

Portable BACnet®/IP to MS/TP Router

Installation Instructions

TL-BRTRP-0

Part No. 24-10414-2, Rev. D

Issued June 29, 2012

Supersedes May 29, 2012

Refer to the [QuickLIT Web site](#) for the most up-to-date version of this document.

Applications

The Portable BACnet®/Internet Protocol to Master Slave/Token-Passing (MS/TP) Router (TL-BRTRP-0) routes information between BACnet/IP and MS/TP networks. It is intended to be used as an interface between the following applications:

- FX CommPro BACnet software (running on your computer) and FX Field Controllers fitted with BACnet MS/TP communication cards
- FX-PCT software (running on your computer) and FX-PC Programmable BACnet Controllers
- Controller Configuration Tool (CCT) software (running on your computer) and BACnet Field Equipment Controllers (FECs)

Note: CCT must be at Release 5.3 or later to support the BACnet routing connection.

To configure the BACnet/IP to MS/TP router, use the router Web page.

The router electronics exist in a small portable case and are powered from the computer USB port; however, no USB drivers are needed. The router contains a 10/100 Mbps Ethernet Auto-Medium Dependent Interface Crossover (MDIX) port and an MS/TP compatible port.

The MS/TP port offers a choice of EIA-485 connectors (an RJ-11 connector or a 3-pin terminal block with removable plug) and is optically isolated from USB power. The MS/TP port can address 127 devices. The MS/TP port also supports up to 32 devices on a single segment, and you can use repeaters to add additional devices or to extend bus length. All MS/TP baud rates are supported.

Installation

Parts Included

Included in this package are the following items:

- BACnet/IP to MS/TP Router
- *BACnet/IP to MS/TP Router Installation Instructions (Part No. 24-10414-2)*
- USB cable

- CAT5 Ethernet cable

Connectors

The BACnet/IP to MS/TP Router contains the following:

- **3-pin (MS/TP) Pin Assignments** (also explained on the product label) - See Figure 1.

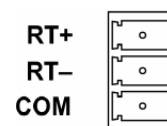


Figure 1: 3-Pin Connector

- **RJ-11 (MS/TP) Pin Assignments**

- 2 RT-
- 4 COM
- 5 RT+
- All other pins are unused. See Figure 2.

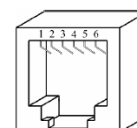


Figure 2: RJ-11 Connector

- **RJ-45 (Medium Dependent Interface [MDI] Ethernet) Pin Assignments**

- 1 TD+
- 2 TD-
- 3 RD+
- 6 RD-
- All other pins are unused. See Figure 3.

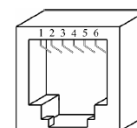


Figure 3: RJ-45 Connector

USB Port

The BACnet router has a USB 2.0, Type B receptacle which is only used to obtain power from a computer. No communications are supported via the USB port. Since no USB driver is required, disregard the unknown hardware window that appears when you connect the BACnet router to a computer's USB port.

MS/TP Port

The MS/TP port uses an EIA-485 transceiver connected to both a 3-pin removable connector and an RJ-11 connector. The + and - lines of the EIA-485 transceiver tie to RT+ and RT- pins of both connectors. The COM pins of both connectors tie to the circuit ground of the EIA-485 transceiver. The port is electrically isolated from the USB power.

The router can support 127 MS/TP devices. Up to 32 devices on a single segment are supported, and you can use repeaters to add additional devices or to extend bus length. The router supports baud rates of 9600; 19,200; 38,400; or 76,800 bps.

Note: FX-PCs and MS-FECs support a BACnet router connection only at the field controller (FC) bus, not at the sensor actuator (SA) bus.

Use field wiring to connect the BACnet router to the controller. A custom cable must be used to connect the BACnet router to the phone jack of an FX-PC or MS-FEC controller. A standard modular jack 6-pin cable does not function correctly. Figure 4 and Table 1 provide the pinout required for the custom cable.

