ALERTON

ALER-9000 CONTROLLER

MOUNTING AND WIRING GUIDE

GENERAL

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About this Guide

This topic contains important information about the purpose, content, context, and intended audience for this document.

Product Documentation

This document is part of the Niagara technical documentation library. Released versions of Niagara software include a complete collection of technical information that is provided in both online help and PDF format. The information in this document is written primarily for Systems Integrators. To make the most of the information in this book, readers should have some training or previous experience with Niagara software, as well as experience working with JACE network controllers.

Document Content

This document covers the mounting and wiring of the following products:

- ALER-9000 (15885)
- WPM-8000

Refer to the ALER-9000 Niagara 4 Install and Startup Guide for Niagara 4 software installation and configuration details.

Related Documentation

Additional information is available in the following documents.

- Alerton ALER-9000 – Quick Start Guide - 31-00663-01
- Alerton ALER-9000 – Install and Startup Guide - 31-00661-01
- Niagara Platform Guide

GENERAL INFORMATION

The following sections list hardware information and material requirements.
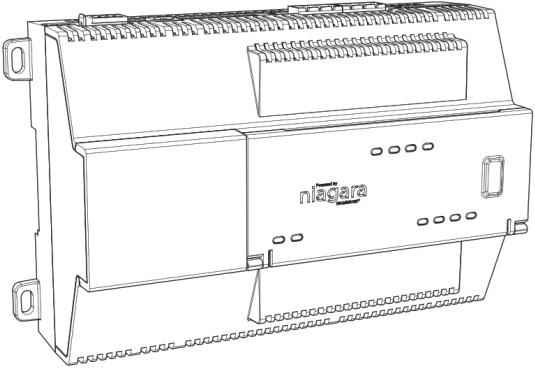
ALER-9000 Controller

Fig. 1 ALER-9000 Controller

The controller provides these features:

Table 1. ALER-9000 Controller Features

Callout	Description
Mounting	DIN rail-mount
Power	24Vac/dc
Processor	Quad Core ARM Cortex-A53 Plus Cortex-M7 1.2GHz
Operating System	Ubuntu Core 20 Linux
Memory	2GB SDRAM 4Mbit FRAM
Storage	8GB (eMMC) 8GB removable microSD (optional)
Ethernet	Two 10/100/1000 Mbit Ethernet ports
RS485	Two electrically isolated RS485 ports

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."

WPM-8000

This is a wall-mount, Class2 Universal AC power adapter. The WPM-8000 supplies 24Vdc to a cable with a barrel-connector plug.

Items Included with the Controller

The following items are also supplied with the ALER-9000 controller:

- MicroSD card in a plastic case (optional for Beta release)
- Two 3-position RS485 connector plugs
- One 2-position power connector plug
- Grounding wire
- ALER-9000 Controller Quick Start Install Guide 31-00655-01

Material and Tools Requirements

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
- WPM-8000 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.

Option Module and Capacity Considerations

The controller 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 RS-232) for a total of three modules. The following figure shows some example combinations

Fig. 2 Valid module combinations

Table 2. Maximum Option Modules Supported by Protocol

Expansion Module	Max Components
NPB-8000–LON	4
NPB-8000–232	4
NPB-8000–2X-485	2

Separate maximum limits may be defined in the controller's license, such as total number of networks, devices, and integration points (capacity licensing).

Table 3. Maximum Wired Field Bus Integrations

Protocol	Maximum	Description, Option Module
RS485	7	Two via onboard RS485, four via two Dual RS485 option modules (2 ports each), plus one via LON or RS-232.
Lonworks FTT-10	4	Four LON option modules (1 port each module)4
RS232	4	Four RS-232 option modules (1 port each module)

The maximums above do not reflect combinations of wired field bus integrations. Two examples:

- Two RS485 modules (via onboard RS485), two Lonworks FTT-10 (2 LON modules), two RS-232 modules. In these configurations, the maximum number of option modules (4) are installed.
- Four RS485 (two via onboard RS485, two from a single Dual RS485 module), two Lonworks FTT-10 (two 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 controller limit.

