



Installation Guide

BACnet® Communication Interface for ReliaTel™ Controllers (BCI-R)

For use with Voyager,™ Odyssey,™ and
Precedent™ rooftop units

Ordering Number: KIT15864

SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.



Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring **MUST** be performed by qualified personnel. Improperly installed and grounded field wiring poses **FIRE** and **ELECTROCUTION** hazards. To avoid these hazards, you **MUST** follow requirements for field wiring installation and grounding as described in **NEC** and your local/state electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, **MUST** follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- Before installing/servicing this unit, technicians **MUST** put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). **ALWAYS** refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.
- When working with or around hazardous chemicals, **ALWAYS** refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.
- If there is a risk of energized electrical contact, arc, or flash, technicians **MUST** put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, **PRIOR** to servicing the unit. **NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ WARNING**Follow EHS Policies!**

Failure to follow instructions below could result in death or serious injury.

- All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.
- Non-Trane personnel should always follow local regulations.

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Revision History

RF-SVN03E-EN

- Change made to figure (Generic BCI-R harness wiring diagram)

RF-SVN03D-EN

- New section added: "About the BACnet Terminator".

RF-SVN03C-EN

- Change made to step 3 in Terminator Wiring.

Change made to figure (Generic BCI-R harness wiring diagram)



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Overview

This installation document contains information about the BACnet Communication Interface for rooftop air conditioning units with ReliaTel unit control.

The following Trane products are supported:

- Voyager and Voyager Commercial constant volume (CV) units.
- Voyager and Voyager Commercial variable air volume (VAV) units.
- Precedent packaged air conditioning unit.
- Odyssey split system air conditioning equipment.

This controller allows the above named equipment the capability to:

- Communicate on a BACnet communications network.
- Be part of a Tracer SC system controller network.

- Provide customers the flexibility to choose the best possible vendor for their building subsystems.
- Easily incorporate Trane products into legacy non-Trane systems in existing buildings.

The BCI-R controller is available as a factory-installed option or field-installed kit. The features and functions described in this manual apply to either option. The following sections describe:

- A brief overview of the BACnet protocol.
- Field kit inspection and controller specifications.
- Controller mounting and installation.
- Rotary switch settings.
- Field-installed wiring.
- LEDs and switches.

BACnet Protocol

The Building Automation and Control Network (BACnet and ANSI/ASHRAE Standard 135-2004) protocol is a standard that allows building automation systems or components from different manufacturers to share information and control functions. BACnet provides building owners the capability to connect various types of building control systems or subsystems together for a variety of reasons. In addition, multiple vendors can use this protocol to share information for monitoring and supervisory control between systems and devices in a multi-vendor interconnected system.

The BACnet protocol identifies standard objects (data points) called BACnet objects. Each object has a defined list of properties that provide information about that object. BACnet also defines a number of standard application services that are used to access data and manipulate these objects and provides a client/server communication between devices. For more information on BACnet protocol, refer to [“Additional Resources,”](#) p. 22.

BACnet Testing Laboratory (BTL) Certification

The BCI-R supports the BACnet communication protocol and has been designed to meet the requirements of the application-specific control profile. For more details, refer to the BTL web site at www.bacnetassociation.org.



Field Kit Parts, Specifications, Dimensions, and Components

Field Kit Parts

Prior to installation, open the box and verify that the following parts are enclosed:

- One (1) BCI-R controller
- Four (4) screws
- One (1) USB service port cable
- Two (2) screws for the USB bulkhead port connector
- One (1) bushing for field wiring
- One (1) USB service port label
- Two (2) 4-wire cable harnesses
 - X19051430020 (Voyager III)

- X19051278010 (Voyager II, Odyssey, and Precedent)

- One (1) BCI-R Integration Guide (BAS-SVP09-EN)

Important: Contact the Trane Parts Center nearest your area should there be any damaged or missing components.

Note: One copy of the appropriate service literature ships inside the control panel of each unit.

Specifications

The following table provides specifications and requirements for the BCI-R controller. All BCI-R controllers are color-coded red for easy identification.

Table 1. Specifications and Requirements

Storage	
Temperature:	-44°C to 95°C (-48°F to 203°F)
Relative humidity:	Between 5% to 95% (noncondensing)
The BCI-R controller has been designed to withstand the effects of dust and corrosion.	
Operating	
Temperature:	-40°C to 70°C (-40°F to 158°F)
Humidity:	Between 5% to 95% (noncondensing)
Power:	24 Vdc ±15%, maximum load 90 mA

Mounting and Installing the Controller

Important: Read the following safety warnings prior to installation. Procedures presented in this guide should be performed only by qualified HVAC technicians.

⚠ WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

⚠ WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

Notes: In addition to these instructions, refer to the specific rooftop unit literature when installing the controller.

To install the BCI-R controller:

1. Disconnect all power from the rooftop unit.
2. Mount the BCI-R controller using the supplied screws. The following figures depict mounting positions for various rooftop units.
3. Route and connect the wiring harness as described in ["Connecting the Factory Wiring Harness,"](#) p. 13.
4. Set the rotary switches as described in ["Setting Addresses Using Rotary Switches,"](#) p. 12.
5. Install the USB bulkhead port in the designated area of the rooftop unit, by using the supplied screws.

Note: The USB bulkhead port is a remote extension of the USB port located on the BCI-R module. Each rooftop unit will have a designated port location. As an example, [Figure 1, p. 8,](#) shows where the port is located on Voyager II rooftop units.

