BASrouterLX — High-Performance BACnet® Router
with Diagnostic Capabilities

The BASrouterLX is a high-performance BACnet router providing stand-alone routing between BACnet networks such as BACnet/IP, BACnet Ethernet (ISO 8802-3), and BACnet MS/TP. Besides its high-speed processor, it has 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®. As a BBMD, up to 50 BDT and 147 FDR entries can be supported. The BASrouterLX 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.

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 troubleshooting
- MS/TP capture using Wireshark®
- BACnet/IP Broadcast Management Device (BBMD)
- Foreign Device Registration (FDR)

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

Convenient Installation
- 24 VAC/VDC (± 10%), 47–63 Hz input voltage
- Din-rail mount (BASRTLX-B) or panel mount (BASRTLX-B/P)
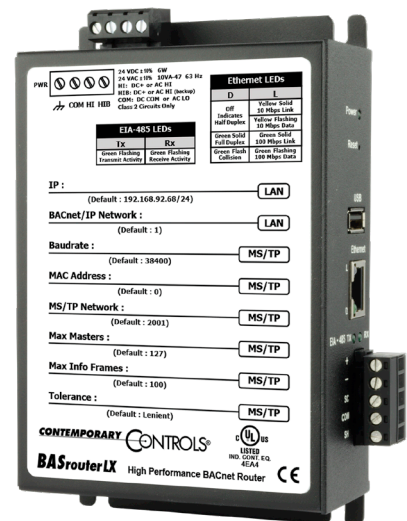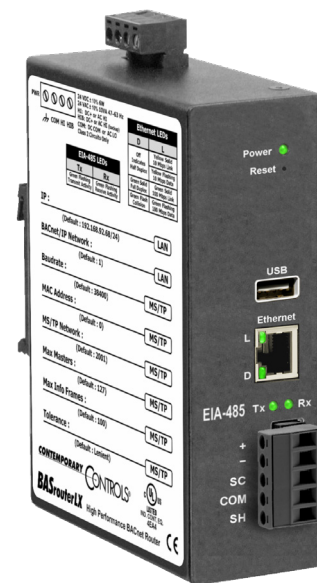
BASrouterLX — High-Performance BACnet® Router

