AAR Controller

Technical Instructions

1150 Roberts Boulevard, Kennesaw, Georgia 30144
770-429-3000 Fax 770-429-3001 | www.automatedlogic.com

AUTOMATEDLOGIC
United Technologies

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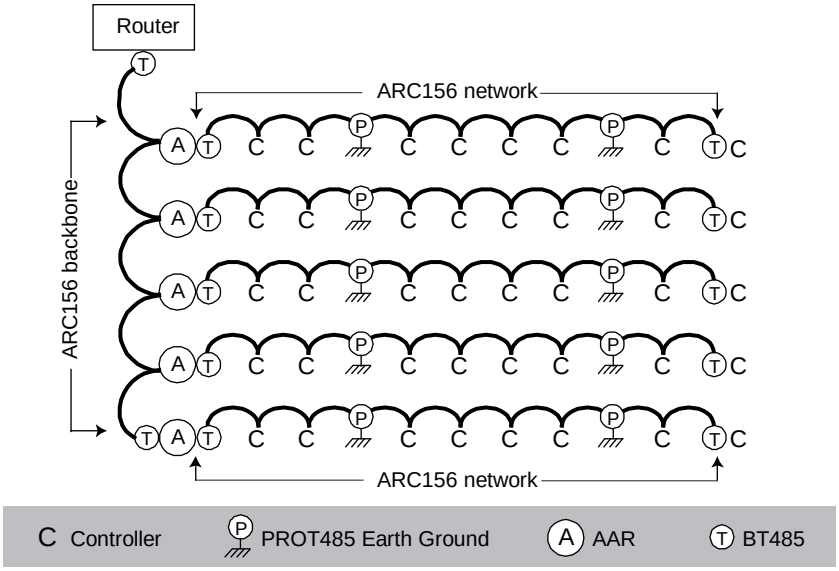
Contents

What is the AAR controller?

The AAR is a BACnet router that provides communication between two ARC156 networks. You can use AAR's to add one or more ARC156 networks to the ARC156 backbone network that leads to the server. See the *ARC156 Wiring Technical Instructions* for network requirements such as configuration, length, and network accessories.



NOTES

- The AAR can be located anywhere on its ARC156 network; it does not have to be at one end of the network.
- Do not place another AAR on an AAR's ARC156 network. Cascading AAR's greatly reduce performance of the network.
- The AAR can act as a color caching/time-sync master and dead module detector.
- The AAR does not support Alarm Store and Forward.
- The AAR does not run a control program.

TIPS

- Put controllers on the AARs' networks where possible instead of on the ARC156 backbone to improve network performance.
- If possible, put all controllers for related terminal units and their air source below one AAR to localize network traffic between them. If this is not possible, try to put the air source controller on the backbone.
- Although an ARC156 network can contain up to 99 controllers, use ±50 controllers as a starting number for the network. Numerous factors such as network configuration and performance affect the number of controllers that an AAR's network can have.

Specifications

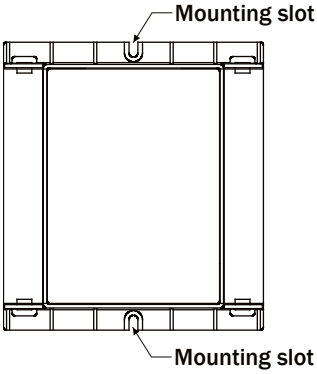
Power	24 Vac ±10%, 50–60 Hz, 20 VA 26 Vdc (25 V min, 30 V max)
Comm ports	Comm 1 communicates with the ARC156 backbone network. Comm 2 communicates with the AAR's ARC156 network.
Local Access port	For system start-up and troubleshooting
Microprocessor	High speed 16-bit microprocessor with ARCNET communication co-processor
Memory	1 MB non-volatile battery-backed RAM, 1 MB Flash memory, 16-bit memory bus
Real-time clock	Battery-backed real-time clock keeps track of time in event of power failure
Battery	10-year Lithium CR2032 battery retains the following data for a maximum of 10,000 hours during power outages: time and editable properties.
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power and network connections are also protected against transient excess voltage/surge events lasting no more than 10 msec.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, and power
Environmental operating range	0 to 130°F (-17.8 to 54.4°C), 10–90% relative humidity, non-condensing **NOTE** The controller must be installed within the building.
Physical	Rugged GE C2950 Cycoloy plastic
Overall dimensions	Width: 5 1/16 in. (12.9 cm) Height: 5 11/16 in. (14.4 cm)
Mounting dimensions	5 9/16 in. (14.1 cm) between mounting slot centerlines
Recommended panel depth	1 1/2 in. (3.8 cm)
Weight	0.4 lbs (0.2 kg)
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE

NOTE The AAR's DIP switches are for future use and currently have no functionality.

