

ControlNet Modular Repeater Adapter

Catalog Number 1786-RPA/B

Topic	Page
Important User Information	2
Environment and Enclosure	3
North American Hazardous Location Approval	4
European Hazardous Location Approval	5
Features and Components of the ControlNet Repeater Adapter	6
Mount the Repeater Adapter Module	8
Wire the Repeater Adapter Module	13
Status Indicators	16
Specifications	19
Additional Resources	23

About the Repeater Adapter Module

The 1786-RPA/B ControlNet repeater adapter module, which has a 24V DC, removable power supply, can be used with 1786 repeater modules to build a ControlNet network repeater. A repeater is used to extend the length of a network, create a star, ring, or point-to-point topology, or perform network media conversion from copper to fiber, and vice versa. A maximum of 20 repeater adapter can be placed in a series.

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.rockwellautomation.com/literature/>) 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, when necessary, we use notes to make you aware of safety considerations.

	WARNING: 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.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard and recognize the consequences.
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Environment and Enclosure



ATTENTION: This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.



This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

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 enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. 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.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#), for additional installation requirements
 - NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures
-

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
<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>
<div style="display: flex; align-items: center;">  <div> <p>WARNING: 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 only be changed in an area known to be nonhazardous. </div> </div>	<div style="display: flex; align-items: center;">  <div> <p>AVERTISSEMENT: 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. </div> </div>

European Hazardous Location Approval

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

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC and 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 Zone 2 potentially explosive atmospheres, given in Annex II to this Directive. Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.



WARNING: You must follow these guidelines:

- This equipment must be installed in an enclosure providing at least IP54 protection when applied in Zone 2 environments.
 - This equipment shall be used within its specified ratings defined by Rockwell Automation.
 - Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Zone 2 environments.
 - Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
 - Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
-



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

Prevent Electrostatic Discharge



ATTENTION: 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.
 - Use a static-safe workstation, if available.
 - Store the equipment in appropriate static-safe packaging when not in use.
-

Features and Components of the ControlNet Repeater Adapter

A 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-RPFRF fiber ring repeater module
- 1786-RPFRXL fiber ring repeater module

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-RPFRF and 1786-RPFRXL repeater modules, you can attach as many as two repeaters to the repeater adapter.

See [page 11](#) for more details.



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

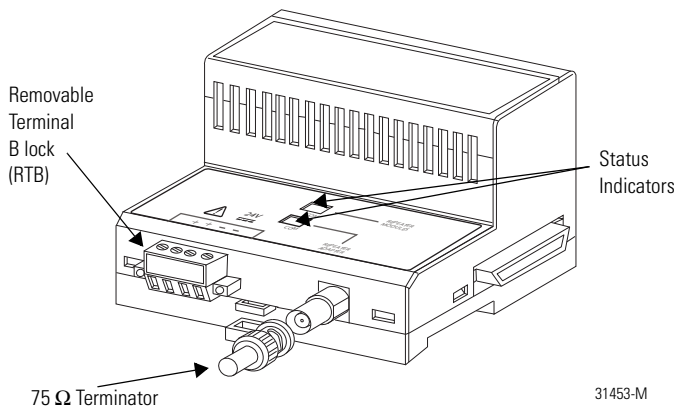
The repeater adapter also provides the following:

- Digital re-timing of ControlNet network data
- Power to repeater modules
- One coax channel
- Status indicators

The repeater adapter ships with the following items:

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

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



Mount the Repeater Adapter Module

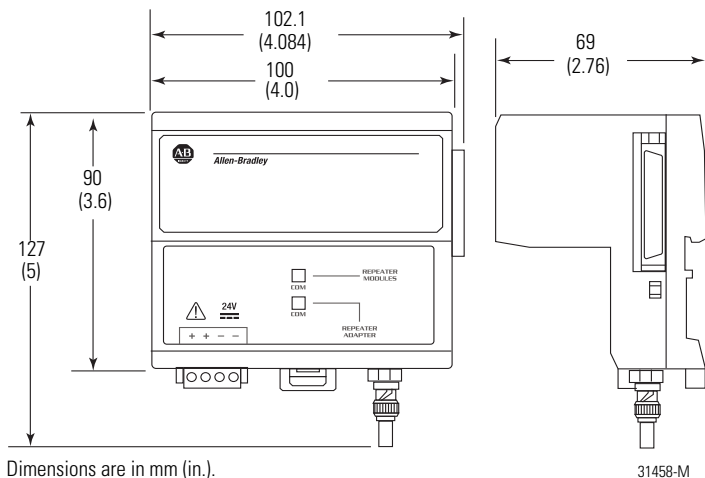
This section explains how to mount the 1786-RPA/B repeater adapter module.