Precautions:

The following precautions should be taken.

⚠ **CAUTION**

Work in a static-free area.
Discharge any static electricity you may have accumulated by touching a known, securely grounded object.

⚠ **WARNING**

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.

⚠ **CAUTION**

Remove all power to controller before attaching (plugging in) or detaching (unplugging) any option module, to prevent possible equipment damage.
Removal of the controller's 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

Perform the following steps:

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 a controller shutdown." Accessing the card uses the space behind the mounting base.
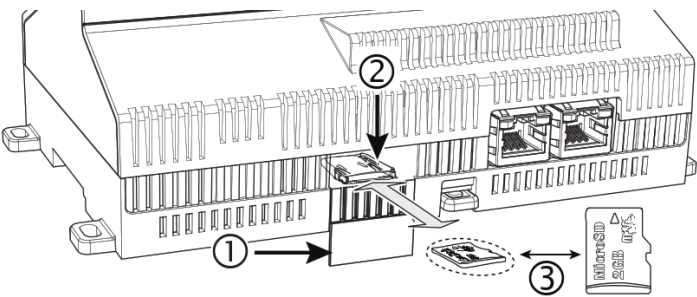

Fig. 3 Inserting or removing the microSD card

Table 4. Inserting or removing the microSD card

Callout	Description
1	Access shutter for microSD card (slide to open or close)
2	Card carrier inside controller
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.

PHYSICAL MOUNTING

Mount the controller in a location that allows clearance for wiring, servicing, and module removal.
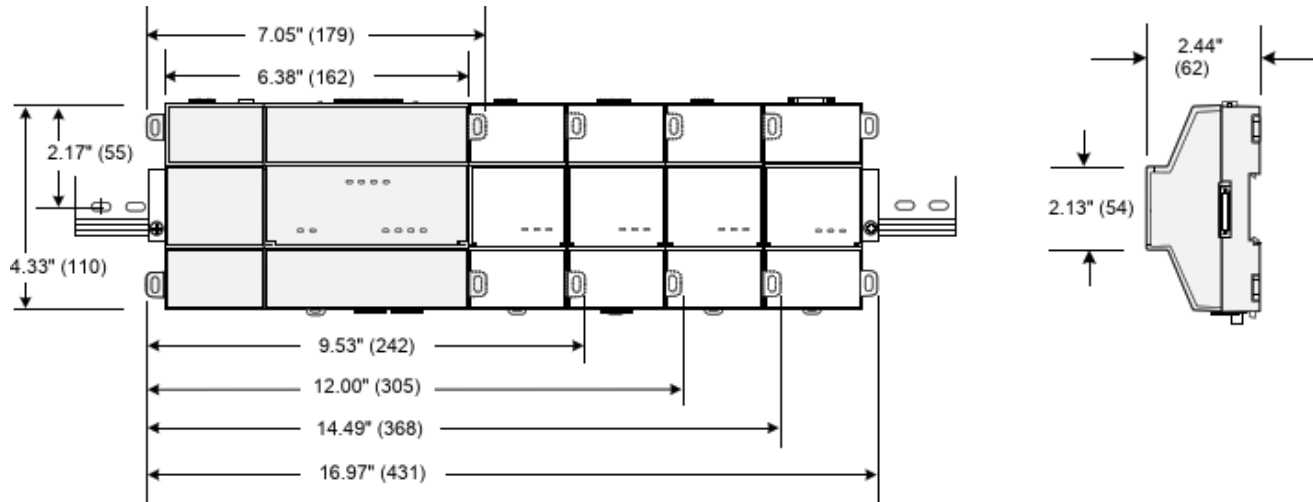

Fig. 4 Mounting dimensions of controller and option modules

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.

The drawing above shows the dimensions of a unit with option modules.

Environmental Requirements

This product is for indoor use only at an altitude no higher than 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 contactors, 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.

