

# ControlNet Accessory Specifications

Catalog Numbers 1786-RPA, 1786-RPCD, 1786-RPFM, 1786-RPFS, 1756-RPFRL, 1786-PRFRXL

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## Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
ControlNet Network Configuration User Manual, publication <a href="#">CNET-UM001</a>	Describes how you can use ControlNet™ communication modules with your Logix5000™ controller and ControlNet network capacity and topology.
ControlNet Coax Media Planning and Installation Guide, publication <a href="#">CNET-IN002</a>	Describes the components and topologies for creating a ControlNet coax media system.
ControlNet Fiber Media Planning and Installation Guide, publication <a href="#">CNET-IN001</a>	Describes the components and topologies for creating a ControlNet fiber media system.
Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications link on the website, <a href="http://www.ab.com">http://www.ab.com</a>	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.



## 1786-RPA/B ControlNet Modular Repeater Adapter

The 1786-RPA/B repeater adapter can be used with the following modules to build a ControlNet network repeater:

- 1786-RPCD repeater dual-copper module
- 1786-RPFS repeater short-distance fiber module
- 1786-RPFM repeater medium-distance fiber module
- 1786-RPFRL fiber ring repeater module
- 1786-RPFRXL fiber ring repeater module

A repeater extends the length of a network; creates a star, ring, or point-to-point topology; and performs network media conversion from copper to fiber, and from fiber to copper. You can place a maximum of 20 repeater adapters in a series.

- TIP**
- If the 1786-RPA/B repeater adapter is used with the 1786-RPCD, 1786-RPFS, and 1786-RPFM repeater modules, you can attach as many as four repeaters to the repeater adapter.
  - If the 1786-RPA/B repeater adapter is used with the 1786-RPFRL and 1786-RPFRXL repeater modules, you can attach as many as two repeaters to the repeater adapter.

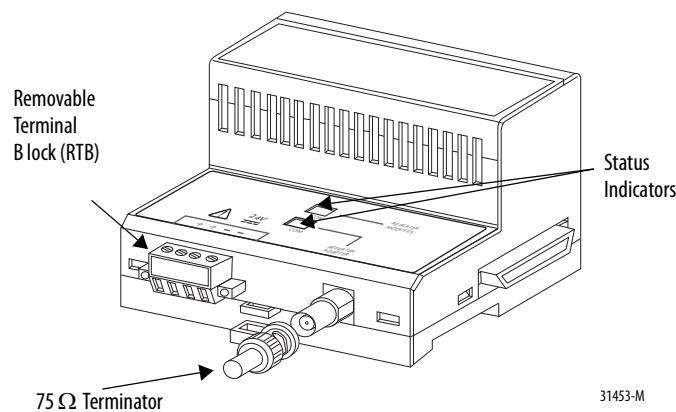
The repeater adapter also provides:

- Digital retiming of ControlNet network data
- Power to repeater modules
- One coax channel
- Status indicators
- 24V DC, removable power supply

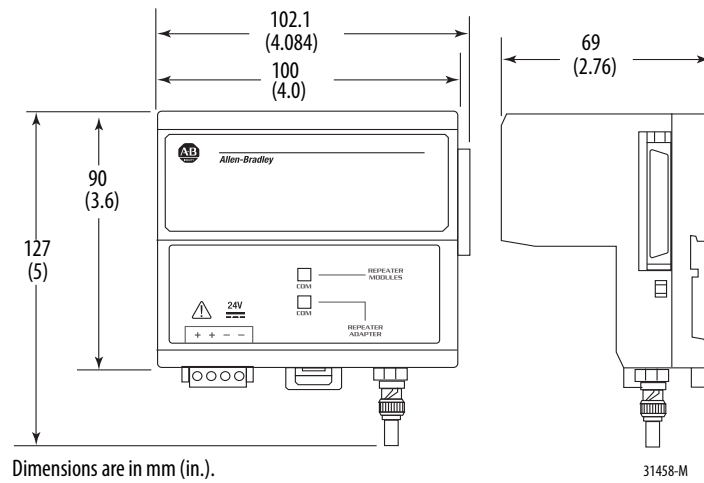
The repeater adapter ships with the following items:

- One removable terminal block (power connector) attached to the repeater adapter.
- One 75  $\Omega$  terminator for terminating an unused port.
- Two DIN rail locks.

The illustration shows the components that comprise the 1786-RPA/B repeater adapter.

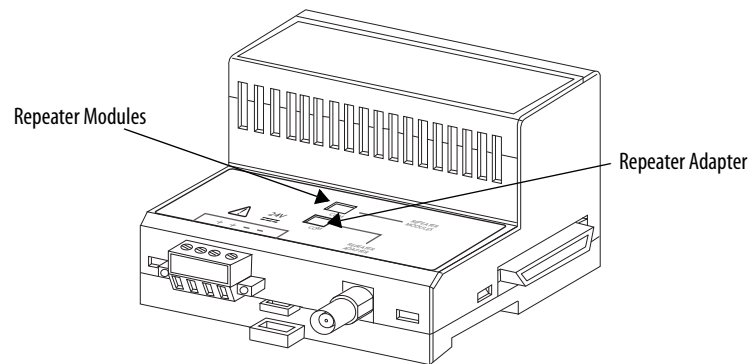


## Mounting Dimensions



## Status Indicators

The status indicators on the repeater adapter can be interpreted alone or together.



Tables 1, 2, and 3 list different combinations of status indicators and their interpretations.

Status Indicators	Page
Power up and fault conditions	<a href="#">Table 1 on page 4</a>
Repeater adapter only	<a href="#">Table 2 on page 4</a>
Repeater modules only	<a href="#">Table 3 on page 4</a>

**IMPORTANT** These combinations are the only valid indicator combinations. Other combinations are not valid. For example, if the repeater adapter status indicator is solid green and the repeater module status indicator is solid red, then this combination probably indicates a defective module.

**Table 1 - Power-up and Fault Conditions**

Indicator	Description	Action
Alternating red/green	Repeater adapter is being powered-up or reset.	Do nothing. The repeater adapter is operating properly.
Solid red	A jabber condition has occurred. Another node or repeater on the network is transmitting constantly.	Check the network and components for proper operation.
Off	Repeater adapter is not powered up or has failed.	Check the power input to the repeater adapter for correct voltage and polarity.

**Table 2 - Repeater Adapter Status Indicator**

Indicator	Description	Action
Solid green	Error-free data is being recovered at the coax port of the repeater adapter.	Do nothing. This mode is the normal operating mode.
Flashing green/off	Data with errors is occasionally being recovered at the coax port of the repeater adapter.	This situation can normally correct itself. If the situation persists, check the following: <ul style="list-style-type: none"> <li>• All BNC connector pins are seated properly.</li> <li>• All taps are Rockwell Automation taps.</li> <li>• All terminators are 75 <math>\Omega</math> and are installed at both ends of all segments.</li> <li>• Coax cable has not been grounded.</li> </ul>
Flashing red/off	Either no data is being received at the coax port of the repeater adapter, or data with many errors is being received at the coax port of the repeater adapter.	Check the following components: <ul style="list-style-type: none"> <li>• Broken cables</li> <li>• Broken taps</li> <li>• Missing segment terminators</li> </ul>

**Table 3 - Repeater Module Status Indicator**

Indicator	Description	Action
Solid green	Error-free data is being recovered at all attached repeater modules.	Do nothing. This mode is the normal operating mode.
Flashing green/off	Data with errors is occasionally being recovered at some or all repeater modules.	<ul style="list-style-type: none"> <li>• This situation can normally correct itself. If the situation persists, check the following:</li> <li>• All BNC connector pins are seated properly.</li> <li>• All taps are Rockwell Automation taps.</li> <li>• All terminators are 75 <math>\Omega</math> and are installed at both ends of all segments.</li> <li>• Coax cable has not been grounded.</li> <li>• Fiber-optic connectors are of the correct type and are correctly attached to the fiber-optic cable.</li> <li>• Fiber-optic cable is the correct type.</li> </ul>
Flashing red/off	Either no data is being received at any of the repeater modules, or the received data at some or all repeater modules has a high number of errors.	Check the following components: <ul style="list-style-type: none"> <li>• Broken cables</li> <li>• Broken taps</li> <li>• Missing segment terminators</li> </ul>

## Specifications

**Table 4 - Technical Specifications - 1786-RPA/B**

Attribute	1786-RPA/B
Power consumption, max	16.8 W
Power dissipation, max	8.8 W
Input current rating, max	700 mA @ 24V DC max, SELV <sup>(2)</sup>
Input voltage range <sup>(1)</sup>	18...36V DC
Backplane output current, max	1.6A @ 5V DC, max
Isolation voltage	N/A (SELV), Functional Insulation Type, ControlNet to System
Wire size	0.21...3.3 mm <sup>2</sup> (24...12 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 1.2 mm (3/64 in.) insulation max for power connections
Wiring category	2 - on power ports 2 - on ControlNet ports <sup>(3)</sup>
Terminal block torque specifications	0.6...0.8 N·m (5.3...7.1 Lb·in) on Power RTB
Enclosure type rating	None (open-style)
North American temp code	T5
IECEX temp code	T5
ATEX temp code	T5

(1) UL certification for 24V DC nominal. Rockwell Automation-specified to 18...36V DC.

