



Foxboro™ DCS

FBM228 FOUNDATION™ Fieldbus Module for Control in the Field Applications

PSS 41H-2S228

Product Specification

October 2021



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Overview

The FOUNDATION™ Fieldbus Redundant Module (FBM228) provides a high-capacity interface between FOUNDATION fieldbus devices and Foxboro™ DCS. The FBM228, which can be used in single or redundant configurations, supports four H1 Links for a maximum of 64 fieldbus devices.

The H1 fieldbus is a bi-directional, all digital communication bus designed for the integration of process measurement and control devices. The H1 bus provides all the benefits of the traditional 4 to 20 mA standard, while providing greater data access to both control and system health information.

FOUNDATION fieldbus enables you to take full advantage of intelligent field devices, resulting in access to device maintenance information, reduced equipment and wiring costs, and a wider selection of suppliers due to interoperability.

The FBM228 connects the H1 field devices to the versatile and robust Foxboro DCS, where control resources include support for all FOUNDATION fieldbus device blocks either with the universal FOUNDATION fieldbus block (UNIVFF) or one of the following dedicated function blocks:

AI	AO	DI
DO	MAI	MAO
MDI	MDI	PID

The FBM228 enables the control station to access any block parameter in any H1 device. With FOUNDATION fieldbus blocks, parameters in the H1 device are dynamically updated in the control station memory and are connectable to all other blocks in the station, thus allowing easy construction of control loops that contain H1 function blocks and control station blocks.

With the FBM228 and Foxboro DCS Control Software, for each control loop you have a choice of locating the PID block in the field device or in the host control station. Complex strategies can be subdivided so that faster secondary loops consisting of AI, PID and AO device blocks run in the field, while the primary PID loop and other complex blocks run in the host system.

The FBM228 also supports an enhanced DCI block set that enables the control station to access block parameters in an H1 device. The parameters specified by offset.subindex are the parameters in resource, transducer, and function blocks. These DCI blocks can be used, for example, to source device diagnostic information for the development of maintenance and alarm strategies.

The blocks include:

- BIN for binary input
- IIN for integer values
- RIN for real input
- ROUT for real output
- PAKIN for bit-enumerated parameters
- STRIN for string data

The FBM228 is electrically compatible with standard HART signals.

Features

- Conforms to the FOUNDATION fieldbus specifications and supports all FOUNDATION fieldbus H1 field devices registered to the Interoperability Test Kit (ITK) 4.6 or greater.
- Provides support for standard FF Views 1, 2, and 4 which include presentation of dynamic block parameters that may be used as connectable values in control strategies configured in the control station.
- Provides all applications operating on Control Core Services workstations access to block parameters in the field devices.
- Enables the development of an integrated control database that seamlessly connects H1 function blocks and control station function blocks. The database is built using the graphical control strategy diagram in the Foxboro DCS Control Editors.
- Supports control in the host and control in the field loops.
- Can be installed as a redundant pair providing maximum uptime, with fully redundant communications between the FBM228 and fault-tolerant control processors.
- Integrates H1 device data into a Foxboro DCS format for consistent operator display of alarms, trends, and operator displays that are independent of the protocol/communication bus used to bring them into the system.
- Compatible with a variety of power conditioning devices from Foxboro and third-party manufacturers. Bus powering is a function of the type of field termination assembly. The typical non-intrinsic safety termination assembly contains power converters that provide from 300 mA to 1 A of conditioned power to each H1 Link (see Power Options, page 5).
- Provides a Link Active Scheduler (LAS) for each H1 Link.
- Supports use of Link Master devices as backup LAS on H1 segments.
- The Fieldbus Module (FBM) automatically detects and schedules all devices on each H1 Link, providing faster start-up, commissioning, and device replacement.
- The FOUNDATION fieldbus links conform to ANSI/ISA S-50, IEC 61158, and CENELEC EN 50170.
- The FBMs are suitable for installation in Class 1, Division 2, and Zone 2 locations.

Control Stations

The FBM228 provides the interface to H1 devices for the DIN rail mounted FCP280 Field Control Processors.

