



ControlNet Dual Copper Repeater Module

Catalog Number 1786-RPCD

This document describes how to install and apply the 1786-RPCD dual copper repeater module.

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Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://www.ab.com/manuals/gi>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





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.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.

<p>WARNING</p> 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
<p>IMPORTANT</p>	Identifies information that is critical for successful application and understanding of the product.
<p>ATTENTION</p> 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you: <ul style="list-style-type: none">• identify a hazard• avoid a hazard• recognize the consequence
<p>SHOCK HAZARD</p> 	Labels may be located on or inside the equipment to alert people that dangerous voltage may be present.
<p>BURN HAZARD</p> 	Labels may be located on or inside the equipment to alert people that surfaces may be dangerous temperatures.

ATTENTION**Environment and Enclosure**

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as “open type” equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

NOTE: See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 (“Industrial Automation Wiring and Grounding Guidelines”), for additional installation requirements pertaining to this equipment.

ControlNet is a trademark of ControlNet International, Inc.

ATTENTION



Preventing Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch connectors or pins on component boards.
 - Do not touch circuit components inside the equipment.
 - If available, use a static-safe workstation.
 - When not in use, store the equipment in appropriate static-safe packaging.
-

ATTENTION



This product is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (e.g., aluminum, plastic, etc.) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding.

European Hazardous Location Approval

If you install the module in a European Zone 2 location, consider:

ATTENTION



European Zone 2 Certification (The following applies when the product bears the EEx Marking)

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC.

The LCIE (Laboratoire Central des Industries Electriques) certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in potentially explosive atmospheres, given in Annex II to this Directive. The examination and test results are recorded in confidential report No. 28 682 010.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 50021.

IMPORTANT

This equipment is not resistant to sunlight or other sources of UV radiation.



The secondary of a current transformer shall not be open-circuited when applied in Class I, Zone 2 environments.

Equipment of lesser Enclosure Type Rating must be installed in an enclosure providing at least IP54 protection when applied in Class I, Zone 2 environments.

This equipment shall be used within its specified ratings defined by Allen-Bradley.

Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Class I, Zone 2 environments.

North American Hazardous Location Approval

<p>The following information applies when operating this equipment in hazardous locations:</p>	<p>Informations sur l'utilisation de cet équipement en environnements dangereux:</p>
<p>Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.</p>	<p>Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.</p>
<p>WARNING</p> 	<p>EXPLOSION HAZARD</p> <ul style="list-style-type: none"> Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. Substitution of components may impair suitability for Class I, Division 2. If this product contains batteries, they must be changed only in an area known to be nonhazardous.
<p>AVERTISSEMENT</p> 	<p>RISQUE D'EXPLOSION</p> <ul style="list-style-type: none"> Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. S'assurer que l'environnement est classé non dangereux avant de changer les piles.

WARNING

If you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. If you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

WARNING

If you connect or disconnect the communications cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

About the Dual Copper Repeater Module

Use this copper repeater module when the:

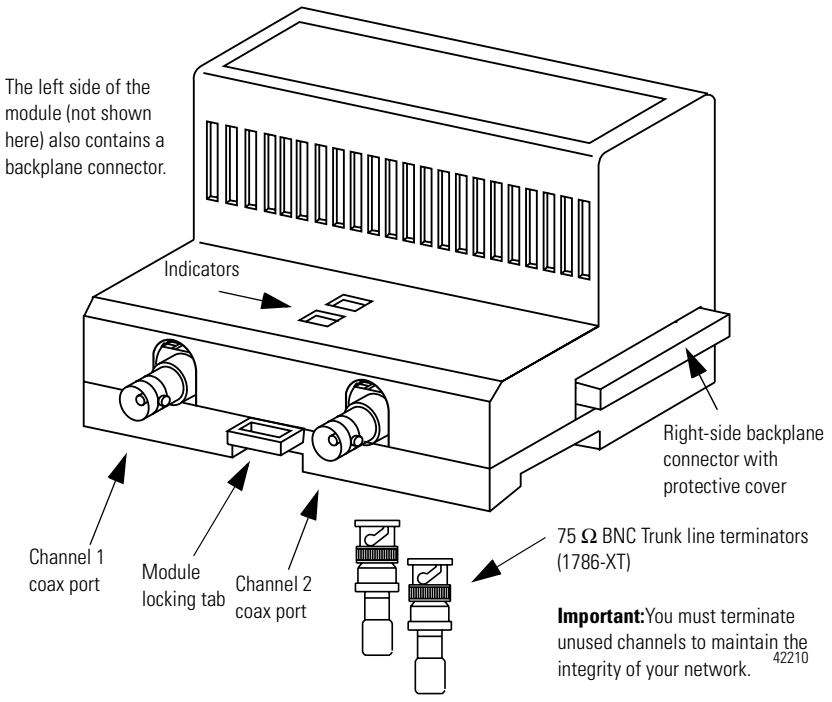
- design of the network requires a hub-based topology
- segment requires a greater copper distance
- design requires an isolated segment
- number of nodes requires the use of repeaters (refer to Understand Constraints of the Coax Segment on page 1-17)