6. Complete wiring procedures as described in ["Field Wiring Procedures,"](#) p. 13.

Figure 1. Voyager II (all units)

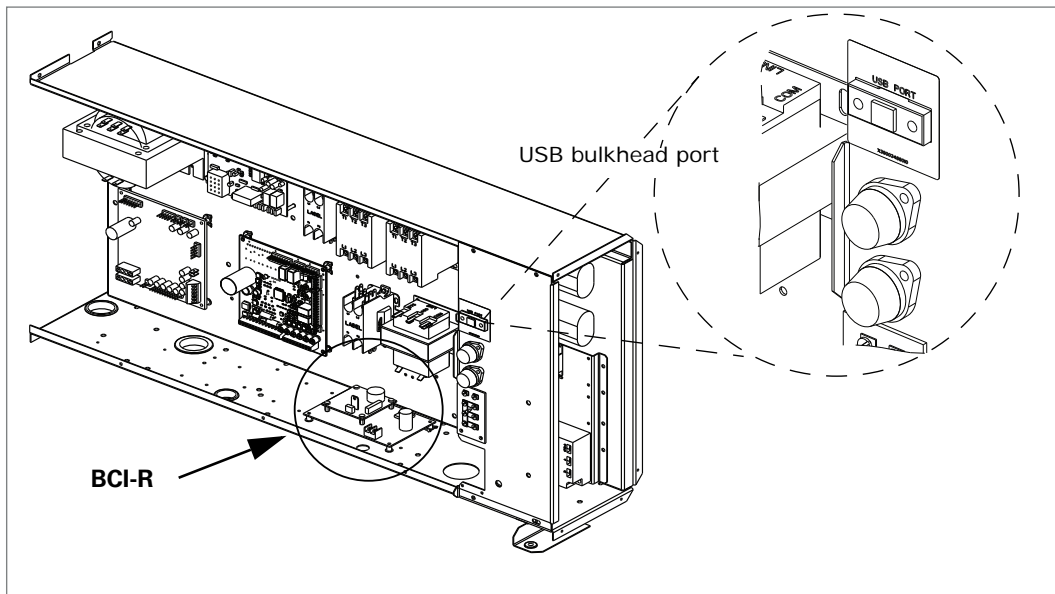
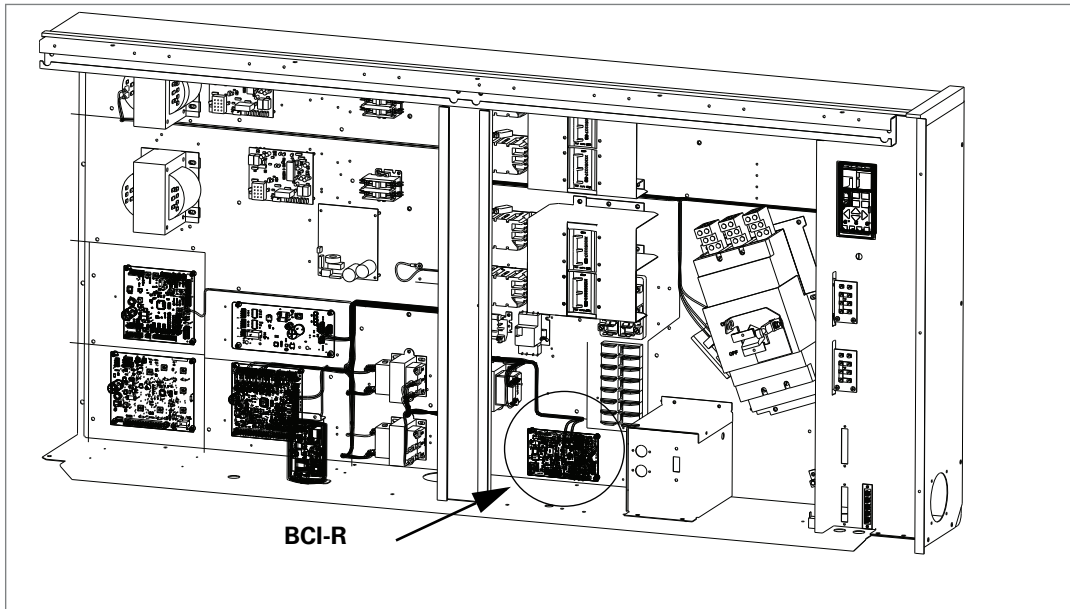
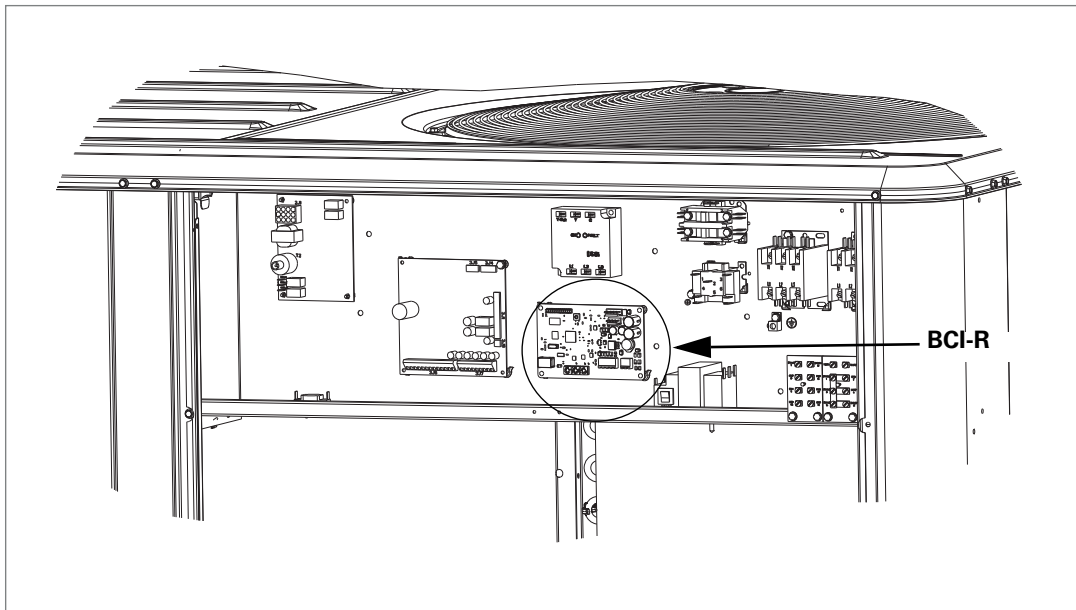


Figure 2. Voyager III Commercial (all units)**Figure 3. Precedent: (T/Y)SC(072-120)E, (T/Y)HC(048-072)E, WSC(060-090)E**