With the optionally redundant FBM228, a highly available system can be configured, including:

- A redundant FBM228
- Fault-tolerant control processors
- Redundant communications between the CP and FBMs
- Redundant power conditioners and power supplies

Power Options

Power to the H1 bus is always a function of the selected power conditioners. To allow customers' preferences in cabinet design and hazardous area configurations, the Foxboro DCS FOUNDATION fieldbus is designed to let customers select power conditioners from the many different solutions available on the market.

Figure 1 illustrates an integrated baseplate solution jointly developed with Pepperl+Fuchs that mounts two FBM228 modules plus up to eight P&F power conditioners. Lower installed costs, more than 80% fewer manual connections, and improved reliability result from 52 pairs of built in connections that distribute bulk power, link the FBM228 modules and the power conditioners to the H1 segments, and tie together power conditioner alarm contacts.

- The FBTA-228-BPFB-R-4R and FBTA-228-BPFB-R-8R are used with one (4R) Or two (8R) redundant pair(s) of FBM228 modules, plus a redundant pair of power conditioners for each of the four (4R) or eight (8R) H1 segments.
- The FBTA-228-BPFB-8 is used with two non-redundant FBM228 modules, plus a non-redundant power conditioner for each of the 8 H1 segments.

The two P&F power conditioner choices include:

- The passive HD2-FBCL-1.500
- The galvanically isolating HD2-FBPS-1.500

Figure 2 illustrates a typical generic setup usable for any third-party power conditioners in either redundant or non-redundant configurations. A T1 termination cable (see Table 1, page 13 for cable types and lengths) and a passive termination assembly (p/n RH922VC) provide the connection between the baseplate and the power conditioning modules. The third party modules are then connected using standard H1 practices with respect to power conditioning, distances, bus termination, and safety certifications.

Example power conditioning options include:

- Pepperl+Fuchs® KLD2-PC-1.1 IEC
- Relcom® FPS-1 redundant power system with terminators
- Fieldbus Intrinsically Safe Concept (FISCO) power conditioners from Pepperl+Fuchs and MTL
- Entity Concept intrinsically safe power conditioners from Pepperl+Fuchs and MTL
- Fieldbus Non-Incendive Concept (FNICO) power conditioners from Pepperl+Fuchs and MTL

For hazardous area configurations, an alternative to using Entity, FISCO, or FNICO power conditioners is to use general purpose power conditioners in combination with a wiring block having built in field barriers for intrinsic safety.

The number of devices on the bus may be limited by the choice of powering arrangement and other factors such as desired macrocycle times and loop design. The following table indicates the typical bus power availability for various methods:

General Purpose Power Conditioners (See vendor specifications)	Up to 1 A @ 30 V dc
FISCO Power Conditioners	100 mA @ 24 V dc
Entity Concept Power Conditioners	70 mA @ 24 V dc

Intelligent Field Device Link Master

The FBM228 acts as an intelligent field device link master, scheduling devices on each H1 Link. A publisher/subscriber relationship between the FBM and the H1 field device helps guarantee that the communication in each link acts in a deterministic fashion.

The FBM228 receives digital messages from the field devices in engineering units. Published device data is communicated with each macrocycle, and dynamic data views are regularly updated to the control processor. All device data is accessible for diagnostics software and other applications.

Redundant Operation

The FBM228 extends the uptime benefits of the Fault Tolerant Foxboro DCS architecture from the control station to the termination assembly. When configured as a redundant pair, the FBM228s operate in a master/tracker relationship, with one module providing the interface and scheduling the connected H1 devices, and the other tracking the master. If there is an operating fault in the master, the two modules automatically switch roles with no interruption in service. The role switch includes transfer of the link active scheduling functions so there is no interruption in service, and thus, no need for configuring link backup functions within the devices.

A failed module can be removed from the baseplate and replaced with no interruption in service.

Standard, Rugged Design

The FBM228 has a rugged extruded aluminum exterior for physical and electrical protection of the circuits. Enclosures specially designed for mounting of FBMs provide various levels of environmental protection, up to harsh environments per ISA Standard S71.04.