The BASrouterLX is housed in a metal case available as 35-mm DIN-rail mount (BASRTLX-B) or Panel mount (BASRTLX-B/P) model. It is powered from a 24 VAC/VDC (± 10%) source. Its half-wave rectified power supply allows sharing of power with other half-wave devices. There are two ports on the unit — one Ethernet and one EIA-485.
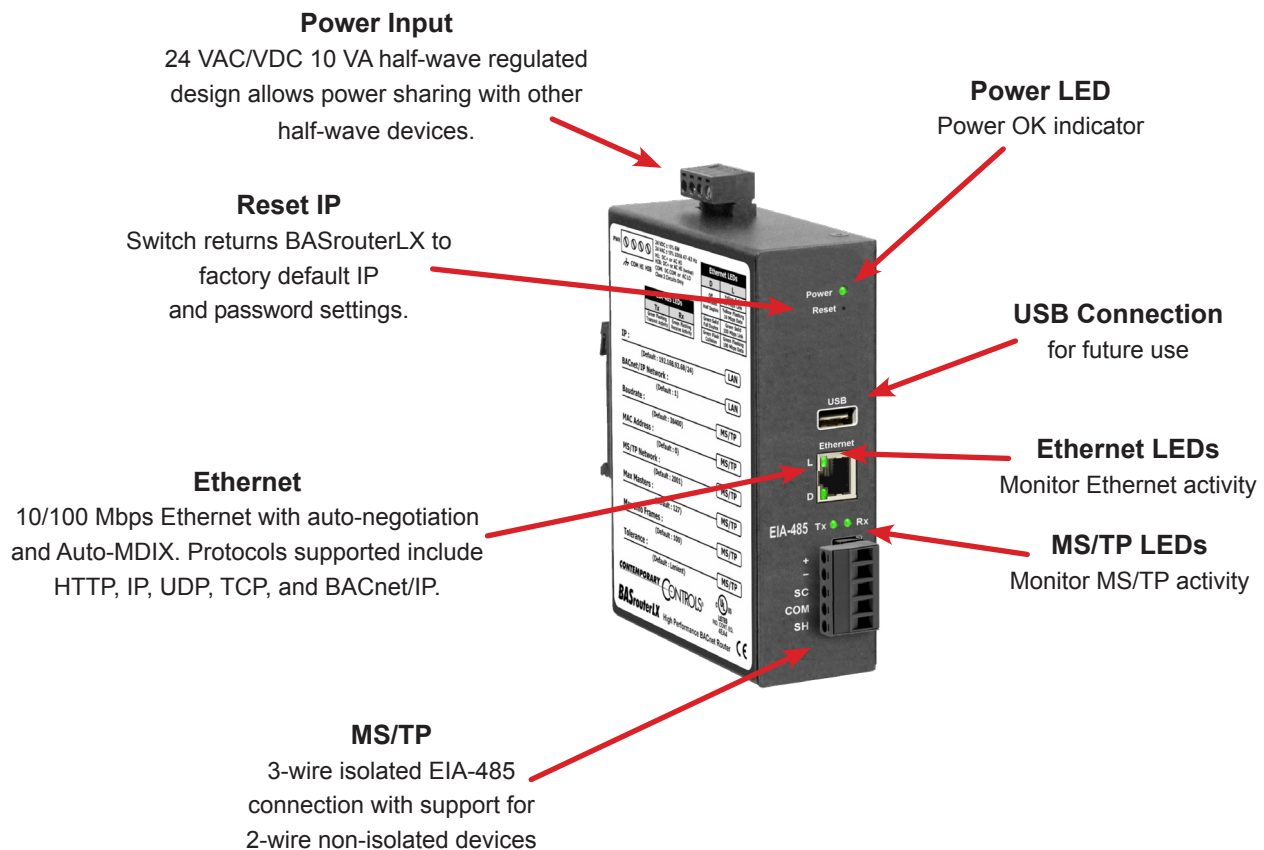
The optically-isolated EIA-485 serial port allows for connection to either 2-wire or 3-wire MS/TP networks using a removable 5-pin terminal block. Up to 31 full-load or 62 half-load EIA-485 devices can share the serial bus at data rates between 9.6 and 115.2 kbps. Internal jumpers provide 120Ω termination and bias. These jumpers can be removed for mid-span installations.

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 CAT5 straight-through or crossover 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 BASrouterLX functions as their proxy.

A resident web server allows for 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, data rate and duplex. Two EIA-485 LEDs indicate transmission and reception of data.

Power Input
24 VAC/VDC 10 VA half-wave regulated design allows power sharing with other half-wave devices.

Reset IP
Switch returns BASrouterLX to factory default IP and password settings.

Ethernet
10/100 Mbps Ethernet with auto-negotiation and Auto-MDIX. Protocols supported include HTTP, IP, UDP, TCP, and BACnet/IP.

MS/TP
3-wire isolated EIA-485 connection with support for 2-wire non-isolated devices

Power LED
Power OK indicator

USB Connection
for future use

Ethernet LEDs
Monitor Ethernet activity

MS/TP LEDs
Monitor MS/TP activity

Web Page Configuration, Status and Diagnostics

Basic Setup

Onboard Help

Advanced Options

Capture/View MS/TP Frames Without Extra Hardware

Setup — System Settings

Setup — System Settings

Device Parameters	Default Value	Description
Device Name	BASRTLX-Bxxxxxx	The unique default value ends with the last 6 characters of the unit's Ethernet MAC address. You can edit it to be up to 20 characters. This value must be unique throughout the entire BACnet network. By default this value is unique by using the device's ethernet MAC address in the device name.
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		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 Ethernet Parameter	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 Parameters	Default Value	Description
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.
IP Address	192.168.92.68	IP address in dotted decimal format. Select a valid address in the range from 0.0.0.1 through 255.255.255.254.
IP Subnet	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.
IP Gateway	192.168.92.1	IP Gateway address in dotted decimal format. Select a valid address in the range from 0.0.0.0 through 255.255.255.254.

