BACnet/IP to BACnet MS/TP Router

Provisional Installation Guide

Installation Notes

These notes should be used in conjunction with the BACnet/IP to BACnet MS/TP router data sheet.

Description

The BASRT-B routes messages between BACnet/IP and BACnet MS/TP networks as per the ANSI/ASHRAE 135-2004 standard. It allows BACnet/IP devices operating over Ethernet to communicate with MS/TP devices. The router is configurable via its internal webpage.

The BASRT-B features a user-accessible switch to reset the IP address, subnet mask and gateway address to the factory defaults. When using the BASRT-B to communicate on routed IP networks (ones which use multiple IP subnets), a separate device with BBMD functionality must be provided. If all IP devices use the same subnet, then BBMD functionality is not required. For example, if the BASRT-B uses IP address 192.168.1.1 and another BACnet/IP device (which will communicate with the BASRT-B) uses 10.0.0.1, then BBMD functionality is required from another device on your network.

Power

The BASRT-B requires 24 VAC or 24 VDC (see Power Options in datasheet) while drawing no more than 3 W of power. The recommended conductor size is 16 18 AWG. COM is directly connected to zero volts and the chassis is DC isolated from zero volts. Input connections are reverse-polarity protected.

WARNING: Powering devices can present hazards. Read the text on the following page carefully.

POWER SUPPLY PRECAUTIONS

Internally, the router utilises a half-wave rectifier and therefore can share the same AC power source with other half-wave rectified devices. Sharing a common DC power source is also possible. Sharing AC power with full-wave rectified devices is NOT recommended. Full-wave rectified devices usually require a dedicated AC power

source that has a secondary elevated above ground. Both secondary connections are considered HOT.

AC power sources that power several half-wave devices have a common secondary connection called either COMMON, LO, or GROUND. This connection might be tied to frame ground or earth. The other side of the secondary is considered the HOT or HI side of the connection. Connect the HOT side of the secondary to either the HI or the HIB input on the router and the LO side to COM on the router. All other half-wave devices sharing the same AC power source need to follow the same convention. When using a DC power source, connect the positive terminal of the source to either the HI or the HIB input and the negative terminal to COM on the router. Reversing polarity to the router will not damage the router. If shielded cable is used, it is recommended to tie all shield segments together and connect one of the shield ends to chassis while taping back the other.

For MS/TP devices that share a power source with the BASRT-B, see Figure 7 for proper 2-wire bus connections and Figure 8 for proper 3-wire bus connections.