TIP Horizontal mounting is preferred. Vertical mounting is allowed. We recommend that the 1786-RPA/B module be mounted at the top if vertical mounting is chosen.



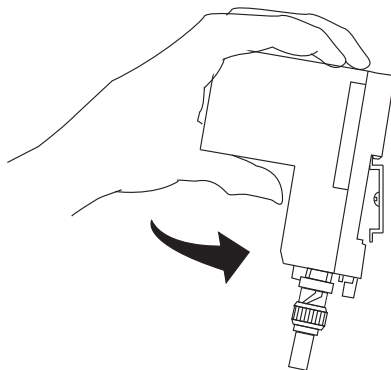
ATTENTION: This product is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (for example, aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

Figure 1 - Mounting Dimensions



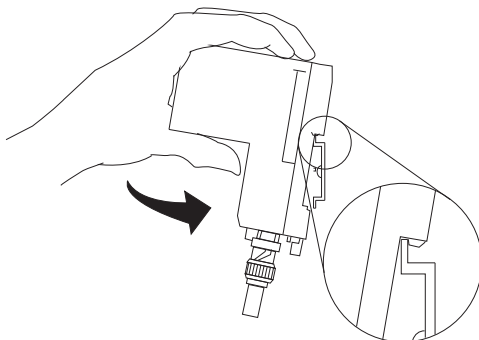
Do these steps to mount the 1786-RPA/B module.

1. Position the repeater adapter module on the 35 x 7.5 mm (1.4 x 0.3 in.) DIN rail (Allen-Bradley part number 199-DR1) at a 30° angle.



31454A-M

2. Hook the lip on the rear of the 1786-RPA/B repeater adapter module onto the top of the DIN rail, and rotate the repeater adapter module onto the rail.



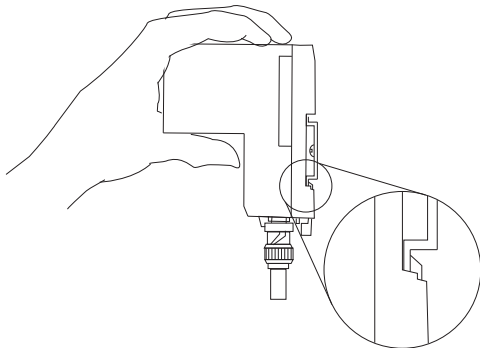
31454B-M

3. Press the repeater adapter module down onto the DIN rail until flush.

The locking tab should snap into position and lock the repeater adapter module to the DIN rail.

10 ControlNet Modular Repeater Adapter

If the repeater adapter module does not snap into position, use a screwdriver or similar device to move the locking tab down while pressing the repeater adapter flush onto the DIN rail.

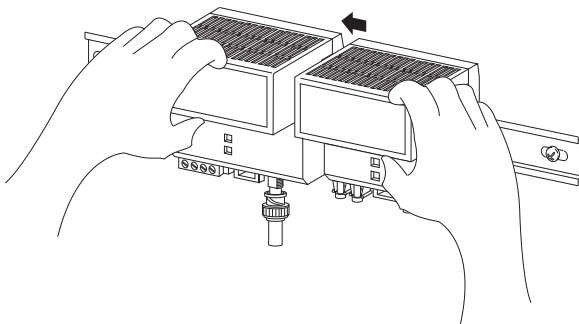


31454C-M

4. Release the locking tab to lock the adapter in place.

If necessary, push up on the locking tab to lock.

5. Once the repeater adapter module is attached to the DIN rail, slide the repeater modules to the left to mate with the repeater adapter module.



31455-M



WARNING: Removal and insertion under power (RIUP) is not supported. This module must be powered down while connecting and disconnecting it from any interconnected modules.

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.

6. Attach the DIN rail locks to the left side of the repeater adapter module and the right side of the attached modules to lock the repeater adapter module and modules in place.

IMPORTANT Make certain that the repeater adapter and modules are secured together with DIN rail locks on either side. Failure to do so may result in the loss of communication and/or cause damage to the modules.

IMPORTANT The total number of modules that can be attached to the 1786-RPA/B repeater adapter cannot exceed four or the total power consumption of the modules cannot exceed 8 W or 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. The maximum current draw at 5V DC is 400 mA for the 1786-RPFM module, 300 mA for the 1786-RPFS module, and 499 mA for the 1786-RPCD module.