(2) For applications within the U.S., use a power supply that is appropriately certified as Class 2 per the definition in the National Electrical Code, ANSI/NFPA 70, Article 725. For applications outside the U.S., use a power supply with safety extra low voltage (SELV) or protected extra low voltage (PELV) output. A power supply with SELV or PELV output is built with appropriate isolation to withstand single fault conditions. The output cannot exceed 30V rms, 42.4V peak, or 60V DC under fault conditions.

(3) Use this Conductor Category information for planning conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

**Table 5 - Environmental Specifications - 1786-RPA/B**

Attribute	1786-RPA/B
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...85 °C (-40...185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC60068-2-27 (Test Ea, Unpackaged Shock)	50 g

**Table 5 - Environmental Specifications - 1786-RPA/B**

Attribute	1786-RPA/B
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz and 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity IEC 61000-4-4	±4 kV at 5 kHz on power ports ±4 kV at 5 kHz on ControlNet ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±2 kV line-earth (CM) on ControlNet ports
Conducted RF Immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

**Table 6 - Certifications<sup>(1)</sup> - 1786-RPA/B**

Certification <sup>(2)</sup>	1786-RPA/B
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A, B, C, D Hazardous Locations. See CSA File LR69960C.
FM	FM Approved Equipment for use in Class I Division 2 Group A, B, C, D Hazardous Locations.
CE	European Union 2004/108/EC EMC Directive, compliant with the following: <ul style="list-style-type: none"> <li>EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>EN 61000-6-2; Industrial Immunity</li> <li>EN 61000-6-4; Industrial Emissions</li> <li>EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
C-Tick	Australian Radiocommunications Act, compliant with the following: <ul style="list-style-type: none"> <li>AS/NZS CISPR 11; Industrial Emissions</li> </ul>
Ex	European Union 94/9/EC ATEX Directive, compliant with the following: <ul style="list-style-type: none"> <li>EN 60079-15; Potentially Explosive Atmospheres, Protection 'n'</li> <li>EN 60079-0; General Requirements</li> <li>II 3 G Ex nA IIC T5 Gc</li> <li>SIRA14ATEX4171X</li> </ul>
IECEx	IECEx System, compliant with: <ul style="list-style-type: none"> <li>IEC 60079-0; General Requirements</li> <li>IEC 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>II 3 G Ex nA IIC T5 Gc</li> <li>IECExSIR14.0048X</li> </ul>
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> <li>Article 58-2 of Radio Waves Act, Clause 3</li> </ul>
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
CI	ControlNet Int'l conformance tested to ControlNet specifications.

(1) When product is marked.

(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

## 1786-RPCD ControlNet Dual Copper Repeater Module

The copper repeater module lets you attach multiple 1000 m copper segments to a repeater adapter (1786-RPA). The module provides two copper channels and activity status indicators for each channel.

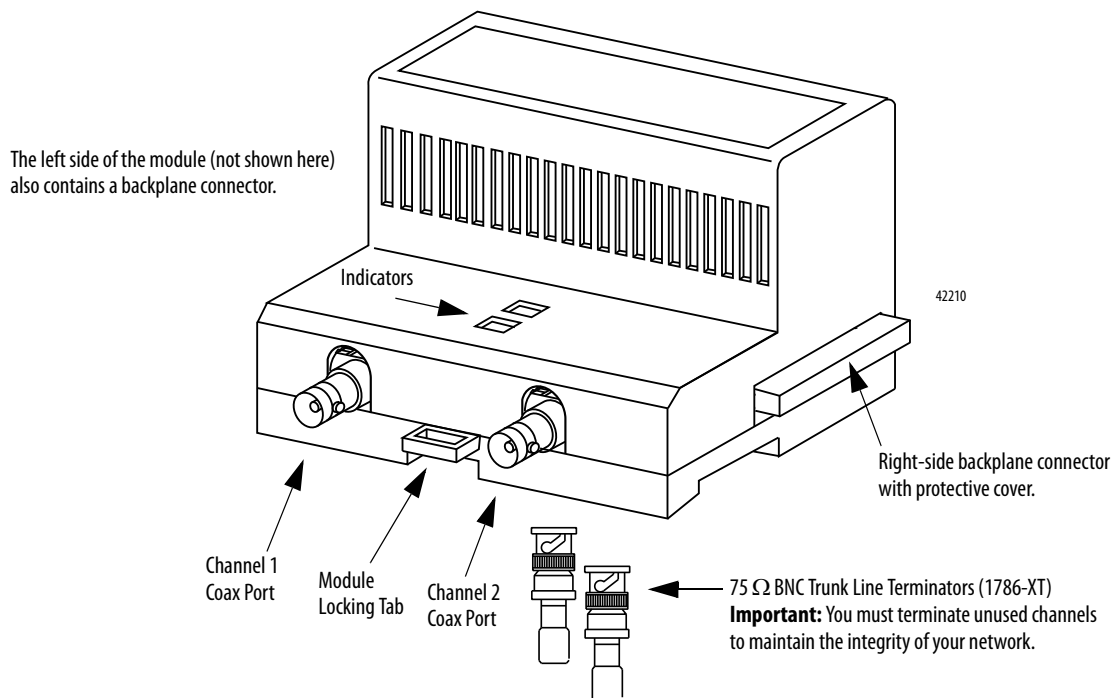
See pages [8](#) - [11](#) for topology examples and segment length constraints.

Use this copper repeater module when:

- The design of the network requires a hub-based topology.
- The segment requires a greater copper distance.
- The design requires an isolated segment.
- The number of nodes requires the use of repeaters.

See [Understand Constraints of the Coax Segment on page 11](#).

This figure identifies the components of the module.

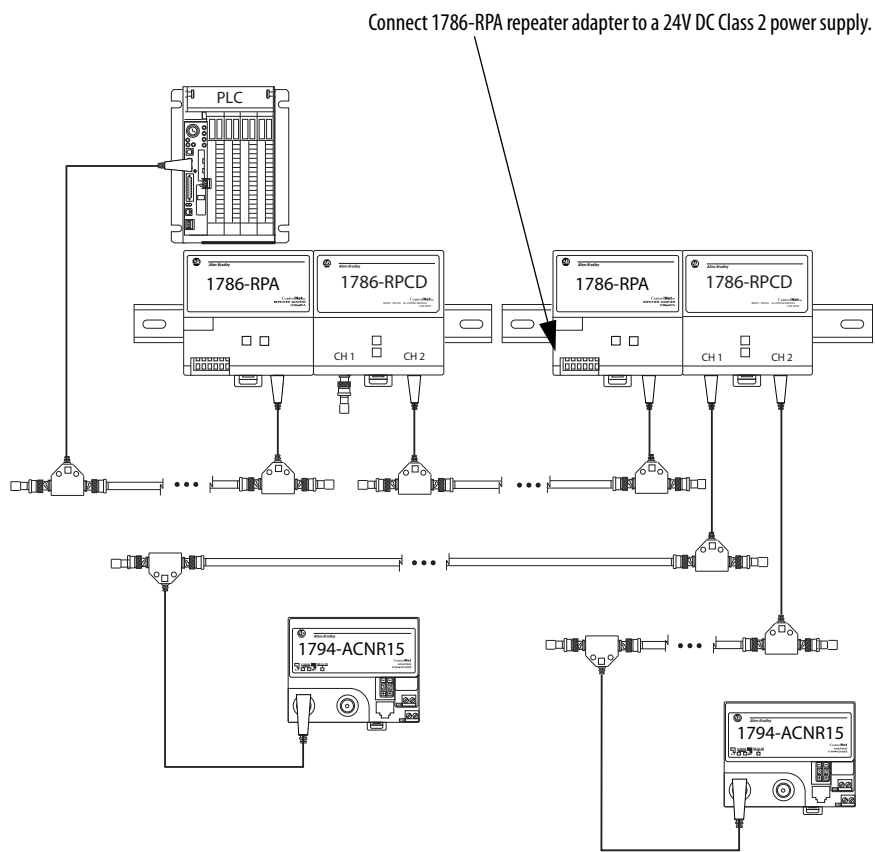


## Understand Common Topologies

These topologies show how you can use the module.

### Series Topology

This figure shows the 1786-RPCD wired in series. This topology can be used to extend the trunk line.



