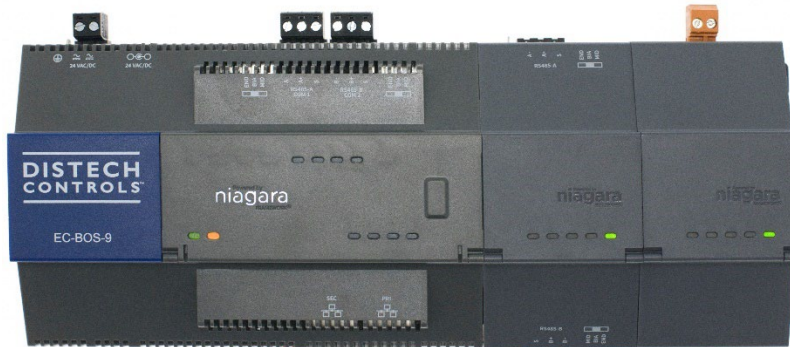# EC-BOS-9

Mounting and Wiring Guide

Product Description

The EC-BOS-9 is a compact, embedded controller and server platform for connecting multiple and diverse devices and sub-systems. With Internet connectivity and Webserving capability, the EC-BOS-9 provides integrated control, supervision, data logging, alarming, scheduling and network management. It streams data and graphical displays to a standard Web browser via an Ethernet or wireless LAN, or remotely over the Internet. The EC-BOS-9 operates with EC-Net™ web-based building management platform powered by the Niagara Framework®.

The integral power supply requires either 24Vac 50/60Hz, 24Vdc, or a wall-mount AC power adapter. Internal battery backup is not required or available. DIN rail-mount option modules directly attach for additional communications ports, including for:

- LonWorks (FTT-10)
- RS232 (DB-9)
- Dual RS485

The controller supports up to four (4) option modules. See *Option Module and Capacity Considerations*. Remote I/O expansion modules are supported by the RS485 connection to the controller. See *RS485 Wiring*.

Included with the EC-BOS-9

The following items are also supplied with the controller.

- MicroSD card in a plastic case
- Two 3-position RS485 connector plugs
- One 2-position power connector plug
- Grounding wire

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Material and Tools Required

The following material and tools are needed.

Power source

- UL listed, Class 2, 24Vac transformer, rated at minimum of 24Va. A dedicated transformer is required (cannot power additional equipment), or
- UL listed Class 2 or LPS 24Vdc power supply, capable of supplying at least 1A (24W), or
- wall-mount AC power adapter with barrel connector plug.

Mounting

- DIN rail, type NS35/7.5 (35mm x 7.5mm)
- DIN rail end-clips (stop clips)
- Suitable tools, fasteners, and accessories for mounting.

The controller can also be panel mounted.

Related Documentation

See the following documents for additional EC-BOS-9 information:

- EC-BOS-9 Quick Start Guide
- EC-BOS-9 Install and Startup Guide
- EC-Net 4 Platform Guide

Option Module and Capacity Considerations

The EC-BOS-9 supports a maximum total of four option (expansion) modules in certain combinations. If you use two RS485 option modules, you are limited to one additional "non-RS485" module (LON or 232) for a total of three. The following figure shows some example combinations.
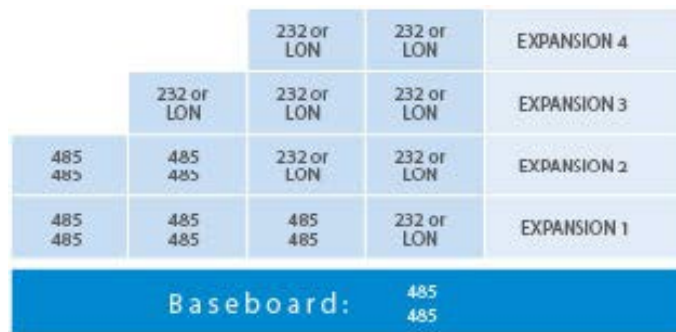

Figure 1:   Valid module combinations

Expansion Module	Max Components
EC-NPB8-LON	4
EC-NPB8-232	4
EC-NPB8-2X-485	2

Table 1:   Maximum option modules supported by protocol

Separate maximum limits may be defined in the EC-BOS-9 license, such as total number of networks, devices, and integration points (capacity licensing).

Protocol	Max	Description, Option Module
RS485	7	Two via onboard RS485, four via two Dual RS485 option modules (2 ports each), plus one via LON or RS232.
Lonworks FTT-10	4	Four LON option modules (1 port each module)
RS232	4	Four RS232 option modules (1 port each module)

Table 2:   Maximum wired field bus integrations.

Note that maximums in *Table 2* do not reflect combinations of wired field bus integrations. Two examples:

- Two RS485 (via onboard RS485), two Lonworks FTT-10 (2 LON modules), two RS232 (2 RS232 modules). Maximum number of option modules (4) are installed.
- Four RS485 (2 via onboard RS485, 2 from a single Dual RS485 module), two Lonworks FTT-10 (2 LON modules). In this case, three (3) option modules are installed.

Future option module types may have additional maximum limits, within the "4 total" option per EC-BOS-9 limit.