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 BASrouterLX.
MS/TP Tolerance	Lenient	Affects the degree to which interoperability with devices is successful. Lenient option causes less efficient traffic but optimises 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 NAT page under the Advanced tab to 0.

Setup — Setting 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 that date and time settings are not retained after power is removed from the unit.

Setup — Username and Password

Change the **Username** and **Password** to access the BASRTLX-B webpage. Each string must be between 5 and 63 alpha-numeric characters — and is case sensitive.

Setup — Configure Upload/Download

Router settings can be uploaded or downloaded to and from your PC. Click on the **Browse...** button 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 the router 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 BASrouterLX. Click on the **Browse...** button 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.

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	Normally the primary port is selected. The secondary port is used in very special applications with NAT routing.
Accept FDR	Checked	Uncheck to disable foreign devices from registering with this router. Both BBMD Enable and Accept FDR must be checked to allow Foreign Device Registration.

Advanced — Network Address Translation (NAT)

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 BASrouterLX 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.

DS-BASRTBX0-AC1

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 has first been enabled.
Auto Slave Table		This table lists the slaves that have been automatically discovered. To view the table, click View Auto Slaves.
Manual Slave Proxy Entry		Enter the MAC address, Device Instance, Vendor ID and Max APDU for each slave device and then click Apply.
Manual Slave 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 except for this router. These entries will appear in the Broadcast Distribution Table. Up to 50 entries can be made.
Broadcast Distribution Mask	255.255.255.255	Use the default setting in almost all cases. If the IP router can pass broadcast messages, enter the same mask as the IP router.
Broadcast Distribution Table (BDT)		This table lists the IP addresses and broadcast distribution masks of all the other BBMDs located on the network. Entries can be deleted by entering the entry number and clicking on Delete Entry No. button.

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. The BACnet/IP devices on either side of the routers in this case have no idea of the MS/TP link in between and this can result 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.

MS/TP Backbone: ◯ Enable ⦿ Disable

Advanced - Broadcast I-Am

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 this feature is enabled, the router does not forward the broadcast I-Am messages to the MS/TP side.

Block Broadcast I-Am: ◯ Enable ⦿ Disable

Advanced - Allowlist

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

Whitelist: ⦿ Enable ◯ Disable

Whitelist IP Address	Enabled
192 . 168 . 92 . 144	☑
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐
. . .	☐

Status — MS/TP Driver

Item	Description
Current MS/TP Driver Status:	For Contemporary Controls to assist a customer with an MS/TP bus issue, information about the bus is available within the BASrouterLX. During a technical support call, the customer may be asked to supply the information from this status page. Although to the customer the information is confusing, it could be helpful to the staff at Contemporary Controls. What follows are short definitions of the types of data being stored on an ongoing basis. The status page is refreshed automatically.

