



## Using BASrouters and IP Routers to Communicate Across Subnets



The Building Automation industry expects connectivity across a variety of BACnet networks – IP, Twisted-Pair and Ethernet. A BACnet router provides this capability with support for BACnet/IP, BACnet MS/TP and BACnet Ethernet. The ASHRAE 135 standard defines a network layer allowing multiple BACnet networks to send and receive messages over a single BACnet internetwork without concern for different data links. But a BACnet internetwork is different from multiple IP networks defined by subnets. An IP router connects these sub-netted IP networks together while two BACnet/IP networks can be interconnected using a BACnet router. The setup requires configuring both the IP router and BACnet routers appropriately. This configuration across subnets applies equally for access to remote sites across the internet.

Most IP routers will not pass broadcast messages which are crucial to BACnet's operation. The solution is to incorporate

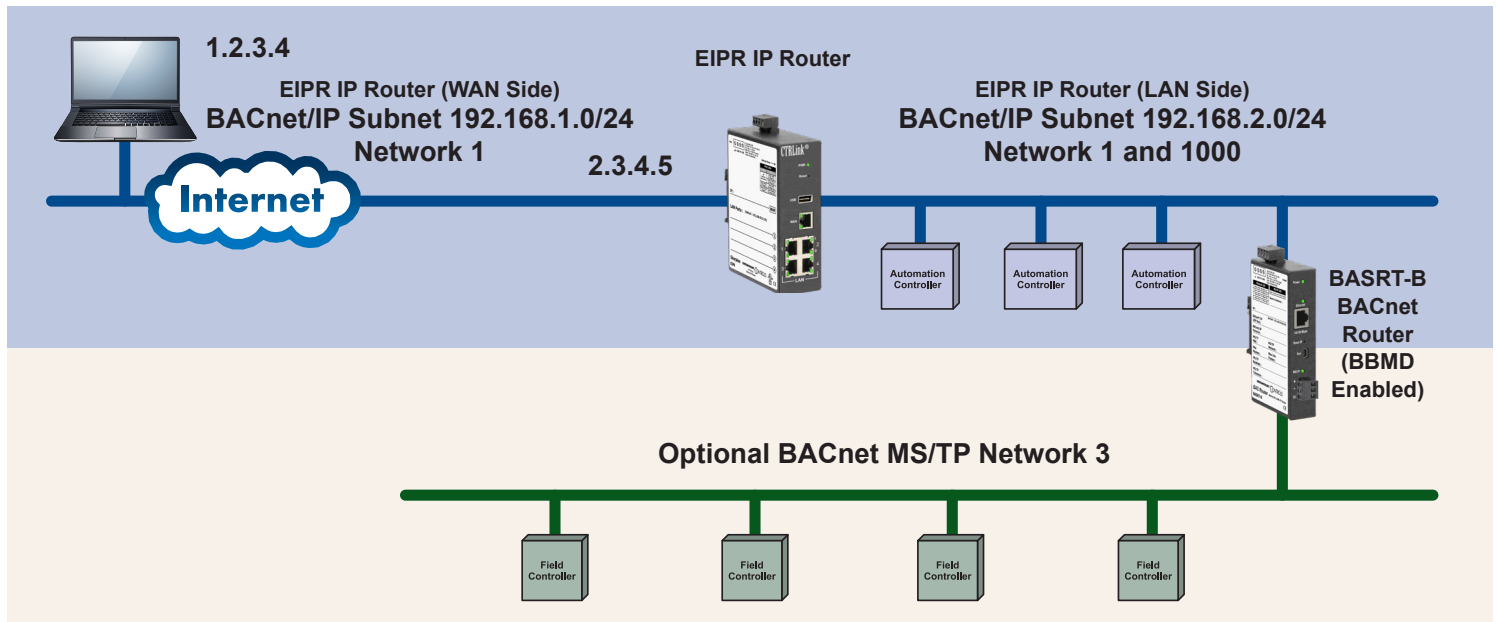
BACnet/IP Broadcast Management Device (BBMD) functionality within the BACnet internetwork.

