BASrouterSX — BACnet® Multi-Network Router

The BASrouterSX is a high-performance BACnet router that provides stand-alone routing between BACnet networks such as BACnet/IP, BACnet Ethernet (ISO 8802-3), and BACnet MS/TP. The BASrouterSX-GSA is a GSA-compliant model which has been tested and approved for use in U.S. government buildings.

Besides a high speed processor, the routers have advanced features such as MS/TP Backbone, Backward Routing, Allowlist option for enhanced security, MS/TP slave proxy support (allowing auto-discovery of MS/TP slaves), and MS/TP frame capture and storage for use with Wireshark®. An MS/TP Status webpage features a graphical table that provides real-time status of all BACnet MS/TP devices on the network. As a BACnet/IP Broadcast Management Device (BBMD), up to 50 BDT and 147 Foreign Device Registration (FDR) entries can be supported. The BASrouterSX has two physical communication ports—a 10/100 Mbps BACnet/IP Ethernet port and an optically-isolated EIA-485 port for MS/TP. Router configuration is accomplished via web pages using HTTPS (HTTP over SSL) that provides encrypted webpage communications with the BASrouterSX.

Versatile Routing Between …

- BACnet/IP and BACnet MS/TP
- BACnet Ethernet and BACnet MS/TP
- BACnet/IP and BACnet Ethernet
- BACnet/IP and BACnet Ethernet and BACnet MS/TP
- Two BACnet/IP networks (between two UDP ports)

IP Network Support

- Web server for commissioning and trouble-shooting
- MS/TP capture using Wireshark®
- 50 BBMD entries, 147 FDR entries
- Webpage configurations over HTTPS

Flexible Communications

- 10/100 Mbps Ethernet with auto-negotiation and Auto-MDIX
- MS/TP slave auto-discovery and proxy support
- MS/TP Backbone
- Backward Routing
- Allowlist
- Optically-isolated MS/TP port
- MS/TP baud rates from 9.6–115.2 kbps

Convenient Installation

- 24 VAC/VDC (± 10%), 47–63 Hz input voltage
- DIN rail mount

Advanced Diagnostics

- Webpage with graphical network map of all 128 MS/TP master devices and device status

Overview

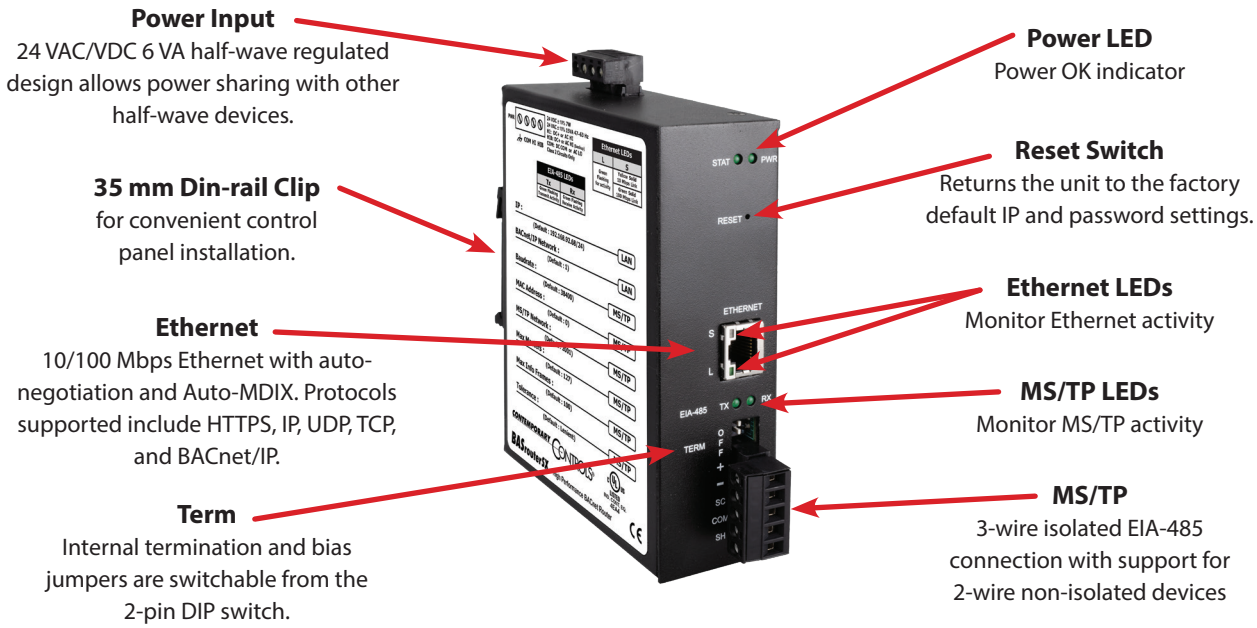
The BASrouterSX and BASrouterSX-GSA are housed in a metal case available as 35-mm DIN-rail mount model. Powered from a 24 VAC/VDC (± 10%) source, their half-wave rectified power supply design allows sharing of power with other half-wave devices. There are two ports on the unit — one Ethernet and one EIA-485.

The optically-isolated EIA-485 serial port allows for connection to either 2-wire or 3-wire MS/TP networks using a removable 5-pin terminal block. Up to 31 full-load or 62 half-load EIA-485 devices can share the serial bus at data rates between 9.6 and 115.2 kbps. A 2-pin DIP switch is accessible from the front of the unit that can provide 120 Ω termination and bias.

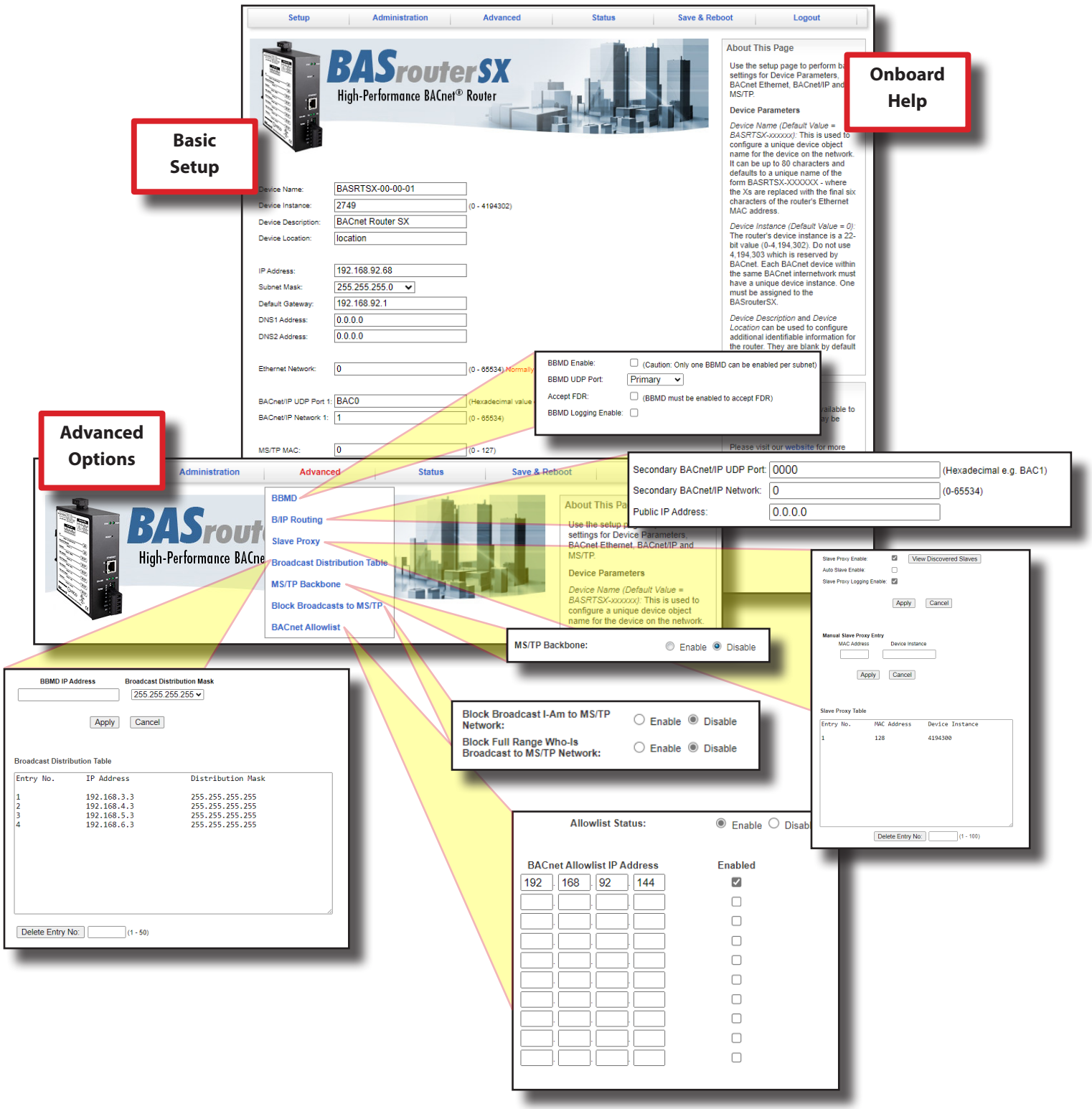
The Ethernet port offers a shielded RJ-45 connector. Through auto-negotiation and Auto-MDIX, it automatically matches connections to the attached equipment. Thus, either straight-through or crossover Ethernet cable can be used to attach to the BACnet/IP network at either 10 or 100 Mbps.