The copper repeater module allows multiple 1000m copper segments to be attached to a repeater adapter (1786-RPA). See pages 15-18 for topology examples and segment length constraints.

The module provides two copper channels and activity status indicators for each channel.

8 ControlNet Dual Copper Repeater Module

The figure below identifies the components of the module:



Mount the Repeater Module

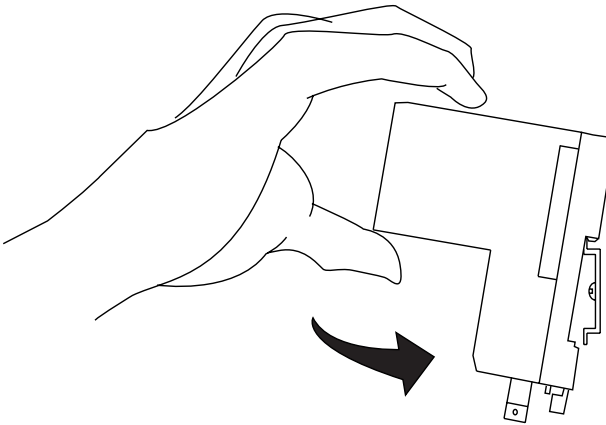
To mount the module on the DIN rail:

ATTENTION



This product is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (e.g., aluminum, plastic, etc.) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding.