Safety Precautions

- Work in a static-free area
- Discharge any static electricity you may have accumulated by touching a known, securely grounded object.
- Disconnect power before installation or servicing to prevent electrical shock or equipment damage.
- Use copper conductors only. Make all connections in accordance with local, national, and regional electrical codes.
- To reduce the risk of fire or electrical shock, install in a controlled environment relatively free of contaminants.
- This device is only intended for use as a monitoring and control device. To prevent data loss or equipment damage, do not use it for any other purpose.
- To comply with FCC and Industry Canada RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.
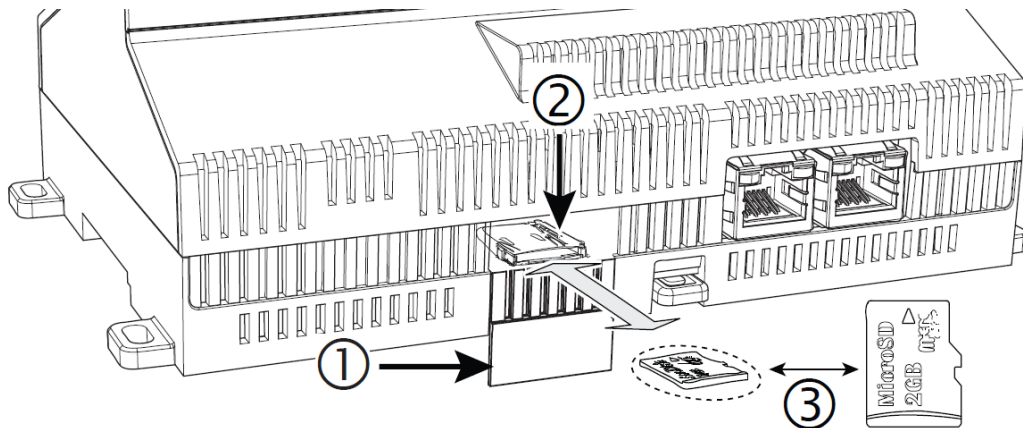
General Precautions

- Remove all power to the EC-BOS-9 before attaching (plugging in) or detaching (unplugging) any option module, to prevent possible equipment damage.
- Removal of the EC-BOS-9 cover is not required. No configurable or user-serviceable items (such as jumpers or a battery) require cover removal—all items are accessible as switches and connectors on the unit's top, bottom, and side, or behind the unit's front access door or microSD card shutter.

Inserting or Removing the MicroSD Card

The microSD card is used to store backups. Backups, once generated, are encrypted with a system passphrase that is stored in the controller. You must re-enter this same passphrase to restore a backup from the microSD card, using a serial connection to the unit's Debug port.

Prerequisites: You are working in a static-free area and have discharged any static from your body. Otherwise, equipment damage is likely to occur.

1. If the unit is currently running, shut it down and unmount it from any DIN rail or screw-tab mounting. For the shutdown procedure refer to *Initiating an EC-BOS-9 Shutdown*. Accessing the card uses the space behind the mounting base.

1	Access shutter for microSD card (slide to open or close).
2	Card carrier inside the EC-BOS-9.
3	MicroSD card to insert or remove from card carrier. Typically, the microSD card never needs removal. However, in the case where a controller has been electrically damaged or found to be faulty, you can remove the card and install it in another like unit, so it can become a functional replacement.

2. To open the plastic shutter, carefully slide it open. The shutter should remain captive in the base, revealing the microSD card socket.

3. To insert the microSD card, slide it into card carrier, label side up, until the spring catch engages. If properly inserted, the card is behind the shutter track.

4. To remove the microSD card, push it in until the spring release pushes it partially out of the card carrier, grasp the card, pull it completely out of the unit and store it in a static free protective case.

5. Carefully slide the card shutter back over the card carrier opening until it clicks in place. When properly closed, the shutter should not protrude behind the mounting base.

Mounting

Mount the EC-BOS-9 in a location that allows clearance for wiring, servicing, and module removal. The following drawing shows the dimensions of an EC-BOS-9 with option modules.
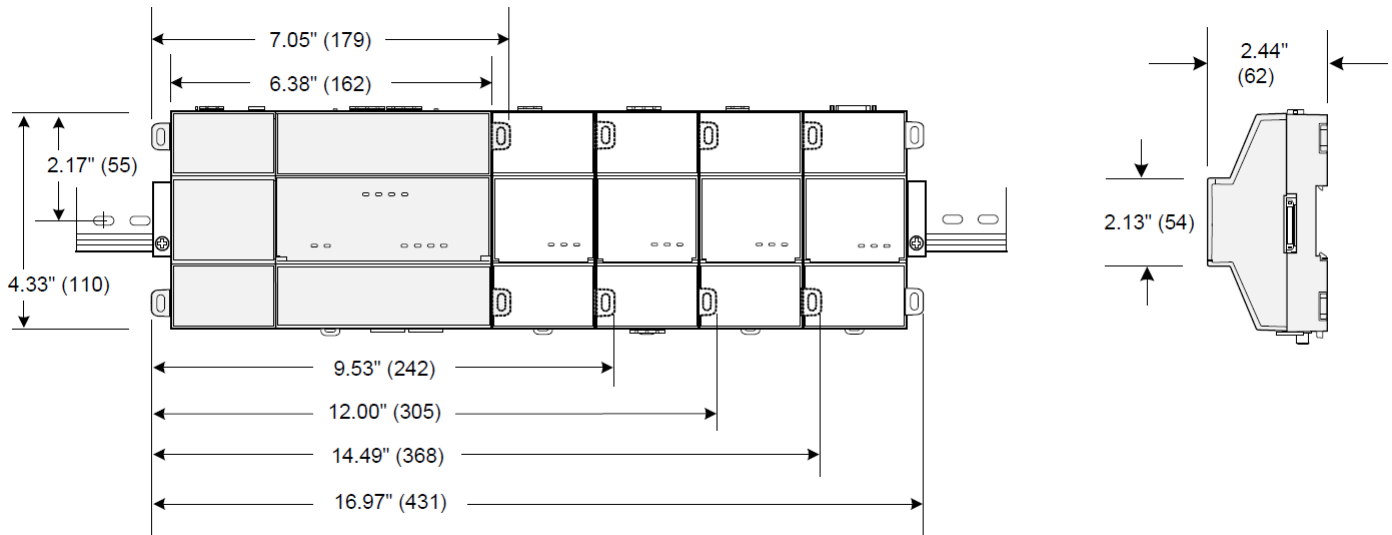