BACnet MS/TP Line Discipline 2.24
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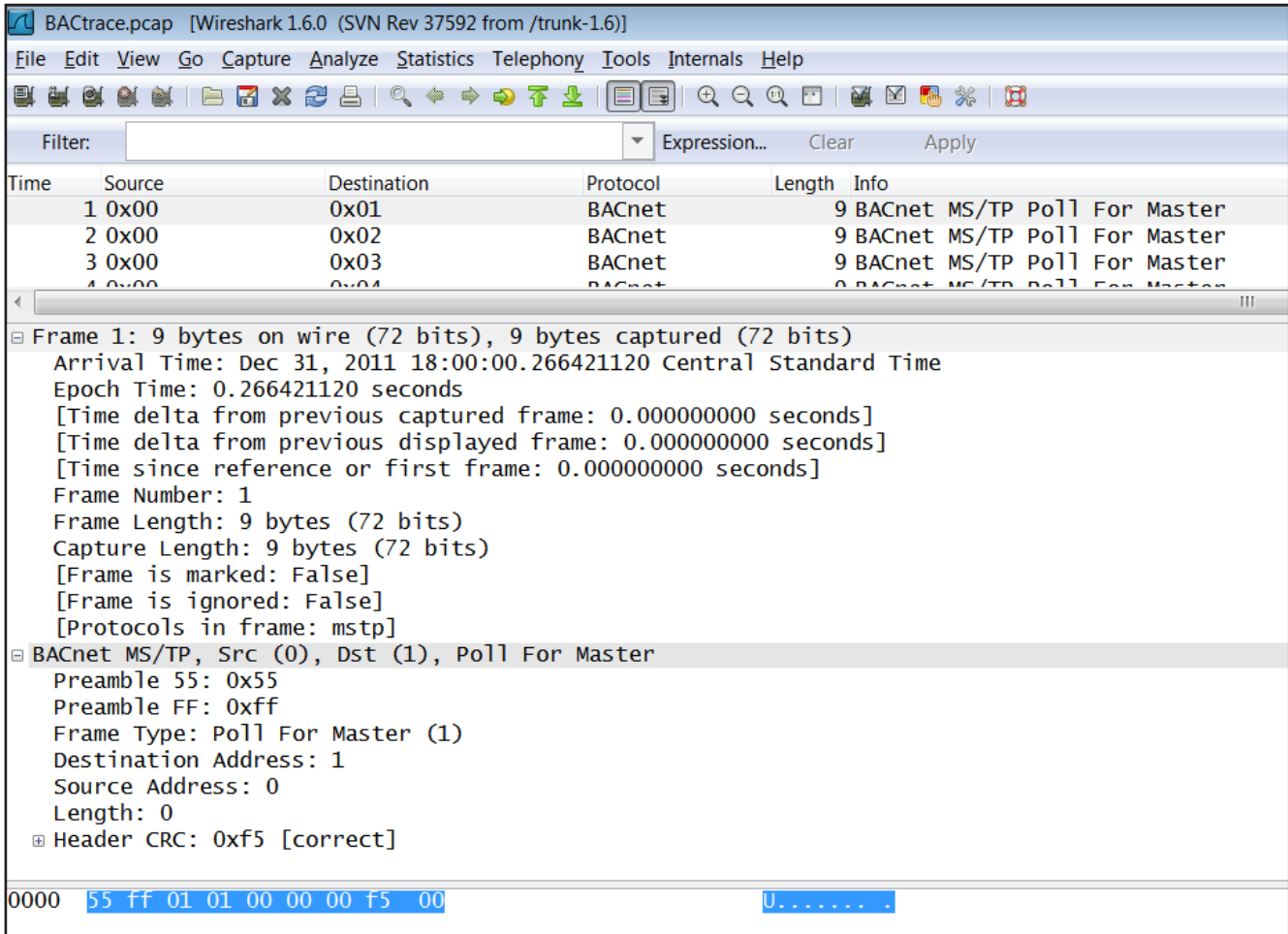| Item	Description
Baud Rate: 76800	Confirms the baud rate of the MS/TP segment
SilenceTimer: 12	A counter indicating the amount of time between successive characters
Nmax_master: 127	The highest address of a master node as set by the router
Nmax_info_frames: 100	The maximum number of frames the router can send before a token pass
This_Station: 0	MAC address of the router
Next_Station: 67	The router's logical neighbour in the token pass
Poll_Station: 39	The last MAC address sent by the router in a poll-for-master sequence
RFSM State: 00 Idle	Receive frame state machine: current state
MNSM State: 01 Idle	Master node state machine: current state
Tturnaround: 1	Time between the end of a reception to the beginning of a transmission
PFM timeout: 30	Poll-for-master timeout setting
TP timeout: 85	Token-passing timeout setting
Event Count: 24	Number of received characters or error — used to detect activity
Rcv Count: 116482958	Receive frame counter
Rcv Error Count: 0	Receive frame error counter
RX Queue size: 0	Number of messages in the receive queue
TX Queue size: 0	Number of messages in the transmit queue
Trace Queue size: 1438	Background task related to Wireshark capture