Mounting and Installing the Controller

Figure 4. Precedent: (T/Y)SC(036-060)E, (T/Y) HC036E, WSC(036-048)E

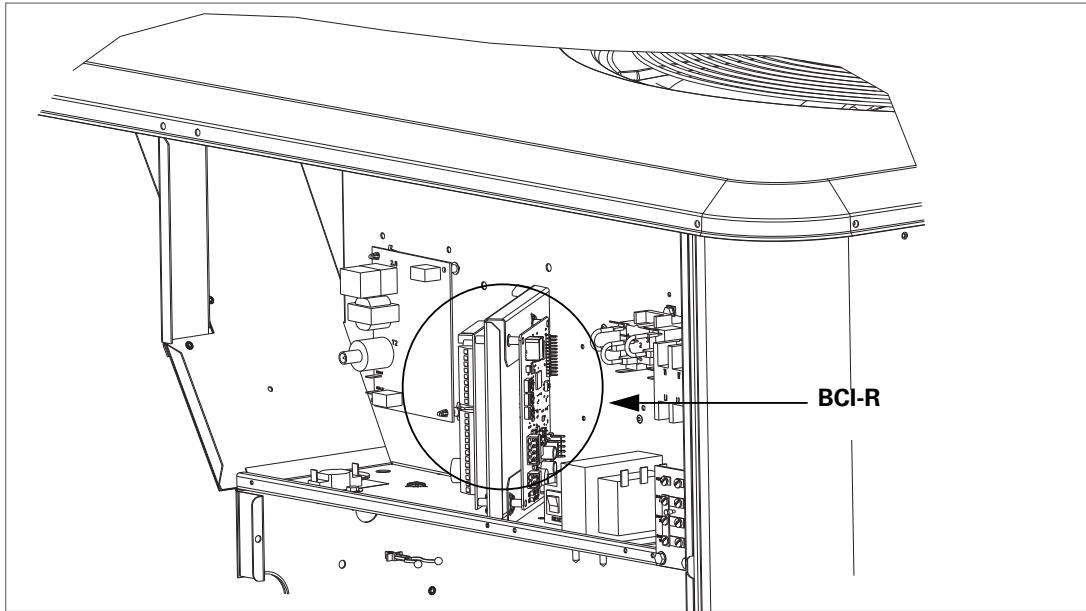


Figure 5. Precedent: (T/Y)HC(092-120)E, WSC120E

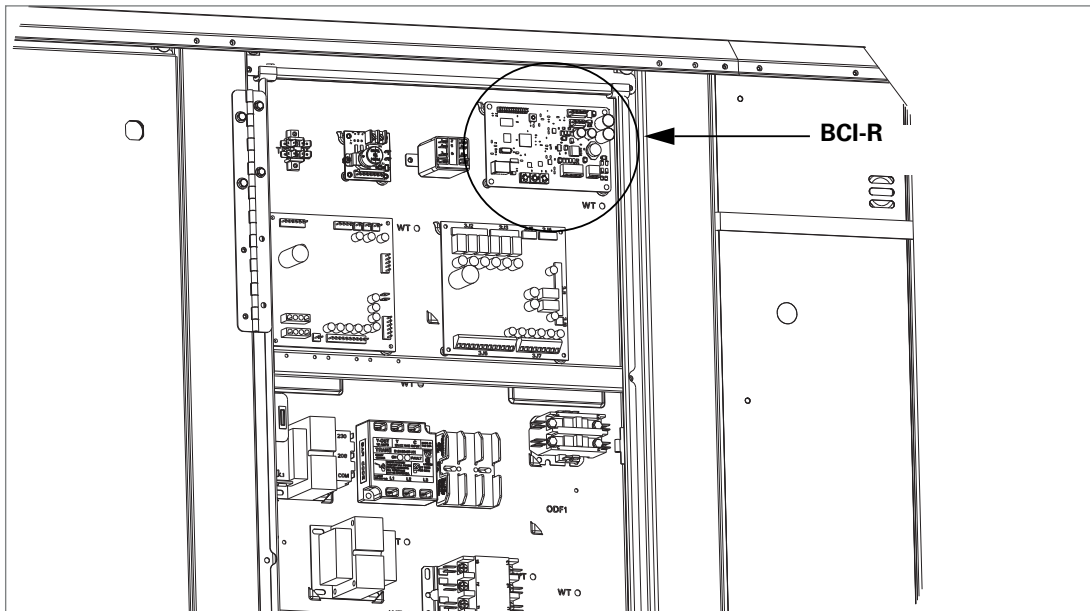
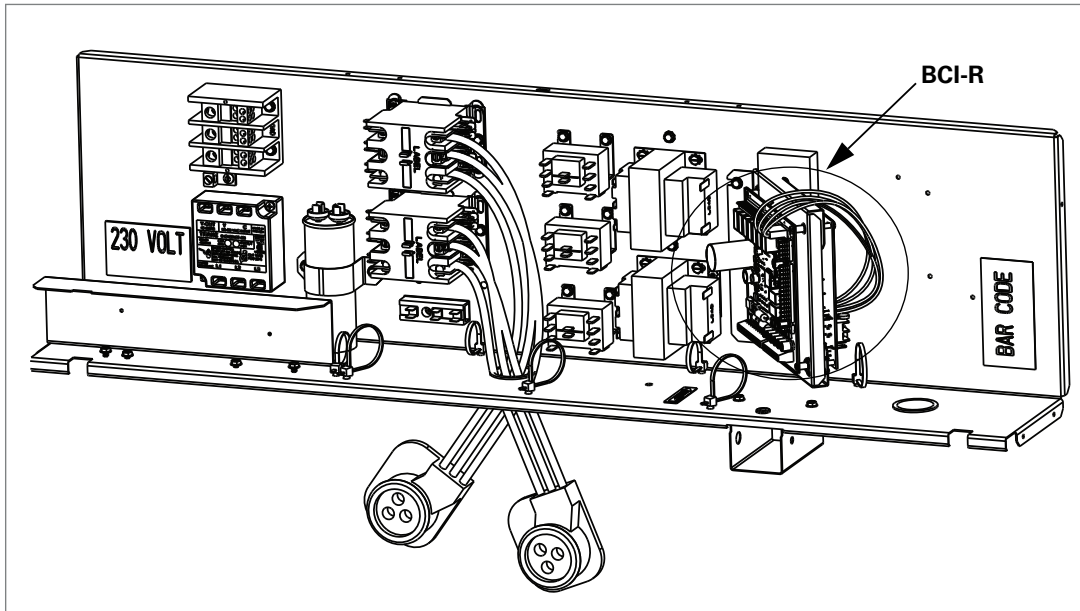
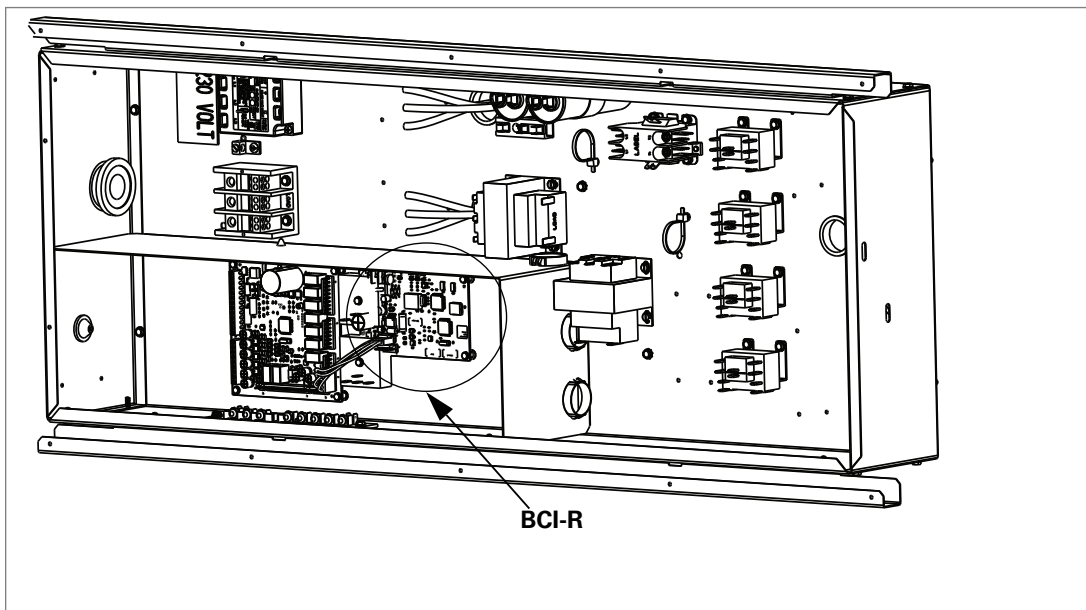