BACnet Router to Controller Cable Pinout (Custom RJ-11 Modular Cable)

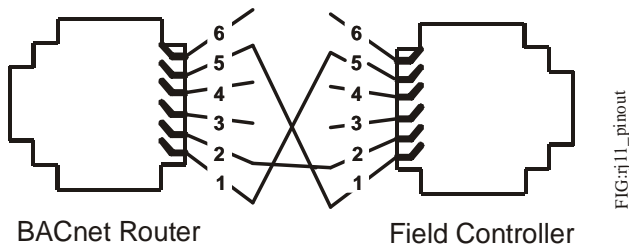


Figure 4: BACnet Router to FEC Controller Cable Pinout

Note: Verify that Pins 3, 4, and 6 are **not** connected in the custom cable.

Table 1: Custom RJ-11 Cable Connections

Connector A Plug ¹	Connector B Plug
Terminal 1+	Terminal 5+
Terminal 2-	Terminal 2-
Terminal 5+	Terminal 1+

1. Terminals 3, 4, and 6 are not used in the custom pinout.

Ethernet Port

The Ethernet port offers a shielded RJ-45 connector. Through auto-negotiation and Auto-MDIX, the port automatically matches its duplex setting, flow control, data rate, and signal polarity to whatever is needed by the attached equipment. Use the included CAT5 Ethernet cable for the connection to your computer.

IP Address Reset Switch

The reset switch is a small hole located on the side of the case. If you press the reset switch with a paper clip (or similar device) for at least 1 second, the switch resets to the default values of the IP address, gateway address, and netmask. After you use the reset switch, you need to reboot the router.

Rebooting the Router

To reboot the router, unplug and then plug the USB cable on the router.

Table 2: Default Address Values

Address Type	Default Address
IP Address	192.168.92.68
Gateway Address	192.168.92.1
Subnet Mask	255.255.255.0 (/24)

Dimensions

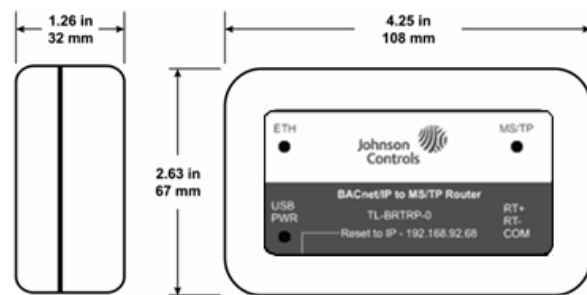


Figure 5: BACnet/IP to MS/TP Router Dimensions, in. (mm)

Operation

Light-Emitting Diodes (LEDs)

The router contains three LEDs. See Table 3.

Table 3: LEDs

Name	Description
USB PWR	The power LED glows when sufficient power is provided from the USB host.
ETH	An Ethernet LED glows green for 100 Mbps and yellow for 10 Mbps (also indicates activities by flashing).
MS/TP	A green LED flashes when the router receives MS/TP traffic.

Web Page Consideration

The BACnet/IP to MS/TP Router contains a Web server. You can access the Web server from any Internet-compatible computer on the local network (Microsoft® Internet Explorer® Version 5.0 or later). To access the MS/TP network, you need the router, a computer used to configure the router, and a connection to the MS/TP network (Figure 6).



Figure 6: Setup for Initial IP Address Configuration

To configure the router, you need a computer with an Ethernet connection, router, and standard Web browser.

Note: Verify that the Use a Proxy Server for your LAN check box in Internet Explorer is not selected or you cannot connect to the router. This check box is located in the Internet Explorer Tools menu > Internet Options > Connections > LAN Settings.

Modifying the Computer IP Address

For initial configuration, you need to temporarily modify the computer IP address.

To modify the computer IP address:

1. From the Start menu, select Network Places. The Network Places window appears (Figure 7).



Figure 7: View Network Connections

2. From the Network Tasks section, select **View network connections**. The Network Connection window appears.
3. Right-click Local Area Connection and select Properties. The Local Area Connection Properties dialog box appears (Figure 8).