MS/TP slave devices do not participate in token passing but can be made assessable throughout the complete MS/TP address range using either Manual Slave Address Binding or Automatic Slave Discovery. Once they are known, the BASrouters functions as their proxy.

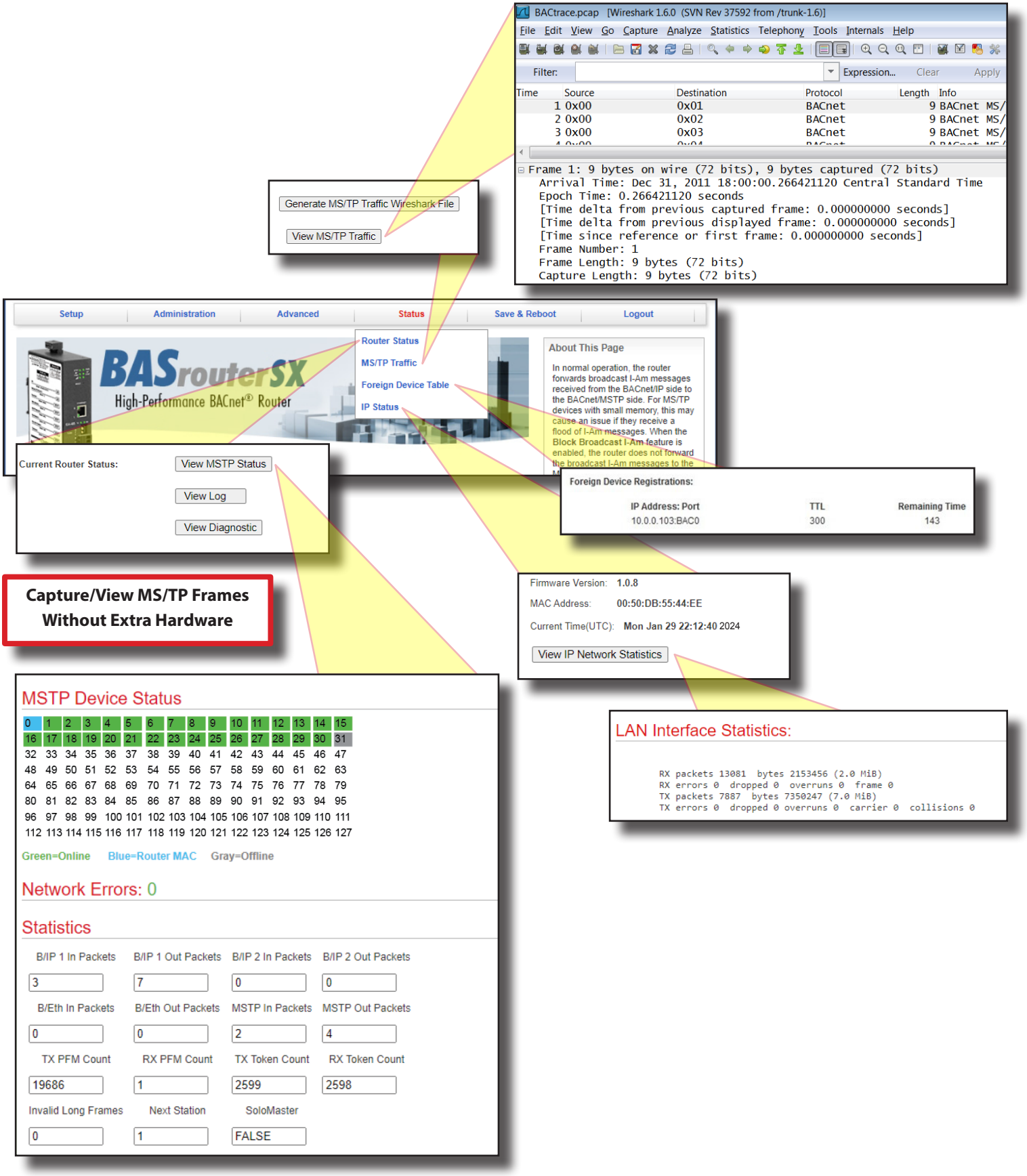
A resident HTTPS web server allows for secure commissioning and troubleshooting via a standard web browser. A reset switch is provided on the router to return the unit to the factory default IP and password settings. Five LEDs are provided. The power LED indicates that proper power is being provided. Two Ethernet LEDs indicate link status, data activity, and data rate. Two EIA-485 LEDs indicate transmission and reception of data.



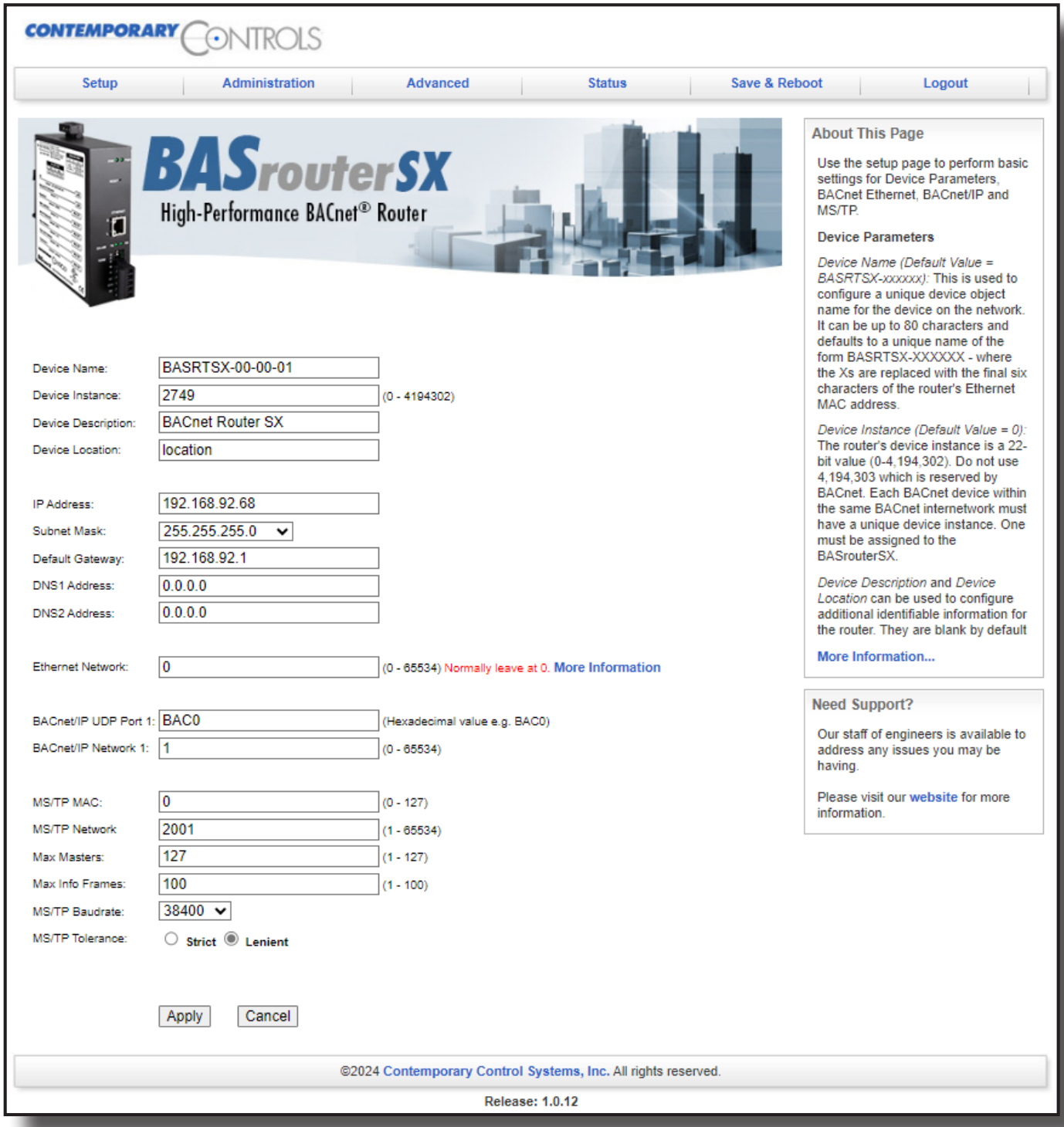
Web Page Configuration, Status and Diagnostics