Figure 2:   Mounting dimensions of the EC-BOS-9 and option modules.

Horizontal mounting (as shown) is required to achieve maximum heat dissipation and meet the operating temperature upper limit requirement. Any other mounting orientation reduces this upper limit.

Mounting on a 35mm wide DIN rail is recommended. The controller's unit base has a molded DIN rail slot and locking clip, as do option modules. DIN rail mounting ensures alignment of the connectors between each device.

Up to four (4) option modules are supported. Refer to *Option Module and Capacity Considerations* for details.

Environmental Requirements

This product is for **indoor use only**, altitude to 2,000m (6,562 ft.).

For a unit mounted inside an enclosure, ensure that the enclosure is designed to keep the unit within its required operating temperature range (considering a 24-watt dissipation by the controller). This is important if the controller is mounted inside an enclosure with other heat-producing equipment.

Ambient conditions must be within these ranges:

- Operating Temperature: -20°C to 60°C (-4°F to 140°F).
- Storage Temperature: -40°C to 85°C (-40°F to 185°F).
- Relative humidity: 5% to 95% non-condensing. Pollution Degree 2
- Supply (mains) voltage allowable voltage fluctuation +/- 10%,

Do not mount the unit:

- In an area with excessive moisture, corrosive fumes, or explosive vapors.
- Where vibration or shock is likely to occur.
- In a location subject to electrical noise, such as in the proximity of large electrical contractors, electrical machinery, welding equipment, and so on.

Mounting on a DIN Rail

The following steps describe how to mount the controller on a DIN rail.

Prerequiste: The 35mm DIN rail should be securely mounted, with at least two screws near the rail ends. The microSD card must be installed in the EC-BOS-9. See *Inserting or Removing the MicroSD Card*.

1. Pull the EC-BOS-9 locking clip down.
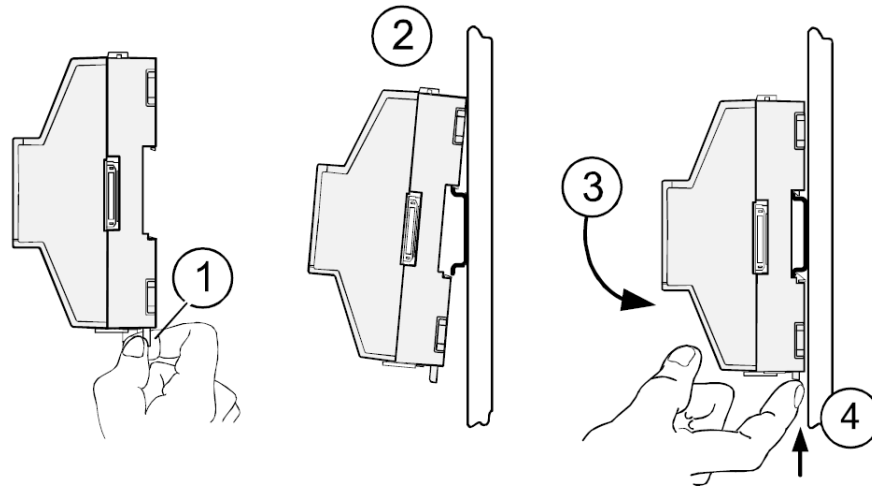
2. Tilt the controller to hook it over the DIN rail.