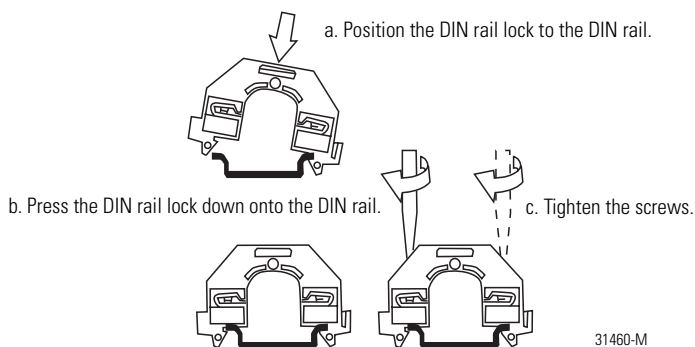
If you exceed the module or power limit, you may cause damage to the modules and repeater adapter.

12 ControlNet Modular Repeater Adapter

- Repeat steps [1](#) through [6](#) for each of the two DIN rail locks.

IMPORTANT For proper operation when using a 1786-RPFRXL/B module with a 1786-RPCD module attached to the same 1786-RPA/B repeater module, you must install any 1786-RPCD module to the left side of any 1786-RPFRL or 1786-RPFRXL/B repeater module.

- Tighten the two screws on the DIN rail lock to a torque of 1.1 N•m (9...11 in•lb).



- Wire the repeater adapter module.

See [Wire the Repeater Adapter Module](#) for details.

- Terminate any unused coax ports by connecting a 75 Ω terminator to the unused BNC connector.

One 75 Ω terminator is shipped with the repeater adapter module.

Wire the Repeater Adapter Module

This section describes how to wire your module.



WARNING: An electrical arc can occur under these circumstances:

- when you connect or disconnect the removable terminal block (RTB) with field side power applied
- if you connect or disconnect the communications cable with power applied to this module or any device on the network

This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

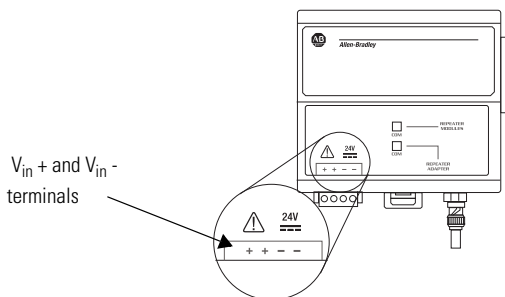
TIP Make sure you have obtained the following items before you begin to wire the module:

- Two lengths of 0.21...3.3 mm² (24...12 AWG) wire
- Wire stripping tool
- Small, flathead screwdriver

Follow these steps to wire the module.

1. Strip about 7 mm (0.28 in.) of insulation from the end of each wire.
2. Attach the V_{in+} wire to one of the V_{in+} terminals on the RTB.

14 ControlNet Modular Repeater Adapter



31456-M

Tighten the screws to 0.6...0.8 N•m (5...7 in•lb).

3. Attach the V_{in-} wire to one of the V_{in-} terminals on the RTB.

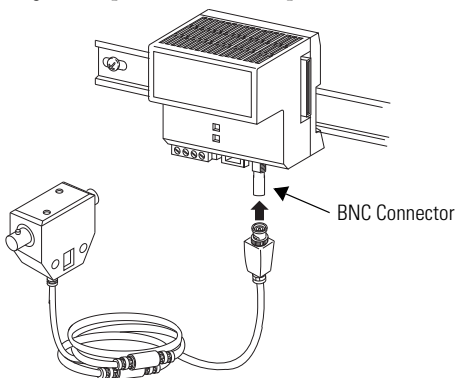
Tighten the screws to 0.6...0.8 N•m (5...7 in•lb).

TIP The unused V_{in+} and V_{in-} terminals can be used to supply power to other devices.

4. Install the RTB onto the repeater adapter module.

Tighten the screws to 0.6...0.8 N•m (5...7 in•lb).

5. Connect the repeater adapter module to the ControlNet network by connecting the drop line of the coax tap to the BNC connector.