Web Page Configuration, Status and Diagnostics



Setup — System Settings

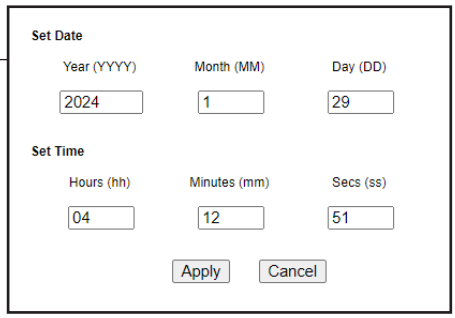


Setup — System Settings

Device Parameters	*Default Value*	*Description*
Device Name	BASRTSX-xxxxxx	The unique default value ends with the last 6 characters of the unit's Ethernet MAC address. You can update it to up to 20 characters. This value must be unique throughout the entire BACnet network.
Device Instance	0	The router device instance is a 22-bit decimal value (0–4,194,302). This value must be unique throughout the BACnet network.
Device Description	BACnet Router SX	If you wish, enter a brief description. This entry is optional.
Device Location		If you wish, specify a location for the device. This entry is optional.
BACnet/IP Parameters	***Default Value***	***Description***
IP Address	192.168.92.68	An IP address in dotted decimal format. The default IP address is 192.168.92.68.
Subnet Mask	255.255.255.0	The default value is 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.
Default Gateway	192.168.92.1	Enter an IP Gateway address in dotted decimal format. Enter the same subnet range.
DNS1 Address	0.0.0.0	IP address of domain name server
DNS2 Address	0.0.0.0	IP address of secondary domain name server
Network Parameters	***Default Value***	***Description***
BACnet Ethernet Network	0	16-bit decimal value (1–65534). Each BACnet network, regardless of technology, must have a unique network number, including BACnet Ethernet. By retaining the default value of 0, BACnet Ethernet routing is disabled — but not BACnet/IP routing.
BACnet/IP UDP Port 1	BAC0	16-bit hex value (0–FFFF) is set to BAC0 as the default value and should be used. All BACnet/IP devices on the same BACnet network must have the same UDP port assignment. For other assignments choose ports in the range from BAC1 to BACF while verifying that these ports are available.
BACnet/IP Network 1	1	16-bit decimal value (1–65534). Each BACnet network, regardless of technology, must have a unique network number. It is recommended that all subnets of the same BACnet/IP network be given the same BACnet network number as well.
MS/TP Parameters	***Default Value***	***Description***
MS/TP MAC Address	0	Decimal value (0–127) represents the MAC address of the router's MS/TP port. Lower MAC address numbers are preferred.
MS/TP Network	2001	16-bit decimal value (1–65535). Each BACnet network, regardless of technology, must have a unique network number.
Max Masters	127	This 8-bit decimal value (1–127) represents the highest master MAC address in the MS/TP network. If the highest value MAC address is unknown or if additional devices are to be added in the future above the current highest MAC address, use the default setting of 127.
Max Info Frames	100	This is the maximum number of messages (1–100) that can be routed onto the MS/TP network by the router per token pass. Values above 20 are typical.
MS/TP Baud Rate	38400	The baud rate of the MS/TP network can be 9600, 19200, 38400, 57600, 76800 or 115200 bps. All MS/TP devices on the same MS/TP network must use the same baud rate. Auto-bauding devices will set their baud rates to that of the BASrouterSX.
MS/TP Tolerance	Lenient	Affects the degree to which interoperability with devices is successful. Lenient option causes less efficient traffic but optimizes interoperability.

NOTE: To disable BACnet/IP functionality on the router, set values for BACnet/IP UDP Port 1 and BACnet/IP Network 1 on the Setup page along with the Secondary BACnet/IP UDP Port and Secondary BACnet/IP Network on the B/IP Routing page under the Advanced tab to 0.

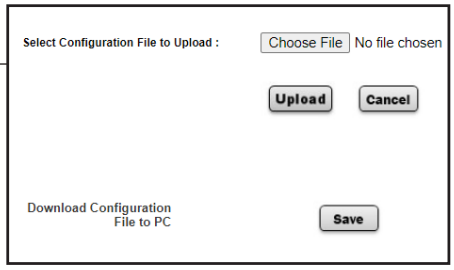
Setup — Date and Time



Set the **Year**, **Month** and **Day** as well as the **Hours**, **Minutes** and **Seconds**. The current date and time is appended to MS/TP captures that are viewed using Wireshark.

NOTE: Date and time settings are stored in a supercapacitor-backed, real-time clock and will be correct when power is lost for a short period of time. Typically, this is about one week.

Setup — Configure Upload/Download



Router settings can be uploaded or downloaded to and from your PC. Click **Choose File** to select the configuration file from your computer and then click **Upload** to upload it to the router. The router will check the file and if it is a valid configuration file, the router will reboot using the settings from the uploaded file.

By clicking on **Save**, the current router configuration is saved to your PC.

Setup — Firmware Upload

New firmware can be uploaded to the BASrouterSX. Click **Choose File** to select the firmware file from your PC, then press **Upload**.

NOTE: The firmware filename should not be changed and used as provided by Contemporary Controls.

Setup — Certificate Upload

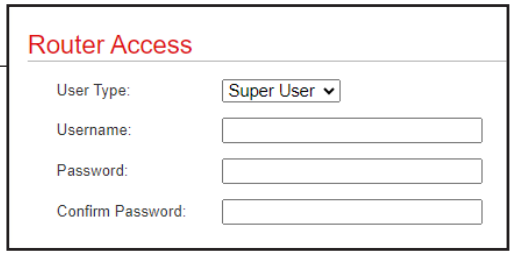
Certificates can be uploaded to the BASrouterSX. First, select the type of certificate to upload from the **Choose Certificate** drop-down menu—Private Key or Private Certificate. Then click **Save**.

Click **Choose File** to select the certificate from your computer and then click **Upload**.

After uploading both the private key and certificate, click **Update Certificates** and **Reboot** to use the uploaded certificate and key files. If there are any issues with the certificate, you may not be able to log into the unit via its webpage. Press the **reset switch** to return to factory installed key and certificate, default user ID/password (admin/admin), and default IP address (192.168.92.68).

NOTE: Wait 2 minutes for the update and reboot to complete, then access the unit.

Administration — Username and Password



Router Access allows you to choose the **User Type** and change **Username** and **Password**.

You can choose the **User Type** from two options: Super User and Viewer Only. A Super User can read device configurations and make changes, while Viewer Only cannot make any changes.

For **Username** and **Password**, each string is case sensitive and must be between 8 and 63 characters. The username can only use alphanumeric characters.

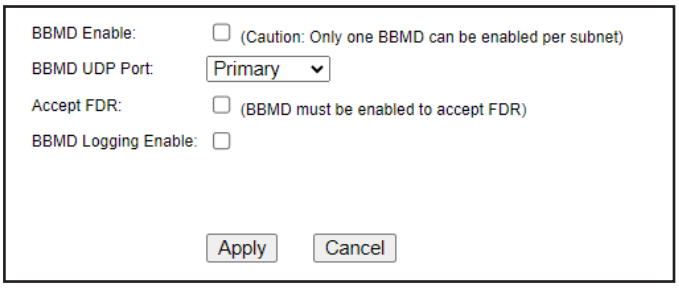
The password can use alphanumeric and special characters: ~!@#%^+[]{}_ and must contain at least one alphabet and one number.

Select **Save**.