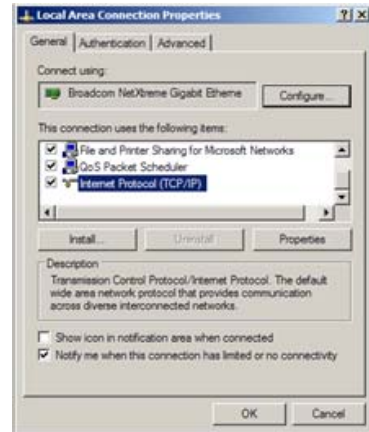


Figure 8: Local Area Connection Properties

4. In the list of connections, select **Internet Protocol (TCP/IP)** and click Properties. The Internet Protocol (TCP/IP) window appears (Figure 9).

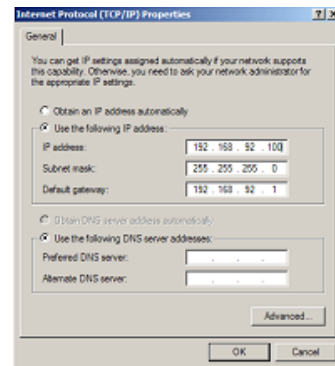


Figure 9: Internet Protocol (TCP/IP) Properties

- Click **Use the following IP address** and enter the values defined in Table 4.

Table 4: PC Address Settings

Address Type	Default Address
IP Address	192.168.92.100 for the PC connected to the router. The final quad can be any value from 3 to 254 (except for 68, which is used by the router).
Subnet Mask	255.255.255.0
Default Gateway	192.168.92.1



Figure 10: Router Configuration Web Page

- Click OK.

Configuring the Router

To configure the router:

- In your Web browser address field, enter the router IP address: **192.168.92.68** (Figure 10).
- Use Table 5 as a reference when you configure the router parameters.

Note: To reset the parameters back to the default parameters, press the reset switch with a paper clip (or similar device) for at least one second. For more information, see [IP Address Reset Switch](#)

Repair Information

If the BACnet/IP to MS/TP router fails to operate within its specifications, replace the unit. For a replacement unit, contact the nearest Johnson Controls® representative.

Table 5: Router Parameters (Part 1 of 2)

Name	Description
Device Instance	Enter a unique 22-bit decimal value (0–4, 194, or 303). Each network device must have a unique device instance. Default Value = 0
Ethernet Network	Enter a unique 16-bit decimal value (1–65,534). Each BACnet network, regardless of technology, must have a unique network number. By retaining a value of 0, BACnet Ethernet routing is disabled. Default Value = 0 Note: The Ethernet Network field represents the BACnet over Ethernet network number. BACnet over Ethernet is a different networking technology than BACnet/IP. Ethernet Network and BACnet/IP Network must each have a unique BACnet network number.
BACnet/IP UDP Port	Enter a 16-bit hexadecimal value. All BACnet IP devices on the same BACnet network must have the same BACnet IP UDP port assignment. Normally, you do not need to change this value. If you do, avoid well-known ports that have hexadecimal addresses, such as 15, 17, or 50. Instead, choose port numbers in the range of BAC1 through BACF. Default Value = BAC0 (hexadecimal) Note: MS-CCT, FX-CommPro BACnet, and FX-PCT identify the BACnet/IP UDP port number in decimal format, while the BACnet router identifies the UDP port number in hexadecimal format. The decimal number 47808 is equivalent to the hexadecimal number BAC0.
BACnet/IP Network	Enter a unique 16-bit decimal value (1–65,535). Each BACnet network, regardless of technology, must have a unique network number. Default Value = 1
IP Address	Enter the IP address of the router in dotted decimal format. Select a valid address in the range from 0.0.0.1 to 255.255.255.254. Default Value = 192.168.92.68

Table 5: Router Parameters (Part 2 of 2)