The BBMD concept requires a broadcast message that originates on one subnet be encapsulated into a directed message and sent to all remote subnets since these directed messages will pass through IP routers. Once the encapsulated messages are received on the remote subnets, a BBMD device will decode the message and resend it on its local subnet as a broadcast message.

It would appear that a BBMD device must be present on each subnet in order to provide this encoding and decoding function. However, this is not the case if all the BACnet/IP devices support Foreign Device Registration (FDR). At a minimum, one BBMD device must be located on one of the subnets with FDR devices registering to this one BBMD.

The following example shows how to use the BBMD server to access your BACnet system from a remote PC connected to Internet, but the BBMD server can also be used to access

a BACnet system from a local PC with or without firewall enabled. Refer to the [BASrouters Application Guide](#) for details.



In this example, the PC is located remotely and attached to the Internet as an IP router. The BACnet/IP network has been sub-netted and connected using an IP router with firewall enabled.

Both the PC and the WAN-side of the IP router have public IP addresses. This example uses public addresses 1.2.3.4 and 2.3.4.5. In reality, the PC TCP/IP configuration screen and the WAN Setup screen will be dictated by the Internet Service Providers (ISP).

The LAN-side of the EIPR IP router controls the building's automation system and contains four BACnet/IP devices — three BACnet/IP controllers and one BASrouter which serves an MS/TP segment.

A firewall requires that message initiation begin on the LAN-side of the IP router and not from the WAN-side. Therefore, it would be impossible for a request initiated on the WAN-side to reach the BASrouter located on the LAN side unless a "port is opened" in the IP router. This action is called Port Forwarding.

However, Port Forwarding can only address one device when, in this example, four devices need to be addressed. Therefore, you need the BASrouter to route between BACnet/IP and BACnet MS/TP as well as another BACnet/IP network. This is completed by opening an alternate BACnet port (BAC1), which is UDP port 47809. Because this is an alternate BACnet port, it is necessary to verify that it is available.

The BASrouter IP address is 192.168.2.2, and the IP router address (on the LAN side) is 192.168.2.1.

From the **IP router Port Forwarding** screen, enable both **47809 TCP/UDP WAN IP Ports to 192.168.2.2**, which is the IP address of the BASrouter and the BBMD Server.

Two UDP ports are required in this example because you need to route between an incoming BACnet/IP network (network 1000) carrying requests from the Internet and an BACnet/IP network (network 1) where three BACnet/IP controllers are attached. Although physically these two BACnet networks are on the same IP subnet (192.168.2.0/24), they are treated differently in terms of BACnet.

Since the existing BACnet system is probably already using port BAC0, it is more convenient not to change this port setting on all the installed devices. Instead, you will configure the **BASrouter Main** screen for BACnet/IP UDP Port 1 as **BAC1** and the BACnet/IP Network 1 as **1000**.

You will configure the **BASrouter Advanced** screen as follows:

- BBMD: Enable
- Secondary BACnet/IP UDP Port: BAC0
- Secondary BACnet/IP Network: 1
- The Public IP Address: 2.3.4.5

Changing the Public IP address to the public address of the IP router will allow for BACnet/IP to BACnet/IP routing using a technique called network address translations (NAT) Traversal.

BBMD must be enabled on the **Advanced** screen, but it is not necessary to have the BACnet/IP controllers be set to Accept Foreign Device Registration (FDR) because they reside on the same IP subnet as the BASrouter.

However, the PC's FDR settings must include a BBMD address of 2.3.4.5 in order to reach the WAN-side of the IP router that will forward the requests through port forwarding.

There are some settings on the IP router that should be explained. On the IP router LAN Setup, DHCP Server Settings are shown to be enabled. This allows DHCP client devices on the attached subnet to receive an IP address if requested. However, the BASrouter IP Address must be manually set to 192.168.2.2 to match the IP router address on the LAN side so that it remains constant, as it is the BBMD device. The port forwarding for UDP Port BAC1 allows BBMD access to the BASrouter, which in turn provides BACnet/IP routing to UDP port BAC0 to discover the other BACnet/IP controllers on the local IP subnet.