3. Push down and in on the unit, fastening it to the rail.

4. Push the locking clip up to secure the controller.

5. To mount any option module onto the DIN rail, slide the module firmly into the controller's connector to seat.

Repeat for other modules as needed (4 maximum).
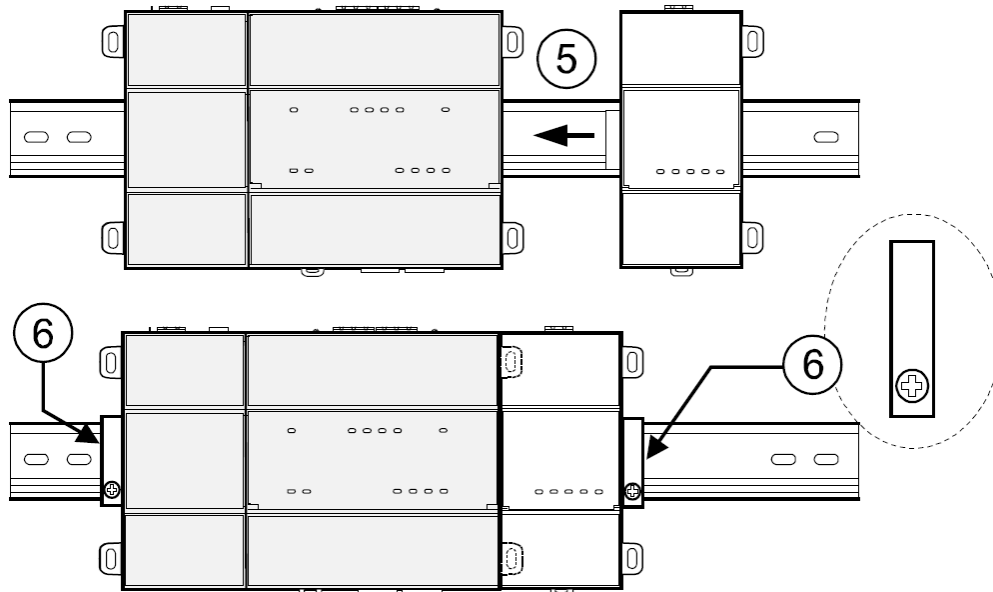
6. Carefully secure both ends of the final assembly with the DIN rail end-clips provided by the DIN rail vendor.

📄 To remove a unit from the DIN rail, pull down its locking clip. Then swing the bottom out and lift the unit away from the DIN rail.

Tab Mounting Dimensions

Measurements shown below are in inches and (mm).

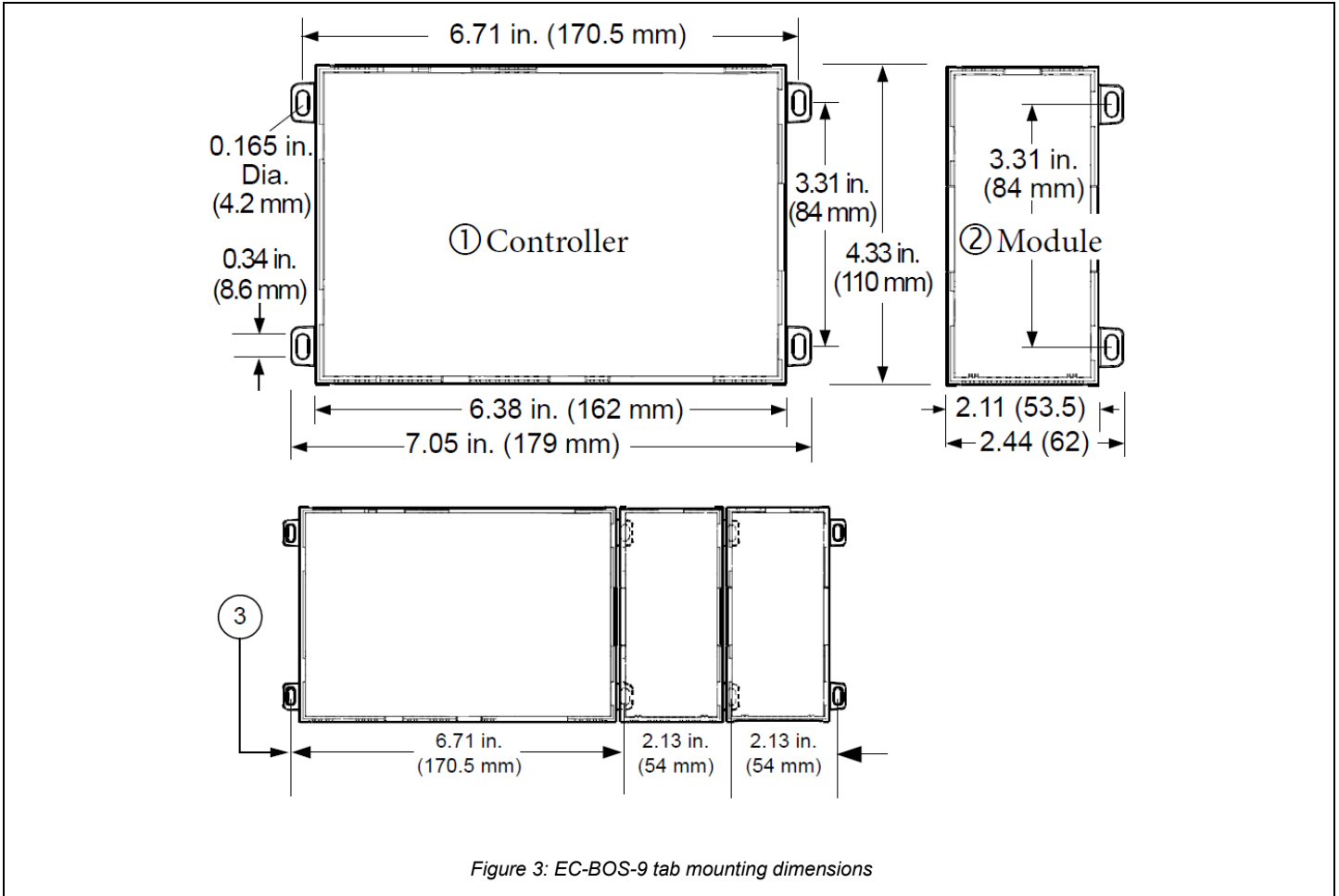Note that DIN mounting is recommended over tab mounting. See *Mounting on a DIN Rail*.