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Application Assistance

Contemporary Controls has produced an Application Guide that covers all its BACnet routers. Numerous network examples are provided with appropriate completed configuration screens to assist the installer on how best to apply BACnet routers in the field. It is available from the company website.

Status — MS/TP Traffic

The BASrouterLX has the ability to view MS/TP traffic from the Ethernet side of the router. This is a handy 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 BASrouterLX continuously records the last 3900 messages sent over MS/TP — including both data and token passes. By pressing the **Generate MS/TP**

Wireshark File, those last 3900 messages are converted to a "pcap" format file for viewing by a Wireshark® protocol analyser. Once the conversion is made, pressing the **View MS/TP Traffic** button sends the captured file to the attached PC for Wireshark viewing. BACnet protocol decoding is built into this free but powerful protocol analyser.

Status — Foreign Device Table

Table or Screen Name	Description
Foreign Device Table (FDT)	This table automatically lists all foreign devices that have registered with this router. Information includes IP address, port number, time-to-live, and remaining time of each lease. Up to 147 entries can be accommodated.

Foreign Device Registrations:

IP Address: Port	TTL	Remaining Time
10.0.0.103:BAC0	300	143

Protocol Implementation Conformance Statement (PICS)

CONTEMPORARY CONTROLS®

BASrouterLX
High-Performance BACnet Router

BACnet Protocol Implementation Conformance Statement (Annex A)

Date: June 9, 2017
Vendor Name: Contemporary Controls
Product Name: BASrouterLX
Product Model Number: BASRTLX-B (DIN-rail mount)**,** BASRTLX-B/P (Panel mount**)**
Applications Software Version: 1.0.0   Firmware Revision: 1.2.0   **BACnet Protocol Revision:** 7
Product Description: BASRTLX-B High-Performance BACnet Router with slave proxy support.

BACnet Standardized Device Profile (Annex L):
- ☐ BACnet Operator Workstation (B-OWS)
- ☐ BACnet Building Controller (B-BC)
- ☐ BACnet Advanced Application Controller (B-AAC)
- ☒ BACnet Application Specific Controller (B-ASC)
- ☐ BACnet Smart Sensor (B-SS)
- ☐ BACnet Smart Actuator (B-SA)

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

DS-RP-A Data Sharing — ReadProperty – A
DS-RP-B Data Sharing — ReadProperty – B
DS-RPM-B Data Sharing — ReadPropertyMultiple – B
DS-WP-B Data Sharing — WriteProperty – B
DS-WPM-B Data Sharing — WritePropertyMultiple – B

DM-DDB-B Device Management — Dynamic Device Binding – B
DM-DOB-B Device Management — Dynamic Object Binding – B
DM-DCC-B Device Management — Device Communication Control – B
DM-RD-B Device Management — ReinitializeDevice – B
DM-R-B Device Management — Restart – B
DM-LM-B Device Management — List Manipulation – B
NM-RC-B Network Management — Router Control

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 directly 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.
- ☒ ANSI X3.4
- ☐ ISO 10646 (UCS-2)
- ☐ IBM™/Microsoft™ DBCS
- ☐ ISO 10646 (UCS-4)
- ☐ ISO 8859-1
- ☐ JIS C 6226