To mount the AAR

NOTE You must mount the AAR inside the building. The AAR's warranty will be void if you mount it outside.

Screw the AAR into an enclosed panel using the mounting slots shown below. Leave about 2 in. (5 cm) on each side of the controller for wiring.



Wiring for power

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

CAUTIONS

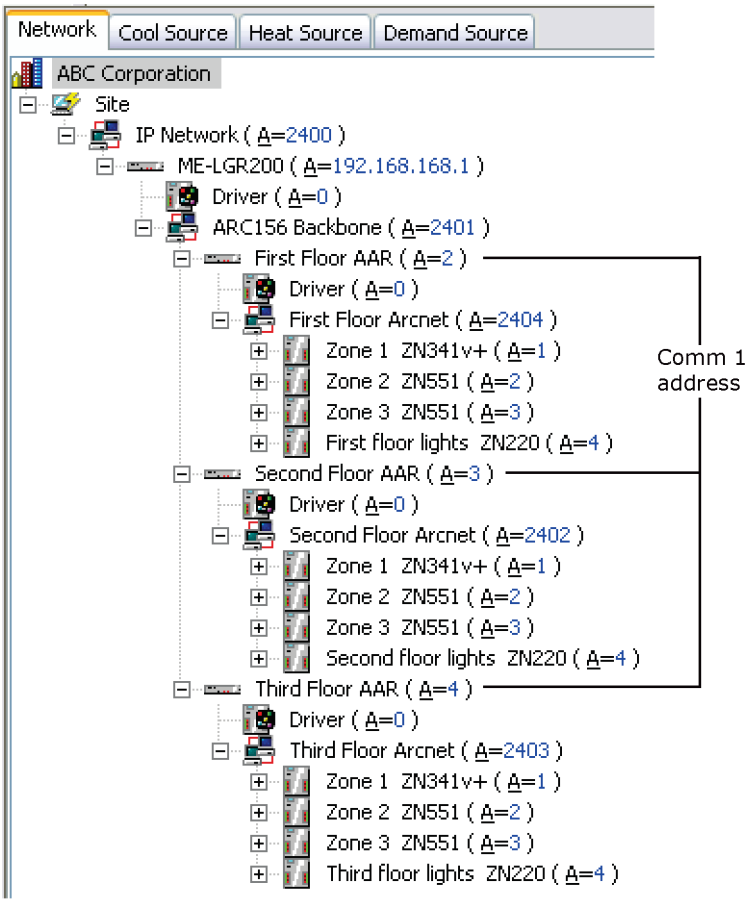
- The AAR is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.
- Automated Logic® controllers can share a power supply as long as you:
  - Maintain the same polarity.
  - Use the power supply only for Automated Logic® controllers.

To wire for power

1. Remove power from the power supply.
2. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
3. Connect the transformer wires to the screw terminal connector.
4. Apply power to the power supply.
5. Measure the voltage at the AAR's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
6. Connect a 4-inch (10.2 cm) wire from **Gnd** to the control panel.
7. Insert the screw terminal connector into the AAR's power terminals.
8. Verify that the **Power** LED is on and the **Run** LED is blinking.

Addressing the AAR

The address of the **Comm 2** port (the AAR's address on its ARC156 controller network) is 101. You must set the address of the **Comm 1** port (the AAR's address on the ARC156 backbone network). The figure below shows addressing in a typical system using AAR's.

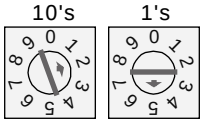


You must give the AAR an address that is unique on the network. You can address the AAR before or after you wire it for power.

To address the AAR

1. If the AAR has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.
2. Using the rotary switches, set the controller's address to match the **Address** in the controller's properties dialog box in SiteBuilder. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10's**) switch to 2 and the arrow on the **Ones** (**1's**) switch to 5.



Wiring for communications

The AAR communicates using BACnet on an ARC156 network communicating at 156 kbps. ARC156 is a unique implementation of the industry standard ARCNET. For a summary of differences between ARCNET and ARC156, see the *ARC156 Wiring Technical Instructions*.