Figure 3: EC-BOS-9 tab mounting dimensions

1	EC-BOS-9. With no option modules added, allow at least 1.5" (38mm) clearance around all sides.
2	Option expansion module. Up to four (4) may be used. See *Option Module and Capacity Considerations*.
3	Distances between center of tabs from one unit to another unit.

Wiring and Power Up

When correctly mounted, the top of the EC-BOS-9 contains the COM ports and the bottom of the controller the Ethernet ports.
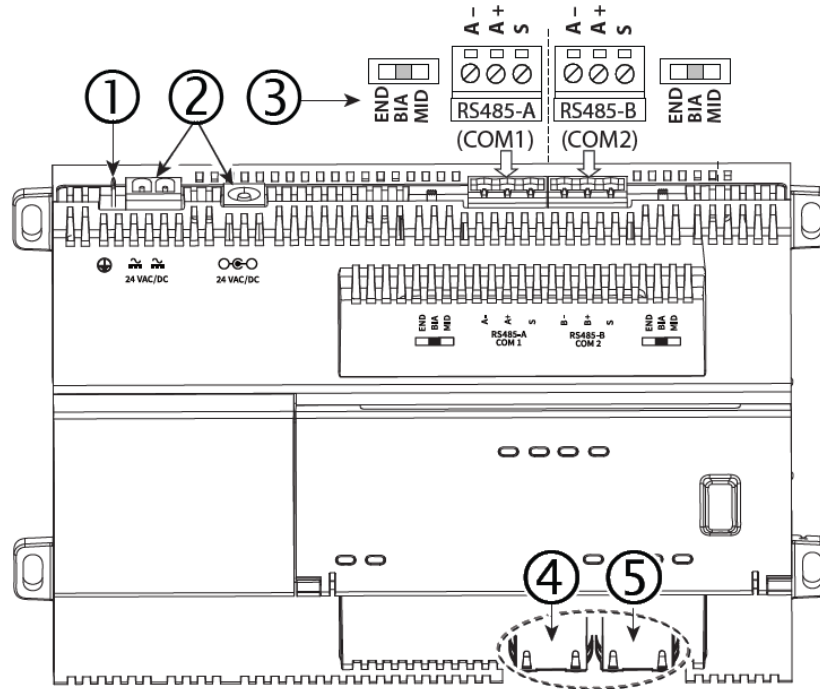

Figure 4:   Power and field communications ports

1	Earth ground
2	Power
3	RS485 ports and bias switches. Refer to *RS485 Wiring* and *RS485 Bias Switches* for details.
4	Secondary Ethernet port (Sec), 10/100/1000 Mbit, RJ–45
5	Primary Ethernet port (Pri), 10/100/1000 Mbit, RJ–45

RS485 Wiring

On the EC-BOS-9 top side, two RS485 ports operate as COM1 and COM2. Each port is capable of up to 115,200 baud, and uses a 3-position, screw terminal connector.
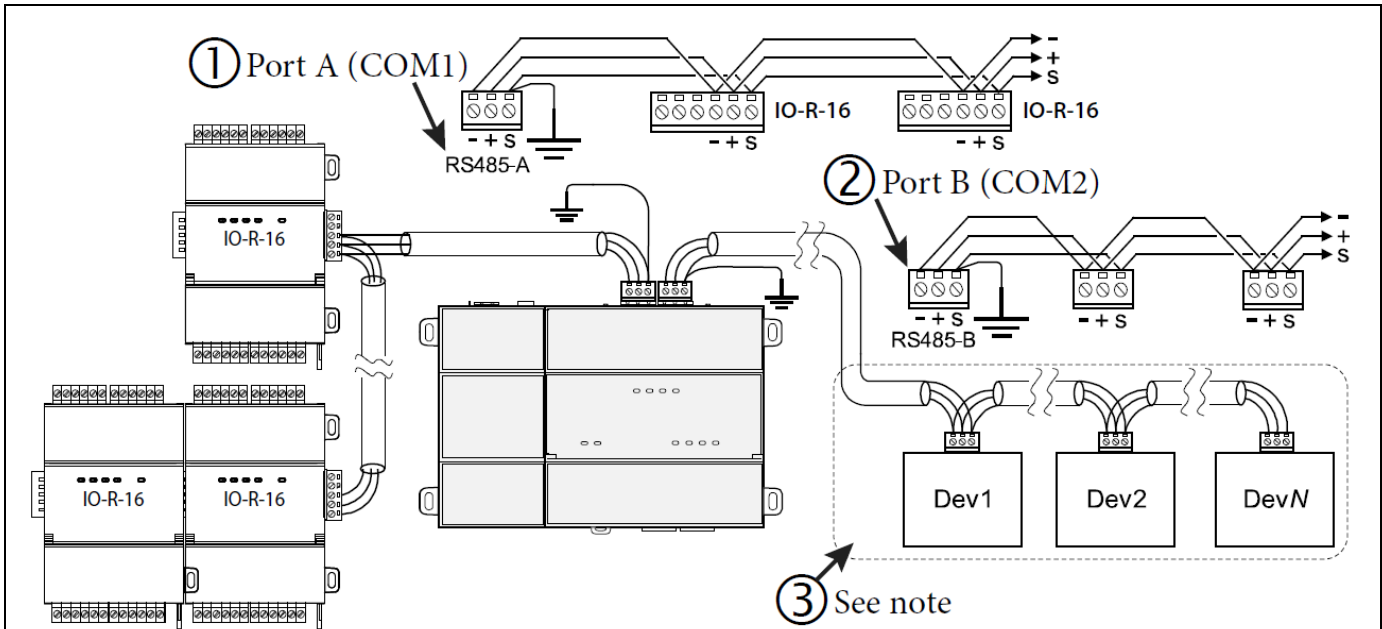
Figure 5:   RS-485 Wiring Example.