WARNING: Devices powered from a common AC source could be damaged if a mix of half-wave and full-wave rectified devices exist. If you are not sure of the type of rectifier used by another device, do not share the AC source with it.
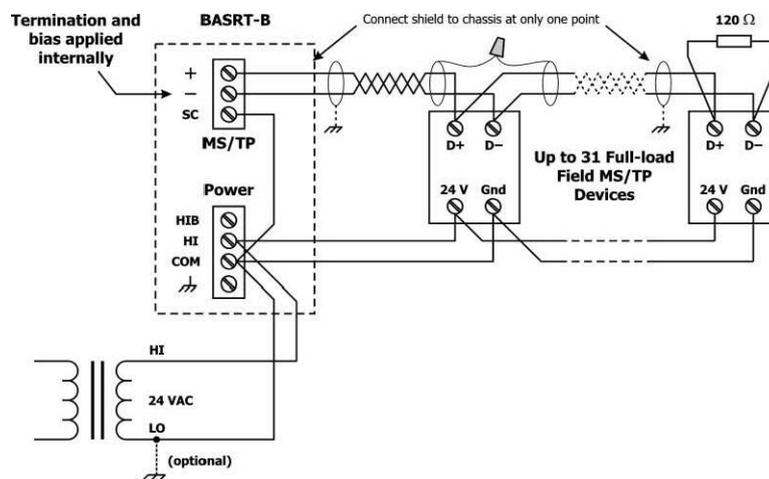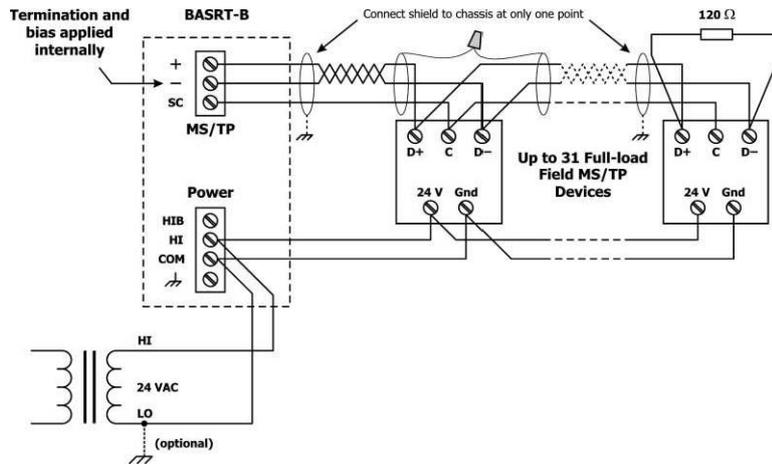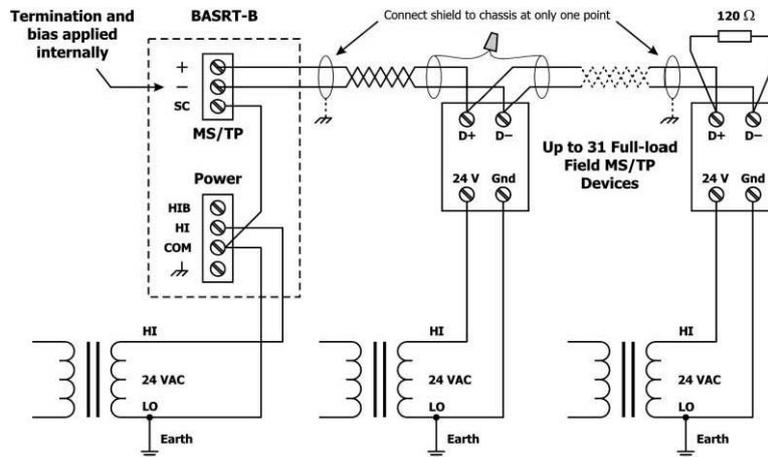

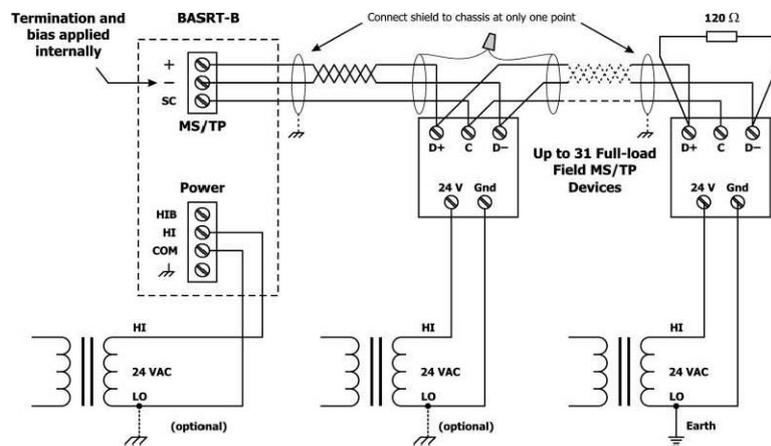**Fig 7 –** Two wire MS/TP Bus with shared power source.

Fig 8 – Three wire MS/TP Bus with shared Power source

For MS/TP devices that use a power source separate from the BASRT-B, see Figure 9 for proper 2-wire bus connections and Figure 10 for proper 3-wire bus connections.