Advanced — BACnet/IP Broadcast Management Device (BBMD)

Parameters	*Default Value*	*Description*
BBMD Enable	Unchecked	Check to enable BACnet/IP Broadcast Management Device (BBMD) which normally will also allow Foreign Device Registration (FDR).
BBMD UDP Port	Primary	The BBMD UDP Port drop-down menu identifies the Primary port as specified on the System page and Secondary port which is specified on the B/IP Routing page.
Accept FDR	Unchecked	Uncheck to disable foreign devices from registering with this router. Both BBMD Enable and Accept FDR must be checked to allow Foreign Device Registration.
BBMD Logging Enable	Unchecked	Enable only when there is a BBMD issue. This will add a considerable amount of BBMD status information in the system log and could overwrite other logging information. The system log can be read via Status ->Router ->View Log.

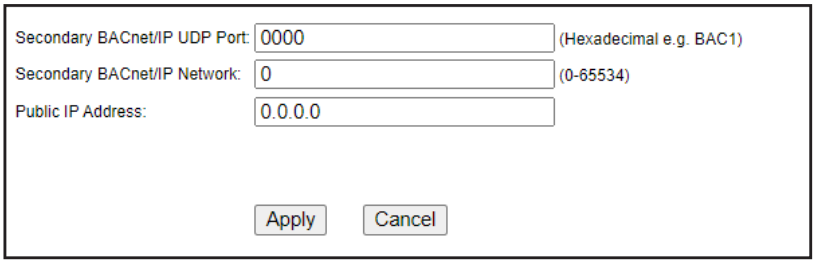
Warning: If you enable BBMD when it is not needed, the router may attempt to find devices that are not present and thus traffic flow will be impaired and communication will suffer.



Advanced — B/IP Routing

Parameters	*Default Value*	*Description*
Secondary BACnet/IP UDP Port	0000	Enter secondary UDP port as a 16-bit hex value (0-FFFF) when operating with two BACnet/IP networks. In this case use BAC1 if it is available.
Secondary BACnet/IP Net	0	Assign a network number unique from all other BACnet networks.
Public IP Address	0.0.0.0	If the BASrouterSX is being accessed through a NAT router then you'll need to enter the public IP address of the NAT router here. If not, leave this value at the default setting of 0.0.0.0.

This webpage allows communication via BACnet/IP through a NAT router (IP router with a firewall enabled). If there are no other BACnet/IP devices on the same subnet as the BASrouterSX, then you can leave the **Secondary BACnet/IP UDP Port** and the **Secondary BACnet/IP Network** at 0. You must set the **Public IP Address** to the NAT router's public IP address.



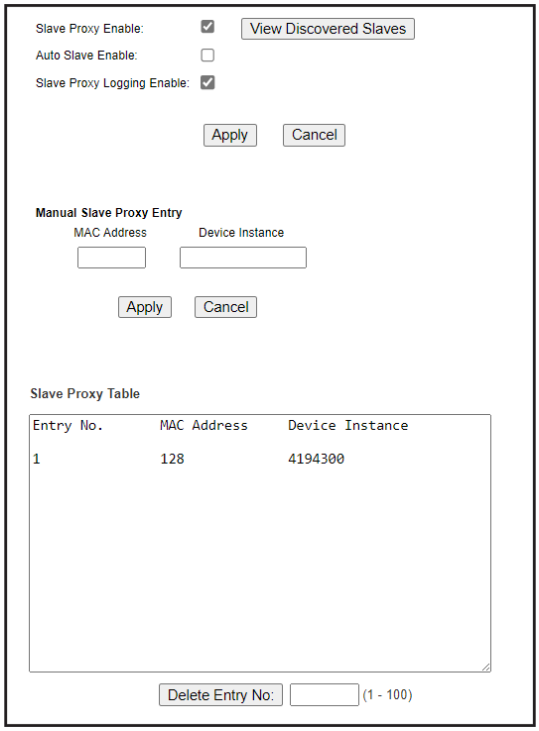
If there are other BACnet/IP devices on the BASrouterSX's subnet, then you need to set a secondary port and a secondary network number. The secondary port, for example BAC1, will be used by all local BACnet/IP devices. This is also known as 47809. The secondary network number will need to be different than any other network number used in the system. Again, set the BASrouterSX public IP address to the NAT router's public IP address.

The NAT router settings must also be modified. You must port forward one UDP port to the BASrouterSX's IP address. Use the BACnet/IP UDP port 1 value specified in the BASrouterSX System webpage.

Refer to our BASrouters Application Guide for more details on how these parameters should be set.

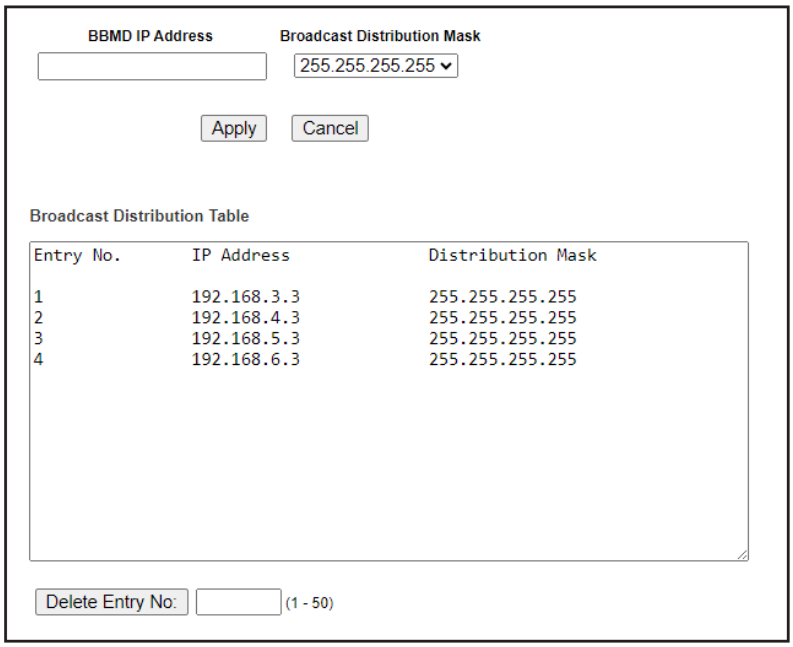
Advanced — Slave Proxy

Parameters	*Default Value*	*Description*
Slave Proxy Enable	Off	When enabled, the router will proxy MS/TP slave devices for clients. Slaves can be discovered (when Auto Slave is enabled), and you can also manually enter information about the slaves. When Auto Slave is disabled, MS/TP slaves must be manually configured.
Auto Slave Enable	Off	When enabled, MS/TP slaves will be automatically discovered if Slave Proxy is also enabled.
Slave Proxy Logging Enable	Off	Enable only when you have a slave proxy issue. This will add a considerable amount of slave proxy status information in the system log and could overwrite other logging information. The system log can be read via Status->Router->View Log.
Auto Slave Table		This table lists all discovered slave devices, manual and automatic. To view the table, click **View Discovered Slaves**.
Manual Slave Proxy Entry		Enter the **MAC Address** and **Device Instance** for each slave device, and then click **Apply**.
Slave Proxy Table		This table lists the slaves that have been manually entered.



Advanced — Broadcast Distribution Table (BDT)

Table or Screen Name	*Default Value*	*Description*
BBMD IP Address		Enter the IP address of every BBMD device on the internetwork. ***Do not include the BASrouterSX's own IP address***. These entries (up to 50) will appear in the Broadcast Distribution Table.
Broadcast Distribution Mask (BDM)	255.255.255.255	Use the default setting in almost all cases. If the BASrouterSX will communicate through an IP router which can forward broadcasts, then set the BDM to the subnet mask assigned to the destination subnet.
Broadcast Distribution Table (BDT)		This table lists the IP addresses and BDMs of all the other BBMDs located on the network. Entries can be deleted by entering the entry number and clicking **Delete Entry No**.



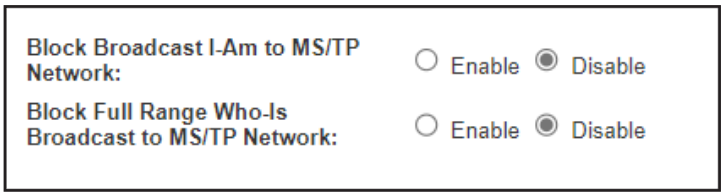
Advanced — MS/TP Backbone

MS/TP backbone allows BACnet communication to occur in some special cases, for example when two routers are connected via MS/TP. In this scenario, the BACnet/IP devices on either side of the routers have no idea of the MS/TP link in between. This results in the messages being dropped because of smaller size of the Max APDU on the MS/TP side. Enabling this feature allows the BACnet/IP devices to work properly.

