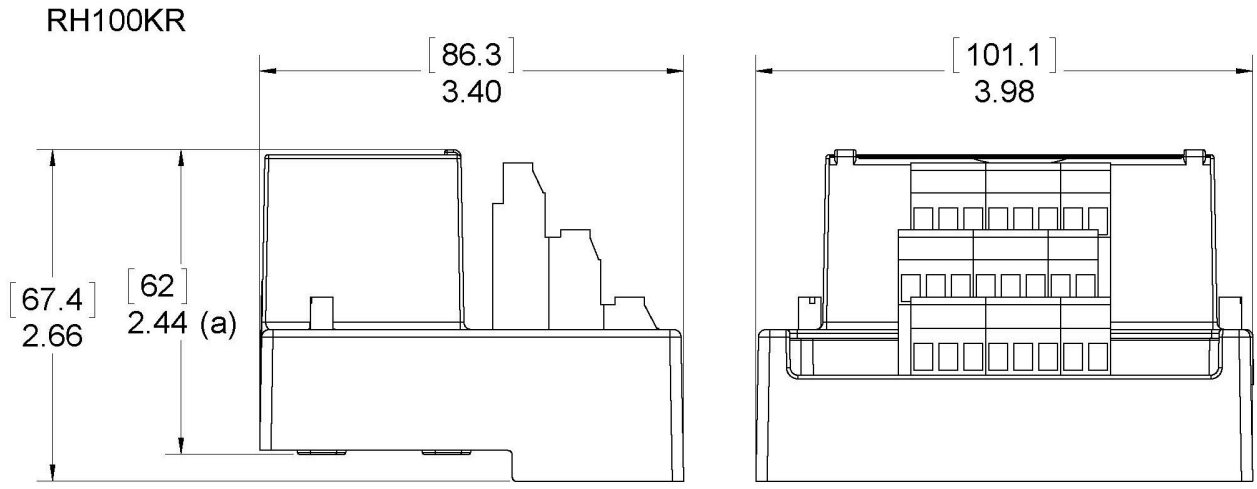


Figure 5 - Baseplate Mounted Termination Assemblies (RH100KR)



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

Related Documents

Document Number	Description
PSS 41H-2SOV	*Standard 200 Series Subsystem Overview*
B0400FA	*Standard and Compact 200 Series Subsystem User's Guide*
PSS 41H-2CERTS	*Standard and Compact 200 Series I/O - Agency Certifications*
PSS 41H-2SBASPLT	*Standard 200 Series Baseplates*
PSS 41H-2GOV	*G-Series Enclosures Overview*
PSS 41H-2KOV	*K-Series Enclosures Overview*
PSS 41H-4TIMESNC	*Time Synchronization Equipment*
PSS 31S-2SOE	*Sequence of Events*
PSS 31S-2TDRA	*Transient Data Recorder and Analyzer*
PSS 41S-3FCPICS	*Field Control Processor 280 (FCP280) Integrated Control Software*
PSS 41S-10FDMHRT	*Field Device Expert for HART Devices Control and I/O*
PSS 2A-1Z3 G	*Model PC50 Field Device Tool for Use with Intelligent Field Devices*

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.

PSS 41H-2S248, Rev B