The module can be removed and replaced without removing field device termination, power, or communications cabling. It mounts on a variety of baseplates, which accommodate 2, 4, or 8 modules. The baseplate is either DIN rail mounted or rack mounted, and includes signal connectors for the FBMs, redundant independent DC power, and I/O cable connections.

Light-emitting diodes (LEDs) incorporated into the front of the module provide visual indication of the FBM operational status, its current role as either master or tracker in a redundant pair, and the communication activity on each H1 Link.

FBM228 Electrical Interface

The FBM228 conforms to FOUNDATION Fieldbus H1 Physical Layer specification, and has passed the FF Physical Layer test as defined in FF-830, *FOUNDATION™ Specification 31.25 kbit/s Physical Layer Conformance Test*.

In this regard, the properties of the FBM228 are:

- Polarity independence
- Open-circuit voltage level of 35 V DC maximum
- Support of non-intrinsically safe H1 devices, and intrinsically safe H1 devices through third-party safety barriers

FOUNDATION Fieldbus Topologies

A basic FOUNDATION fieldbus topology is shown in Integrated FBM228s and Power Conditioners, however, numerous other topologies can be employed. See FF documents AG-181, *FOUNDATION™ fieldbus System Engineering Guidelines* and AG-140 *FOUNDATION™ fieldbus Wiring and Installation 31.25 kbits/s, Voltage Mode, Wire Medium Application Guide* (www.fieldbus.org).

