Foxboro Evo™ Process Automation System

Product Specifications

Foxboro® by Schneider Electric

PSS 31H-2Z47

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 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 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.

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 200 Series FBMs
- Baseplate-mounted TA, which mounts directly onto the field I/O connectors of the 200 Series baseplate. These TAs provide field I/O wiring support for two FBM247s in paired slots (that is, in positions 1 and 2, 3 and 4, 5 and 6, or 7 and 8), as shown in Figure 1.

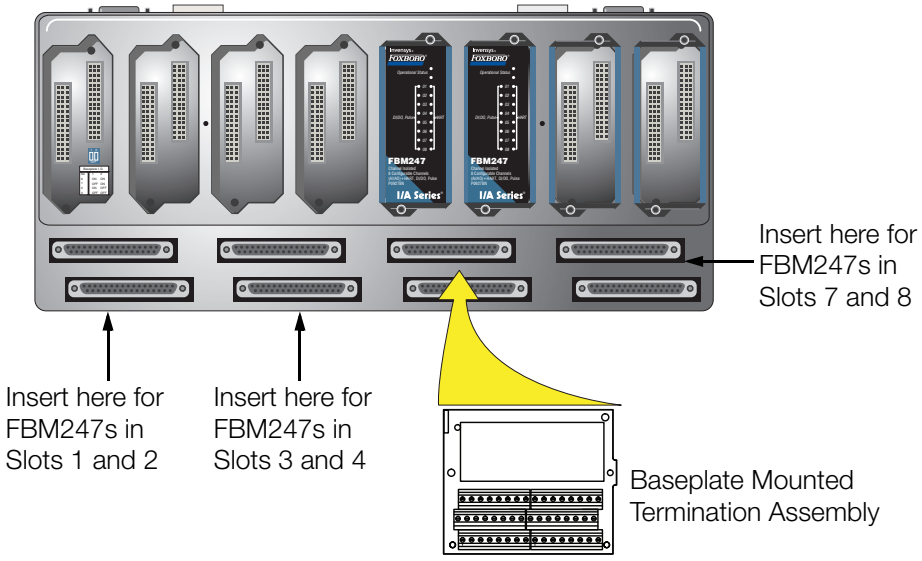


Figure 1. Baseplate-Mounted Termination Assembly

The 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 FBM247 must be used with I/A Series® system software, v8.7 to v8.8 and Foxboro Evo Control Core Services software, v9.0 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 FBM247 enables the G-Series system enclosure to support up to 96 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 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 FBM247'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 FBM247
- Optional baseplate-mounted Termination Assembly (TA) attaches directly to a 200 Series baseplate, eliminating the need for mounting a separate TA on a DIN rail for the FBM247, and requiring space for the TA's cable in an enclosure
- Range of I/O support and baseplate-mounted TAs reduce the amount of cabling and mounting space, eliminating the need for separate marshalling enclosures and cables required for field I/O wiring support
- 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 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

FBM247 has a compact design, with a rugged extruded aluminum exterior for physical protection of the circuits.

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.

EASY REMOVAL/REPLACEMENT

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

SEQUENCE OF EVENTS

The Sequence of Events (SOE) software package (for use with I/A Series software v8.x and Control Core Services software v9.0 or later) 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.

MODULAR BASEPLATE MOUNTING

The module mounts on a Modular baseplate, which accommodates up to eight Fieldbus Modules. 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.

TERMINATION ASSEMBLIES

Field I/O signals connect to the FBM subsystem via:

- DIN rail mounted TA, 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 FBM247 are described in “TERMINATION ASSEMBLIES AND CABLES” on page 9.

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 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 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.