Prerequisites: The 35mm DIN rail is securely mounted with at least two screws near the rail ends. The microSD card is installed in the controller. Refer to "Inserting or removing the microSD card" for details
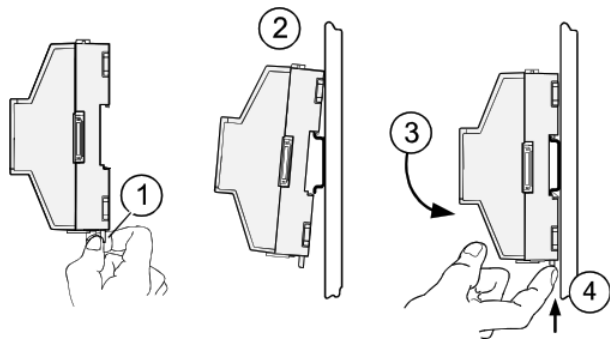
1. Pull the controller's locking clip down.

Fig. 5 Mounting on a DIN rail

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.

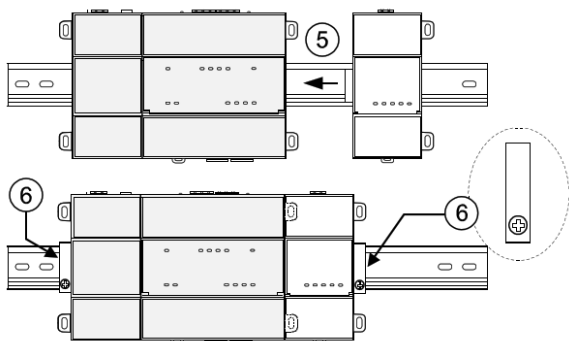   Repeat for other modules as needed (4 maximum).

Fig. 6 Mounting on a DIN rail

6. Carefully secure both ends of the final assembly with the DIN rail end-clips provided by the DIN rail vendor.

📄 **NOTE:**
   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

Tab mounting measurements shown below are in inches and millimeters (mm).

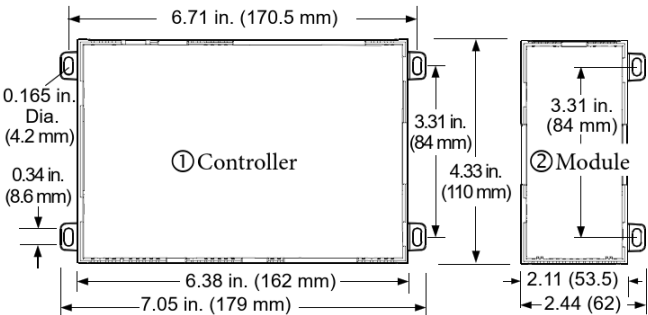DIN mounting is recommended over tab mounting. Refer to "Mounting on a DIN rail" for details.

Fig. 7 ALER-9000 controller tab mounting dimensions

Fig. 8 ALER-9000 controller tab mounting dimensions

Table 5. ALER–9000 controller tab mounting dimensions

Callout	Description
1	ALER-9000 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. Refer to "Option module and capacity considerations" for details.
3	Distances between the center of the tabs from one unit to another unit.

WIRING AND POWER UP

When correctly mounted, the top of the controller contains the COM ports and the bottom of the controller the Ethernet ports.