Figure 1 - Integrated FBM228s and Power Conditioners

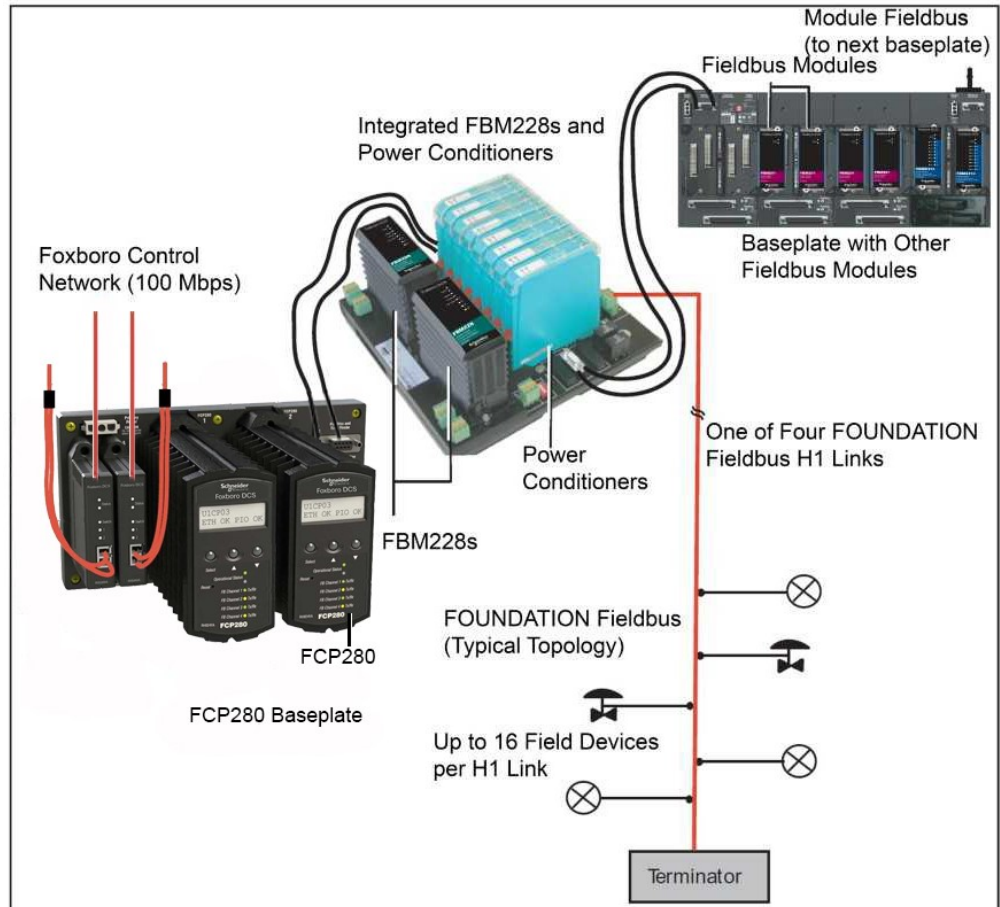
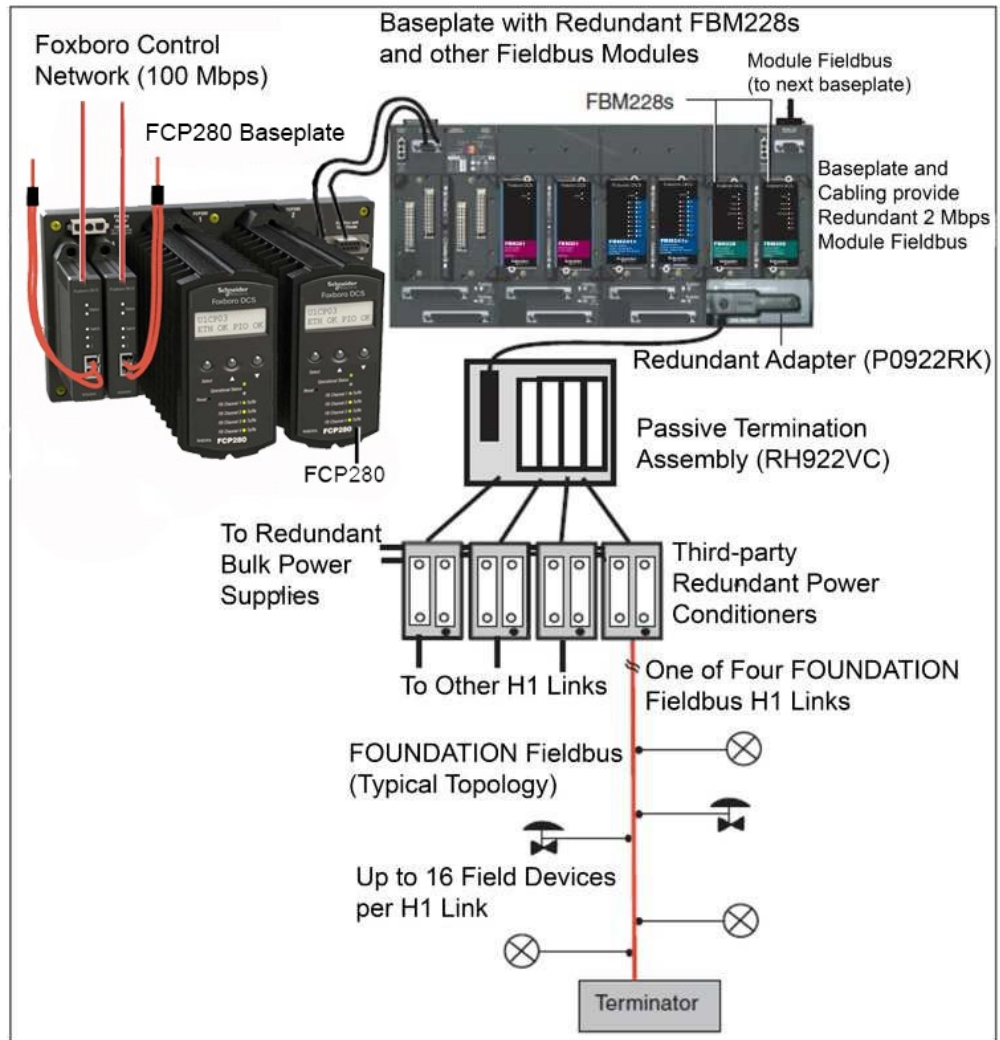