Power Requirements

INPUT VOLTAGE RANGE (SINGLE OR REDUNDANT)
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
Meets: EN 50081-2 Emission standard
EN 50082-2 Immunity standard
EN 61326 EMC Standard (Industrial Levels)

CISPR 11, Industrial Scientific and Medical (ISM) Radio-frequency Equipment - Electromagnetic Disturbance Characteristics - Limits and Methods of Measurement
Meets: Class A Limits

IEC 61000-4-2 ESD Immunity
Contact 4 kV, air 8 kV

IEC 61000-4-3 Radiated Field Immunity
10 V/m at 80 to 1000 MHz

IEC 61000-4-4 Electrical Fast Transient/Burst Immunity
2 kV on I/O, V dc power and communication lines

IEC 61000-4-5 Surge Immunity
2kV on ac and dc power lines; 1kV on I/O and communications lines

IEC 61000-4-6 Immunity to Conducted Disturbances induced by Radio-frequency Fields
3 V (rms) at 150 kHz to 80 MHz on I/O, V dc power and communication lines

IEC 61000-4-8 Power Frequency Magnetic Field Immunity
30 A/m at 50 and 60 Hz

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 Fieldbus modules (Without Safety Barriers) are UL listed as associated apparatus for supplying non-incendive field circuits for Classes I, II, and III, 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). Non-incendive and Class 2 compliance applies only when field circuits are module powered. Note: The UL/UL-C listing requires that the 24 V dc power source for the module is from an Foxboro® power supply that is UL/UL-C recognized (to UL 1950 and CSA C22.2 No.234) as having a Safety Extra Low Voltage (SELV) output.

European Low Voltage Directive 2006/95/EC and Explosive Atmospheres (ATEX) directive 94/9/EC
Module can be used in CENELEC certified Zone 2 enclosure based systems. The modules (Without Safety Barriers) are CENELEC (KEMA) certified as associated apparatus, "EEx n IIC", for supplying non-incendive field circuits for 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).

Calibration Requirements

Calibration of the module and termination assembly is not required.

ENVIRONMENTAL SPECIFICATIONS

Operating Conditions

TEMPERATURE

Module

-20 to +70°C (-4 to +158°F)

Termination Assembly

Polyamide (PA)

-20 to +70°C (-4 to +158°F)

Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS)

-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 +70°C (-40 to +158°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/s^2 (5 to 500 Hz)

PHYSICAL SPECIFICATIONS

Mounting

MODULE

FBM247 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. Refer to *Standard 200 Series Baseplates* (PSS 31H-2SBASEPLT) 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 two field I/O connectors associated with its two FBM247s on a 200 Series baseplate.

Weight

MODULE

373 g (12 oz) approximate

TERMINATION ASSEMBLIES

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),114 mm (4.5 in) including mounting lugs

WIDTH

45 mm (1.75 in)

DEPTH

104 mm (4.11 in)

Dimensions - Termination Assemblies

Refer to page 13 and page 14.

Part Numbers

FBM247 MODULE

P0927BN

TERMINATION ASSEMBLIES

See “FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES” 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

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

TERMINATION ASSEMBLIES AND CABLES

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

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

The baseplate mounted TAs for the FBM247 are available in Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS) material with compression screw terminations.

See the following "FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES" for the TAs used with the FBM247.

The 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 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 for a list of termination cables used with the DIN rail mounted TAs for the FBM247.

FUNCTIONAL SPECIFICATIONS – TERMINATION ASSEMBLIES

FBM Type	Input/Output Signal	TA Part Number		Termination	TA Cable	TA Certification
		PA[a]	PC/ABS[b]	Type[c]	Type[d]	Type[e]
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.	P0924WW		C	1	1, 2
FBM247	Two sets of 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.		P0924WG	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 Table 2 for cable part numbers and specifications.
(e) See Table 1 for Termination Assembly certification definitions.

Table 1. 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 EEx 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 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 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.
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]	Type 1 H/XLPE[c]
0.5 (1.6)	P0916DA	P0928AA	P0916VA
1.0 (3.2)	P0916DB	P0928AB	P0916VB
2.0 (6.6)	P0931RM	P0928AC	P0931RR
3.0 (9.8)	P0916DC	P0928AD	P0916VC
5.0 (16.4)	P0916DD	P0928AE	P0916VD
10.0 (32.8)	P0916DE	P0928AF	P0916VE
15.0 (49.2)	P0916DF	P0928AG	P0916VF
20.0 (65.6)	P0916DG	P0928AH	P0916VG
25.0 (82.0)	P0916DH	P0928AJ	P0916VH
30.0 (98.4)	P0916DJ	P0928AK	P0916VJ

(a) P/PVC is polyurethane outer jacket and semi-rigid PVC primary conductor insulation. Temperature range: -20 to +80°C (-4 to +176°F).