Name	Description
IP Subnet	Enter a decimal value (0–30) for the IP subnet mask. This value is the number of bits with a 1 in the mask. Default Value = 24
IP Gateway	Enter the default gateway for the IP stack. This value is a dotted decimal number that ranges from 0.0.0.1 to 255.255.255.254. Default Value = 192.168.92.1
MS/TP MAC	Enter the 8-bit (0–127) decimal value for the MAC address of the router's MS/TP port. Each device on the local BACnet network must have a unique MAC address. Lower MAC address numbers are preferred. Default Value = 0 Note: Many supervisory class controllers (NxEs and FX20/FX60/FX70s) are assigned MS/TP MAC Address 0; therefore, it is important that you change the default value to a different value. We recommend you set the MS/TP router's MAC address to 3, which is unused in most installations.
MS/TP Network	Enter a unique 16-bit decimal value (1–65,535). Each BACnet network, regardless of technology, must have a unique network number. Default Value = 2,001 Note: If an NxE exists on the network, view the Hardware tab on the trunk to determine the network number.
Max. Masters	Enter an 8-bit decimal value (1–127) representing the highest master MAC address in the MS/TP network. The value can be as high as 127. You should use 127 if you are unsure of other MS/TP device addresses. Each MS/TP device should use the same value. The value you define must equal or exceed the highest MAC address for any master on the network. Optimum performance occurs when: <ul style="list-style-type: none"> • this value equals the highest MAC address • all masters use sequential MAC addresses Default Value = 127
Max. Info Frames	Enter the maximum number of messages that can route onto the MS/TP network by the router per token pass. The range is 1 to 100 and the typical values are above 20. Smaller values provide less access to the MS/TP network from the BACnet/IP network because they give local MS/TP messages higher priority than those passed to the router by BACnet/IP. Default Value = 100
MS/TP Baudrate	Enter the baud rate of the MS/TP network (9600; 19,200; 38,400; or 76,800). All MS/TP devices on the same MS/TP network must use the same baud rate. Default Value = 38,400
MS/TP Tolerance	Poll for Master Timeout = 75 ms when set to Lenient and = 20 ms when set to Strict. This setting determines the degree to which interoperability with devices is successful. The Lenient option is less efficient for traffic flow but optimizes interoperability. Default value = Lenient

Technical Specifications

BACnet to MS/TP Router

Product Code	TL-BRTRP-0
Electrical (USB)	Input Voltage: 5 VDC (nominal) Input Current: 500 mA (maximum)
Environmental	Operating temperature: 0 to 50°C (32 to 122°F) Storage temperature: -40 to 85°C (-40 to 185°F) Relative humidity: 10 to 95%, noncondensing
Signaling	USB: 1.1 (2.0 compatible) Ethernet: 10BASE-T, 100BASE-TX MS/TP: EIA-485, (American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers [ANSI/ASHRAE] 135-2004)
Cable Length Limit	USB: 5 m Ethernet: 100 m MS/TP: 1,200 m (for 18 AWG)
MS/TP bps	9600; 19,200; 38,400; 76,800
MS/TP Node Limit	127 devices 32 devices per segment
LEDs	MS/TP LED Flashing green = receive activity USB (Power) LED Green Ethernet LED Green = 100 Mbps Yellow = 10 Mbps Flashing = Activity
Ethernet Flow Control	Half-duplex – backpressure Full-duplex – Institute of Electrical and Electronic Engineers (IEEE) 802.3x PAUSE
Connectors	3-pin (MS/TP) Pin Assignments (also explained on the product label) RJ-11 (MS/TP) Pin Assignments 2 RT - 4 COM 5 RT+ All other pins are unused. RJ-45 (MDI Ethernet) Pin Assignments 1 TD+ 2 TD- 3 RD+ 6 RD- All other pins are unused.
Compliance	FCC Compliant to CFR 47, Part 15, EN55022 Class A; CE Mark; ROHS



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