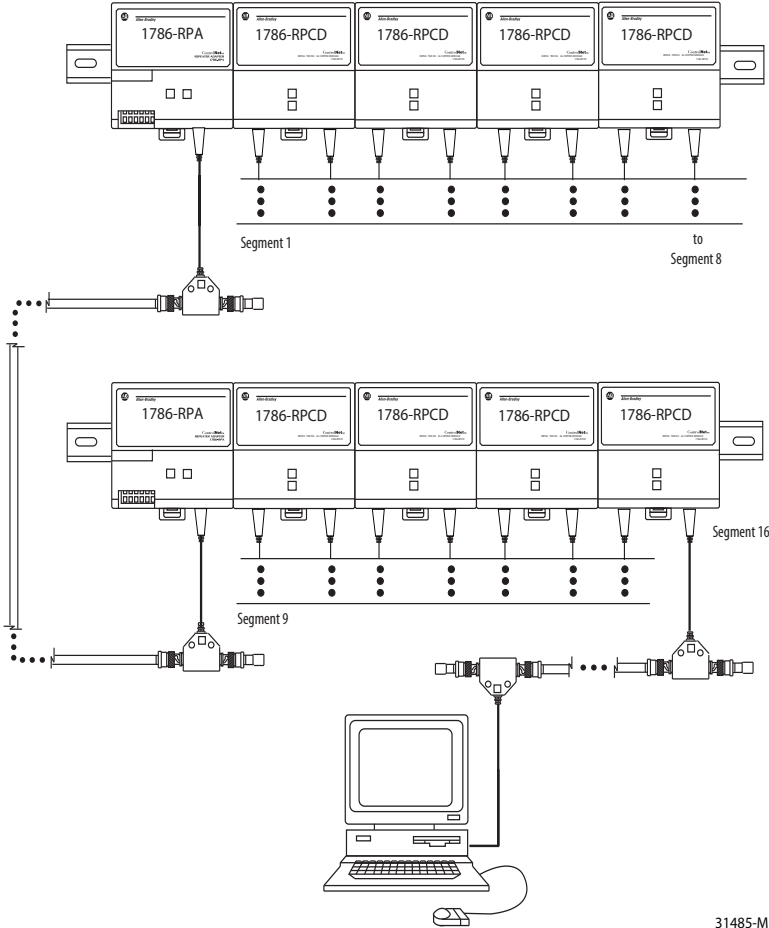
31484-M



### Star Topology

The following figure shows a star configuration that supports 16 usable segments. The two 1786-RPA repeater adapters create a central hub with the 1786-RPCD modules forming 16 segments.

16 segments, 2 1786-RPA repeater adapters in series with a maximum of 4 1786-RPCD modules per repeater adapter.



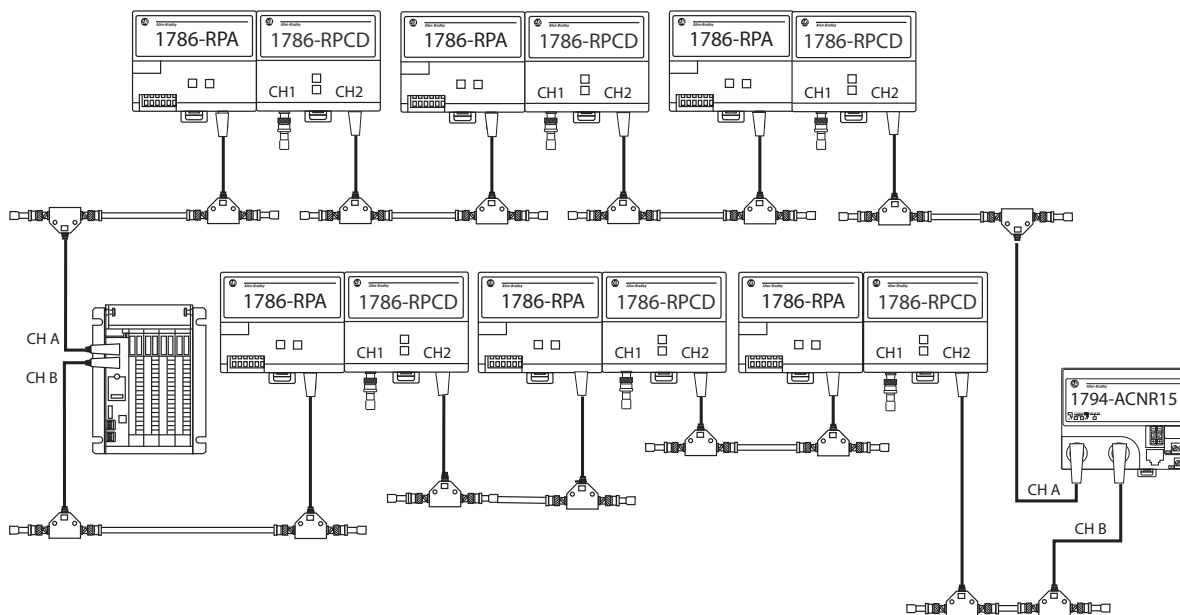
31485-M

## Redundant Topology

Use redundant media when you need module and media redundancy. With redundant media, the channel-to-channel skew travel time difference must be less than 1.6  $\mu$ s.

**TIP** Redundant media can be used with series and star topologies. You cannot use redundant media with ring redundant topology.

For more information on redundant topology, see the ControlNet Fiber Media Planning and Installation Guide, publication [CNET-IN001](#).



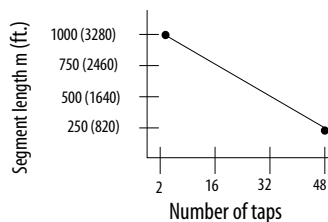
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## Understand Constraints of the Coax Segment

The total allowable length of a segment containing standard RG-6 quad shield coaxial cable depends upon the number of taps in your segment. There is no minimum trunk-cable section length requirement.

The maximum allowable total length of a segment is 1000 m (3280 ft) with two taps connected. Each additional tap decreases the maximum length of the segment by 16.3 m (53 ft). The maximum number of taps that are allowed on a segment is 48, with a maximum length of 250 m (820 ft).

**Figure 1 - Maximum segment length (assumes that you are using 1786-RG6 coax cable)**



$$\text{Maximum allowable segment length} = 1000 \text{ m (3280 ft)} - 16.3 \text{ m (53.4 ft)} \times [\text{number of taps} - 2]$$

30014-M

### EXAMPLE

If your segment requires 10 taps, the maximum segment length is:

$$1000 \text{ m (3280 ft)} - 16.3 \text{ m (53.4 ft)} \times [10 - 2] = 1000 \text{ m (3280 ft)} - 130.4 \text{ m (427.7 ft)} = 869.6 \text{ m (2852.8 ft)}$$

The total trunk-cable length or number of taps can be increased by installing repeaters on the segment to create another segment.

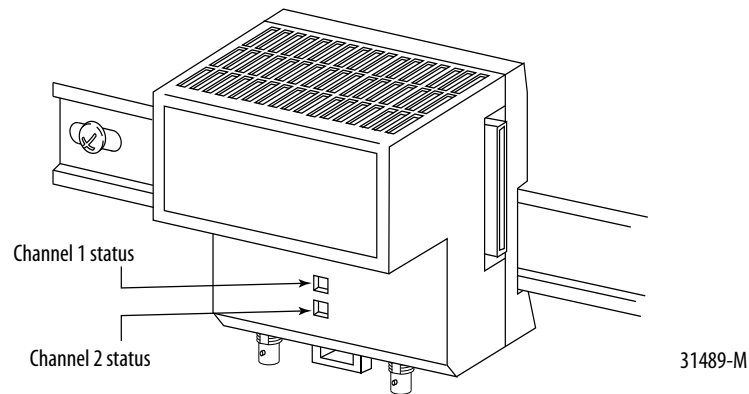
The amount of high-flex RG-6 cable (1786-RG6F) you can use in a system is less than the amount of standard RG-6 cable, so keep high-flex cable use to a minimum. Use BNC bullet connectors to isolate areas that require high-flex RG-6 cable from areas that require standard RG-6 cable. Using bullet connectors allow UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada

UL File E194810s the high-flex RG-6 section to be replaced before flexure life is exceeded.

For more information in the installation of a coax segment, see the ControlNet Coax Media Planning and Installation Guide, publication [CNET-IN002](#).

## Status Indicators

This figure identifies indicators on the module.

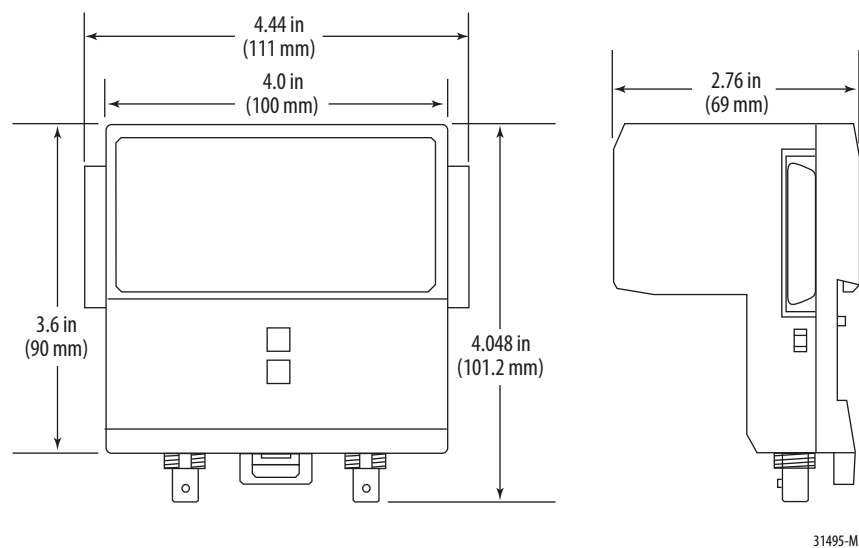


This table defines Channel 1 and Channel 2 status indicators.

Status Indicator	Probable Cause
Off	No power or module faulted
Green	Channel operational
Flashing Green/Off	No data activity on associated channel

## Mounting Dimensions

This figure shows the dimensions for mounting the module.