Advanced — Block Broadcasts to MS/TP

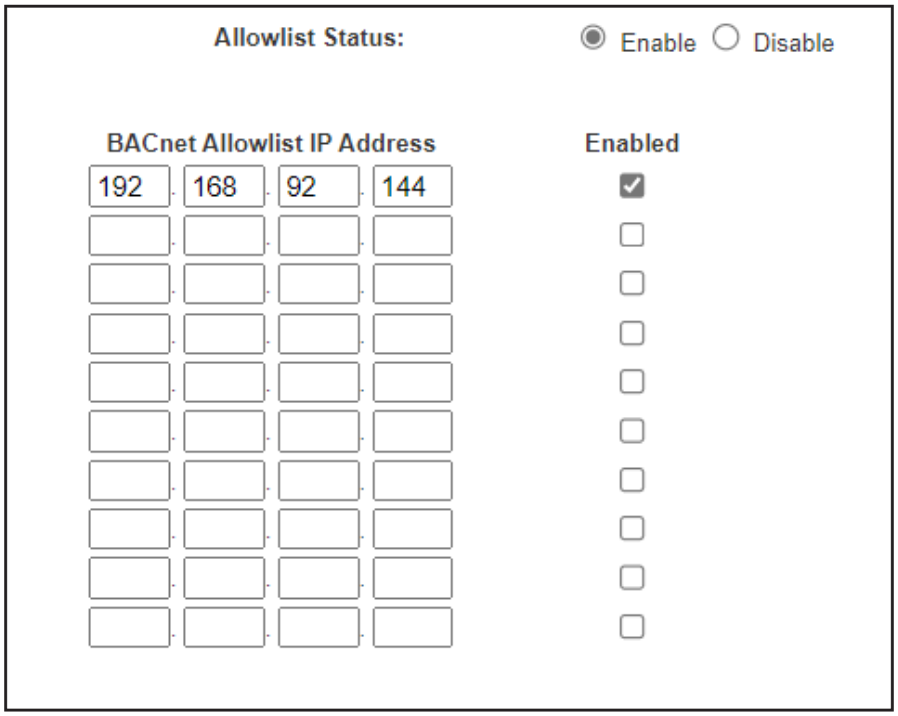
In normal operation, the router forwards broadcast I-Am messages received from the BACnet/IP side to the BACnet/MSTP side. For MS/TP devices with small memory, this may cause an issue if they receive a flood of I-Am messages. When the **Block Broadcast I-Am to MS/TP Network** feature is enabled, the router does not forward the broadcast I-Am messages to the MS/TP side.

The **Block Full Range Who-Is Broadcast to MS/TP Network** feature will block Who-Is requests which are targeted to the full range of BACnet device instances. This is typically used when performing a BACnet device discovery process. This feature can be used to hide MS/TP devices after they have been brought into a head-end. Who-Is requests for a specific device instance will still be passed to the MS/TP network.



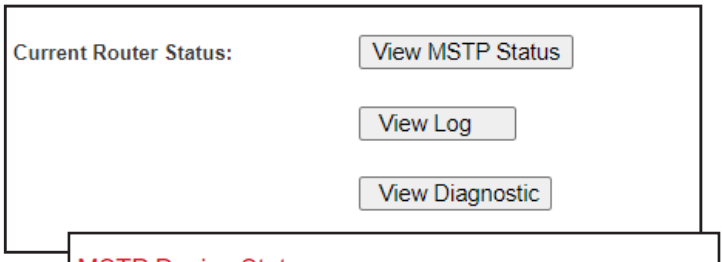
Advanced — BACnet Allowlist

This page can be used to restrict BACnet/IP traffic in the BACnet/IP side. Once it is enabled, only the devices whose IP address is added are allowed access.

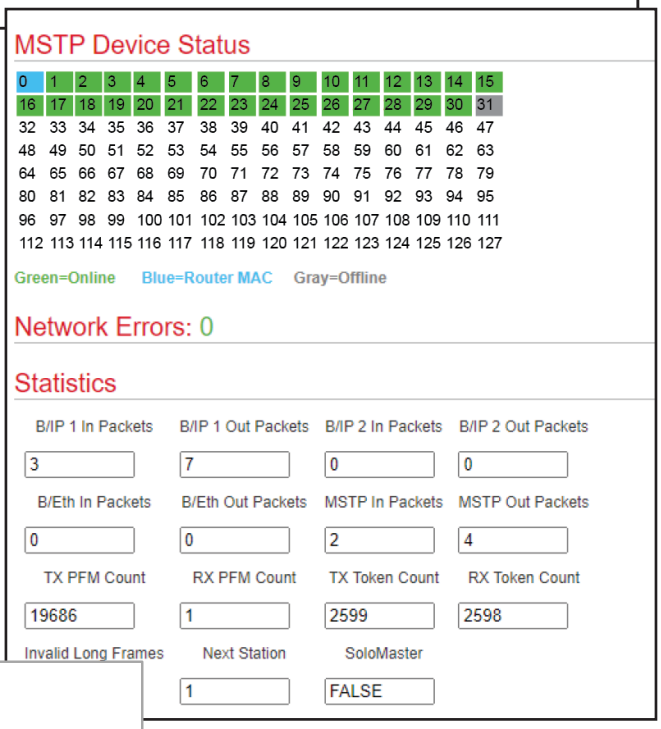


Status — Router Status

The **View MSTP Status** button reports the instantaneous MS/TP and BACnet/IP state of the router. The MS/TP states are documented in the MS/TP portion of the BACnet standard. The page refreshes automatically.



NOTE: "Network Errors" provide a count of BACnet MS/TP network errors, such as invalid frames, partial frames, bad CRC, wrong data length, or silence timer greater than 100 ms. "Next Station" is the MS/TP MAC address of the device to which the router will next pass the token. This value may change if devices leave or enter the network and when the router searches for devices on the network, per the BACnet MS/TP standard.



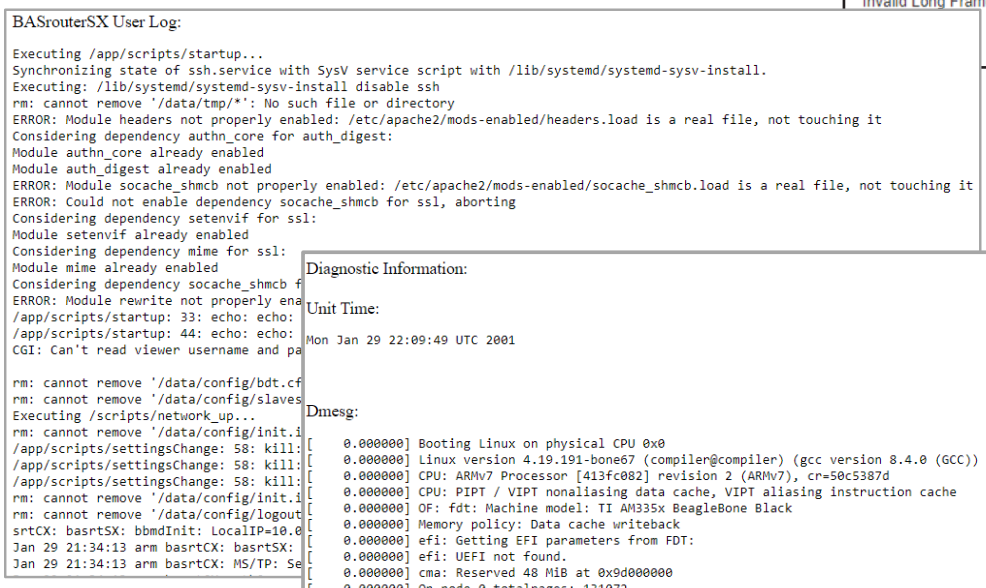
The B/IP packets are the BACnet/IP packets received and transmitted by the BASrouterSX for each configured UDP port.