Fig. 9 Power and field communications ports

Table 6. Power and field communications ports

Callout	Description
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 controller's top side, two RS485 ports operate as COM1 and COM2. Each port is capable of up to 115,200 baud, and uses a three-position screw terminal connector.
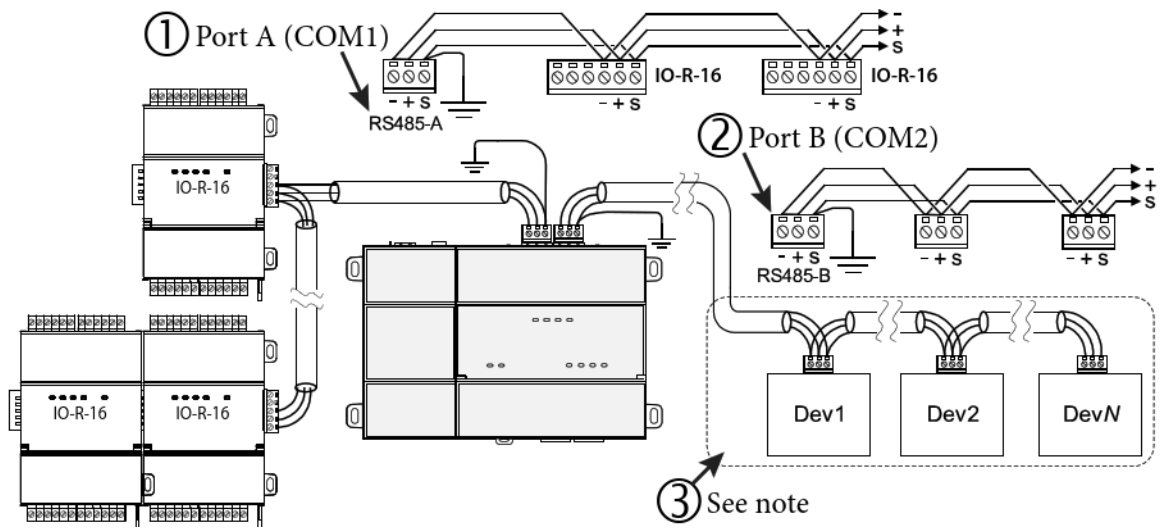

Fig. 10 RS–485 wiring example

Table 7. RS–485 wiring example

Callout	Description
1	This RS485 port A (COM1) could be used to support a trunk of IO-R-16 modules. 📄 **NOTE:** Do not mix different types of RS485 modules or devices on the same RS485 trunk
2	This 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.

📄 **NOTE:**
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 RS48 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 three-position biasing switch.

Each 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 RS485 biasing can improve communications by eliminating indeterminate idle states. For example:

- **BIA** – (Default, middle) is often best if the RS485 trunk needs biasing when the controller is not installed at the end of the trunk.
- **END** – is often best if the controller is installed at the end of an RS485 trunk of devices that is not already biased.
- **MID** – is often best if the controller 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 controller is running. Each RS485 port has two LEDs. Refer to "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.

> ⚠ **CAUTION**
>
> The ALER-9000 is not compatible with a Power–Over-Ethernet (POE) network. Connecting the JACE 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 ALER-9000 Install and Startup Guide for details on the software configuration of the Ethernet ports.

> 📄 **NOTE:**
>
> 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 JACE controller does not provide IP routing or a bridging operation between the two Ethernet ports

Earth Ground and Power

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

Prerequisites: A nearby earth grounding point is available.

> ⚠ **WARNING**
>
> 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.
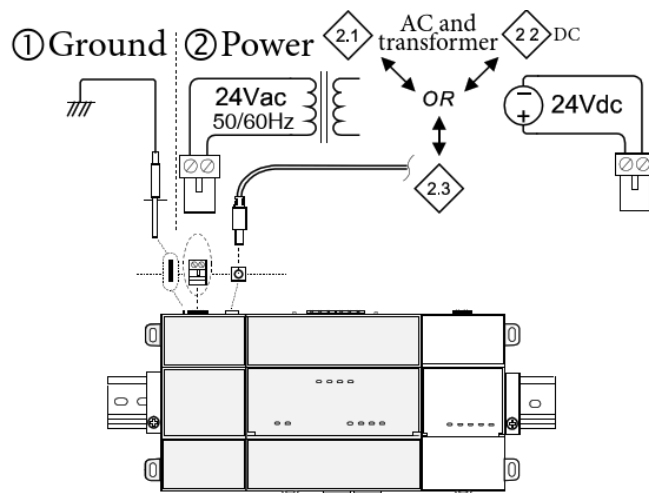

Fig. 11 Earth ground and power options

Depending on your power source:

Table 8. Earth ground and power options

Callout	Description
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, WPM-8000) instead of wiring 24V to two–position connector July.