Figure 6. Odyssey (6-12.5 ton)**Figure 7. Odyssey (15-20 ton)**

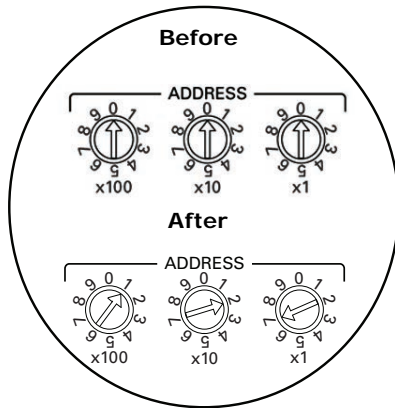
Setting Addresses Using Rotary Switches

There are three rotary switches on the front of the BCI-R controller that are used to define a three-digit address when the BCI-R is installed on a BACnet communications network. The three-digit address setting is used in both the rotary switch value and the BACnet device ID. The illustrations below show how to set rotary switch values.

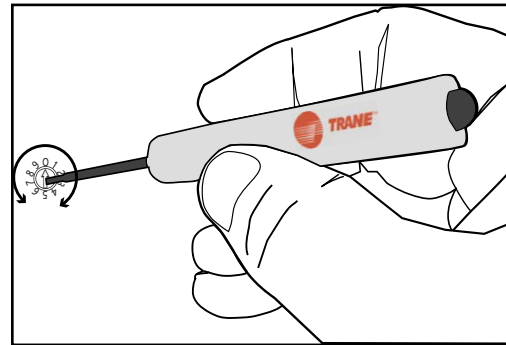
For more information about rotary switches, see ["Understanding Rotary Switch Values and BACnet Device IDs,"](#) p. 17.

Note: All devices are MSTP masters with valid rotary switch addresses of 001 to 127 for BACnet.

Figure 8. Setting the rotary switch value



Setting the rotary switch value to 127 (before and after).



Use a 1/8 inch (3 mm) flathead service screwdriver to set rotary switches.

Important: Each device on the BACnet MS/TP link must have a unique rotary switch value; otherwise, communication problems will occur.

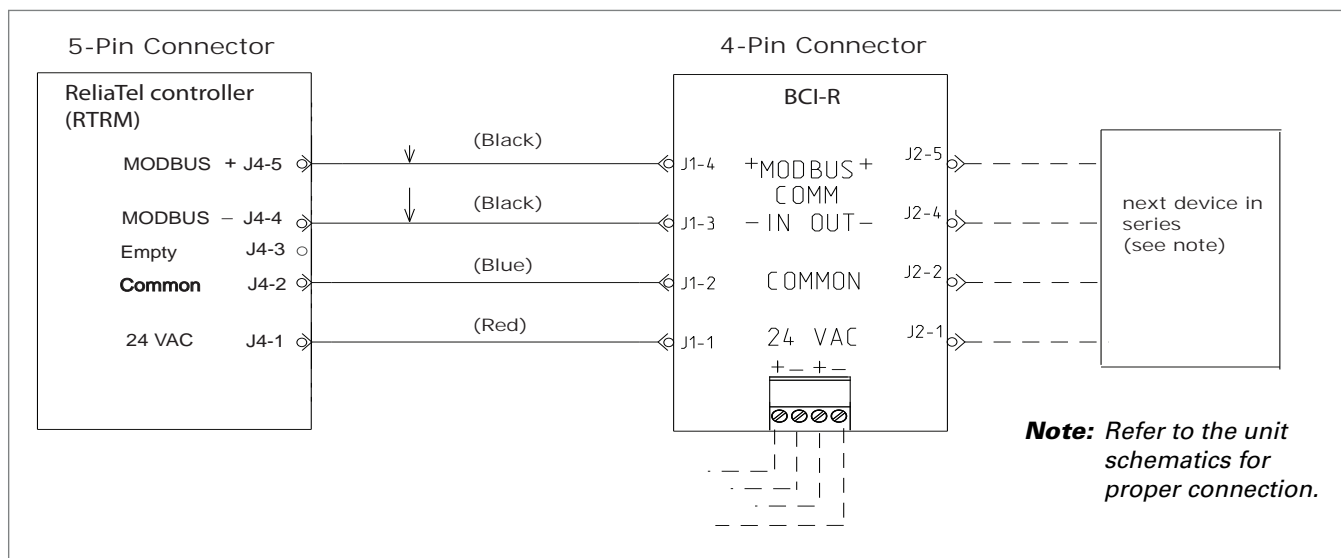
Field Wiring Procedures

Important: Use 18 AWG, (24 pF/ft. max), communication wire (Trane purple wire); strip no more than 2 in. (5 cm) of the outer conductor of shielded wire. For more information, refer to the Unit Controller Wiring Guide, BAS-SVN03-EN.