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

17 Jul 2017   PI-BASRTLX-AA2

Wiring Diagrams

Since the product incorporates 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 product incorporates 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. Near-end bias and termination are internally supplied within the product.
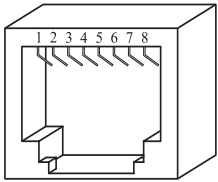
3-wire MS/TP Network
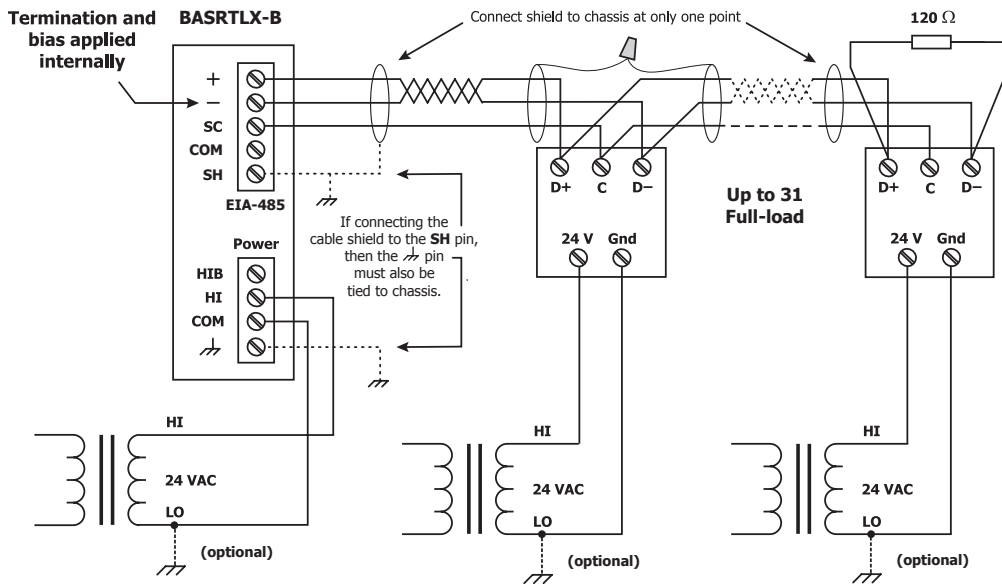
2-wire MS/TP Network
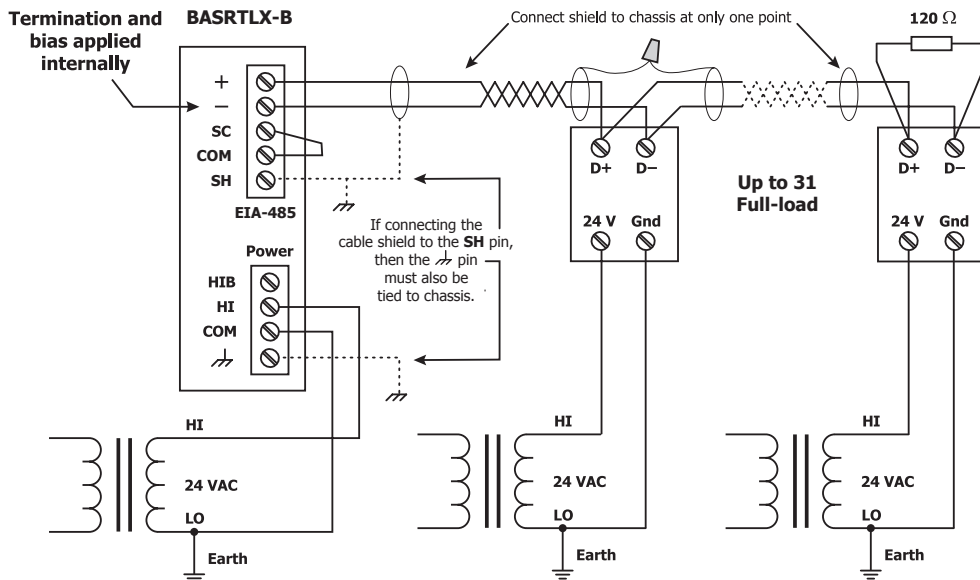
Connector Pin Assignments