## Specifications

**Table 7 - Technical Specifications - 1786-RPCD**

Specification	1786-RPCD
Voltage and current ratings	Backplane: 400 mA @ 5V DC max
Power Consumption	2 W max
Power Dissipation	2 W max
Isolation Voltage (continuous-voltage withstand rating)	N/A (SELV), Functional Insulation Type, ControlNet to System and between ControlNet channels.
Wiring Category <sup>(1)</sup>	2 - on ControlNet ports
Enclosure Type Rating	None (open-style)
North American temp code	T5
IECEx temp code	T5
ATEX temp code	T5

(1) Use this Conductor Category information for planning conductor routing. See Publication [1770-4.1](#), Industrial Automation Wiring and Grounding Guidelines.

**Table 8 - Environmental Specifications - 1786-RPCD**

Specification	1786-RPCD
Temperature, operating	0...60 °C (32...140 °F)
IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, non-operating	-40...85 °C (-40...185 °F)
IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	
Relative Humidity	IEC 60068-2-30 (Test Db, Unpackaged Nonoperating Damp Heat): 5% to 95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5g@10 - 500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50 g
Emissions	IEC 61000-6-4
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B Immunity	IEC 61000-4-4: ±4 kV at 5 kHz on ControlNet ports
Surge Transient Immunity	IEC 61000-4-5: ±2 kV line-earth (CM) on ControlNet ports
Conducted RF Immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz to 80 MHz

**Table 9 - Certifications<sup>(1)</sup>**

<b>Certification</b>	<b>1786-RPCD</b>
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	Certified Process Control Equipment. See CSA File LR54689C. Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Location. See CSA File LR69960C.
CE <sup>(2)</sup>	European Union 89/336/EEC EMC Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>• EN 61000-6-2; Industrial Immunity</li> <li>• EN 61000-6-4; Industrial Emissions</li> <li>• EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
C-tick <sup>(2)</sup>	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 60079-0; General Requirements</li> <li>• EN 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>• II 3 G Ex nA IIC T5 Gc</li> <li>• SIRA14ATEX4171X</li> </ul>
IECEx	IECEx System, compliant with: <ul style="list-style-type: none"> <li>• IEC 60079-0; General Requirements</li> <li>• IEC 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>• II 3 G Ex nA IIC T5 Gc</li> <li>• IECExSIR14.0048X</li> </ul>
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation
CI	ControlNet International conformance tested to ControlNet specifications

(1) When product is marked.

(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

## 1786-RPFS ControlNet Modular Repeater Short-distance Fiber Module

Use the 1786-RPFS module when you need a short-distance fiber link between two ControlNet products. Maximum distance is 300 m (984 ft). The fiber link provides ground isolation between nodes and is less susceptible to noisy environments than copper media.

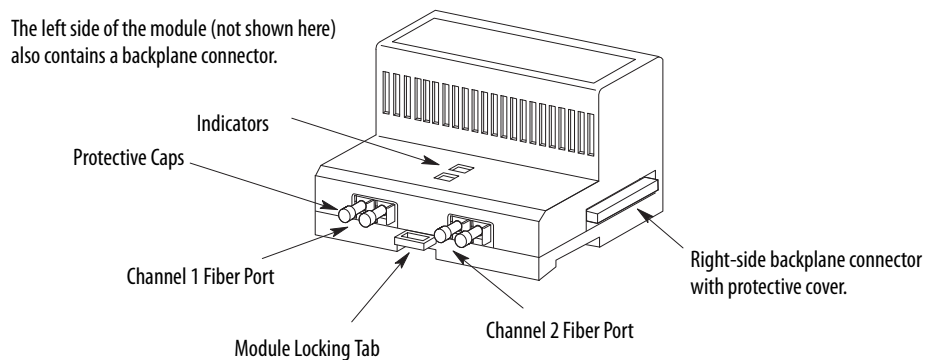
A maximum of four modules can attach to the 1786-RPA/B repeater adapter, and the total power consumption of the modules cannot exceed 1.6 A @ 5V DC, whichever comes first.

### IMPORTANT

- If you exceed the module or power limit, you can damage the repeater adapter and modules.
- The supported distance depends on the quality of the fiber, number of splices, and connectors. The total light loss through the fiber link must be less than 4.2 dB.

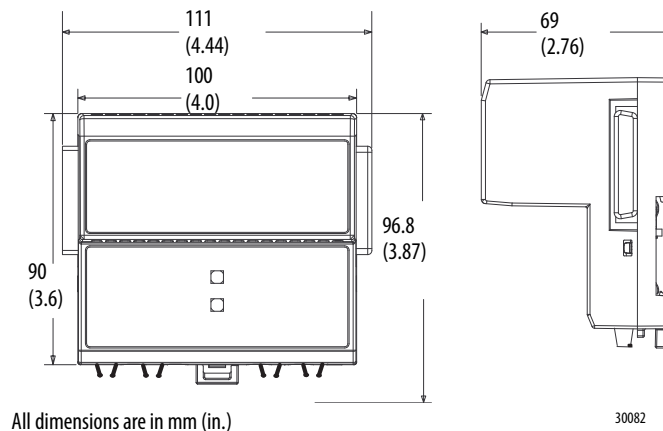
### Module Components

This illustration shows the components that comprise the 1786-RPFS module.



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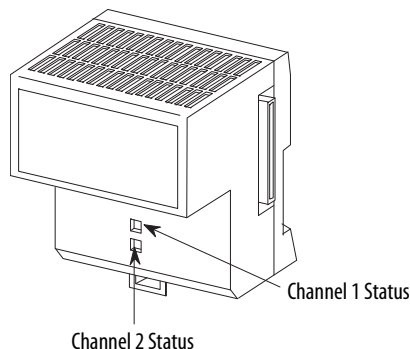
### Mounting Dimensions



30082

## Troubleshoot the Module

Use the channel 1 or 2 status indicators to check module status and troubleshoot the module.



30081

Indicator	Probable Cause
Off	The Repeater is not connected to the power supply.
Green	Channel is operating normally.
Flashing Green	No activity on the channel.



**ATTENTION:** Class 1 laser product. Laser radiation is present when the system is open and interlocks bypassed. Only trained and qualified personnel can be allowed to install, replace, or service this equipment.

## Specifications

**Table 10 - Technical Specifications - 1786-RPFS**

Attribute	1786-RPFS
Voltage and current ratings	Backplane: 300 mA @ 5V DC max
Power consumption	1.5 W max
Power dissipation	1.5 W max
Communication rate	5 Mbps
Fiber type	200/230 micron HCS (hard-clad silica)
Power level	
TX power, min	(-17 dBm) @ 0...70 °C (32...158 °F) into 200 micron HCS fiber
RX responsivity, min	-21.3 dBm @ 0...70 °C (32...158 °F)
Fiber temp range	200 micron HCS: -20...80 °C (-4...176 °F)
Bend radius	38 mm (1.5 in.), during installation 10 mm (0.4 in.), during operation
Tension, max	490 N (110 lb), during installation 370 N (85 lb), during operation
Connection	2 dB (mated pair) when added between transmitter and receiver
Optical power budget	4.2 dB <sup>(1)</sup>
Fiber termination type ST	VersaView® System



**Table 10 - Technical Specifications - 1786-RPFS**

Attribute	1786-RPFS
Fiber operation wavelength	650 nm (red)
Transmitter output	<5 mW/mm <sup>2</sup>
Enclosure type rating	None (open-style)
North American temp code	T5
ATEX temp code	T5
IECEx temp code	T5

(1) Includes all loss that is associated with the fiber link, including splices, fiber attenuation, bulkhead connectors, and the ST terminations.

**Table 11 - Environmental Specifications - 1786-RPFS**

Attribute	1786-RPFS
Temperature, operating	0...60 °C (32...140 °F)
IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating	-40...85 °C (-40...185 °F)
IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	
Relative humidity	5...95% noncondensing
IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	
Vibration	5 g @ 10...500 Hz
IEC60068-2-6 (Test Fc, Operating)	
Shock, operating	30 g
IEC60068-2-27 (Test Ea, Unpackaged Shock)	
Shock, nonoperating	50 g
IEC60068-2-27 (Test Ea, Unpackaged Shock)	
Emissions	IEC 61000-6-4
ESD immunity	6 kV contact discharges 8 kV air discharges
IEC 61000-4-2	
Radiated RF immunity	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz and 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
IEC 61000-4-3	

**Table 12 - Certifications<sup>(1)</sup> - 1786-RPFS**

<b>Certification<sup>(2)</sup></b>	<b>1786-RPFS</b>
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A, B, C, D Hazardous Locations. See CSA File LR69960C.
FM	FM Approved Equipment for use in Class I Division 2 Group A, B, C, D Hazardous Locations
CE	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>• EN 61000-6-2; Industrial Immunity</li> <li>• EN 61000-6-4; Industrial Emissions</li> <li>• EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
C-Tick	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> <li>• AS/NZS CISPR 11; Industrial Emissions</li> </ul>
Ex	European Union 94/9/EC ATEX Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 60079-0; General Requirements</li> <li>• EN 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>• EN 60079-28; Explosive atmospheres, Protection of equipment and transmission systems using optical radiation</li> <li>• II 3 G Ex nA op is IIC T5 Gc</li> <li>• SIRA14ATEX4171X</li> </ul>
IECEx	IECEx System, compliant with: <ul style="list-style-type: none"> <li>• IEC 60079-0; General Requirements</li> <li>• IEC 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>• IEC 60079-28; Explosive atmospheres, Protection of equipment and transmission systems using optical radiation</li> <li>• II 3 G Ex nA op is IIC T5 Gc</li> <li>• IECExSIR14.0048X</li> </ul>
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Framework Act on Telecommunications and Radio Waves Act
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When product is marked.