1	RS485 port A (COM1) is often used to support a trunk of T-IO-16-485 modules. **NOTE:** Do not mix T-IO-16-485s with other types of RS485 devices on the same RS45 trunk.
2	RS485 port B (COM2) supports a network of other field devices using RS485 communications.
3	This port links to up to 32 or more devices, depending on device specifications.

📄   RS485 devices on the same network should use the same protocol and baud rate.

Use shielded, twisted-pair, 18-22 AWG cabling to wire in a continuous multidrop fashion to other RS485 devices: minus-to-minus, plus-to-plus, and shield-to-shield. Connect the shield wire to earth ground at one end only, for example, at the controller.

RS485 Bias Switches

Each RS485 port has an adjacent 3-position biasing switch.

Eacj switch has these settings:

- **BIA** - (Default, middle) RS485 biasing and termination: 2.7K Ohm bias resistors with no termination resistor
- **END** - RS485 biasing and a termination: 562 Ohm bias resistors and 150 Ohm termination resistor
- **MID** - RS485 biasing or termination: 47.5K bias resistors with no termination resistor

Often, adding RS-485 biasing can improve communications by eliminating indeterminate idle states.

- **BIA** - (Default, middle) Often best if the RS485 trunk needs biasing, but when the EC-BOS-9 is not installed at the end of the trunk.
- **END** - Often best if the EC-BOS-9 is installed at the end of an RS485 trunk of devices that is not already biased.
- **MID** - Often best if the EC-BOS-9 is put in the middle of an already-biased RS485 trunk.

If desired, you can change the position of an RS485 port's bias switch while the EC-BOS-9 is running.

Each RS485 port has two LEDs. See *RS485 LEDs* for details.

Ethernet Wiring

Two RJ-45 10/100/1000-Mbit Ethernet connectors are labeled PRI (LAN1) for primary, and SEC (LAN2) for secondary.

Use a standard Ethernet patch cable to an Ethernet switch.

⚠️   The EC-BOS-9 is not compatible with a Power-Over-Ethernet (POE) network. Connecting on a network segment, which carries power, may cause the unit to fail. In that event, you must disconnect it from the POE network segment and power-cycle the unit.

The factory-default IP address for PRI is 192.168.1.140. The subnet mask is 255.255.255.0. By default, the SEC (LAN2) port is disabled. Refer to the *EC-BOS-9 Install and Startup Guide* for details on the software configuration of the Ethernet ports.

Often, you only use PRI (LAN1 primary) unless you have a specific application for the other port. For example, isolating a driver's network traffic using SEC (LAN2). Do not use SEC as the primary port. If enabling SEC, you must connect PRI and SEC to different IP subnets. Further, a controller does not provide IP routing or a bridging operation between the two Ethernet ports.

Earth Ground and Power

Earth grounding provides protection from electrostatic discharge or other forms of EMI.

Prerequisites: A nearby earth grounding point is available.

⚠ Before making power terminations, de-energize the 24V power source. Do not restore power until completing all other mounting and wiring. Refer to *Power Up and Initial Checkout* for more details
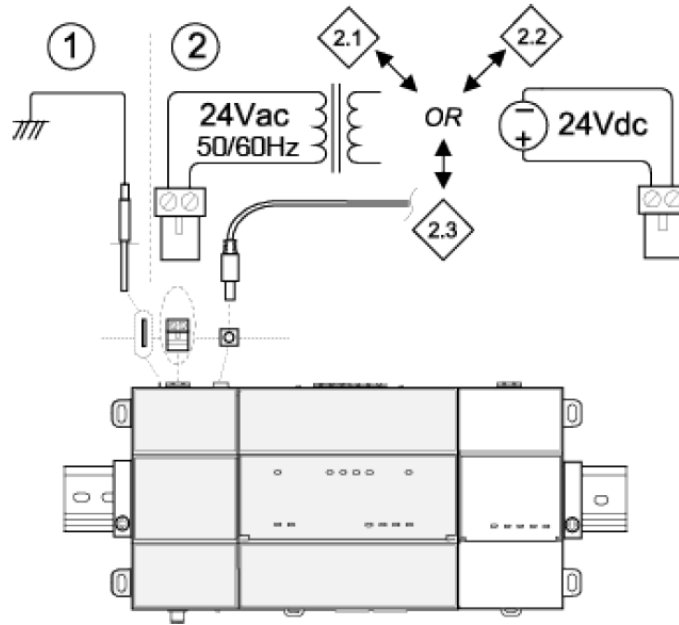

Figure 6:   Earth ground and power options.