1. Position the module on the 35×7.5mm DIN rail (Allen-Bradley part number 199-DRI; 46277-3; EN 50022) at a 30° angle.



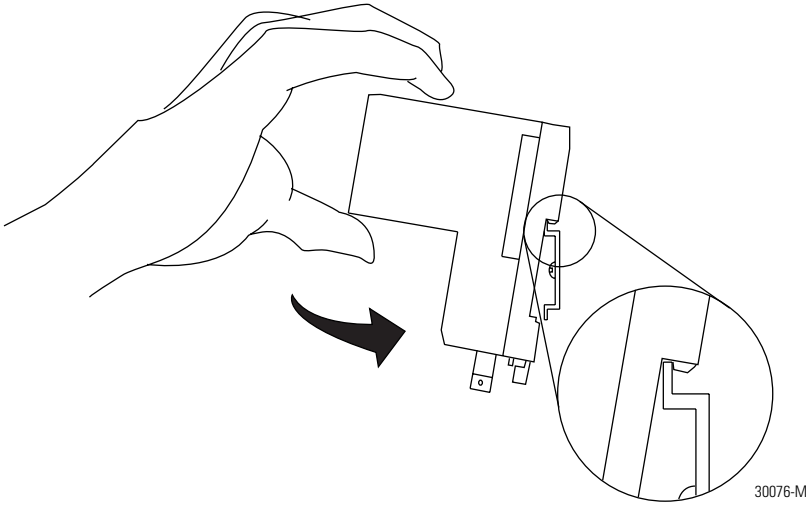
30074-M

IMPORTANT

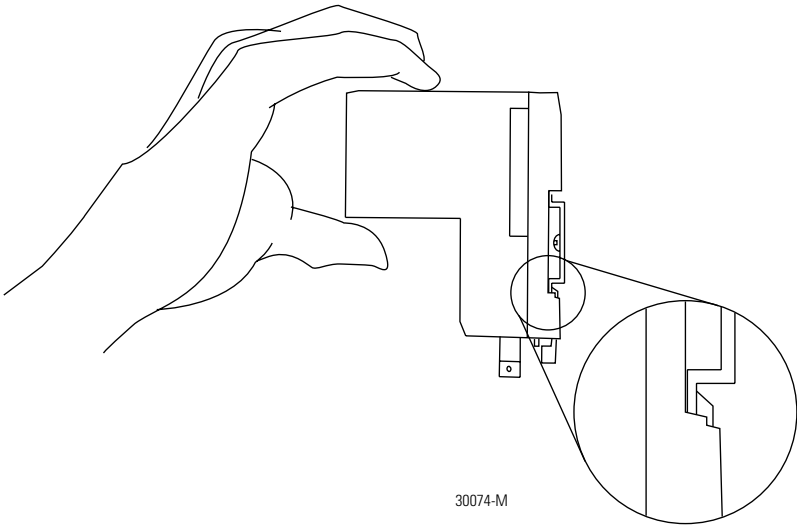
To ensure proper operation of the 1786-RPCD repeater module, you must position the 1786-RPCD module to the left of any 1786-RPFRL or 1786-RPFRXL repeater modules in your configuration.

2. Hook the module lip (on the rear of the module) onto the top of the DIN rail and rotate the module onto the rail.
3. Press the module down to the DIN rail until the module is flush with the rail.

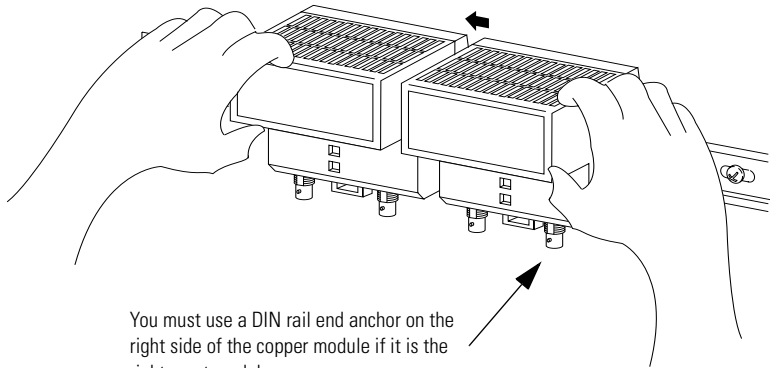
The locking tab should snap into position and lock the module onto the DIN rail. If the tab does not snap into position, follow step 4. If the tab does snap into position, go to step 5.



4. Use a screwdriver to move the locking tab down while you press the module flush onto the DIN rail. Release the locking tab to secure the module in place. If necessary, push up on the locking tab to secure the module in place.



- Once you attach the modules to the DIN rail, slide the modules to the left to attach to the repeater adapter or another repeater module.



31493-M

IMPORTANT

Because the 1786-RPCD repeater module is part of the modular family of ControlNet repeaters, you must use the 1786-RPA repeater adapter to supply power and coordinate the modules' TX and RX function.

To ensure proper operation of the 1786-RPCD repeater module, you must position the 1786-RPCD module to the left of any 1786-RPFRL or 1786-RPFRXL repeater modules in your configuration.

IMPORTANT

You can attach a maximum of four repeater modules (1786-RPCD) to a repeater adapter (1786-RPA). If you exceed the repeater limit, you may cause damage to the repeater adapter and repeaters. Four repeaters can draw up to 1.6A @ 5V dc in power consumption. If you exceed this power limit, you may cause damage to the repeater adapter and repeaters.

- Use DIN rail end anchors to secure the units together.