Figure 2 - Generic Connection of FBM228 Power Conditioners



Functional Specifications

<p>FOUNDATION fieldbus Communications</p>	<p>Interface:</p> <ul style="list-style-type: none"> Four isolated H1 Links <p>H1 Bus Characteristics:</p> <ul style="list-style-type: none"> General: Non-redundant multi-drop communications bus operating at 31.25 kbps. Topology is the bus/tree type. Each FBM228 (and associated H1 Link) has its own Link Active Scheduler (LAS). Maximum Allowable Bus Length and Maximum Allowable Spur Length, Single Device per Spur: See document AG-181, <i>FOUNDATION™ fieldbus System Engineering Guidelines</i>. Maximum Cable Length, FBM228 to Terminator Assembly: 30 m (99 ft) Maximum Number of Devices on Feldbus: 64 devices per module with a maximum of 16 devices per H1 Link. Maximums also vary according to such factors as the power consumption of each device, the type of cable used, and the use of repeaters. Consult FOUNDATION fieldbus Physical Layer Specifications for details. Maximum Number of Points: 128 publisher/subscriber block connections and 256 client/server block connections per FBM, 32 publisher/subscriber block connections and 64 client/server block connections per Link. Total capacity is affected by the update period of client/server access to device block parameters and by the configured macrocycle. Update period is separately configured for each block. Configurable Loop Macrocycle: A minimum macrocycle time of 200 milliseconds is supported. It is automatically adjusted, if necessary, to achieve a 50% unscheduled time to support client/server communications on the H1 Link.
<p>FBM228 Channel Isolation</p>	<p>Each channel is galvanically isolated and referenced to ground. The module can withstand, without damage, a potential of 600 V ac applied for one minute between any channel and earth (ground).</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>⚡ ⚠ DANGER</p> <p>HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH</p> <p>Exceeding input voltage limits, as stated elsewhere in this specification, violates electrical safety codes and may expose users to electric shock.</p> <p>Failure to follow these instructions will result in death or serious injury.</p> </div>
<p>Conformance to FOUNDATION fieldbus Specifications</p>	<p>FOUNDATION fieldbus topologies and communications are in accordance with FOUNDATION Fieldbus H1. Specifically, the FBM228:</p> <ul style="list-style-type: none"> Conforms to FF Physical Layer specification; verified by passing the FF Physical Layer test defined by FF-830 H1 Physical Layer Test Specification: Conforms to H1 Stack Conformance; verified by Fraunhofer Institute according to F-523 H1 Stack Registration Process
<p>Foxboro DCS Fieldbus Communication</p>	<p>The FBM228 communicates with its associated FCP280 via the Foxboro DCS 2 Mbps Module Fieldbus. The FCM and the Control station communicate via an Foxboro DCS 100 Mbps Ethernet trunk fieldbus.</p>

Bus Power Supply	Bus powering is a function of the field termination assembly type. The FBM228 is compatible with various third-party power conditioners, both IS and non-IS.
FBM228 Power Requirements	<ul style="list-style-type: none"> • Input voltage range: 24 V dc +5%, -10% • Consumption: P0922QS - 5.0 W RH101SF - 3.8 W (maximum) • Heat Dissipation: P0922QS - 5.0 W RH101SF - 3.8 W (maximum) <div style="background-color: black; color: white; text-align: center; padding: 5px;">⚠️ DANGER</div> <div style="border: 1px solid black; padding: 5px;"> <p>HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH</p> <p>The redundant FBM228 module (RH101SF (supersedes RH973LB) consumes more power and dissipates more heat than compact and standard modules. Verify that your cabinets do not exceed their rated temperatures and use caution when handling these modules.</p> <p>Failure to follow these instructions will result in death or serious injury.</p> </div>
Signal Connections	See Figure 1 for the preferred approach of directly connecting the H1 segments to the baseplate. An alternative signal connection approach suitable when external power conditioners are used is shown in Figure 2.
Regulatory Compliance: Electromagnetic Compatibility (EMC)	<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
Regulatory Compliance: Product Safety	<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/UL-C listed Class I, Groups A-D; Division 2; temperature code T4 enclosure based systems when connected to specified Foxboro DCS processor modules. 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 <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 2014/34/EU:</i> DEMKO certified as Ex nA IIC T4 for use in certified Zone 2 enclosure when connected to specified processor modules as described in the <i>Standard and Compact 200 Series Subsystem User's Guide</i> (B0400FA).
RoHS Compliance	Complies with European RoHS Directive 2011/65/EU, including amending Directives 2015/863 and 2017/2102.