Wiring specifications

Use 22 AWG, low-capacitance, twisted, stranded, shielded copper wire. See the *ARC156 Wiring Technical Instructions*.

WARNING Do not apply line voltage (mains voltage) to the controller's ports and terminals.

To wire the AAR for communications

1. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
2. Check the communications wiring for shorts and grounds.
3. Connect the ARC156 backbone wiring to the **Comm 1** screw terminals labeled **Net +**, **Net -**, and **Shield**.
4. Connect the wiring for the AAR's ARC156 network to the **Comm 2** screw terminals labeled **Net +**, **Net -**, and **Shield**.

   NOTE Use the same polarity throughout the network segment.
5. If the AAR is at either end of a network segment, connect a BT485 to the AAR.
6. Insert the power screw terminal connector into the AAR's power terminals.
7. Verify communication with the network by viewing a Module Status report in the WebCTRL® interface.

Downloading the AAR

Download the following items to the AAR's battery-backed memory:

Item	Notes
DRV_AAR driver	Must be in **WebCTRLx.x\webroot**<system_name>**\drivers**. **NOTE** To verify that you have the driver's latest version, go to http://accounts.automatedlogic.com/download, then select **Drivers** > **ExecB**. Compare the latest version to the AAR's driver in SiteBuilder.
Editable properties	

If you change any of the above items or the AAR's address after the initial download, you must download again. The first download takes longer than subsequent downloads.

CAUTIONS

- The AAR will lose stored data when you download.
- The AAR will shut down and restart when you download, causing loss of communication with controllers on the **Comm 2** port.

To download from the WebCTRL® interface

If your network is complete, you can download from any network browser. If not complete, connect a laptop with a local copy of the system database to the AAR's local access port. See *To communicate through the local access port* (page 10).

1. On the WebCTRL® **Network** tree, select the controller.
2. Click **Downloads**.
3. Do one of the following:
   - If the controller is in the Downloads list, go to step 4.
   - If the controller is not in the list:
     a. Click **Add**.
     b. In the pop-up, select the controller.
     c. Select **All Content**.
     d. Click **Add**.
     e. Click **Close**.
4. Select the controller in the Downloads list.
5. Click **Start**.

NOTES

- If the download fails, locate and resolve the problem, then retry the download.
- You can also download a controller from the **Devices** page.

To set up the driver

After you download the driver to the AAR, you may want to change its properties in the WebCTRL® interface to suit your application.

1 On the WebCTRL® **Network** tree, click ▷ to the left of the controller.

2 Click ▷ to the left of **Driver** to see its children.

3 Make changes as needed on the **Properties** page for **Driver** and any of its children.

Driver

On the **Driver** page, you can change properties related to module clock synchronization and failure. See table below.

Module Clock	
Clock Fail Date and Time	Date and time the control program uses when controller's real-time clock is invalid. **TIP** Use an occupied date and time (such as a Tuesday at 10 a.m.) so the equipment does not operate in unoccupied mode if the controller loses power during occupancy.
Time Synch Sensitivity (seconds)	When the controller receives a time sync request, if the difference between the controller's time and the time sync's time is greater than this field's value, the controller's time is immediately changed. If the difference is less than this field's value, the controller's time is slowly adjusted until the time is correct.

NOTE BACnet COV Throttling does not apply to the AAR.

Device

On the **Device** page, you can change the following properties:

- BACnet device object properties for the AAR
- AAR network communication

Configuration	**NOTE** The three APDU fields refer to all networks over which the AAR communicates.
Max Masters and Max Info Frames	Do not apply to the AAR.

Notification Classes

Alarms in the WebCTRL® application use Notification Class #1. A BACnet alarm's Notification Class defines:

- Alarm priority for Alarm, Fault, and Return to Normal states
- Options for BACnet alarm acknowledgment
- Where alarms should be sent (recipients)