Connecting the Factory Wiring Harness

1. Remove power from the entire unit to ensure that all circuits are unpowered.
2. Connect the ReliaTel connection harnesses to J4 and J1 as shown in Figure 9. You may need to refer to specific rooftop unit wiring diagram for more details.
3. Restore power to the unit.

Figure 9. Generic BCI-R harness wiring diagram

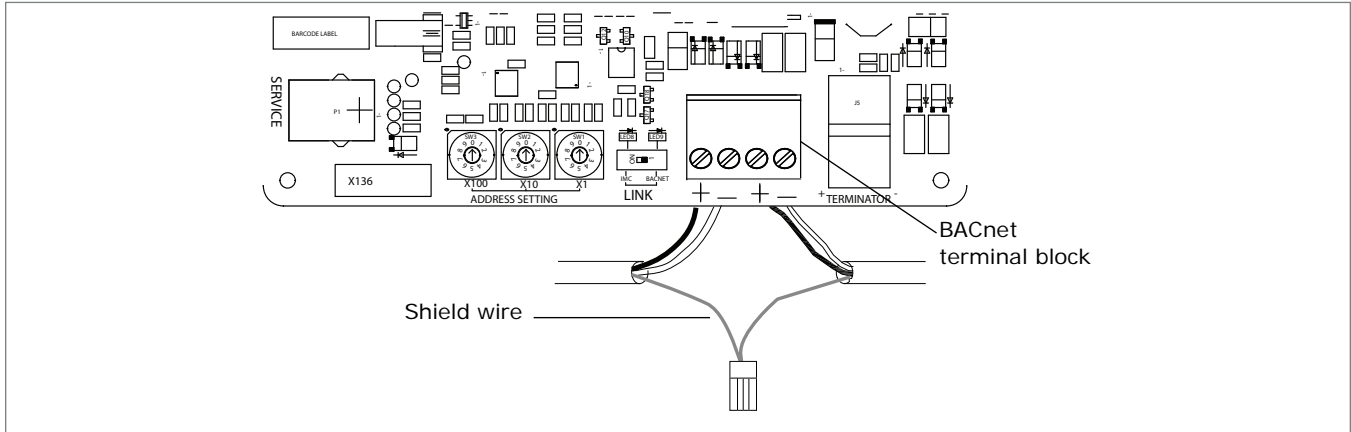


BACnet Wiring

1. Remove power from the entire unit to ensure that all circuits are unpowered.
2. On the BCI-R controller, set the link select switch to BACnet.
3. Attach the communication link wiring to the BACnet terminal block of the BCI-R controller.
4. Wire and tape the shields together or connect the shields using a wire nut as shown in Figure 10, p. 14.
5. Restore power to the unit.

Note: Do not ground the shield at the BCI-R. The entire grounding shield must be grounded only once per segment. Typically, the entire shield will be connected as one segment and grounded at the building management controller. All four terminals on the BCI-R terminal block will always be in use.

Figure 10. BACnet wiring



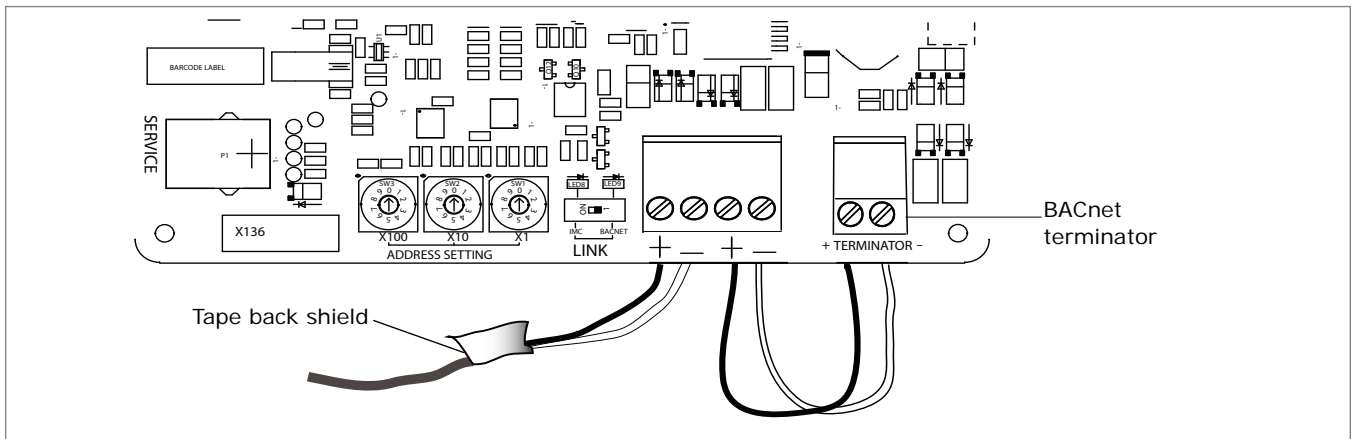
Terminator Wiring

The BCI-R controller has a built in end-of-line termination device (BACnet terminator) to be used in conjunction with the BACnet terminal block.

1. Disconnect power from the entire unit to ensure that all circuits are unpowered.

2. Run communication link wiring from the BACnet terminal block to the BACnet terminator.
3. Connect the wires from the BACnet terminal block to the Terminator terminal block maintaining polarity.
4. Restore power to the unit.

Figure 11. Wiring the BACnet terminator



About the BACnet Terminator

The BCI-R controller has a fully integrated BACnet Terminator built into each board. Additional termination devices are not necessary.