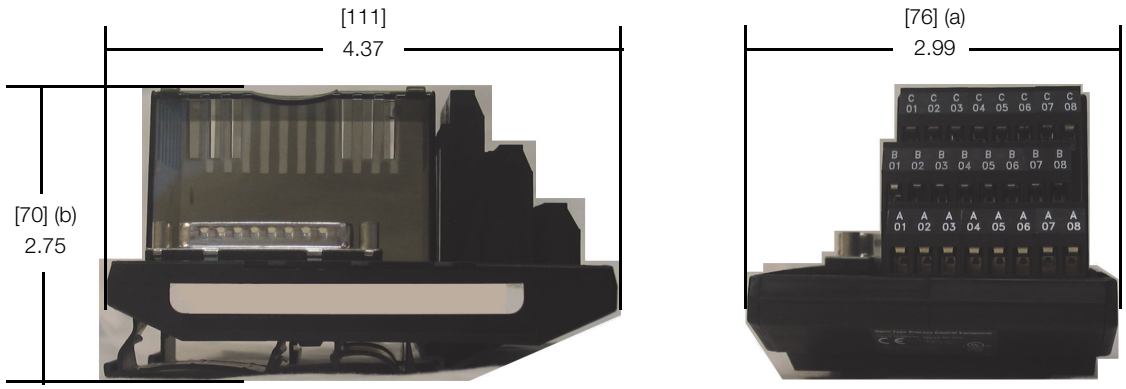
(b) Low smoke zero halogen or low smoke free of halogen (LSZH) is a material classification used for cable jacketing. LSZH is composed of thermoplastic or thermoset compounds that emit limited smoke and no halogen when exposed to high sources of heat. Temperature range: -40 to +105°C (-40 to +221°F).

(c) H/XLPE is Hypalon outer jacket and XLPE (cross-linked polyethylene) primary conductor insulation. Temperature range: -40 to +90°C (-40 to +194°F). Hypalon cables are no longer available for purchase.

DIMENSIONS–NOMINAL

[mm]
in
DIN Rail Mounted Termination Assembly

P0924WW

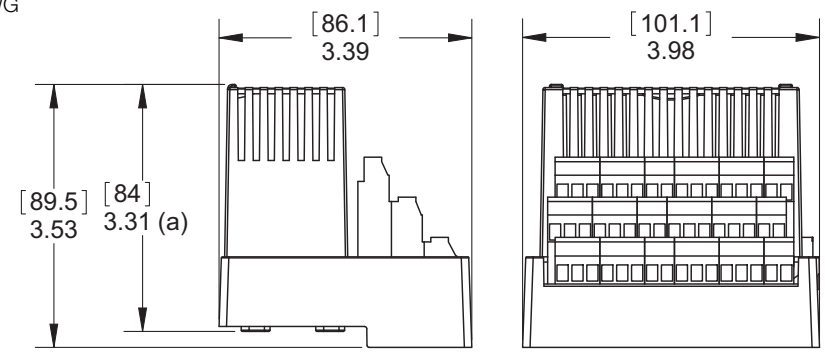


(a) Overall width – for determining DIN rail loading.
(b) Height above DIN rail (add to DIN rail height for total).

DIMENSIONS–NOMINAL

[mm]
in
Baseplate Mounted Termination Assembly

P0924WG



(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-2S200	Standard 200 Series Subsystem Overview
PSS 31H-2CERTS	Standard and Compact 200 Series I/O - Agency Certifications
PSS 31H-2SBASEPLT	Standard 200 Series Baseplates
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 21S-3CP270ICS	Control Processor 270 (CP270) Integrated Control Software

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