(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

## 1786-RPFM ControlNet Modular Repeater Medium-distance Fiber Module

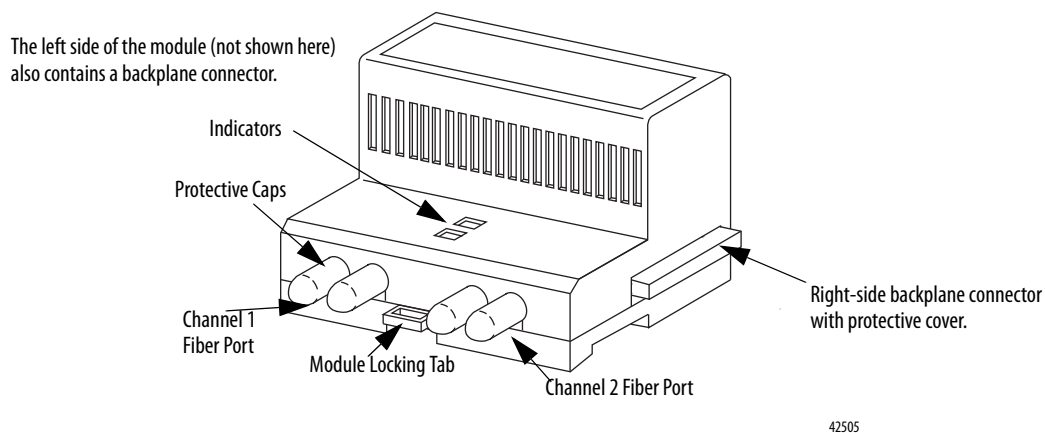
Use the 1786-RPFM module when you need a medium-distance fiber link between two ControlNet products. Maximum distance is 3000 m (9843 ft). The fiber link provides ground isolation between nodes and is less susceptible to noisy environments than copper media.

A maximum of four modules can attach to the 1786-RPA/B repeater adapter, and the total power consumption of the modules cannot exceed 1.6 A @ 5V DC, whichever comes first.

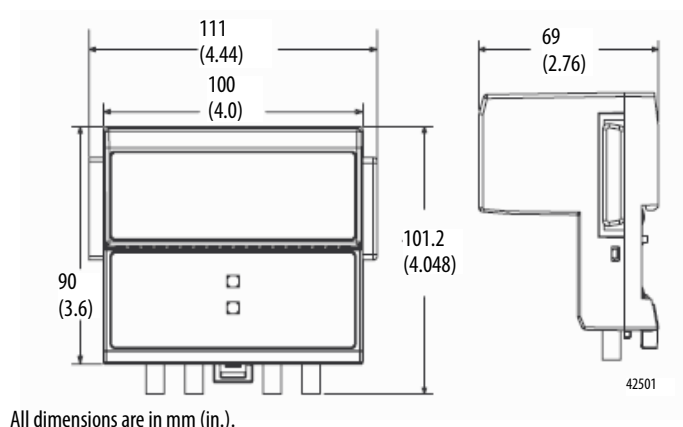
- 
- IMPORTANT**
- If you exceed the module or power limit, you can damage the repeater adapter and modules.
  - The supported distance depends on the quality of the fiber, number of splices, and connectors. The total light loss through the fiber link must be less than 13.3 dB.
- 

### Module Components

The illustration shows the components that comprise the 1786-RPFM module.



### Mounting Dimensions



## Select Fiber Cable

The type of fiber cable you choose depends on the network environment. The quality of fiber cable determines the distance that you can achieve. The maximum length of a fiber cable section for the module depends on the quality of fiber, number of splices, and the number of connectors. The total attenuation for a cable must be less than 13.3 dB. Typically, cable attenuation for a wavelength of 1300 nm is less than 1.5 dB/km.

See the specification table on [page 21](#) and also to the ControlNet Fiber Media Planning and Installation Guide, publication [CNET-IN001](#), for more details.

Also, consult with your local distributor for attenuation specifications before you purchase your fiber media components.

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**IMPORTANT** Avoid splicing your cable. Connectors can cause considerable attenuation and limit the maximum length of your system. Verify the attenuation of different cable sections after you install the cable.

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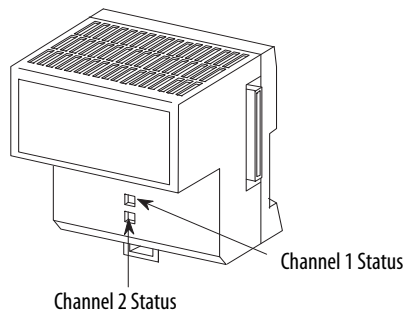
## Terminate Your Cable

You must terminate a medium distance cable in the field. To terminate, we recommend that you cover unused ports with a suitable protector cap to prevent dust and other contaminants from damaging the fiber transceiver ports.

For unused ports, we recommend that you place a simplex jumper between the transmit port and receive port of an unused channel.

## Status Indicators

Use the channel 1 or 2 status indicators to check module status and troubleshoot the module.



30041

Indicator	Probable Cause
Off	The repeater is not connected to the power supply.
Green	Channel is operating normally.
Flashing Green	No activity on the channel.



**ATTENTION:** Class 1 laser product. Laser radiation is present when the system is open and interlocks bypassed. Allow only trained and qualified personnel to install, replace, or service this equipment.

## Specifications

**Table 13 - Technical Specifications - 1786-RPFM**

Attribute	1786-RPFM
Voltage and current ratings	Backplane: 400 mA @ 5V DC max
Power Consumption	2 W max
Power Dissipation	2 W max
Communication rate	5 Mbps
Mounting orientation	Any mounting orientation
Minimum enclosure size (HxWxD), approx	304.8 x 196.8 x 101.6 mm (12 x 7.75 x 4 in.)
Fiber type	62.5/125 Micron multimode OM-1 fiber
Power level	
TX power, min	(-16 dBm) @ 25 °C (77 °F) into 62.5/125 µm Micron multimode fiber (-19.5 dBm) @ 25 °C (77 °F) into 50/125 µm Micron multimode fiber
RX responsivity, min	-32.8 dBm @ 25 °C (77 °F)
Fiber termination type ST	Plastic or ceramic
Fiber operation wavelength	1300 nm
Optical power budget	13.3 dB <sup>(1)</sup>
Transmitter output	<5 mW/mm <sup>2</sup>
Enclosure type rating	None (open-style)
North American temp code	T5
ATEX temp code	T5
IECEX temp code	T5

(1) Includes all loss that is associated with the fiber link, including splices, fiber attenuation, bulkhead connectors, and the ST terminations.

**Table 14 - Environmental Specifications - 1786-RPFM**

Attribute	1786-RPFM
Temperature, operating	0...60 °C (32...140 °F)
IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating	-40...85 °C (-40...185 °F)
IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	
Relative humidity	5...95% noncondensing
IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	
Vibration	5 g @ 10...500 Hz
IEC60068-2-6 (Test Fc, Operating)	

**Table 14 - Environmental Specifications - 1786-RPFM**

Attribute	1786-RPFM
Shock, operating IEC60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating IEC60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz and 1890 MHz 3V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz

**Table 15 - Certifications<sup>(1)</sup> - 1786-RPFM**

Certification <sup>(2)</sup>	1786-RPFM
UL	UL Listed Industrial Control Equipment. See UL File E65584.
CSA	CSA Certified Process Control Equipment. See CSA File LR54689C. CSA Certified Process Control Equipment for Class I, Division 2 Group A, B, C, D Hazardous Locations. See CSA File LR69960C.
FM	FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations
CE	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> <li>EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>EN 61000-6-2; Industrial Immunity</li> <li>EN 61000-6-4; Industrial Emissions</li> <li>EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
C-Tick	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> <li>AS/NZS CISPR 11; Industrial Emissions</li> </ul>
Ex	European Union 94/9/EC ATEX Directive, compliant with: <ul style="list-style-type: none"> <li>EN 60079-0; General Requirements</li> <li>EN 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>EN 60079-28; Explosive atmospheres, Protection of equipment and transmission systems using optical radiation</li> <li>II 3 G Ex nA op is IIC T5 Gc</li> <li>SIRA14ATEX4171X</li> </ul>
IECEx	IECEx System, compliant with: <ul style="list-style-type: none"> <li>EN 60079-0; General Requirements</li> <li>EN 60079-15; Potentially Explosive Atmospheres, Protection "n"</li> <li>EN 60079-28; Explosive atmospheres, Protection of equipment and transmission systems using optical radiation</li> <li>II 3 G Ex nA op is IIC T5 Gc</li> <li>IECExSIR14.0048X</li> </ul>
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

(1) When product is marked.