Depending on power source used:

1	Ground
2	Power
3	• **2.1** (AC): Dedicated 24V transformer required, with neither side of the transformer secondary tied to ground, or • **2.2** (DC): Polarity is unimportant (uses onboard diode bridge), with neither leg tied to ground, or • **2.3** (Wall-mount AC adapter) instead of wiring 24V to 2-position connector.

1. Install the included earth ground wire to the controller's earth ground spade lug and terminate the other end to a nearby earth ground.

2. Unplug the controller's two-position power connector plug and terminate the 24V supply source (AC or DC) to the connector. Leave the connector unplugged for now.

Power Up and Initial Checkout

Enabling power starts a sequence of blinking LEDs. Also, the Niagara Framework logo on the cover illuminates whenever power is applied to the controller.

Prerequiste: Ensure power and ground wiring to the EC-BOS-9 are ready—see wiring *Earth Ground and Power*.

1. **Apply power**. To do this, do one of the following:
   - Insert the 2-position 24V power connector plug, *or*
   - Insert the barrel plug of the wall-mount AC adapter into an outlet.

2. **Check the BEAT (heartbeat) LEDs**. After power is applied, during bootup, the BEAT LED flashes at rate patterns indicated in the table below. The patterns communicate the status of the bootup process in terms of system state, niagarad, and station. When bootup completes and the heartbeat led shows pattern B then the controller is ready for network communication.

Pattern	Blink pattern	System state	Niagara daemon	Station

A	200ms on / 200ms off	System up	niagarad starting	No station running
B	200ms on / 1000ms off	System up	niagarad running	No station running
C	1000ms on / 1000ms off	System up		Station running

3. If after applying power, the BEAT LED comes on (steady) and stays lit over 2 minutes, contact Systems Engineering for technical assistance.

For more details in this mounting and wiring document, see:

- *Status LEDs*
- *BEAT (Heartbeat) LED*

For what to do next, refer to the _EC-BOS-9 Install and Startup Guide_, which explains how to commission a new EC-BOS-9 controller, that is, how to install the EC-Net 4 software, configure EC-Net platform settings, and install an EC-Net station:

Initiating an EC-BOS-9 Shutdown

When locally servicing an installed and configured (commissioned) unit, use this feature before removing power.

Prerequiste: The EC-BOS-9 has been commissioned (EC-Net 4 installed, platform configured, a station installed) and the unit is running the station. The **BEAT** LED is flashing at the normal 50%/50% On/Off duty cycle rate.

1. Press and hold the recessed **SHUT DOWN** button just until the Green **SHUT DOWN** LED illuminates.
2. Release the **SHUT DOWN** button. The station and software are put into a safe state. The shutdown process starts. During shutdown, the **SHUT DOWN** LED blinks in working mode. When shutdown is done, the **SHUT DOWN** LED turns **Off**.
3. You can safely remove 24V power from the unit.

In the case where the system cannot be put into a safe state, the **SHUT DOWN** LED blinks in error mode: two quick 200ms flashes On, 3 seconds Off, repeating.

Status LEDs

The EC-BOS-9 provides a number of status LEDs and a heartbeat LED. All but one is visible with the front access door closed.
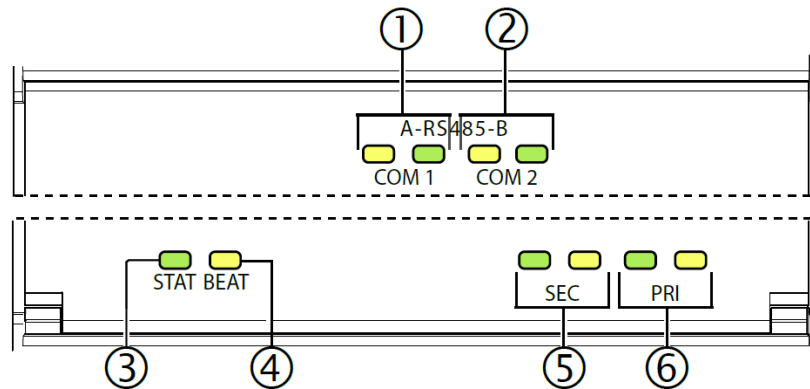

Figure 7: LEDs and brief descriptions.

1	**RS485 A** (COM1): Transmit (TX, Yellow) and Receive (RX, Green). See *RS485 LEDs*.
2	**RS485 B** (COM2): Transmit (TX, Yellow) and Receive (RX, Green). See *RS485 LEDs*.
3	**STAT** (Green): Remains lit. See *STAT (Status) LED*.
4	**BEAT** (Yellow): Heartbeat LED that blinks at 1Hz during normal operation. See *BEAT (Heartbeat) LED*
5	**SEC** Secondary Ethernet, (LAN2) Link (Green) and Activity (Yellow). See *PRI, SEC (Ethernet)* LEDs
6	**PRI** Primary Ethernet (LAN1) Link (Green), Activity (Yellow). See

PRI, SEC (Ethernet) LEDs

After applying power to the controller, LED and heartbeat blink patterns are provided to indicate the status of communication and operation of the EC-BOS-9. The following table provides a summary description of 3 different heartbeat blink patterns, describing what each pattern indicates regarding the current state of controller operating system (system snap), Niagara daemon (niagarad), and station.