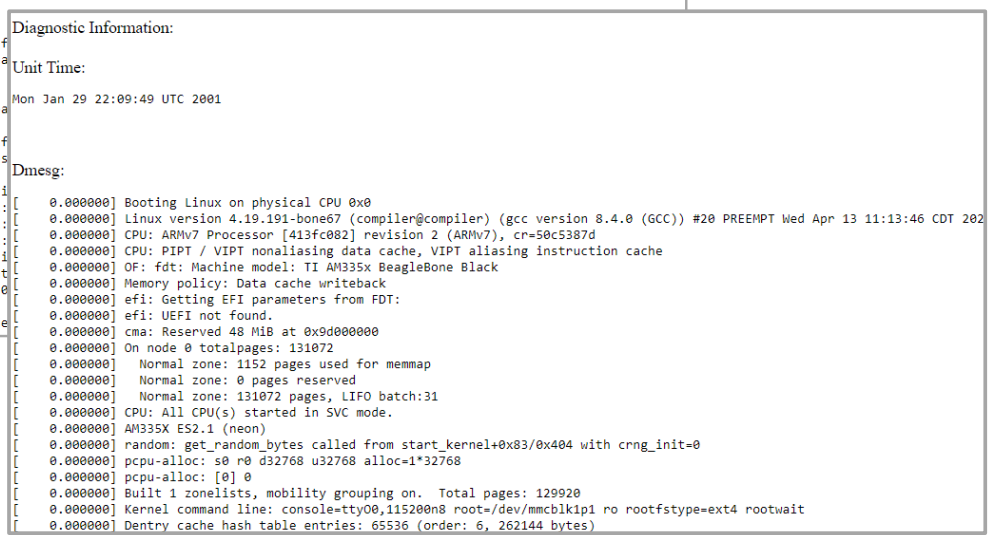
B/Ethernet are the BACnet Ethernet packet counts.

If the Invalid Large Frames is high, there could be a bias or termination issue.

The **View Log** button provides the BASrouterSX log file. If you have enabled BBMD or Slave Proxy logging it will be visible in this screen. The log is erased if the BASrouterSX loses power. Refresh this view to see new logging information.

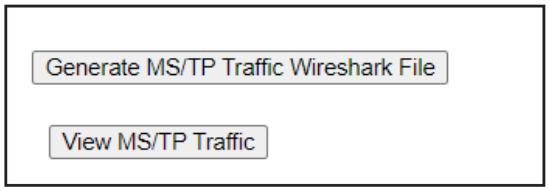
The **View Diagnostic** button provides the BASrouterSX diagnostic file.



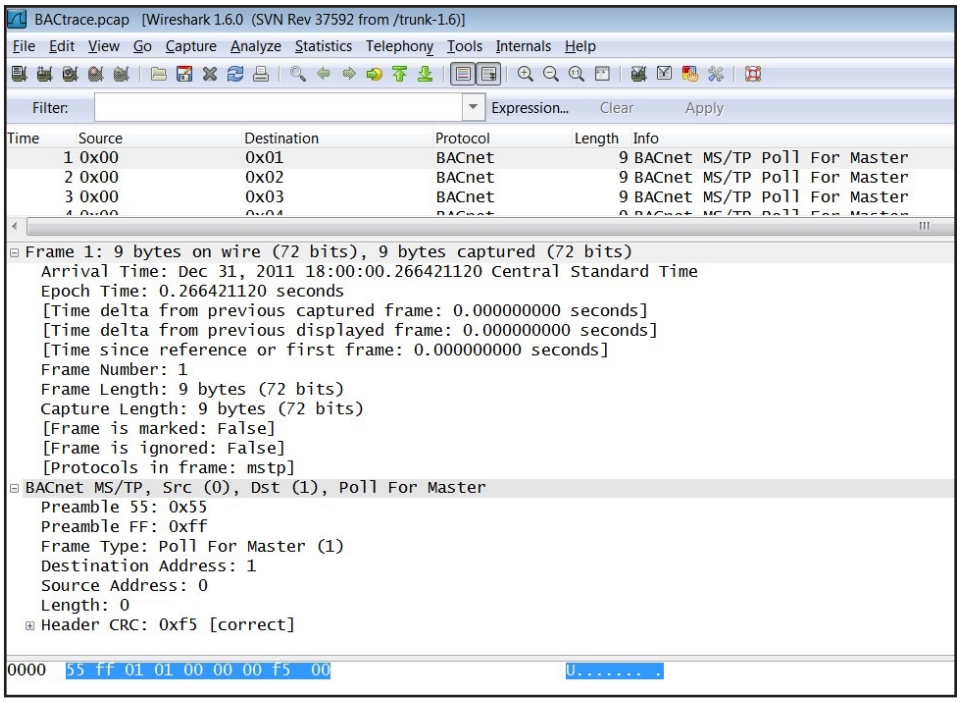


Status — MS/TP Traffic

The BASrouterSX can view MS/TP traffic from the Ethernet side of the router. This is a helpful feature when verifying proper MS/TP network activity without the need of installing specialized interfacing hardware to the MS/TP bus. As a background task, the BASrouterSX continuously records, approximately, the last 32,000 messages sent over MS/TP —including both data and token passes. By selecting the **Generate MS/TP Wireshark File**, those last 32,000 messages are converted to a ".pcap" format file for viewing by a Wireshark protocol analyzer. Once the conversion is made, click the **View MS/TP Traffic** button to send the captured file to the attached PC for Wireshark viewing. BACnet protocol decoding is built into this free but powerful protocol analyzer.



NOTE: You must have Wireshark on installed on your PC to view the .pcap file

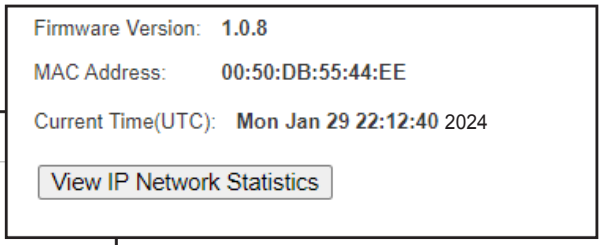


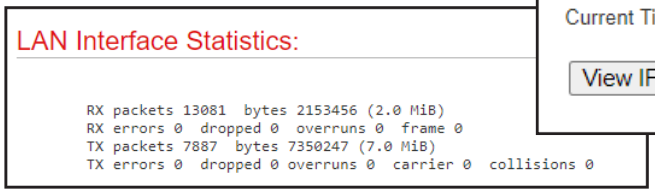
Status — Foreign Device Table

If BBMD and FDR are enabled on the Advanced->BBMD page, this table will report all devices that have registered with the BASrouterSX as Foreign Devices and how long they will remain registered unless a re-registration occurs. Information includes IP address and port number, time-to-live, and remaining time of each lease. Up to 147 entries can be accommodated.

Status — IP Status

This read-only page reports the BASrouterSX Firmware Version, MAC Address, Current Time, and IP Network Statistics.





Protocol Implementation Conformance Statement (PICS)

CONTEMPORARY CONTROLS

BASrouterSX

BACnet® Multi-Network Router with Optional GSA Compliance

BACnet Protocol Implementation Conformance Statement (Annex A)

Date: November 14, 2024
Vendor Name: Contemporary Controls
Product Name: BASrouterSX/BASrouterSX-GSA
Product Model Number: BASRTSX-B/BASRTSX-B-GSA

Applications Software Version: 1.0.2 **Firmware Revision:** 1.4.3 **BACnet Protocol Revision:** 15

Product Description: BASRTSX-B/BASRTSX-B-GSA BACnet® Multi-Network Router with slave proxy support and optional GSA compliance.

BACnet Standardized Device Profile (Annex L):

☒ **BACnet Router (B-RTR)**
☒ **BACnet Broadcast Management Device (B-BBMD)**

List all BACnet Interoperability Building Block Supported (Annex K):

DS-RP-B Data Sharing — ReadProperty – B
DS-RPM-B Data Sharing – ReadPropertyMultiple – B
DM-DOB-B Device Management — Dynamic Object Binding – B
DM-DDB-B Device Management — Dynamic Device Binding – B
NM-RC-B Network Management — Router Configuration – B
NM-BBMDC-B Network Management — BBMD Configuration – B

Segmentation Capability:

☐ Able to transmit segmented messages
☐ Window Size: Able to receive segmented messages
Window Size:

Standard Object Types Supported:

Object Type Supported	Can Be Created Dynamically	Can Be Deleted Dynamically
Device	No	No

No optional properties are supported. **NOTE:** The above object is directed supported on the router. The router will pass to the appropriate network all BACnet communications not directed to the router.