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

USB

Pin	Function
1	+5V
2	–Data
3	+Data
4	Ground

Mechanical Drawing

DIN-Rail
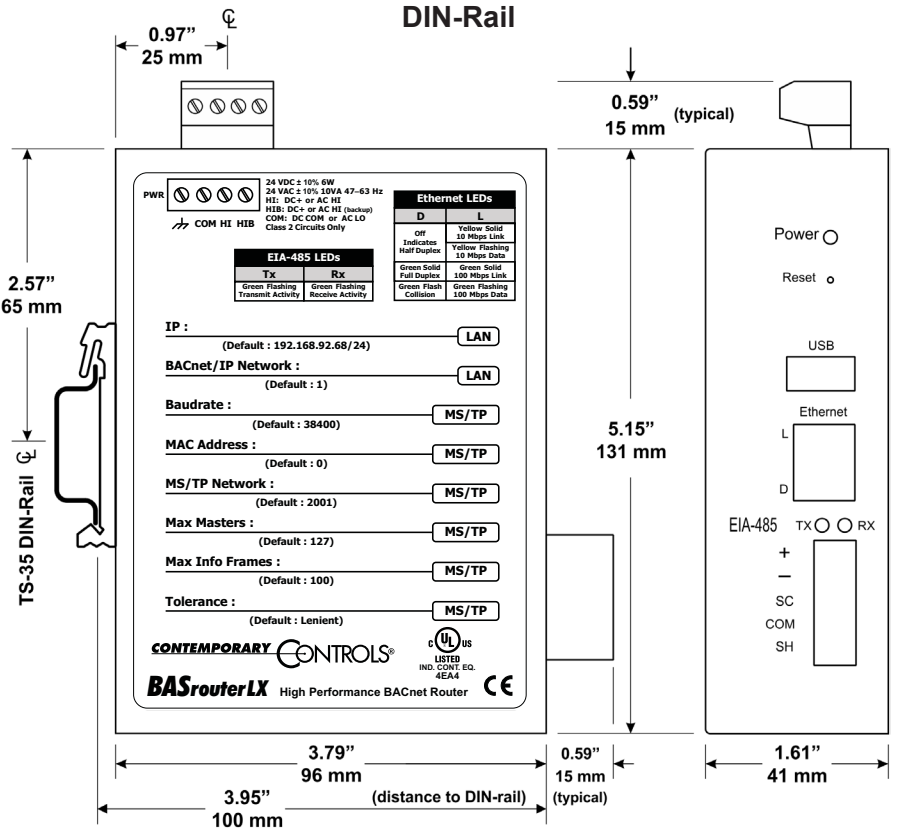
Panel Mount
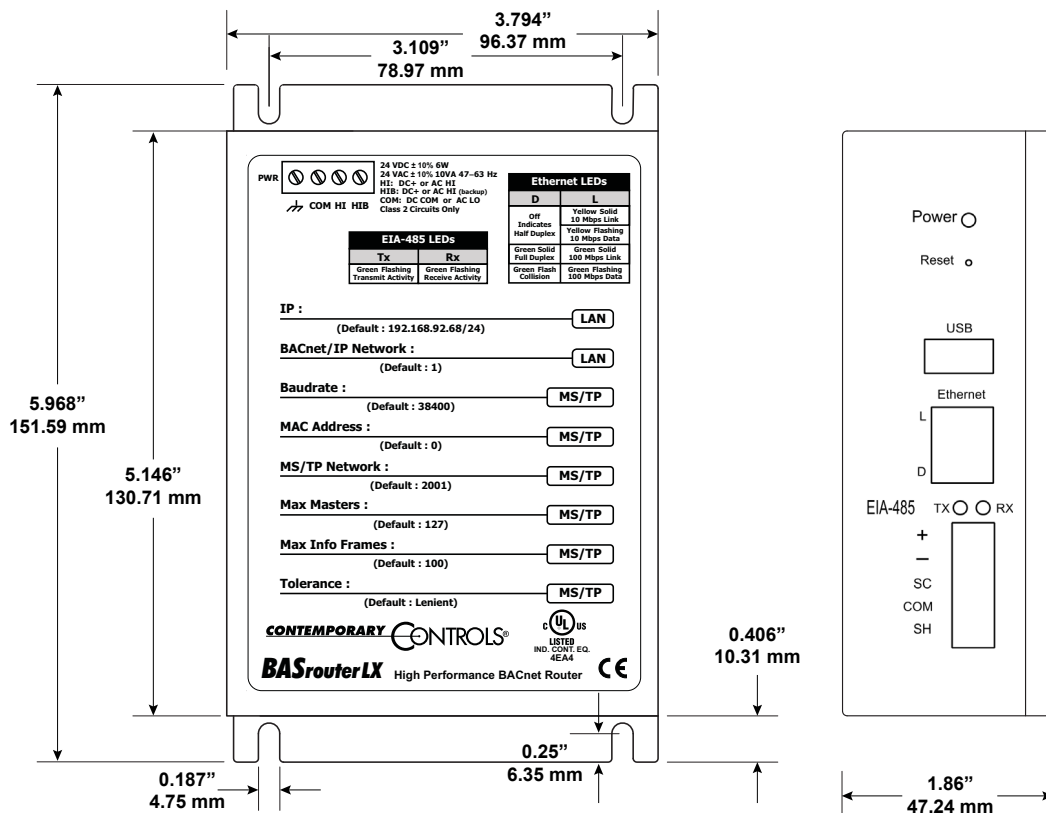
Specifications