(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

## 1786-RPFRL/B, 1786-RPFRXL/B ControlNet Fiber-optic Ring Repeater Modules

The ControlNet Fiber-optic Ring Repeater module supports fiber media redundancy by using a ring topology. The fiber-optic technology permits long (1786-RPFRL/B module) or extra long (1786-RPFRXL/B module) transmission ranges. Both modules provide optimum protection against EMI effects along the transmission link and at the repeaters themselves. The fiber link provides ground isolation between nodes and is less susceptible to noisy environments than traditional copper media.

The 1786-RPFRL/B and 1786-RPFRXL/B modules provide:

- Two fiber channels
- Activity status indicators for each fiber channel
- Relay contact connector for communication and system status

You must use an Adapter (1786-RPA/B) with the 1786-RPFRL/B or 1786-RPFRXL/B modules to provide power to all repeaters, and control the flow of data from one repeater to the next.

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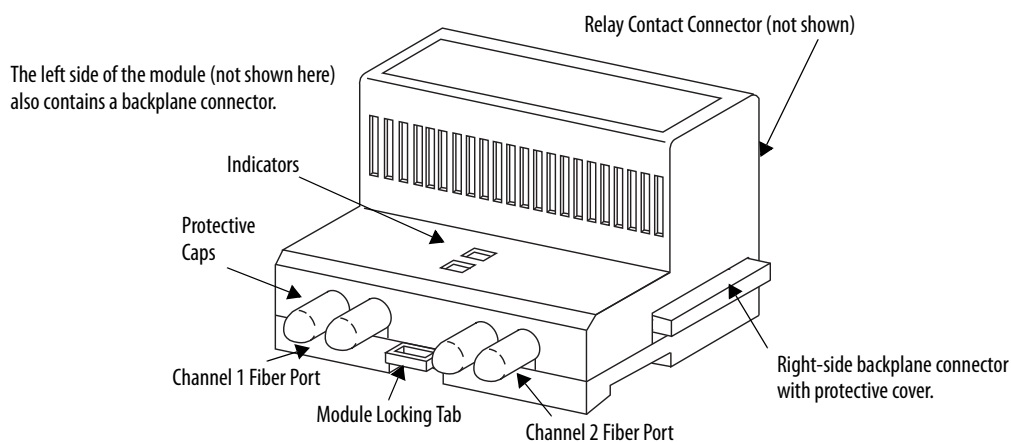
**IMPORTANT** The distance between repeaters that can be supported is dependent on the quality of the fiber, number of splices, and connectors. The total loss of the fiber link must be less than 15 dB for the 1786-RPFRL/B module and 10.5 dB for the 1786-RPFRXL/B module.

The total size of the ring or length of the copper and fiber ControlNet network is limited by the ControlNet protocol to 20 km or less. See Determine Maximum Network Length on [page 27](#) for more information.

To determine the maximum distance between any two fiber modules, refer to the table on [page 26](#).

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### Module Components



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## About Fiber Topology

The 1786-RPFRL/B or 1786-RPFRXL/B long or extra-long modules can be used to create a redundant optical link between segments. When used in a ring topology, a media failure between any two repeater modules in a ring does not affect the communication link.

The repeaters detect the failure of an optical link. When a failure occurs, the affected channel port status indicator displays one of the following:

- Red, indicating a faulty link
- Flashing green/off, indicating no network activity is present

See Status Indicators on [page 29](#) for more information.

In addition, a relay contact connector on the 1786-RPFRL/B and 1786-RPFRXL/B modules indicates a remote faulty link. See [page 30](#) for more information on the relay contact connector.

We recommend that you install the duplex optical cables of the two optical channels along different routes. For more information on cabling, refer to the ControlNet Fiber Media Planning and Installation Guide, publication [CNET-IN001](#).

The fiber repeater consists of the following:

- A 1786-RPA/B repeater adapter
- Up to two 1786-RPFRL/B or 1786-RPFRXL/B long or extra-long fiber repeater modules
- Up to four 1786-RPCD copper fiber repeater modules
- Up to four 1786-RPFS or 1786-RPFM short- or medium-distance fiber repeater modules

The maximum number of repeater modules (in any combination) you can use in a configuration is dependent on the current draw of each repeater module. Total current draw supplied by the 1786-RPA/B repeater adapter cannot exceed 1.6 A @ 5V DC.

You can also use the fiber repeater to do the following:

- Extend the total length of your segment
- Create a point-to-point or star configuration (multiple directions from one point)
- Provide electrical isolation and immunity to interference
- Use in hazardous areas

The number of fiber repeaters and cable length total limit depends on your network topology.



## Example Topology Application

For more information on topology application rules in relation to fiber rings, refer to the ControlNet Fiber Media Planning and Installation Guide, publication [CNET-IN001](#).

**IMPORTANT** You cannot have media redundancy if you have a closed-loop ring installation anywhere in the network. You can use the 1786-RPFRL/B, 1786-RPFRXL/B, 1786-RPFM, or 1786-RPFS modules in a linear fiber topology.

Do not mix fiber repeater modules to achieve a ring topology and 1786-RPFM modules to achieve a redundant media topology in one configuration.

For additional topology configurations, refer to Allowable Configurations When Using Repeaters in a Ring Topology on ControlNet, Knowledgebase Technical Note [ID 32215](#).

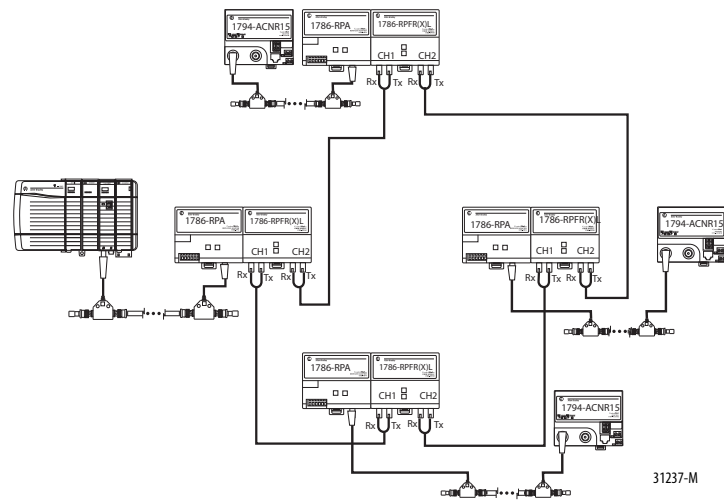
### Fiber-optic Ring Topology

Use this configuration for long distances. A fiber-optic ring can contain as many as 20 member modules. These member modules (four shown in [Figure 2](#)) include the following:

- 1786-RPA/B repeater adapter
- 1786-RPFRL/B long-distance ring repeater module
- 1786-RPFRXL/B extra long-distance ring repeater module

**T** You cannot exceed 20 repeater modules in a series. If a ring is broken, whether accidentally or on purpose for testing, the configuration then becomes linear and the number of repeaters depends on where the ring is broken.

**Figure 2 - Fiber Ring Topology Example**



On all fiber repeater modules, the leftmost connector is the RX (Receive) port; the rightmost connector is the TX (Transmit) port.



**ATTENTION:** Be certain that the adapter and repeater modules are secured together with DIN rail anchors. Failure to do so can result in the loss of communication and/or damage to the modules. A maximum of four modules can attach to the 1786-RPA/B repeater adapter, and the total power consumption of the modules cannot exceed 1.6 A @ 5V DC, whichever comes first. The 1786-RPFRL/B and 1786-RPFRXL/B modules require 570 mA each, therefore you can attach only two of these modules to a 1786-RPA/B repeater module. If you exceed the module or power limit, you can damage the modules and repeater adapter.

## Choose Fiber-optic Cable for the Module

The type of fiber cable you choose to use depends on the network environment. Consult your installation professional to determine the proper cable type to use for your environmental conditions. See the ControlNet Fiber Media Planning and Installation Guide, publication [CNET-IN001](#), for details.

## Understand the Maximum Optical Power Budget

This table shows the maximum optical power budget available for different cable types. The 1786-RPFRL/B module cannot be used with single-mode fiber.

Module	Cable Type	Optical Power Budget	Termination Type
1786-RPFRL/B	62.5/125 $\mu\text{m}$ , multimode, 1300 nm, graded index	15 dB	ST connectors, plastic or ceramic; no metal connectors
1786-RPFRXL/B	62.5/125 $\mu\text{m}$ , multimode, 1300 nm, graded index	10.5 dB	
	9/125 $\mu\text{m}$ , single mode, 1300 nm, graded index		

The sample formulas in the example illustrate how you can determine the total loss for fiber-optic cables in your system configuration. The values that we use in the formulas are typical: yours can vary, depending on your application.

### EXAMPLE Determining total loss for fiber-optic cables

The total loss of the fiber-optic cable between two modules must not exceed the optical power budget. The total loss is the sum of each connector loss plus the loss of the fiber plus the loss that is associated with the splices in the system, if any. The total loss can be determined as follows:

$$\text{Total loss} = [(\text{loss per connector}) \times (\text{the number of connectors})] + [(\text{loss per km of fiber}) \times (\text{km of fiber})] + [(\text{other losses})]$$

For example, with two connectors, each having 0.3 dB of loss,

10 km of multimode fiber with a loss of 1 dB/km, and no splices, the total loss is 10.6 dB. See the following formula:

$$\text{Total loss} = [(0.3 \text{ dB} \times 2) + (1 \text{ dB/km} \times 10 \text{ km})]$$

$$\text{Total loss} = 10.6 \text{ dB}$$

This fiber-optic cable is acceptable for use between two 1786-RPFRL/B modules because the total loss is less than the optical power budget of 15 dB. However, this cable could not be used with the 1786-RPFRXL/B module because the total loss exceeds the optical power budget of 10.5 dB.