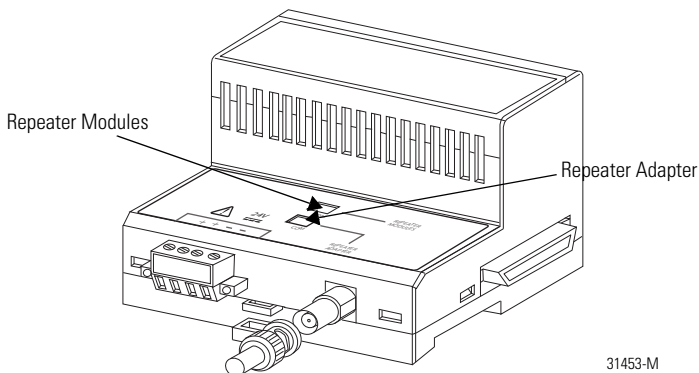


6. Terminate any unused coax ports by connecting a $75\ \Omega$ terminator to the unused BNC connector.

One $75\ \Omega$ terminator is shipped with the repeater adapter module.

Status Indicators

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



The following three tables list different combinations of status indicators and their interpretations.

Status Indicators	Page
Power-up and fault conditions	Table 1 on page 17
Repeater adapter module only	Table 2 on page 17
Repeater modules only	Table 3 on page 18

IMPORTANT The following are the only valid indicator combinations. Other combinations are not valid. For example, the combination of the repeater adapter module's status indicator being solid green and the repeater module's status indicator being solid red is not valid and probably indicates a defective module.

Table 1 -Power-up and Fault Conditions

Indicator	Description	Action
Alternating red/green	Repeater adapter module is being powered-up or reset.	Do nothing. The repeater adapter module 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 module is not powered up or has failed.	Check the power input to the repeater adapter module for correct voltage and polarity.

Table 2 -Repeater Adapter Module Status Indicator

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

Table 3 -Repeater Modules Status Indicator

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

Specifications

Technical Specifications - 1786-RPA/B

Attribute	1786-RPA/B
Power consumption, max	16.8 W
Power dissipation, max	8.8 W
Input voltage rating, max	700 mA @ 24V DC, Class 2/SELV ⁽¹⁾
Input voltage range	18...36V DC
Backplane output current, max	1.6A @ 5V DC
Minimum enclosure size (HxWxD), approx	304.8 x 196.8 x 101.6 mm (12 x 7.75 x 4 in.)
Mounting orientation	Any mounting orientation
Isolation voltage	50V (continuous), Basic insulation type, Power to system Type tested at 710V DC for 60 s
Wire size	0.21...3.3 mm ² (24...12 AWG) solid or stranded copper wire rated at 75 °C (167 °F), or greater, 1.2 mm (3/64 in.) insulation max for power connections
Wiring category	2 - on power ports 2 - on communication ports ⁽²⁾
Enclosure type rating	None (open-style)
North American temp code	T5
IEC temp code	T4

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

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
Emissions CISPR 11	Group 1, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges

Environmental Specifications - 1786-RPA/B

Attribute	1786-RPA/B
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 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 power ports ±4 kV at 5 kHz on communication 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 communication ports
Conducted RF Immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

Certifications⁽¹⁾ - 1786-RPA/B

Certification⁽²⁾	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.

Certifications⁽¹⁾ - 1786-RPA/B

Certification ⁽²⁾	1786-RPA/B
CE	European Union 2004/108/EC EMC Directive, compliant with the following: <ul style="list-style-type: none">• EN 61326-1; Meas./Control/Lab., Industrial Requirements• EN 61000-6-2; Industrial Immunity• EN 61000-6-4; Industrial Emissions• EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with the following: <ul style="list-style-type: none">• AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with the following: <ul style="list-style-type: none">• EN 60079-15; Potentially Explosive Atmospheres, Protection 'n'• EN 60079-0; General Requirements• II 3 G Ex nA IIC T4 X
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.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
ControlNet Coax Taps Installation Instructions, publication 1786-IN007	Document contains procedures and specifications for the installation of ControlNet coaxial taps.
ControlNet Coax Media Planning and Installation Guide, publication CNET-IN002	Document describes the components and topologies for creating a ControlNet coax media system.
ControlNet Fiber Media Planning and Installation Guide, publication CNET-IN001	Document describes the components and topologies for creating a ControlNet fiber media system.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Document contains more information on proper wiring and grounding techniques.

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

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://www.rockwellautomation.com/support/>, 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://www.rockwellautomation.com/support/>.

Installation Assistance

If you experience a problem 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 product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its 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, follow these procedures.

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

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication [RA-DU002](#), available at <http://www.rockwellautomation.com/literature/>.

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