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 logo on the cover illuminates whenever power is applied to the controller.

Prerequisites: Power and ground wiring to the controller are ready. See wiring "Earth ground and power."

1. To apply power, do one of the following:
   - Insert the two-position 24V power connector plug.
   - Insert the barrel plug of the wall-mount AC adapter (WPM-8000) into an outlet.
2. Check the BEAT (heartbeat) LED.

   After power is applied, during bootup, the "BEAT" LED flashes at rate patterns indicated in the table below. The patterns communicate 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.

Table 9. ALER-9000 BEAT (heartbeat) LED blink pattern

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 for over two (2) minutes, contact Systems Engineering support for technical assistance.

For more details in this mounting and wiring document, refer to the following sections in this document:

- "ALER-9000 Status LEDs"
- "USB ports and push button switches"
- "BEAT (Heartbeat) LED"

For what to do next, refer to the "ALER-9000 Install and Startup Guide", which explains how to commission a new ALER-9000 controller, that is, how to install the Niagara 4 software, configure Niagara platform settings, and install a Niagara station.

Initiating a Controller Shutdown

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

Prerequisites: The controller has been commissioned (Niagara 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 is 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 the 24V power from the unit.

   If 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.

ALER-9000 STATUS LEDS

The ALER-9000 provides a number of status LEDs and a heartbeat LED. All but one are visible with the front access door closed.
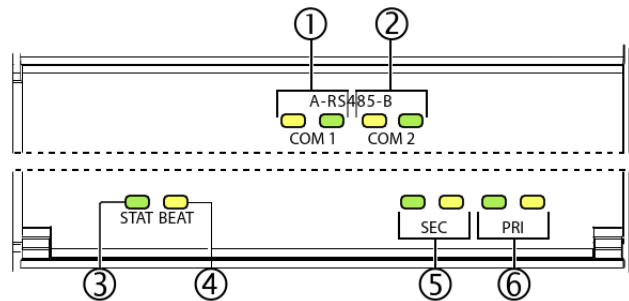

Fig. 12 ALER-9000 LEDs

Table 10. ALER-9000 LEDs and brief descriptions

Callout	Description
1	**RS485 A** (COM1): Transmit (TX, Yellow) and Receive (RX, Green). Refer to "RS485 LEDs."
2	**RS485 B** (COM2): Transmit (TX, Yellow) and Receive (RX, Green). Refer to "RS485 LEDs."
3	**STAT** (Green): Remains lit. Refer to "STAT (Status) LED."

4	**BEAT** (Yellow): Heartbeat LED that blinks at 1Hz during normal operation. Refer to "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 ALER-9000. 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.

Table 11. ALER-9000 BEAT (heartbeat) LED blink pattern

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

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:**
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.

- Yellow (TX): indicates the controller is transmitting data on the RS485 port.
- Green (RX): indicates the controller 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 controller 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, with a 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.

Table 12. ACE-9000 BEAT (heartbeat) LED blink pattern

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

⚠️ **CAUTION**
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 (typical 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.

Fig. 13 SHUT DOWN switch and debug port behind access door

Table 13. SHUT DOWN switch and debug port

Callout	Description
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 a controller 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 ALER-9000 Install and Startup Guide.

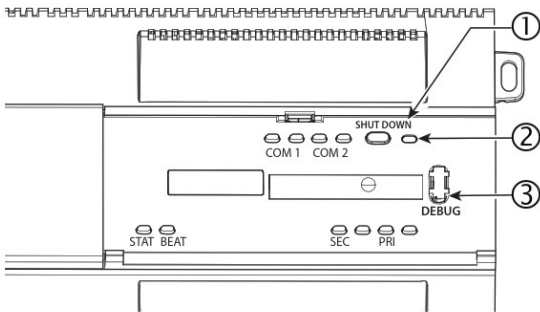> 📄 **NOTE:**
> Login requires admin-level platform credentials.

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