Power Requirements	24 VAC ±10% 10 VA 47–63 Hz or 24 VDC ±10% 6 W	
Operating Temperature	0°C to 60°C	
Storage Temperature	−40°C to 85°C	
Relative Humidity	10–95%, non-condensing	
Protection	IP30	
USB Port	USB 2.0, Type A	

Communication	**Ethernet**	**EIA-485**
Compliance	IEEE 802.3	ANSI/ASHRAE 135 (ISO 16484-5)
Protocols supported	BACnet/IP	BACnet MS/TP
Data rate	10 Mbps, 100 Mbps	9.6, 19.2, 38.4, 57.6, 76.8, 115.2 kbps
Physical layer	10BASE-T, 100BASE-TX	EIA-485, 3-wire isolated
Cable length (max)	100 m	1200 m (or 1000 m if using 115.2 kbps)
Port connector	Shielded RJ-45	5-pin removable terminal

LEDs	**L (Link)**	**D (Duplex)**	**Tx**	**Rx**
	Green = 100 Mbps	Green = Full-duplex	Green = activity	Green = activity
	Yellow = 10 Mbps	Off = Half-duplex		
	Flash = activity	Flash = Collision		

Regulatory Compliance	CE Mark; CFR 47, Part 15 Class A; RoHS UL 508, C22.2 No. 142-M1987

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Ordering Information

Model	RoHS	Description
BASRTLX-B	✔	BASrouterLX High Performance BACnet Router DIN-Rail Mount
BASRTLX-B/P	✔	BASrouterLX High Performance BACnet Router Panel Mount

United States	**China**	**United Kingdom**	**Germany**
Contemporary Control Systems, Inc.	**Contemporary Controls (Suzhou) Co. Ltd**	**Contemporary Controls Ltd**	**Contemporary Controls GmbH**
2431 Curtiss Street Downers Grove, IL 60515 USA	19F, Metropolitan Towers, No.199 Shishan Road, Suzhou New District, 215009 China	14 Bow Court Fletchworth Gate Coventry CV5 6SP United Kingdom	Fuggerstraße 1 B 04158 Leipzig Germany
Tel: +1 630 963 7070 Fax:+1 630 963 0109	Tel: +86 512 68095866 Fax: +86 512 68093760	Tel: +44 (0)24 7641 3786 Fax:+44 (0)24 7641 3923	Tel: +49 341 520359 0 Fax: +49 341 520359 16
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