Fig 9 - Two wire MS/TP Bus with separate power source

Fig 10 – Three wire MS/TP Bus with separate power source

Limited Power Sources

The router should be powered by a limited power source complying with the requirements of the National Electric Code (NEC) article 725 or other international codes meeting the same intent of limiting the amount of power of the source. Under NEC article 725, a Class 2 circuit is that portion of the wiring system between the load side of a Class 2 power source and the connected equipment. For AC or DC voltages up to 30 volts, the power rating of a Class 2 power source is limited to 100 VA. The transformer or power supply complying with the Class 2 rating must carry a corresponding listing from a regulatory agency such as Underwriters Laboratories (UL).

LEDs

Power glows green if power supplied to the unit is proper *Ethernet* glows solid for a valid link (green for 100 Mbps or yellow for 10 Mbps) and flashes to show activity *MS/TP* flashes green when receiving valid MS/TP traffic

Operation

MS/TP Port

The MS/TP port uses isolated EIA-485 transceiver that is connected to a 3-pin removable connector (Fig 1). The EIA-485 transceiver's +ve and –ve lines tie to the +ve and –ve pins of this connector. The SC pin ties to the circuit ground of the EIA-485 transceiver.

In (Fig 11) a simplified schematic of the isolated EIA-485 transceiver is shown. Notice that the transceiver common (SC) is electrically isolated from the router power supply common (COM) through the use of opto-isolators and an isolated DC-DC converter. By providing an isolated EIA-485 transceiver there is less opportunity to damage the transceiver by subjecting it to high common-mode voltages, but there is still a risk. Surge suppression is applied between the two differential inputs and between each input and ground. Since the transceiver is electrically isolated the transceiver's circuit common must be brought out for connection to the other devices on the MS/TP network. This is accomplished by pin SC. The differential pair is labelled + and corresponds to the same designations in the BACnet MS/TP standard. This requires a three-wire connection to the MS/TP network. When connecting other isolated MS/TP devices there is no problem since each device requires a 3-wire connection. Just make corresponding connections. For non-isolated MS/TP devices, usually only a 2-wire connection is provided. The third wire is the power supply common. In this situation, the SC connection must be made to the power supply common of the non-isolated device. **Refer to the Vendor's instructions for connecting such a device.**

In a router application where one connection is made to Ethernet and the other to MS/TP, the location of the router is probably at the end of the MS/TP bus segment and therefore both bias and termination must be applied to the segment end. The router is shipped with bias and termination applied, but this can be changed by removing three jumpers. This should be done if the router is to be connected anywhere between the end MS/TP devices.
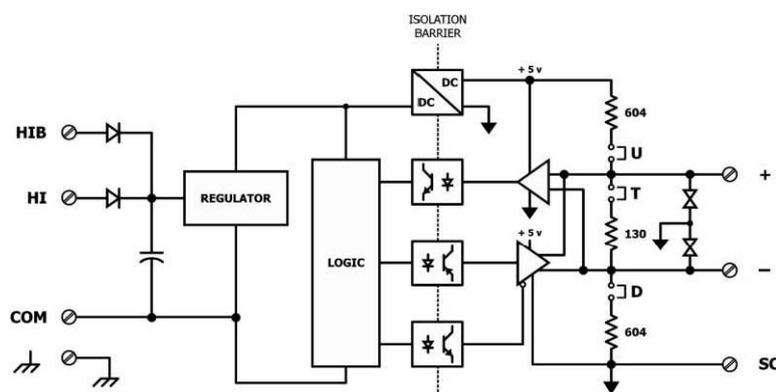

Figure 11 — Isolated EIA-485 Transceiver Circuitry

The router can address 254 MS/TP devices and supports 31 devices on the local bus at rates of 9600, 19200, 38400, or 76800 bps.

EIA-485 Bias and Termination Jumpers

After removing the BASRT-B cover, three jumpers are accessible on a 6-pin jumper block located near the MS/TP connector. These impart 604 ohms of pull-up and pull-down bias at jumpers U and D, and 130 ohms of termination impedance for the T jumper. With all three jumpers installed, the effective termination resistance is 120 ohms consistent with the BACnet standard. If the BASRT-B is not installed at the end of a segment, remove all the jumpers and install at the far end of the bus.