- Use the BACnet Terminator when the BCI-R is at the end of the communications link.
- Do not use the BACnet Terminator terminals to provide power to other terminal devices.
- The BACnet Terminator is self-powered from the BCI-R board. Additional power connections are not necessary.
- If the BCI-R is not at the end of the communications link, the BACnet termination terminals should remain unused.

Wiring the Air-Fi™ Wireless Communications Interface (WCI)

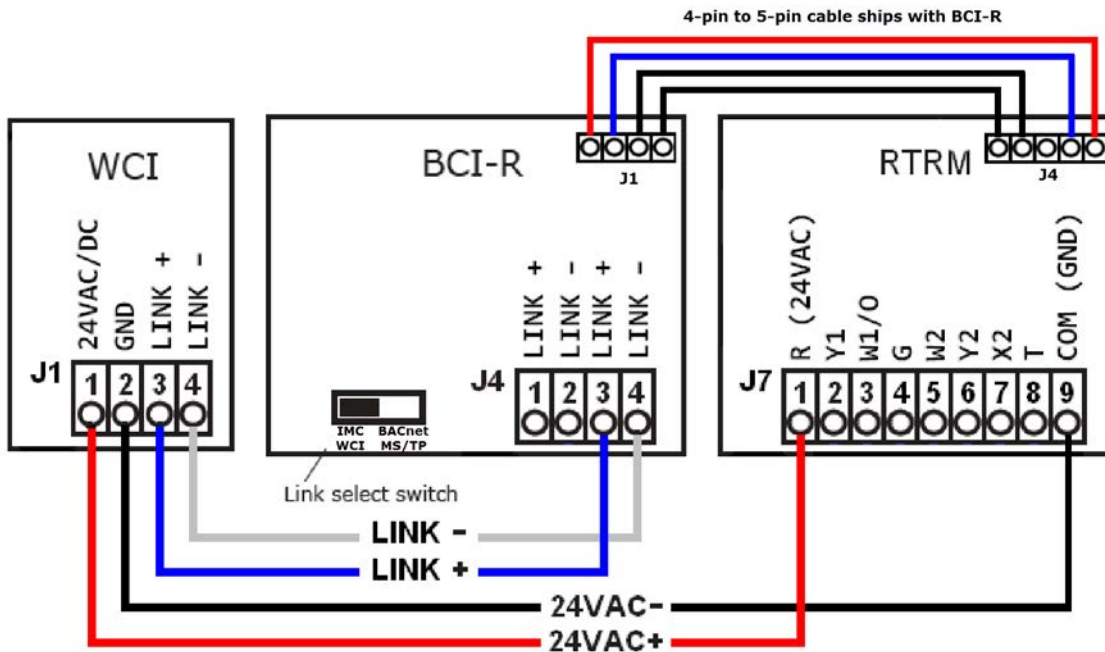
If a wireless receiver is used as a wireless communications interface, follow these instructions.

Note: For more information regarding the WCI, refer to "Installing the Air-Fi Wireless Interface," X39641264-01.

5. On the BCI-R controller, set the Link Select switch to IMC (wireless communication).
6. Route the wires from the WCI through either:
 - a. The opening at the back of the back plate.
 - b. The hole in the bottom of the cover.

7. Remove power from the entire unit to ensure that all circuits are unpowered.
8. Connect the IMC wires (gray and blue) to the BCI-R controller and the ground and the 24 Vdc/Vac wires (black and red) as shown in Figure 12.
9. Restore power to the unit.

Figure 12. Wiring the Air-Fi Wireless Communication Interface (WCI)




Configuring the BCI-R

The BCI-R can be configured with either the Tracer BACnet Setup Tool or the Tracer TU service tool.

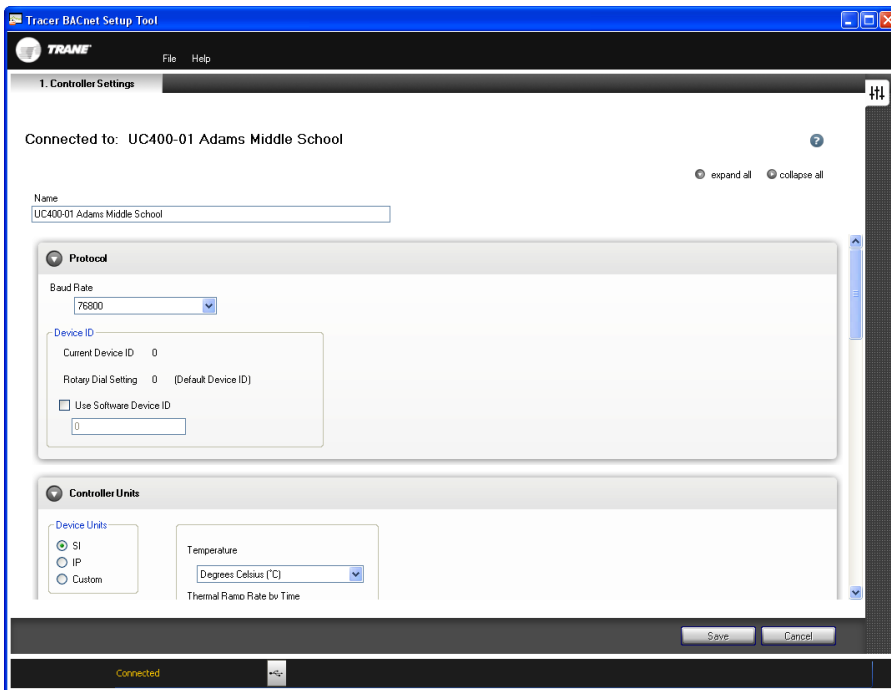
Note: *The BCI-R controller is fully configured from the factory for use with Tracer SC based systems. Additional configuration, or the use of Tracer TU, may be necessary. Additionally, the BCI-R self-configures itself to match the unit type upon initial power-up. However, you may want to change the controller default name to one that is more meaningful.*

Using the BACnet Setup Tool

This section describes how to configure the BCI-R controller using the Tracer BACnet Setup Tool. For assistance with using the setup tool, click the help  icon located in upper right portion of the screen.