Environmental Specifications

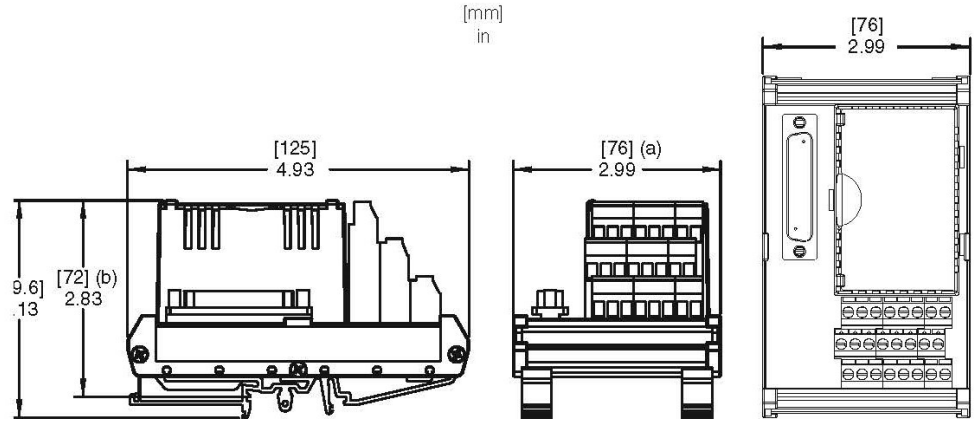
	Operating		Storage
Altitude/ Temperature	-300 to +914 m (-1,000 to +3,000 ft) -20 to +70°C (-4 to +158°F)	+915 to +3,000 m (+3,000 to +10,000 ft) -20 to +60°C (-4 to +140°F)	-300 to +12,000 m (-1,000 to +40,000 ft) -40 to +70°C (-40 to +158°F)
Relative Humidity	5 to 95% (noncondensing)		5 to 95% (noncondensing)
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 (0.75 g) from 5 to 500 Hz		

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

Physical Specifications

Mounting	The FBM228 mounts on a baseplate. The baseplate can be mounted on a DIN rail (horizontally or vertically), or horizontally mounted on a 19-inch rack using a mounting kit. See <i>Standard 200 Series Baseplates</i> (PSS 41H-2SBASPLT) for details.
Weight	284 g (10 oz) approximate (each module)
Dimensions	<ul style="list-style-type: none"> • Height: 102 mm (4 in) 114 mm (4.5 in) including mounting lugs • Width: 45 mm (1.75 in) • Depth: 104 mm (4.11 in)
Indicators Mounted on the Front of the FBM	<ul style="list-style-type: none"> • Operational Status: Red and green light-emitting diodes (LEDs) • Role: Amber LEDs indicating role of module as master or tracker. • Channel Connection Activity: Amber LEDs, one per channel
Part Numbers	<ul style="list-style-type: none"> • FBM228 Module: RH101SF (supersedes RH973LB) • Redundancy Adapter: RH922RK
Termination Assembly (RH922VC (supersedes P0922VC))	<ul style="list-style-type: none"> • Type: Compression screw • Construction Material: PVC • Weight: 363 g (0.8 lb) approximate • Dimensions: See Figure 3

Figure 3 - Compression Termination Assembly



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

Table 1 - Termination Cable Types and Part Numbers

Cable Length m (ft)	Type 1 P/PVC ^(a)	Type 1 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).

Related Product Documents

Document Number	Description
B0400FA	<i>Standard and Compact 200 Series Subsystem User's Guide</i>
PSS 41H-2SBASPLT	<i>Standard 200 Series Baseplates</i>
PSS 41S-3FCPICS	<i>Field Control Processor 280 (FCP280) Integrated Control Software</i>

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