Priorities	**NOTE** BACnet defines the following Network message priorities for Alarms and Events.	
	Priority range	**Network message priority**
	00–63	Life Safety
	64–127	Critical Equipment
	128–191	Urgent
	192–255	Normal
Priority of Off-Normal	BACnet priority for Alarms.	
Priority of Fault	BACnet priority for Fault messages.	
Priority of Normal	BACnet priority for Return-to-normal messages.	
Ack Required for Off-Normal, Fault, and Normal	Specifies whether alarms associated with this Notification Class require a BACnet Acknowledgment for Off-Normal, Fault, or Normal alarms. **TIP** You can require operator acknowledgment for an Alarm or Return-to-normal message (stored in the WebCTRL® database). In the WebCTRL® interface on the **Alarm** > **Enable/Disable** tab, change the acknowledgment settings for an alarm source or an alarm category.	
Recipient List		
Recipients	The first row in this list is the WebCTRL® application. Do not delete this row. Click **Add** if you want other BACnet devices to receive alarms associated with this Notification Class.	
Recipient Description	Name that appears in the **Recipients** table.	
Recipient Type	Use **Address** (static binding) for either of the following: • Third-party BACnet device recipients that do not support dynamic binding • When you want alarms to be broadcast (you must uncheck **Issue Confirmed Notifications**). This use is rare.	
Days and times	The days and times during which the recipient will receive alarms.	
Recipient Device Object Identifier	Type the **Device Instance** from SiteBuilder (or from the network administrator for third-party devices) in the **#** field.	
Process Identifier	Change for third-party devices that use a BACnet Process Identifier other than 1. The WebCTRL® application processes alarms for any 32-bit Process Identifier.	
Issue Confirmed Notifications	Select to have a device continue sending an alarm message until it receives delivery confirmation from the recipient.	
Transitions to Send	Uncheck the types of alarms you do not want the recipient to get.	

Calendars

Calendars are provided in the driver for BACnet compatibility only. Instead, use the **Schedules** feature in the WebCTRL® interface.

Common and Specific Alarms

On these pages, you can enable/disable, change BACnet alarm properties, or set delays for the following BACnet alarms.

Common alarms:

- Module Halted
- All Programs Stopped
- Duplicate Address
- Locked I/O
- Control Program
- Program Stopped
- Excessive COV

Specific alarm:

- Dead Module Timeout

NOTE To set up alarm actions for controller generated alarms, see *Setting up alarm actions* in WebCTRL® Help.

Module Generated Alarm	
Description	Short message shown on the **Alarms** page or in an alarm action when this type of alarm is generated.
Events	
Alarm Category and Alarm Template	See *Customizing alarms* in WebCTRL® Help.
Enable	Clear these checkboxes to disable Alarm or Return to normal messages of this type from this controller.
Notification Class	Do not change this field.

BACnet router properties

On the **BACnet router properties** page, you can change the following properties:

- BACnet routing settings
- Color and prime variable caching settings

BACnet Router Options	
Ignore all Reject-Message-to-Network, Reason=1 messages	Clear to delete and rediscover a route if a network's router indicates that the network is no longer present (reason=1). Select to continue routing messages to a network even if its router indicates that the network is no longer present.

Color/Prime Variable Caching	
Disable Color Cache	Clear (enable) to improve responsiveness in retrieving colors. Select (disable) to reduce network traffic to third-party (non-color-supporting) devices. **NOTE** Selecting this checkbox also disables dead module alarms.
Dead Module Timeout	After this period (minutes:seconds) of non-response from an ExecB controller, the router sends an alarm to the server.

To communicate through the local access port

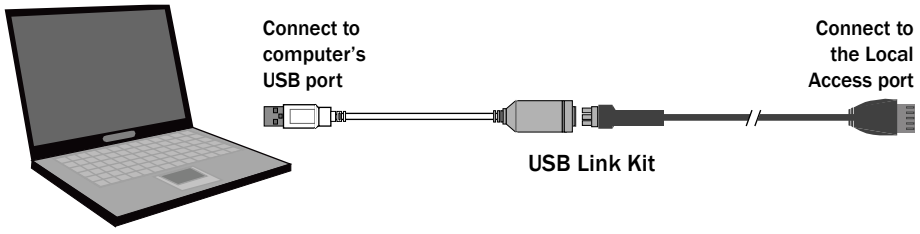
Using a computer and a USB Link Kit, you can communicate locally with the AAR to download or to troubleshoot.

PREREQUISITES

- A computer with a USB port
- A USB Link Kit. See the *USB Link Kit Technical Instructions*.
  NOTE The USB Link Kit driver is installed with a WebCTRL® v5 or later system. But if needed, you can get the latest driver from *http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx*. Install the driver before you connect the USB Link Kit to your computer.
- v1.73c.005 or later controller driver

CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link Kit and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link Kit. Purchase a USB isolator online from a third-party manufacturer.

Connect the USB Link Kit to the computer and to the controller's Local Access port.