10. Open the Tracer BACnet Setup Tool.
 - The Controller Settings screen appears (Figure 13).
11. In the Protocol and Controller Units sections, change or keep the default settings for the baud rate, software device ID, and the device units.
12. Click **save**.

Figure 13. BACnet Setup Tool Controller Settings screen (connected to a UC400 as an example)



Using Tracer TU

This section describes how to first connect to the Tracer TU software and then configure the BCI-R controller. If Tracer TU is not installed, refer to the "Tracer TU Service Tool Getting Started Guide" (TTU-SVN02). Tracer TU software, Version 7.0 or higher, is required.

To connect to Tracer TU:

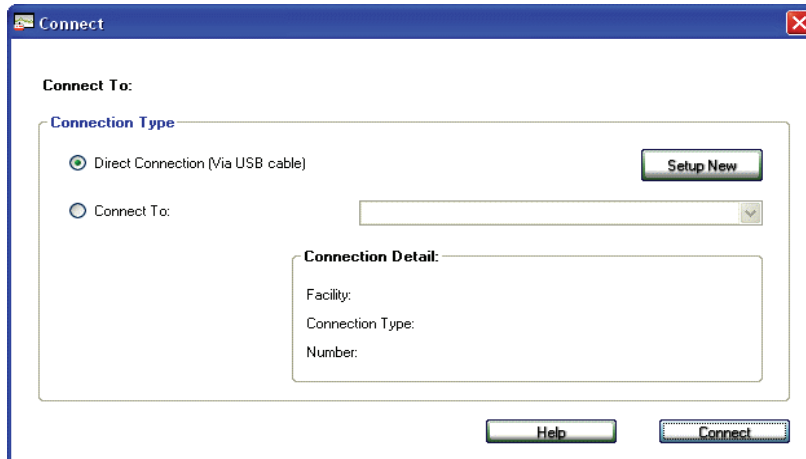
1. Connect the USB cable directly from the laptop to the BCI-R, or to an equipment control panel USB port connected to the controller.

Important: *If using a PC with multiple USB ports, connect by using the same process outlined below for the same piece of equipment. This is normal operation. Observe existing USB standards for cable length. (For more information go to informational Web sites, such as <http://www.USB.org>.)*

2. Click either the **Tracer TU** desktop icon or the **Tracer TU** program item in the Tracer TU group on the **Start** menu.

The Tracer TU splash screen appears briefly followed by the **Connect** dialog box.

Figure 14. Connect dialog box



3. Select the **Direct Connection (USB cable)** radio button if it is not already selected.
4. Click the **Connect** button and the **Unit Summary** page will appear after successful connection.

To configure the BCI-R controller:



1. Select the **Controller Settings Utility** tab from the vertical tab set located on the right side of the TU window.

Note: *The content of this screen is based on the type of controller that is connected and the system protocol used to communicate with the controller.*
2. Enter a meaningful name for the controller.
3. Click the **Controller Units** expanding box label to display its contents.
4. Confirm the preferred units of measure for data communicated across the BACnet link.
5. Click the **Protocol** expanding box heading to display its contents.
6. Select the preferred **Baud Rate** in the drop-down list box.
7. If a software Device ID is required, check the **Use Software Device ID** box and enter a BACnet Device ID.
8. Click **Save**.

Understanding Rotary Switch Values and BACnet Device IDs

Rotary Switch Values

The rotary switch value is the physical address of a device on a network. It is often referred to as the MAC address. The term is generic and is used to denote the physical address of many types of networks.

For example, the rotary switch value of a BACnet MS/TP network has a valid range of zero (0) to 255 and can be represented by a single byte. The rotary switch value of an Ethernet network is six bytes in length. Each device must be assigned a unique rotary switch value. Failure to assign a unique address to each device will result in communication errors.

BACnet Device ID

The BACnet Device ID uniquely identifies each BACnet device as a logical address. The valid range of this address is 0 to 4194303. The logical address in an Internet Protocol (IP) network is the IP address, which is four bytes in length and is typically written in the format of 192.168.1.125. Failure to assign unique address to each device will result in communication errors.

Tracer SC uses the rotary switch value to create the BACnet device ID. The Tracer SC adds an SC rotary switch address and a link number to artificially create a unique BACnet Device ID for each node.

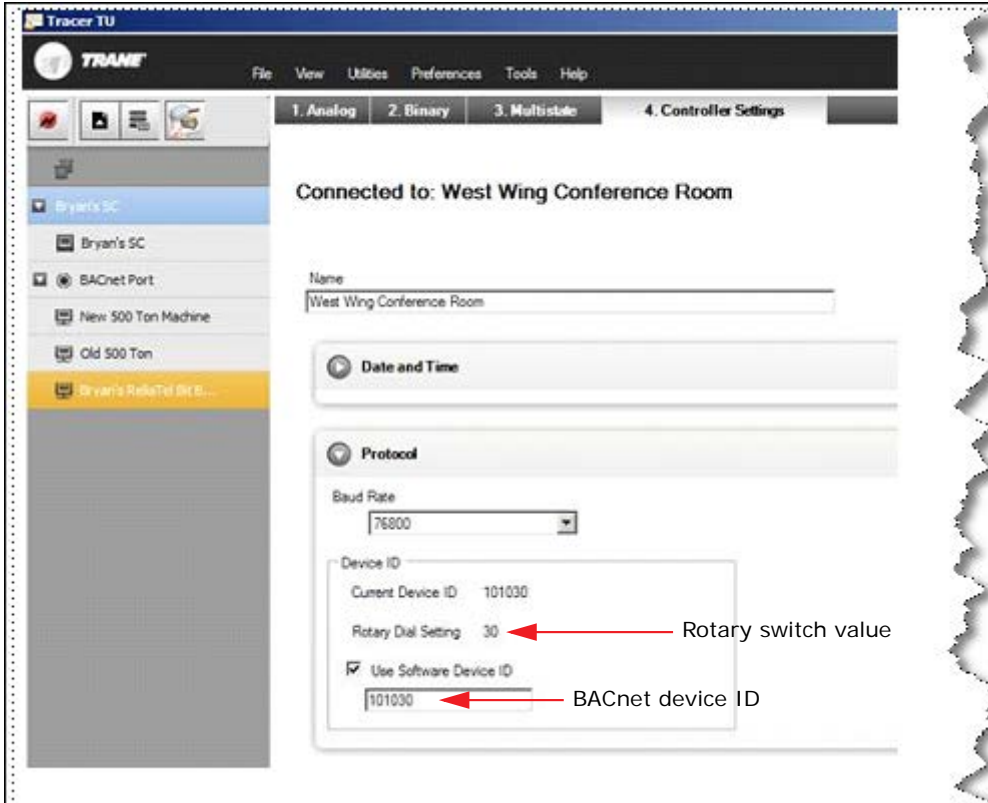
Figure 15, p. 18 shows how Tracer TU displays the rotary dial settings and the resulting BACnet device ID:

- The rotary switch values on the BCI-R are set to 30 (0,3,0).