ATTENTION

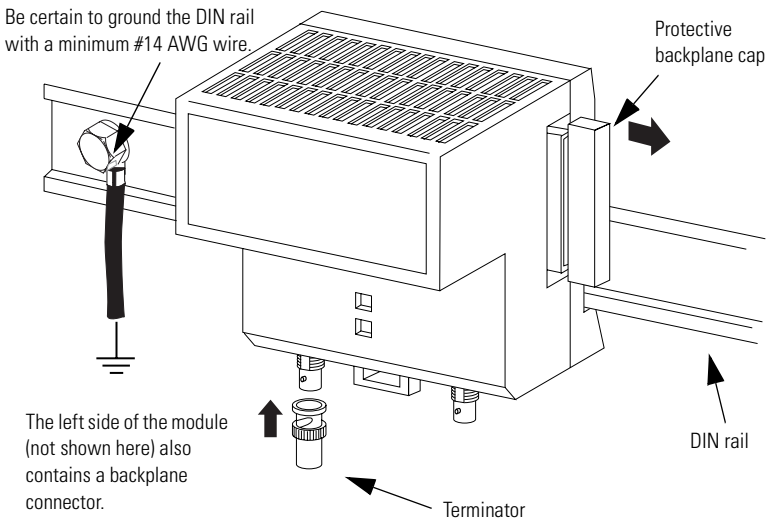
Be certain that you secure the adapter and repeater modules together with DIN rail end anchors. Failure to do so may result in loss of communication and/or damage to modules.

- Connect terminators to unused channels as shown in Use Trunk Line Terminators on page 12.

8. Connect the module wiring as shown in Connect the Module For Coax Channels 1 and 2 on page 14.
9. Ground your DIN rail in accordance with local codes using a minimum #14 AWG wire. See page 12 for DIN rail ground wire example.

Use Trunk Line Terminators

When you are not connecting a trunk line to a channel on the 1786-RPCD repeater module, connect a 75 Ω terminating resistor (1786-XI) to maintain the integrity of your network.



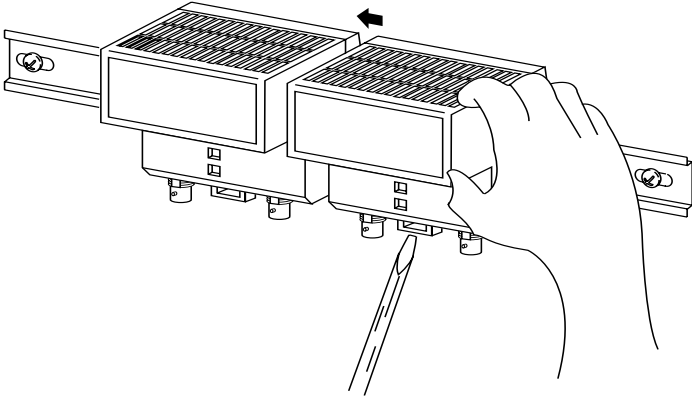
31494-M

If:	Then:
you are not going to use a channel	keep the terminator on an unused channel for optimal network performance
you connect another repeater module or repeater adapter to the right backplane connector	remove the protective backplane cap and save the cap for future use
you are not going to connect a module to the right backplane connector	leave the backplane cap attached
the module is in the right-most position	attach a DIN rail end anchor

Remove the Repeater Module from the DIN Rail

To remove the module from the DIN rail, do the following:

1. Insert a screwdriver into the module locking tab.



31491-M

2. Gently pry up on the locking tab.

The module should detach from the DIN rail. If the module does not unlock, try more pressure while you pry up on the locking tab with the screwdriver.