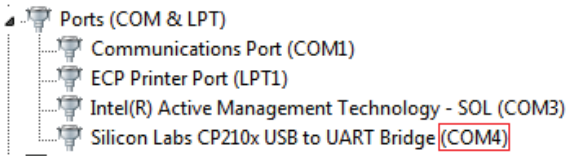
NOTE If using a USB isolator, plug the isolator into your computer's USB port, and then plug the USB Link Kit cable into the isolator.

To set up a Local Access connection in the WebCTRL® interface

For the WebCTRL® application to communicate with the Local Access port, you must do the following:

1. On the **System Configuration** tree, select **Connections**.
2. On the **Configure** tab, click **Add**.
3. From the **Type** drop-down list, select **BACnet Local Access**.
4. Optional: Edit the **Description**.
5. Type the computer's **Port** number that the USB cable is connected to.

   NOTE To find the port number, plug the USB cable into the computer's USB port, then select **Start** > **Control Panel** > **System** > **Device Manager** > **Ports (Com & LPT)**. The COM port number is beside **Silicon Labs CP210x USB to UART Bridge**.



6. Set the **Baud** rate to 115200.
7. Click **Accept**.
8. On the **View** tab, click the button next to the BACnet/IP network, then select **BACnet Local Access**.
9. Click **Accept**.
10. On the **Configure** tab, select **BACnet Local Access**, then click **Start**.

    NOTE If an error message appears, make sure the COM port you selected is not in use. For example, PuTTY may be open and is holding the port open.
11. On the **Network** tree, select the controller that you are connected to.
12. Click , then select **Manual Command**.
13. Type `rnet here` in the dialog box, then click **OK**.
14. On the **Properties** page, click **Module Status**. If a Modstat report appears, the WebCTRL® application is communicating with the controller.

Troubleshooting

If you have problems mounting, wiring, or addressing the AAR, contact ALC Technical Support.

LED's

The LED's on the AAR show the status of certain functions.

If this LED is on...	Status is...
Power	The AAR has power
Comm 1 Rx	The AAR is receiving data from the Comm 1 port

Comm 1 Tx	The AAR is transmitting data over the Comm 1 port
Comm 2 Rx	The AAR is receiving data from the Comm 2 port
Comm 2 Tx	The AAR is transmitting data over the Comm 2 port

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same network address
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Obtain a Module Status Report (Modstat) to determine which of the following occurred: • Exec halted after frequent system errors • Control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout
On	On	Failure. Try the following solutions: • Turn the AAR off, then on. • Format the AAR. • Download the AAR. • Replace the AAR.

NOTE If you resolve the issue but the **Error** LED does not turn off, cycle power to the controller.

To format the controller

If you cannot communicate with a controller after downloading it, as a last resort, you can manually format the controller to erase its memory.

1. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**.
2. Make sure the address switches are not set to 0, 0.
3. Short the **Format** jumper's pins and maintain the short for steps 3 and 4.
4. Insert the power screw terminal connector into the AAR's power terminals.

5 Continue to short the jumper until the **Error** LED flashes three times in sync with the **Run** LED.

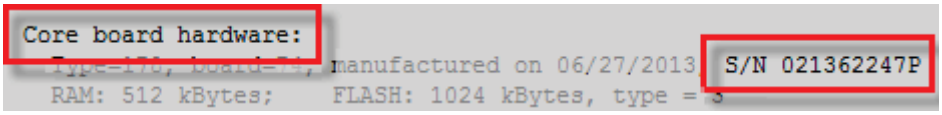
6 Remove the short.

7 Download the AAR.

To get the AAR's serial number

If you need the AAR's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (Modstat) under **Core** (or **Main**) **board hardware**



To obtain a modstat in the WebCTRL® interface:

1 Select the AAR in the **Network** tree.

2 On the **Properties** page, click **Module Status**.

Recovering from a power outage

The AAR has a 10-year Lithium CR2032 battery that retains the following data for a maximum of 10,000 hours during power outages.

- Time
- Editable properties

If the above data is lost after power returns, replace the battery and then download the AAR. See instructions below.

To replace the AAR's battery

If the AAR experiences a power outage and loses parameters such as network numbers, obtain a modstat. If one of the entries under **Information message history** is **Possible battery failure**, replace the battery.