Ethernet Port

This port offers a shielded RJ-45 connector. Through auto-negotiation and Auto-MDIX, it automatically matches its duplex setting, data rate and communication pair usage to whatever is needed by the attached equipment. Thus, any CAT5 cable (cross-over or straight-through) may be used to connect to the Ethernet.

IP Address Reset Switch

To reset the routers IP address default value (192.168.92.68), gateway address (192.168.92.1) and subnet mask (/24 or 255.255.255.0), use a paperclip or similar tool to press the reset button for at least 3 seconds while the router is powered. Release the reset button. Then remove power from the router for 3 seconds. Restore power and the unit will now use the default values.

Web Page Configuration

Each router contains an interactive web server, accessible from any Internet-compatible PC on the local network and compatible with recent versions of Internet Explorer (5.0 or later, suggested) or Netscape Navigator (7.1 or later, required). It is factory-programmed with a default IP address of 192.168.92.68 and a Class C subnet mask of 255.255.255.0 (/24).

Figure 12 shows the setup for accessing the MS/TP network using BACR-B, a computer for configuration, and a connection to the MS/TP network.

To configure the router, attach it to a computer with an Ethernet connection and a standard web browser. For initial configuration, the PC chosen for the procedure should temporarily have its IP address modified as illustrated in *Figure 13* which employs a Windows® XP example.
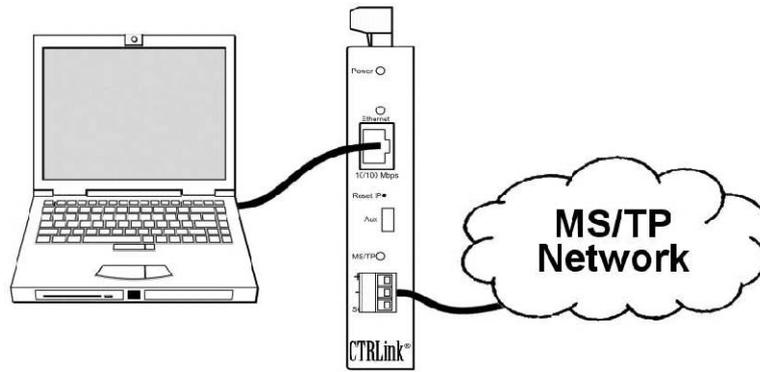
Figure 12 — Setup for Initial IP Address Configuration