Connect the Repeater Module

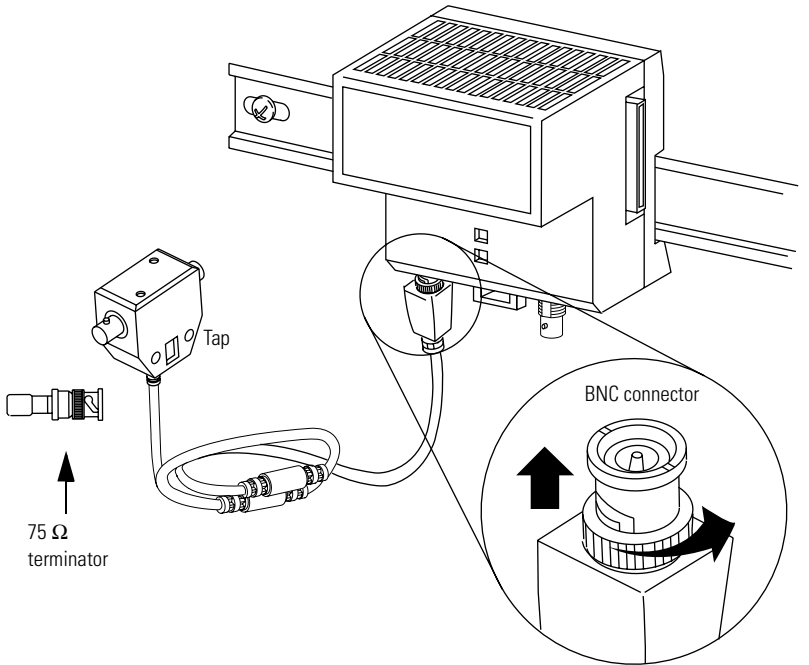
TIP

If you need to connect only one coax channel on the 1786-RPCD module, you can use either channel 1 or channel 2. Both channels 1 and 2 operate identically and can be used interchangeably.

Be sure to terminate the unused channel with a 75- Ω terminating resistor (1786-XI).

Connect the Module For Coax Channels 1 and 2

1. Connect the ControlNet tap to port #1.
 - a. Align the knob of the BNC cable connector with the locks of the BNC module connector, and insert the connector into channel 1.



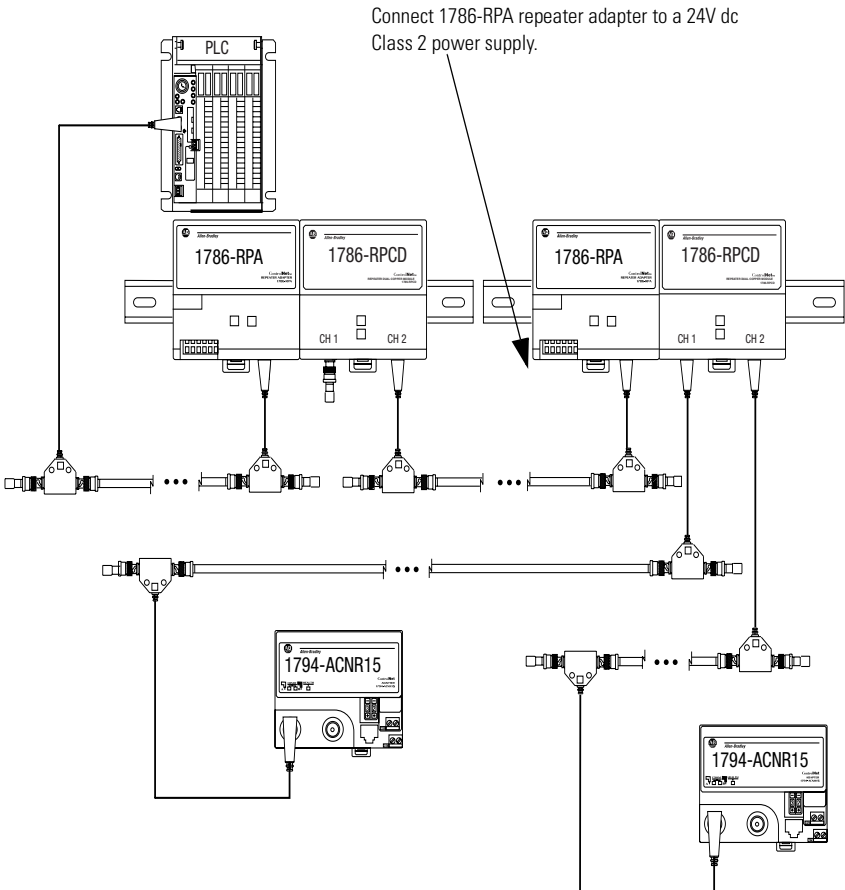
- b. Twist the BNC connector until the bayonet lug is locked into place.
2. To connect channel 2, repeat Step 1 for channel 2. If channel 2 is not used, connect a 75-Ω terminating resistor (1786-XT) to the port labeled channel 2.
3. For examples of properly connected channels, refer to the example topologies on pages 15 through 17.