1 Verify that the AAR's power is on.

2 Remove the battery from the controller, making note of the battery's polarity.

3 Insert the new battery into the controller, matching the polarity of the battery you removed.

4 Download the AAR.

To take the AAR out of service

If needed for troubleshooting or start-up, you can prevent the WebCTRL® application from communicating with the AAR.

1 On the WebCTRL® **Network** tree, select the AAR.

2 On the **Properties** page, check **Out of Service**.

3 Click **Accept**.

Compliance

FCC Compliance

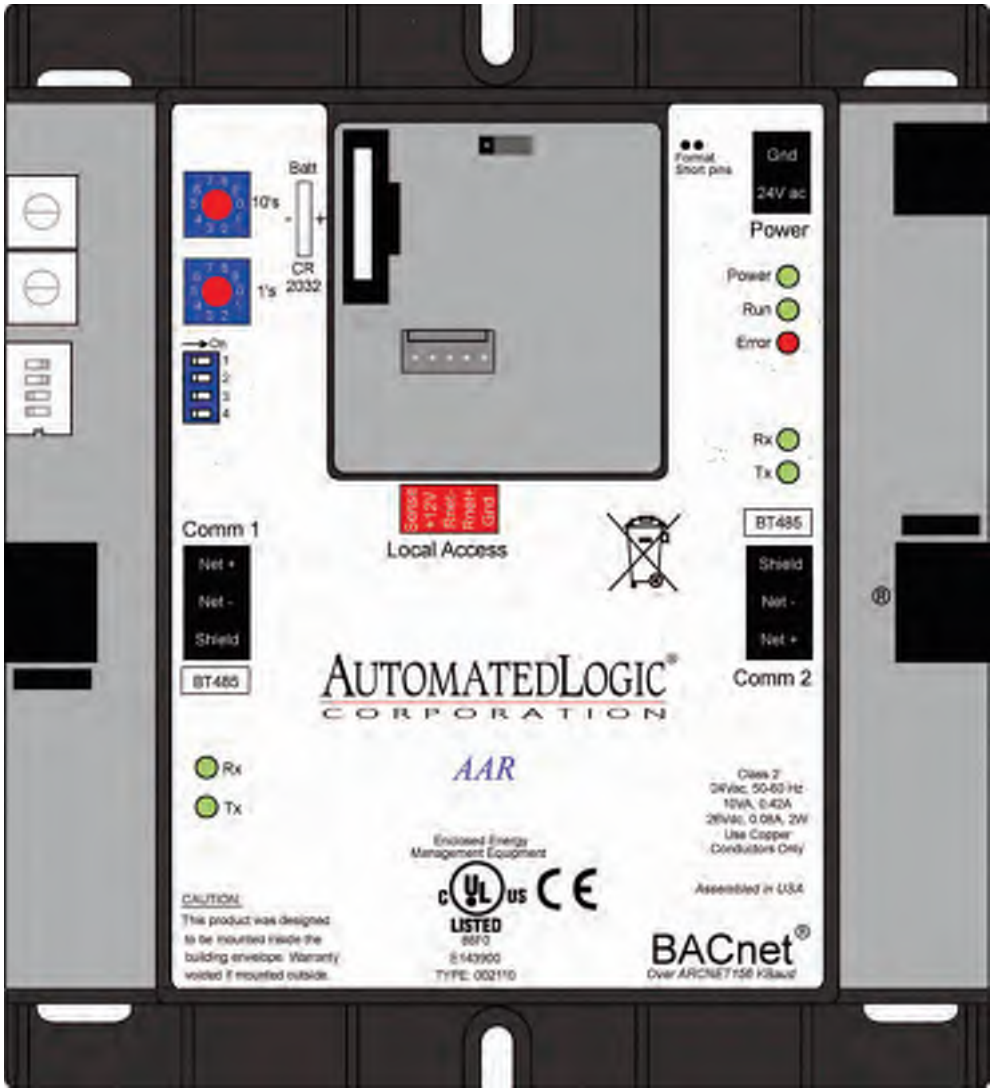
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

Appendix - AAR coverplate



Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
9/26/16	To set up a Local Access connection in the WebCTRL interface	Updated WebCTRL menu button in step 12.	A-D
	Appendix - AAR coverplate	Updated coverplate	A-D
4/16/15	Entire document	New look, no content changes	A-D
9/4/14	LED's	Changed the Status description for when the Run LED shows 2 flashes per second and the Error LED is On. Also added a note below the table regarding cycling power to turn off Error LED.	A-TS-JM-F-BK

* For internal use only