Data Link Layer Options:

☒ BACnet IP, (Annex J)
☒ BACnet IP, (Annex J), Foreign Device
☒ ISO 8802-3, Ethernet (Clause 7)
☐ ANSI/ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s):
☒ MS/TP master (Clause 9), baud rate(s): 9600; 19,200; 38,400; 57,600; 76,800; 115,200
☐ MS/TP slave (Clause 9), baud rate(s):
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):
☐ Point-To-Point, modem, (Clause 10), baud rate(s):
☐ LonTalk, (Clause 11, medium:
☐ Other:

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☒ Yes ☐ No

Networking Options:

☒ Router, Clause 6 — routing between BACnet/IP, ISO 8802-3, and MS/TP
☐ Annex H, BACnet Tunnelling Router over IP
☒ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? ☒ Yes ☐ No

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.
☒ ISO 10646 UTF-8

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports: No gateway support.

November 14, 2024 PI-BASRTSX-AA0

Wiring Diagrams

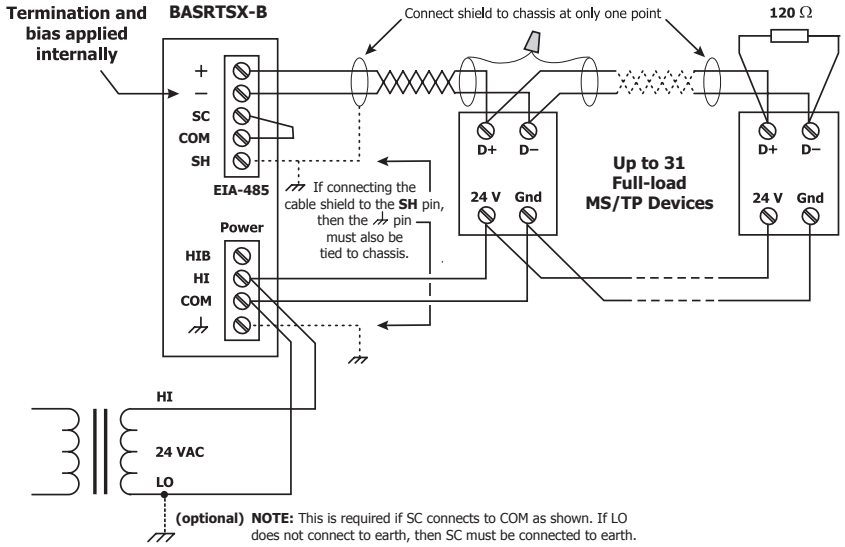
Since the routers incorporate a half-wave rectifier circuit, it can share the same 24 VAC power with other half-wave rectified devices. It can also be powered from a 24 VDC source. A redundant power connection exists for back-up power schemes.

The routers incorporate a 3-wire optically-isolated EIA-485 interface for the serial connection, allowing better circuit protection and noise immunity. To connect to other 3-wire devices simply make a one-to-one connection to the other devices. But when connecting to 2-wire non-isolated devices, the signal common (SC) on the product must share the reference used by the 2-wire devices. This is accomplished by tying the SC pin to COM on the product and by grounding the low-side of each power supply on all connected devices. In this way all EIA-485 transceivers share the same earth reference. Notice that the SC pin is signal common and not a shield pin. For shield connections, use the SH pin. Far-end external termination is required as shown. Termination and bias is switchable from the 2-pin DIP switch on the front of the unit.

MS/TP Physical Layer Connection Options (2-wire MS/TP Bus)

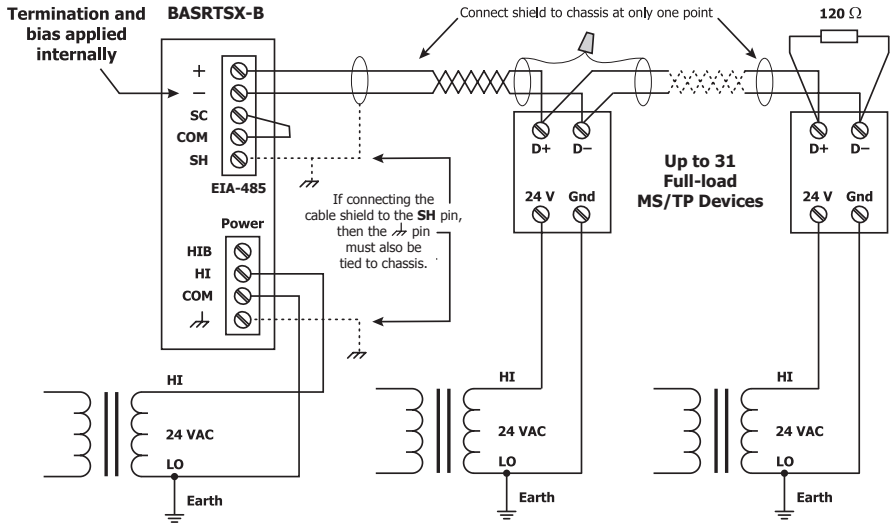
For MS/TP devices that share a power source with the BASRTSX-B

2-wire MS/TP Network with Shared Power Source



For MS/TP devices that use a power source separate from the BASRTSX-B

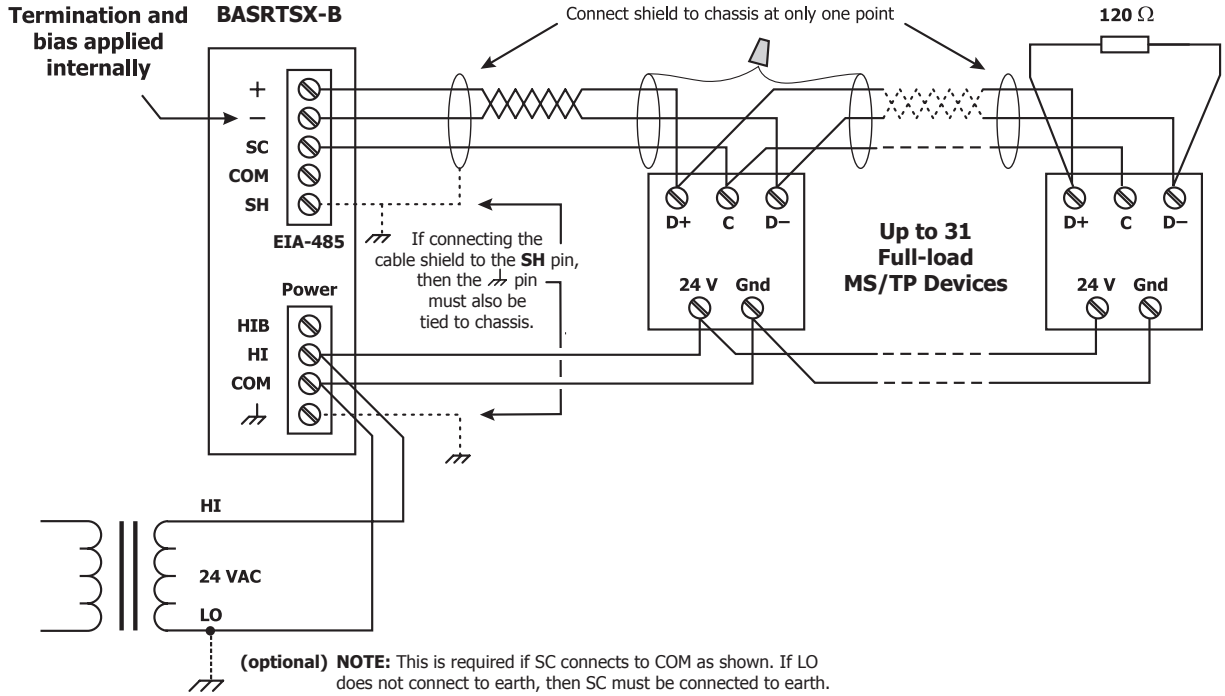
2-wire MS/TP Bus with Separate Power Sources



MS/TP Physical Layer Connection Options (3-wire MS/TP Bus)