Understand Common Topologies

The following topologies show how you can use the module.

Series Topology

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

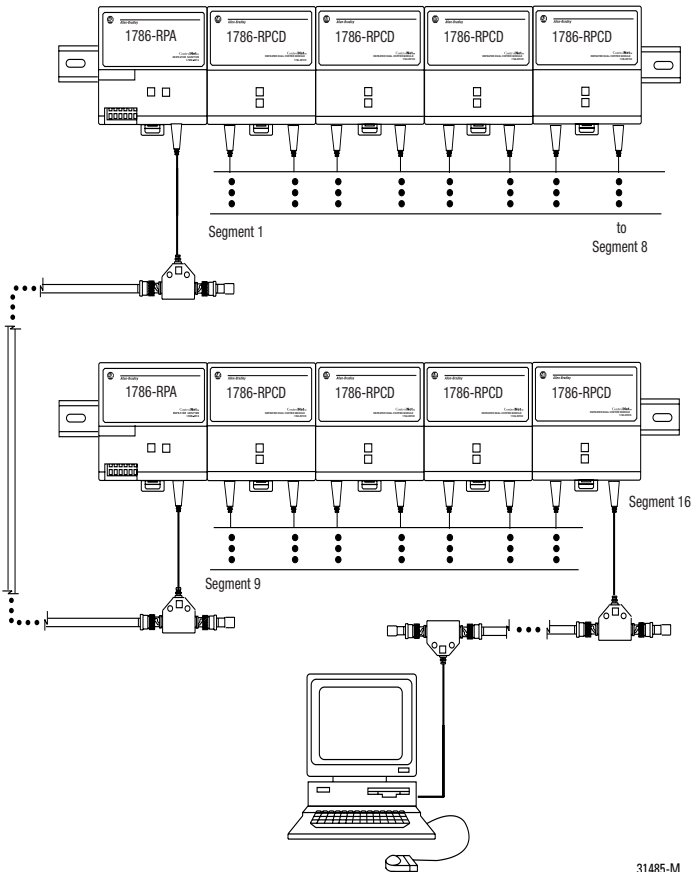


31484-M

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

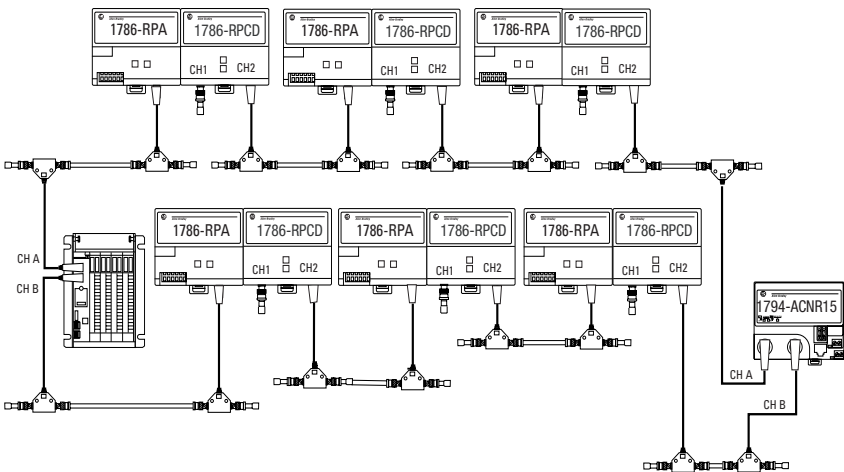
Redundant Topology

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 $1.6\mu\text{s}$.

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, refer to the ControlNet Fiber Media Planning and Installation Guide, publication CNET-IN001.



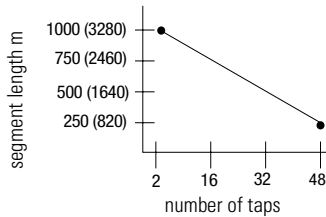
31497-M

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 1,000m (3,280ft) with two taps connected. Each additional tap decreases the maximum length of the segment by 16.3m (53ft). The maximum number of taps allowed on a segment is 48 with a maximum length of 250m (820ft).