## Determine Maximum Network Length

The quality of the fiber cable determines the maximum distance between modules in a networked system. The delay in the system (described in Table 16) determines the maximum length that you can achieve with your network.

The worst-case delay (between any nodes) must be less than 121  $\mu$ s. This table lists worst-case delays for physical layer components.

**Table 16 - Worst-case Delay**

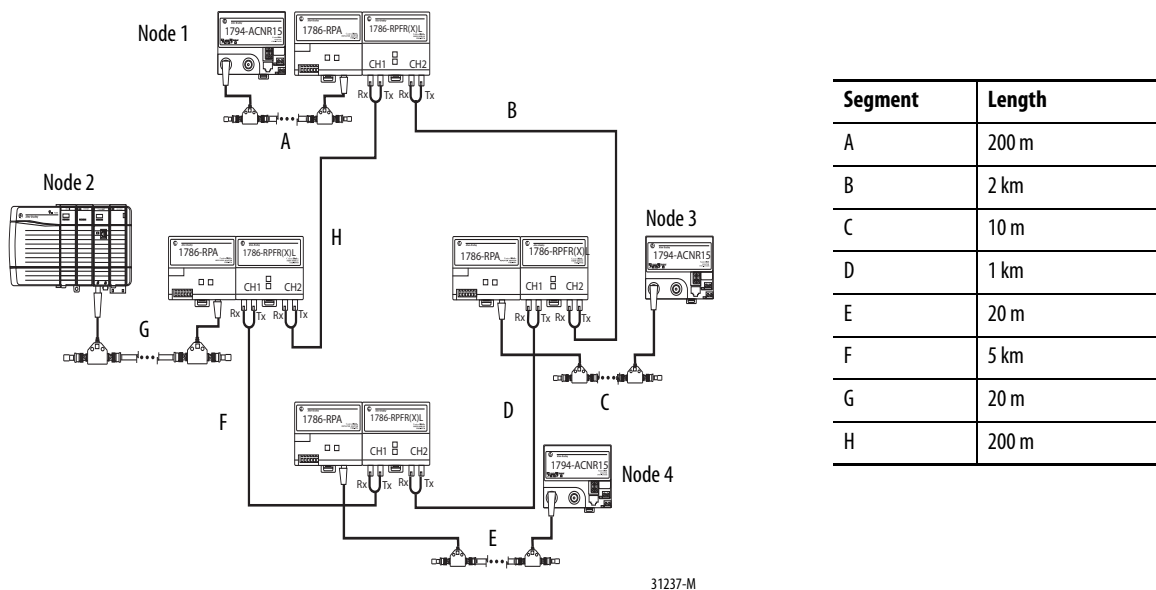
Component	Delay
Coaxial cable	4.17 ns/m
Fiber	5.01 ns/m
1786-RPA/B module	901 ns
1786-RPFM module	153 ns
1786-RPFS module	94 ns
1786-RPCD module	100 ns
1786-RPFRL/B 1786-RPFRXL/B modules	100 ns

**TIP** When determining the worst-case delay for your system, consider how many components you want to use. The worst-case delay determines the maximum network length. You can use up to 20 fiber repeater modules in a ring or series as long as you do not exceed the maximum network length.

The maximum cable distance (that is, the longest route between any two adjacent or non-adjacent nodes) is limited by the ControlNet protocol to 20 km or less.

See [Figure 3](#) on [page 27](#) and the example on [page 28](#) to understand how to determine the worst-case delay for your system.

**Figure 3 - Determine Worst-case Delay**



**EXAMPLE Determining worst-case delays**

This example shows you in a simple way how to account for worst-case delays.

To determine the worst-case delay in a ring topology, first disregard the shortest fiber segment in the system.

In [Figure 3 on page 27](#), the shortest segment is segment H, with the 200 m fiber. Remove segment H. You see that the worst-case delay is now between nodes 1 and 2.

You must account for worst-case delays that the physical media introduces when configuring the media configuration screen in RSNetWorx™ software. If too many components with too great a delay are entered into RSNetWorx for ControlNet software, the delay becomes too great for the bandwidth RSNetWorx software has available. This delay affects system performance and limits network length. If you do not account for all media components in the worst-case delay path, erratic network operation can result. See the documentation that is supplied with RSNetWorx for more information on system delays. In this example, you enter the total length of all media components between nodes 1 and 2 into RSNetWorx for ControlNet software. The totals of the components between nodes 1 and 2 are as follows, as specified in [Table 16 on page 27](#):

**Coax media delay:** 200 m (A) + 20 m (G) = 220 m x 4.17 ns

Fiber media delay: 2 km (B) + 1 km (D) + 5 km (F) = 8 km x 5.01 ns

**1786-RPA/B module delay:** 1 (at node 1) + 1 (at node 3) + 1 (at node 4) + 1 (at node 2) = 4 x 901 ns

**1786-RPFRL/B or 1786-RPFRXL/B module:** 1 (at node 1) + 1 (at node 3) + 1 (at node 4) + 1 (at node 2) = 4 x 100 ns

In summary:

**Worst-case delay** = 220 x 4.17 + 8000 x 5.01 + 4 (901) + 4 (100) = 45 μs

This delay is acceptable because 45 μs is less than the maximum allowable delay of 121 μs.

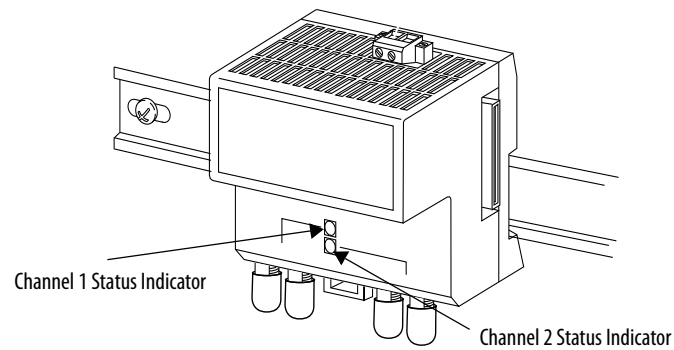
## Configure the Network SMAX Parameter in RSNetWorx Software

You must configure the SMAX parameter in RSNetWorx for ControlNet software to use with the 1786-RPFRL/B or 1786-RPFRXL/B module. The SMAX parameter sets the maximum scheduled node address on a ControlNet network. See the documentation that is supplied with the RSNetWorx for ControlNet software.

You must set the SMAX parameter at least one node number higher than the highest used scheduled node number. For example, on a network with 49 scheduled nodes (with 49 being the highest used scheduled node number), you must set SMAX to at least 50. In this example, node number 50 is an unused scheduled node number.

**IMPORTANT** When setting the SMAX parameter, you must allow one unused scheduled node address. This unused node address must be the highest available scheduled node number. Therefore, the maximum usable node address when using the 1786-RPFRL/B or 1786-RPFRXL/B module is 98.

## 1786-RPFRL/B or 1786-RPFRXL/B Status Indicators

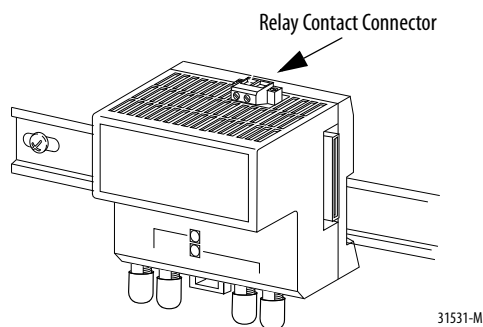


**Table 17 - Fiber Repeater Module Status Indicators**

Status Indicator State	Description	Action
Off	Fiber repeater module is not connected to the power supply.	Connect the repeater to the power supply.
Green	Fiber repeater module is running without network errors.	Do nothing. The fiber repeater module is operating properly.
Flashing green/off	No data activity on network.	If the cable is attached, do the following: <ul style="list-style-type: none"> <li>• Ensure that the receive (RX) channel is connected to the transmit (TX) channel on both modules.</li> <li>• Check for broken fiber.</li> </ul>
Flashing red/off	Module is powered, but not ready for operation. This state also occurs during module reset and last for approximately 5 seconds.	Do nothing. The fiber repeater module is operating properly.
Intermittent red	As more data errors are detected the frequency of the flashing red increases until a solid red displays.	Check for proper operation.
Red	Excessive receive signal distortion.	Review these items: <ul style="list-style-type: none"> <li>• Be certain that you are using the correct fiber type for your module.</li> <li>• Check fiber length and attenuation to make sure that it is within specification.</li> <li>• Replace the downstream 1786-RPFRL module on the channel that is having the intermittently flashing red status indicator.</li> <li>• Be certain that your total network length is not out of specification.</li> <li>• Be certain that SMAX is correctly defined in the RSNetWorx for ControlNet software.</li> </ul>

## 1786-RPFRL/B or 1786-RPFRXL/B Relay Contact Connector

The fiber repeater module contains an electromechanical relay for communication and system status.