The example in *Figure 13* suggests an IP address for the PC of 192.168.92.**69**, but the final quad of the address could be any value from 3 to 254 except for **68** which is used by the router. After the IP address of the PC has been set to the same subnet as the router, a browser can access the router via its default IP address.
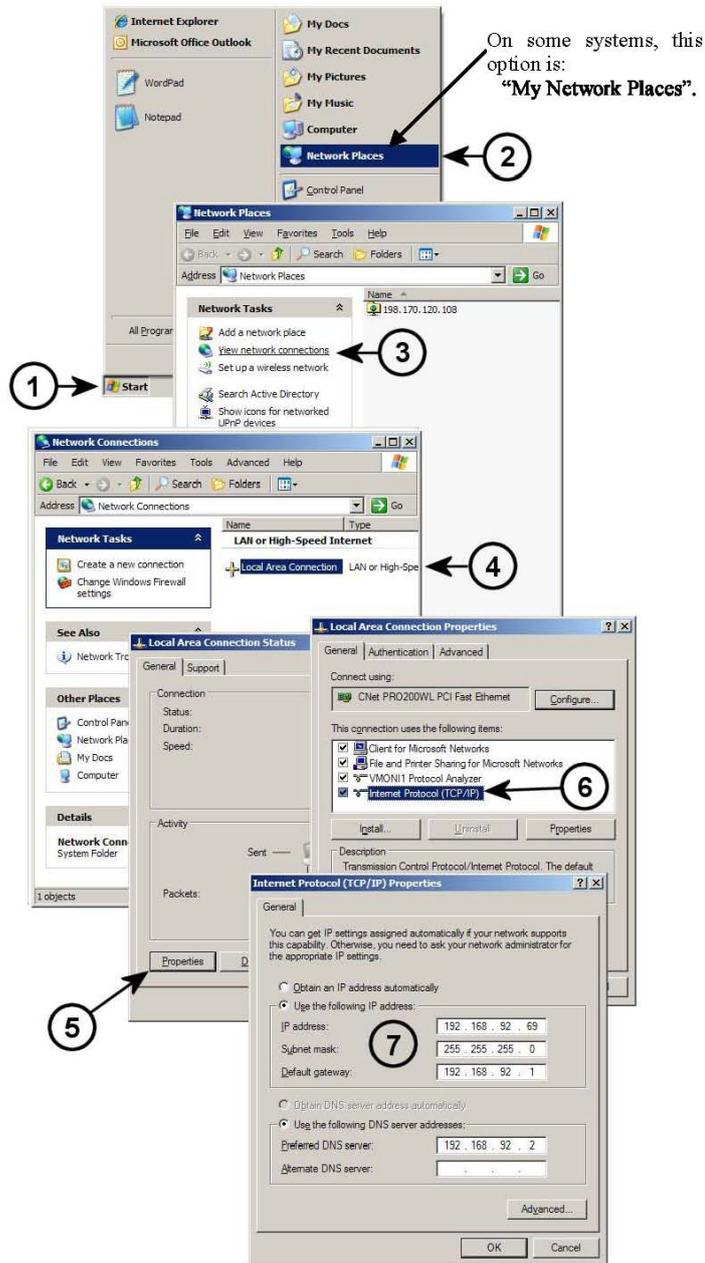
Figure 13 — Steps for Changing the IP Address of the PC Used for Setup

After entering the router's IP address into your browser's address field you will see the Router Configuration Page with the default values as shown in (Fig 14) – using Windows Explorer.
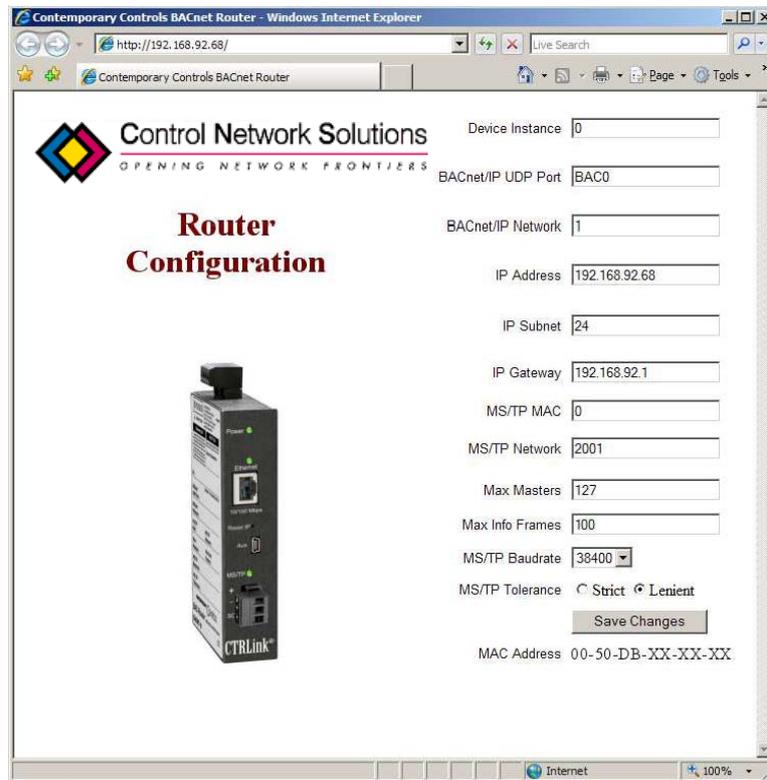
Figure 14 — Router Configuration Page with Default Values

Each configuration parameter is explained on the following pages. When *save changes* is selected, the parameters are stored to non-volatile memory and you are prompted to recycle power to the unit. Until power is removed and then restored, your changes **will not apply**.