Pattern	Blink pattern	System state	Niagara daemon	Station
A	200ms on / 200ms off	System up	niagarad starting	No station running
B	200ms on / 1000ms off	System up	niagarad running	No station running
C	1000ms on / 1000ms off	System up		Station running

Table 3:   EC-BOS-9 BEAT (heartbeat) LED blink pattern

LED blink patterns can change to indicate that a certain state has changed from running to stopped, or not running. For example:

- If a station is killed or stopped, the heartbeat pattern should change from pattern C to pattern B.
- If a station is started, or restarted, the heartbeat pattern should change to pattern C.

Note that after Niagara daemon startup, niagarad is not monitored.

RS485 LEDs

RS485 port A (COM1) and RS485 port B (COM2) each have two LEDs reflecting port activity as follows:

- **Yellow** (TX): indicates the EC-BOS-9 is transmitting data on the RS485 port.
- **Green** (RX): indicates the EC-BOS-9 is receiving data from an RS485 device connected to this port.

These LEDs use a fixed "on time" when a message is detected on the port. If a receive LED is on constantly, this can indicate a wiring problem, such as a shorted wire or reversed wiring.

STAT (Status) LED

The green **STAT** LED provides a CPU machine status check and should remain lit whenever the EC-BOS-9 is powered. If the status LED does not light while power is applied, contact System Engineering for technical support.

BEAT (Heartbeat) LED

In normal operation, the yellow heartbeat **BEAT** LED blinks at 1 Hz, at 50%/50% on/off duty cycle.

After power is applied, during bootup, the **BEAT** LED flashes at a 1 Hz rate, at 50%/50% on/off duty cycle. The bootup process status is indicated by blink patterns as described in the table below.

Pattern	Blink pattern	System state	Niagara daemon	Station
A	200ms on / 200ms off	System up	niagarad starting	No station running
B	200ms on / 1000ms off	System up	niagarad running	No station running
C	1000ms on / 1000ms off	System up		Station running

Table 4:   EC-BOS-9 BEAT (heartbeat) LED blink pattern

⚠️ Do not remove power from the controller during bootup or during other critical operations, such as firmware upgrade to the controller or any attached modules.

If the BEAT LED stays on constantly, does not light or blinks very fast, contact System Engineering for technical support.

PRI, SEC (Ethernet) LEDs

Two LEDs for each of the two LAN ports flash green and yellow.

- The green (left side) Link LED operates as follows:
  - Off indicates no Ethernet link is made.
  - On indicates an Ethernet link is made.
- The yellow (right side) Activity LED operates as follows:
  - Off indicates no Ethernet activity.
  - On and blinking indicates activity (typically if the Link is on).

SHUT DOWN Switch and DEBUG Port

Behind the controller's front access door there is one USB port, one pushbutton switch, and an associated LED.
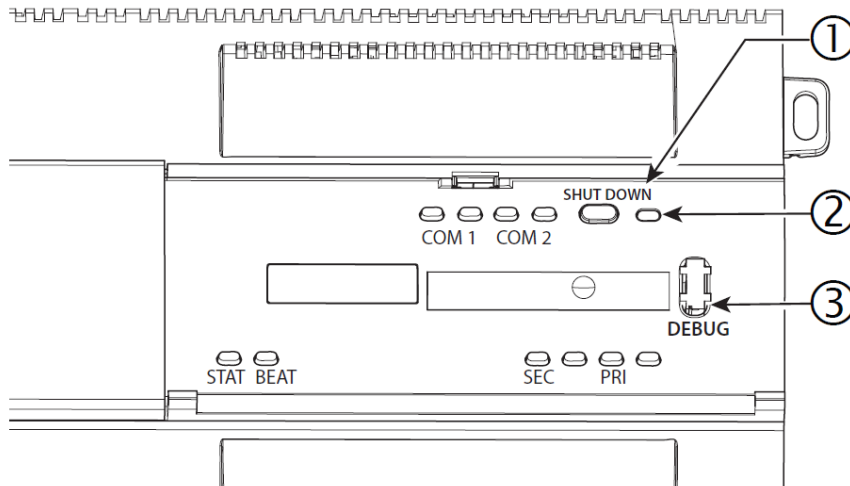
Figure 8:   SHUT DOWN switch and debug port behind access door

1	**SHUT DOWN**: Push button switch for a controlled shutdown. The **SHUT DOWN** push button initiates a controlled shutdown of the controller, ensuring that all station data are preserved. This provides an alternative to the platform stop station command while the controller is connected online. Refer to *Initiating an EC-BOS-9 Shutdown* for details.
2	**SHUT DOWN LED (Green)** Shut down "job in progress" indicator.
3	**DEBUG**: The DEBUG port is a USB-C port for serial debug communications to the controller only.

You can use a serial terminal program (for example: PuTTY) with the DEBUG port to access the controller's system shell menu. This provides access to a few basic platform settings. Default DEBUG port settings are: 115200, 8, N, 1 (baud rate, data bits, parity, stop bits).

For more details, refer to the *EC-BOS-9 Install and Startup Guide*.

📄   Login requires admin-level platform credentials.

EC-BOS-9-Mounting-Wiring_IG_10_EN