Configuring the BCI-R

- The Tracer SC created a BACnet device ID of 101030.
- The BCI-R is installed on link 1.
- The Tracer SC address is "0,1,0".

Figure 15. Example showing rotary switch value and BACnet device ID



What To Do After Adding Options or Equipment to the Unit

Restoring the BCI-R controller to factory defaults is necessary if the unit setup has changed after the initial self-configuration process. This process is called “clearing the controller”.

For example, an economizer was added to the machine after the initial installation. In order for the BCI-R controller to recognize the economizer, it must be restored to factory defaults.

The BCI-R controller self-configures upon initial power-up to match the connected equipment type. This configuration is then permanently stored in the memory of the controller. Through this process, the controller generates the correct list of BACnet points.

Clearing the Controller and Restoring Factory Defaults to the BCI-R

Clearing the controller is necessary to collect equipment information and reinstall the configuration.

Using the BACnet Setup Tool to clear the controller and restore to factory defaults

1. Navigate to the Controller Settings screen.
2. Click within the light gray area at the bottom left of the screen just above the "Connected" indicator.

The Clear Controller button appears at the top right of the screen.

3. Click **Clear Controller**.

A message box appears stating that the configuration will be reset (deleted).

4. Click **OK**.

When the controller is cleared, the Select Device Units message box appears.

5. Click **OK** and then expand the Controller Units box on the Controller Settings screen.
6. Select the units (SI, IP, or Custom).

Note: This selection defaults to Custom after clearing the controller. If you want to use Custom, ensure that all unit options are set correctly.

7. Click **Save**.

Using Tracer TU to clear the controller and restore to factory defaults

1. Establish the connection between Tracer TU and the BCI-R controller.
2. Select the **Controller Settings Utility** tab from the vertical tab set located on the right side of the TU window.
3. On the controller settings page, there is a gray bar at the bottom with the **Save/Cancel** buttons. Move the

cursor near the left edge of the gray bar, keeping the cursor inside the bar; click on this area. A **Clear Controller** button will appear in the upper right portion of the screen display.

4. Click the **Clear Controller** button and a pop-up window will appear with a message that asks for confirmation to reset the device. Click **Yes**.
5. A pop-up window will appear confirming that the controller has been reset and that the controller will be restarted. Click **OK**. The BCI-R controller is restored to its *factory default* state after it restarts.
6. Follow the steps in “[Configuring the BCI-R](#)” to reconfigure the controller.

Updating the Application Code

The application code in the BCI-R controller can be upgraded in the field by using Tracer TU. Follow the instructions in Tracer TU to upgrade the application code.



Managing Device Units on the Controller Units Screen

The BCI-R device units can be viewed and managed on the Controller Units screen from either the BACnet Setup Tool or Tracer TU.

When the BCI-R first powers up, or after the controller has been cleared, a list of points (the role document) is created from the information supplied to the BCI-R from the ReliaTel RTRM module through the Modbus link.

Note: *The BCI-R creates the role document immediately (often within one second).*

Immediately after the points are created, the device units are set and saved and appear on the Controller Units screen. The values that correspond to the device units are set to default to SI values. In some cases, the Custom radio button may be selected; however, the device units will still default to SI.

If you are using Tracer TU to change the Device Units to IP by clearing the controller, it is best to either unplug the Modbus cable to the BCI-R, or to power down the entire unit (the BCI-R). By doing this, the BCI-R will not see Modbus traffic. This method will enable the Device Units radio button selection, which allows you to make changes.

LEDs and Switches

Table 2. Interpreting the LEDs and switches

LED type	LED activity	Indicates...
Service LED	Solid green	The controller is in boot mode. The controller will be placed into boot mode if the service pin is held in when power is applied. In boot mode, the controller is non-operational and is waiting for a new main application to be downloaded. While in boot mode, the system will not run any applications
	Not illuminated	Application code is running; operating normally
Status LED	Solid green	Normal operation
	Blinking green	The controller is updating the flash
	Solid red	A crash has occurred
	Blinking red	Alarms or faults are present
	Not illuminated	The controller is off
Link Tx/Rx	TX blinks green	Data is being transferred, received, or transmitted
	RX blinks yellow	Blinks at the data transfer rate when the unit receives data from other devices on the link <ul style="list-style-type: none"> • ON solid yellow; indicates there is reverse polarity
Modbus Tx/Rx	Not illuminated	No activity is occurring
	Blinking	Data is being transferred, received, or transmitted
Link LEDs	Not illuminated	No activity is occurring
	BACnet is illuminated	The Link Switch has been set to wired communication
	IMC is illuminated	The Link Switch has been set to wireless communication
Switch/Button type	Purpose	
Link Select Switch	Use this switch to select wired communication (BACnet) or wireless communication (IMC)	
Service Button	Press this button and restart the controller to put it into boot mode	
Rotary Switches	Use these switches to set unique MS/TP MAC addresses	



Additional Resources

Additional Resources

Use the following documents and links as additional resources:

- *BACnet Communication Interface for ReliaTel (BCI-R) Integration Guide* (BAS-SVP09)
- Product support online:
 - www.bacnet.org
 - www.bacnetassociation.org
 - www.ashrae.org
- *Tracer BACnet Terminator Installation Instructions* (X39641151-01)
- *Tracer TU Help online*
- *Tracer TU Service Tool Getting Started Guide* (TTU-SVN02) (X39641083)

For further assistance, contact your local Trane sales office.

Trane - by Trane Technologies (NYSE: TT), a global climate innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

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