Device Parameter

Device Instance (Default Value = 0)

The router's device instance is a 22-bit value (0 4,194,302). Do not use 4,194,303 which is reserved by BACnet. Each BACnet device within the same BACnet internetwork must have a unique device instance. One must be assigned to the BACR-B.

BACnet/IP Parameters

BACnet/IP UDP Port (Default Value = 0xBAC0)

This 16-bit hex value (BAC0 BACF) is set to BAC0 by default. Usually, this default value should not be changed. In a typical installation, each BASRT-B will be assigned the same UDP port.

BACnet/IP Network (Default Value = 1)

The BACnet/IP network number is a 16-bit value (1 65534). Each network within the BACnet internetwork must have a unique number. This includes the BACnet/IP and MS/TP sides of the BASRT-B. Do not use addresses 0 or 65535 since these addresses are reserved.

IP Address (Default Value = 192.168.92.68)

The IP address of the router can be 0.0.0.1 255.255.255.254. A private address is usually assigned to the BASRT-B.

IP Subnet (Default Value = 24)

This value (0-30 in the "slash" notation) is the number of bits with a "1" in the mask. The default vakue of 24 corresponds to 255.255.255.0 in the dotted decimal format

All devices on the same subnet which communicate via BACnet/IP should use the same subnet mask.

IP Gateway (Default Value = 192.168.92.1)

The default gateway for the IP stack is a dotted decimal number in the range of 0.0.0.0 255.255.255.254. This will be the IP address of your local IP router if one exists.

MS/TP Parameters

MS/TP MAC (Default Value = 00)

This is the unique 8-bit (0 127) MAC address of the router MS/TP port, in decimal. Lower MAC address numbers are preferred with the default recommended. It is further recommended that all other BACnet devices attached to the same MS/TP network be assigned consecutive MAC addresses beginning with 1 without allowing any gaps in addressing. Slave devices may have MAC addresses of 128 254, but MAC address 255 is reserved.

MS/TP Network (Default Value = 2001)

This 16-bit decimal network number (1 65534) must be unique for all BACnet networks within the BACnet internetwork. No other networks, regardless of type, can have the same network number. Do not use addresses 0 or 65535 since these addresses are reserved.

Max Masters (Default Value = 127)

Only master nodes participate in the MS/TP token-passing process. The highest master MAC address (in decimal) in the MS/TP network is 127 and you should use 127 if you are unsure of other MS/TP device addresses. Each MS/TP device should use this same

value. For a value in this field to be proper, it must equal or exceed the highest MAC address for any master on the network. Optimum performance occurs when this value:

1. ***equals*** the highest MAC address of any master, and
2. all masters use ***sequential*** MAC addresses starting with 1

Since many BACnet devices do not allow this parameter to be changed, leave the BACR-B at the default value.

Max Info Frames (Default Value = 40)

This is the maximum number of messages that can be routed onto the MS/TP network by the router per token pass. Its range is 1 100, and typical values are 20 40. Smaller values provide less access to the MS/TP network from the BACnet/IP network because they give native MS/TP messages higher priority than those passed by the router from BACnet/IP. The default value usually provides good performance.

MS/TP Baud Rate (Default Value = 38400)

The baud rate of the MS/TP network can be 9600, 19200, 38400 or 76800 bps. All MS/TP devices on the same MS/TP network must use the same baud rate. On power up the router checks for other masters; if finding none, it begins token passing at which point autobauding devices will adjust to the router's baud rate.

MS/TP Tolerance (Default Selection = 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. A slight improvement in performance will be realised by selecting the *Strict* setting.

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