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



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

30014-M

EXAMPLE

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

$$1000\text{m (3280ft)} - 16.3\text{m (53.4ft)} \times [10 - 2]$$

$$1000\text{m (3280ft)} - 130.4\text{m (427.7ft)} = 869.6\text{m (2852.8ft)}$$

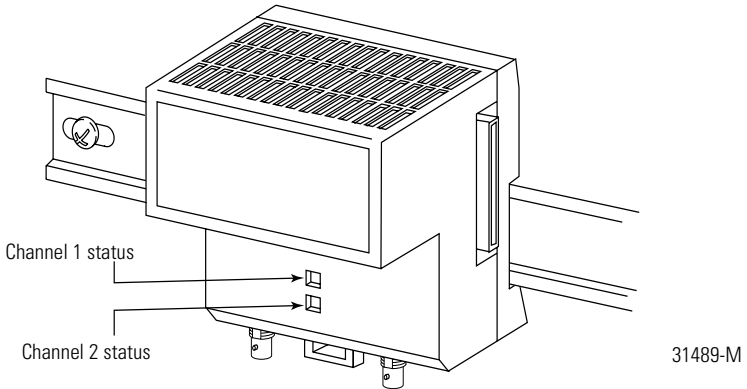
The total trunk-cable length or number of taps can be increased by installing repeaters on the segment. This creates another segment.

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 you should 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; this allows 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 publication CNET-IN002, ControlNet Coax Media Planning and Installation Guide.

Status Indicators

The figure below identifies indicators on the module:

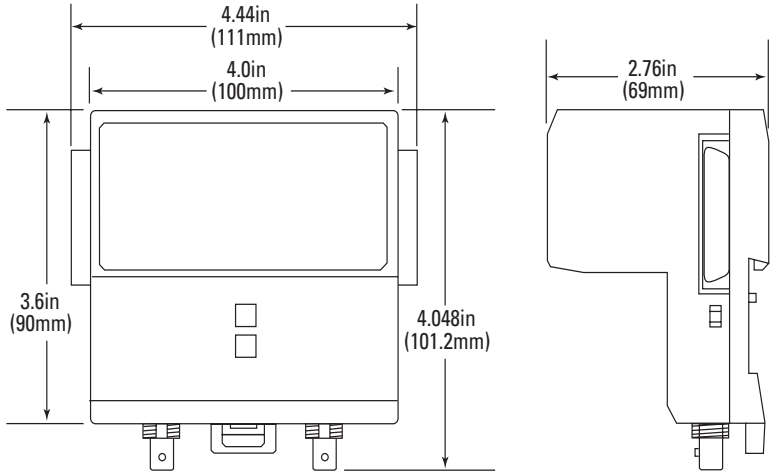


The table below defines Channel 1 and Channel 2 status indicators.

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

Mounting Dimensions

The figure below shows the dimensions for mounting the module.



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Specifications

Specification	Value
Operational Temperature	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 to 60 °C (32 to 140 °F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85 °C (-40 to 185 °F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5g@10 - 500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g

Specification	Value
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80% AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100% AM at 900MHz
EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80% AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Power Consumption	499 mA @ 5V dc Class 2 from 1786-RPA
Power Dissipation	2W
Isolation Voltage (continuous-voltage withstand rating)	50 V continuous

Specification	Value
Wiring Category ¹	1 - on communications ports
Certifications (when product is marked)	<p>UL Listed Industrial Control Equipment</p> <p>CSA Certified Process Control Equipment</p> <p>CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations</p> <p>CE² - European Union 89/336/EEC EMC Directive, compliant with:</p> <p style="padding-left: 40px;">EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions</p> <p>C-tick² - Australian Radiocommunications Act, compliant with:</p> <p style="padding-left: 40px;">AS/NZS CISPR 11; Industrial Emissions</p> <p>EEx² - European Union 94/9/EC ATEX Directive, compliant with:</p> <p style="padding-left: 40px;">EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)</p> <p>CI - ControlNet International conformance tested to ControlNet specifications</p>

¹ Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

² See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

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