Configuring the BASrouter and IP Router

Main Screen

Device Name Router(BBMD Enabled)

Device Instance 0

Device Location Application #9

Ethernet Network 0

BACnet/IP UDP Port 1 BAC1

BACnet/IP Network 1 1000

IP Address 192.168.2.2

IP Subnet 24

IP Gateway 192.168.2.1

MS/TP MAC 0

MS/TP Network 3

Max Masters 127

Max Info Frames 100

MS/TP Baudrate 38400

MS/TP Tolerance Strict Lenient

MAC Address 00-50-DB-00-D8-E7

Firmware Revision 2.7.2

Advanced Screen

BBMD Enable

BBMD UDP Port Primary

Accept FDR

Broadcast Distribution Table

Foreign Device Table

Secondary BACnet/IP UDP Port BAC0

Secondary BACnet/IP Network 1

Public IP Address 2.3.4.5

IP Router Port Forwarding

WAN IP Port	TCP/UDP	TO	LAN IP Address	LAN IP Port	Enabled
47809	Both	TO	192.168.2.2	47809	<input checked="" type="checkbox"/>
	Both	TO			<input type="checkbox"/>
	Both	TO			<input type="checkbox"/>
	Both	TO			<input type="checkbox"/>

Save Cancel

IP Router Setup

WAN Setup

Connection Type Static IP

IP Address 2.3.4.5

Subnet Mask 255.0.0.0

Default Gateway 10.0.0.1

Static DNS 1 0.0.0.0

Static DNS 2 0.0.0.0

Static DNS 3 0.0.0.0

Optional Settings (required by some ISPs)

Host Name

Domain Name

MTU Enable Disable Size 1500

LAN Setup

Router IP

Local IP Address 192.168.2.1

Subnet Mask 255.255.255.0

Network Address Server Settings (DHCP)

Local DHCP Server Enable Disable

Start IP Address 192.168.2.100

Number of Addresses 10 (1 to 50)

Client Lease Time 0 minutes (0 means one day)

PC Configuration

Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

Obtain an IP address automatically

Use the following IP address:

IP address 192.168.1.2

Subnet mask 255.255.255.0

Default gateway 192.168.1.1

Obtain DNS server address automatically

Use the following DNS server addresses:

Preferred DNS server

Alternate DNS server

Advanced...

OK Cancel

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AN-SUBNET00-AA0

Contemporary Controls provides three models of BACnet routers — the BASrouter, Portable BASrouter and the BASrouterLX. Contemporary Controls IP Routers are industrial grade routers with built-in switches with

advanced features such as a Stateful Firewall, Port Forwarding and NAT. Visit the [BACnet Routers](#) and the [IP routers](#) webpages to learn more.

## Ordering Information

<b>Model</b>	<b>RoHS</b>	<b>Description</b>
<a href="#">BASRT-B</a>	✓	BASrouter BACnet/IP to MS/TP to Ethernet DIN-Rail Mount
<a href="#">BASRTP-B</a>	✓	BASrouter Portable BACnet/IP to MS/TP to Ethernet
<a href="#">BASRTLX-B</a>	✓	BASrouterLX High Performance BACnet Router DIN-Rail Mount
<a href="#">BASRTLX-B/P</a>	✓	BASrouterLX High Performance BACnet Router Panel Mount
<a href="#">EIGR-C3</a>	✓	Skorpion GigE IP Router with Cellular (Verizon) 0 to 60°C
<a href="#">EIGR-E</a>	✓	Skorpion GigE IP Router 0 to 60°C
<a href="#">EIGR-V</a>	✓	Skorpion GigE IP Router with VPN 0 to 60°C
<a href="#">EIPR-E</a>	✓	Skorpion 10/100Mbps IP Router
<a href="#">EIPR-V</a>	✓	Skorpion 10/100Mbps IP Router with VPN

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