**Table 18 - Relay Contact Connector Diagnostics**

If	Then
<ul style="list-style-type: none"> <li>No receive data is present at one or both fiber-optic ports for more than 1300 ms. For example, if either Channel 1 or Channel 2 status indicators are not solid green, the fault relay opens.</li> <li>The repeater is not connected to the power supply.</li> </ul>	The relay contact is open.
<ul style="list-style-type: none"> <li>Neither of the above two conditions are met.</li> </ul>	The relay contact is closed.

## Specifications

**Table 19 - Technical Specifications - - 1786-RPFRL/B, 1786-RPFRXL/B**

Attribute	1786-RPFRL/B, 1786-RPFRXL/B
Voltage and current ratings	Input: 570 mA @ 5V DC, max Relay: 900 mA @ 30V DC, Class 2, resistive only
Power consumption	2.8 W max
Power dissipation	2.8 W max
Communication rate	5 Mbps
Mounting orientation	Any mounting orientation
Relay contact connector voltage	30V DC, max
Relay contact connector current consumption	1 mA, min; 900 mA, max
Relay contact load type	Resistive only
Isolation voltage	50V (continuous), Basic insulation type, Relay contacts to system
Wire size	0.25... 2.5 mm <sup>2</sup> (22...14 AWG) solid or stranded copper wire that is rated at 105 °C (221 °F), or greater, 1.2 mm (3/64 in.) insulation max for relay connections
Wiring category	2 - on relay ports <sup>(1)</sup>
Enclosure type rating	None (open-style)
North American temp code	T4A

(1) Use this Conductor Category information for planning conductor routing. See Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

**Table 20 - Environmental Specification - 1786-RPFRL/B, 1786-RPFRXL/B**

<b>Attribute</b>	<b>1786-RPFRL/B, 1786-RPFRXL/B</b>
Temperature, operating  IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	0...60 °C (32...140 °F)
Temperature, surrounding air, max	60 °C (140 °F)
Temperature, nonoperating  IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...85 °C (-40...185 °F)
Relative humidity  IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration  IEC60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating  IEC60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Shock, nonoperating  IEC60068-2-27 (Test Ea, Unpackaged Shock)	50 g
Emissions	IEC 61000-6-4
ESD immunity  IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity  IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 MHz and 1890 MHz 1V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity  IEC 61000-4-4	±4 kV at 5 kHz on relay ports
Surge transient immunity  IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on relay ports
Conducted RF Immunity  IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

**Table 21 - Certifications<sup>(1)</sup> - 1786-RPFRL/B, 1786-RPFRXL/B**

Certification <sup>(2)</sup>	1786-RPFRL/B, 1786-RPFRXL/B
c-UL-us	UL Listed for Class I, Division 2 Group A, B, C, D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE <sup>(3)</sup>	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>• EN 61000-6-2; Industrial Immunity</li> <li>• EN 61000-6-4; Industrial Emissions</li> <li>• EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
RCM	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> <li>• AS/NZS CISPR 11; Industrial Emissions</li> </ul>
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3
EAC	Russian Customs Union TR CU 020/2011 EMC Technical Regulation Russian Customs Union TR CU 004/2011 LV Technical Regulation

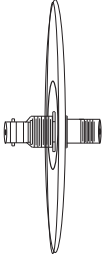
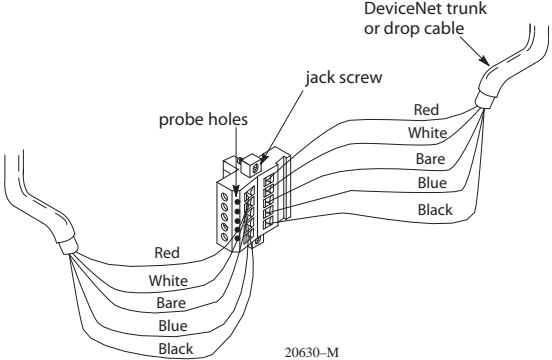
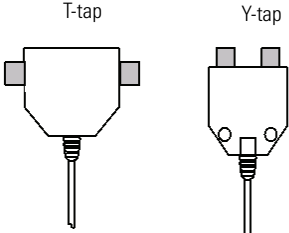
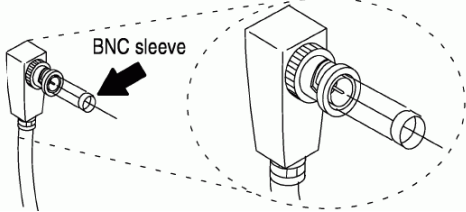
(1) When product is marked.

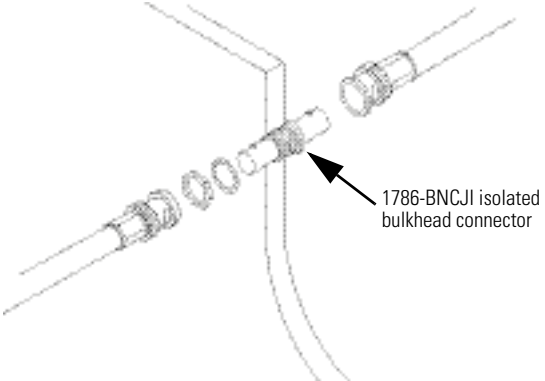
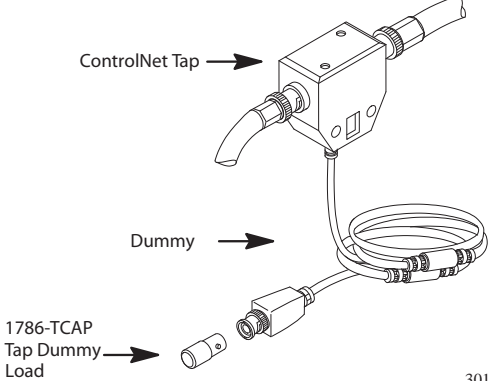
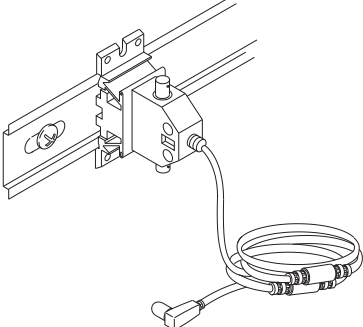
(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

(3) To comply with the CE Low Voltage Directive (LVD), the relay connection power source must comply with safety extra low voltage (SELV) or protected extra low voltage (PELV).



## Connectors and Taps

Product	Catalog Number	Description
ControlNet coax adapter	1786-BNC2TNC	<p>Use the BNC2TNC Coax adapter to connect a BNC coax cable segment to a TNC coax cable segment. With the adapter you can isolate a segment, install the adapter in a cabinet, or install the adapter in a wall.</p> 
ControlNet 10-pin linear plug	1787-PLUG10R	<p>Use the 10-pin linear plug for making a thick or thin cable daisy-chain segment. It has jack screws that you can use with devices that have a mating header with screw flanges.</p> 
ControlNet coax taps	1786-TPR, 1786-TPS, 1786-TPYR, 1786-TPYS	<p>The ControlNet taps are available in two body types to accommodate the connections for your installation.</p> 
ControlNet BNC tap sleeve	Part number 94238101	<p>The nickel-plated ControlNet BNC sleeve helps prevent the shield -inside the BNC connector- from compressing after the shield has been repeatedly connected to a ControlNet device. Using the sleeve improves the shield connection to the ControlNet device that the tap is connected to.</p> 

Product	Catalog Number	Description
ControlNet standard and high-flex coax cable	1786-RG6, 1786-RG6F	A ControlNet segment has one or more sections of trunk cable that is separated by taps and terminated at both ends. The total cable length of a segment is equal to the sum of all trunk-cable sections.
ControlNet Isolated Bulkhead Connector	1786-BNCJIConnector	The isolated bulkhead connector allows ControlNet cable trunk lines to pass through metal enclosures. The isolated bulkhead connector prevents the ControlNet cable from inadvertently being grounded to metallic surfaces that can cause noise on a network. Any number of isolated bulkhead connectors can be placed in a system.
ControlNet tap dummy load	1786-TCAP	<p>The tap dummy load terminates a tap not in use, and lets you install extra taps on your trunk line without installing ControlNet nodes. Using tap dummy load facilitates the maintenance of your network by holding a space for a node to be added in the future. You can use the tap dummy load on any number of taps in your ControlNet system.</p> 
ControlNet IP67 tap and cable assembly kit	1786-TCT2BD1, 1786-TPST2T, 1786-TPRT2T	<p>The tap dummy load terminates a tap not in use, and lets you install extra taps on your trunk line without installing ControlNet nodes. Using tap dummy load facilitates the maintenance of your network by holding a space for a node to be added in the future. You can use the tap dummy load on any number of taps in your ControlNet system.</p>  <p style="text-align: right;">30131-M</p>
ControlNet IP67 tap and cable assembly kit	1786-TCT2BD1, 1786-TPST2T, 1786-TPRT2T	<p>The kit contains a tap body and a 1-meter drop cable with overmolded connectors. The drop cable has a TNC connector at the tap body end, and either a BNC or TNC connector at the ControlNet node end (depending on the kit). The tap and cable are rated to IP67 when mated to a sealed connector, which means they are water-tight.</p> 

**Notes:**

## Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

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