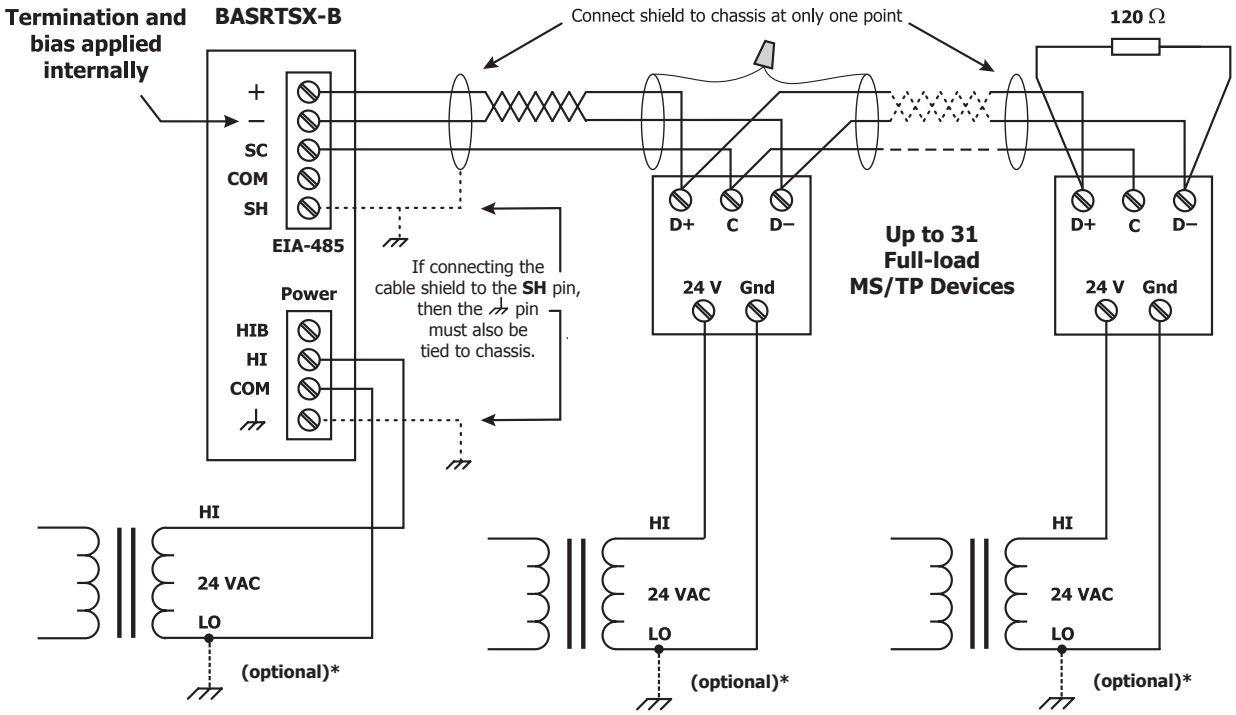
For MS/TP devices that share a power source with the BASRTSX-B

3-wire MS/TP Network with Shared Power Source



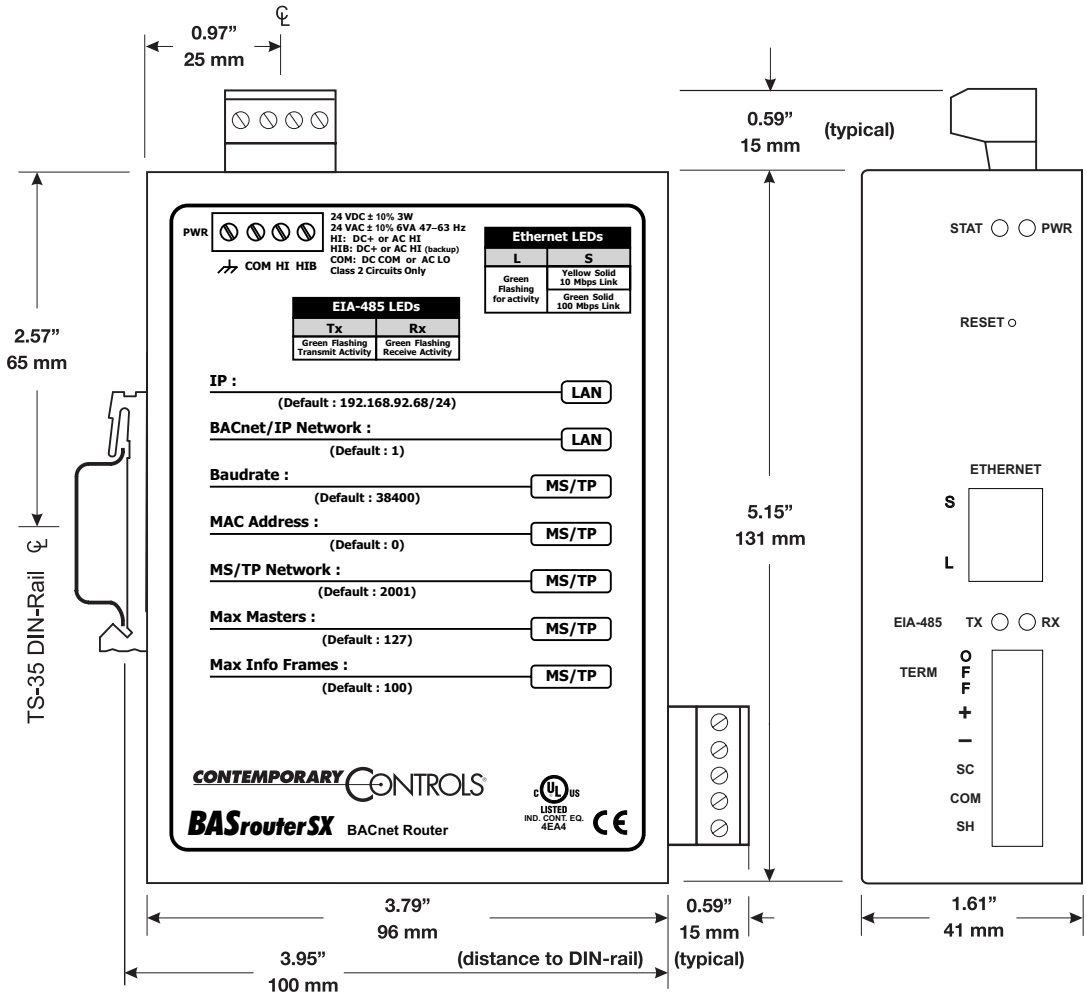
For MS/TP devices that use a power source seperate from the BASRTSX-B

3-wire MS/TP Bus with Separate Power Sources



* **NOTE:** This is required if SC connects to COM as shown. If LO does not connect to earth, then SC must be connected to earth.

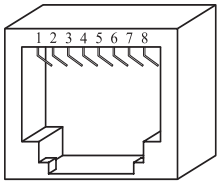
Mechanical Drawing (all dimensions are in mm)



Connector Pin Assignments

Ethernet

Pin	Function
1	TD+
2	TD–
3	RD+
4	N/C
5	N/C
6	RD–
7	N/C
8	N/C



EIA-485

Pin	Function
+	Signal High
–	Signal Low
SC	Signal Common
COM	0V
SH	Shield (Chassis)

Power

Pin	Function
HIB	Redundant Power
HI	DC+ or AC High
COM	0V or AC Low
⏚	Chassis

Specifications

Power – Input Power

Item	Limits
Input power	24 VAC ± 10% 6 VA 47-63 Hz or 24 VDC ± 10% 3W
Operating Temperature	–40°C to +75°C
Storage Temperature	–40°C to +85°C
Relative Humidity	10–95%, non-condensing
Protection	IP30

Communication	Ethernet	MS/TP
Compliance	IEEE 802.3	ANSI/ASHRAE 135 (ISO 16484-5)
Protocols Supported	BACnet/IP, ISO 8802-3	BACnet MS/TP
Data rate	10 Mbps, 100 Mbps	9.6, 19.2, 38.4, 57.6, 76.8, 115.2 Kbps MS/TP node limit: 254 devices total, 31 full-load devices per segment
Physical layer	10BASE-T, 100BASE-TX	EIA-485
Cable length (max)	100 m	1200 m (1000 m if using 115.2 Kbps)
Port Connector	Shielded RJ-45	5-pin removable terminal
LEDs	**L** (Link) Green = link, Flash = activity **S** (Speed) Green = 100 Mbps, Yellow = 10 Mbps	**Tx** Green = activity **Rx** Green = activity

Regulatory

CE Mark; CFR47, Part 15 Class A; RoHS
UL 508, C22.2 #142-M1987

c UL us LISTED IND. CONT. EQ. 4EA4

Ordering Information

Model	RoHS	Description
BASRTSX-B	✓	BACnet/IP to MS/TP to Ethernet Router with SSL
BASRTSX-B-GSA	✓	BACnet/IP to MS/TP to Ethernet Router for GSA

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