PELICAN

Model: PEARL
Advanced Controller (Thermostat Accessory)
Installation Guide

Before you start

- **Read Instructions:** Review all steps in this guide to avoid issues.

- **System Requirements:** The PEARL is for 24VAC systems only and must be installed by a licensed professional.

- **Required Components:** You need a Pelican Thermostat and Gateway. Some projects may require a PEARL Expansion Module (PEM-VDC) for additional outputs.

- **Need Help?:** If unsure about the setup, stop and contact Pelican Technical Support.

What is the PEARL?

The PEARL is a thermostat accessory that offers advanced HVAC system control. It can manage:

- **Outside Damper Control** (for ventilation and economizer functions).

- **Supply Fan Control** (for single-zone variable air volume).

- **Modulating Heating** (hot water, steam, gas, or electric).

- **Modulating Cooling** (chilled water or compressor systems).

- **External Temperature Inputs**.

For zone damper or reheat control, refer to the Zone Damper Control manual or contact Pelican support.

Key Features

Placement: Install near the controlled equipment. Connects to a Pelican thermostat via a 3-wire power and communication line (maximum distance: 500 feet).

Outputs & Inputs: Two (2) Modulating outputs, Three (3) temperature or dry-contact inputs, and One (1) binary output control capabilities.

Configuration: Use the Pelican Connect web app for setup and adjustments. An Pelican Gateway with an Internet connection is required for initial configuration but not for regular operation.

California Title 24

When installed and commission correctly, this device meets California's Title 24 energy efficiency standards.

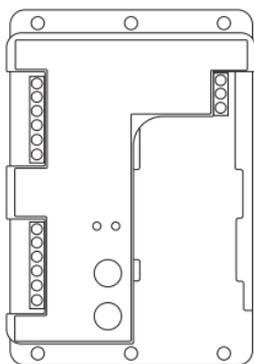## Safety Considerations

Disconnect electrical power to the power source and/or the HVAC equipment before starting to install any Pelican devices. Failure to follow this warning could cause electrical shock, personal injury, or damage to the controller.
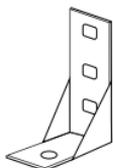
Included Parts

(1) Duct Temp Sensor
(10K Type 2 Thermistors)

(2) Vinyl Temp Sensors
(10K Type 2 Thermistors)

(1) PEARL
Advanced Rooftop
Controller
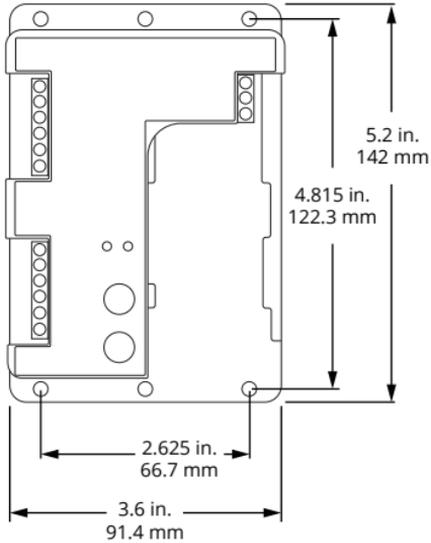
(1) Stand
(for Outside Temp Probe)

(2) 3/16" Sheet Metal Screws
(for mounting)

Dimensions

Specifications

- **Power:** 24 VAC, 60 Hz, 50 mA

- **Operating Voltages:** 23 — 30 VAC

- **Outputs:** Two Analog (0-10 VDC), One Binary

- **Inputs:** Three Temperature (10K Type II Thermistors) or Dry-Contact, and Two Analog (0-10 VDC)

- **Temperature Detection Range:** -20°F — 180°F

- **Binary Output Relay Ratings:** 24 VAC @ 2.0 A running

- **Code Compliant:** Meets California T24 Code. Follows ASHREA Economizer and Ventilation Standards.

- **Compatibility:** Works with all Pelican Thermostats.

- **Wired Communication:** Pelican 3-wire power and communication.

- **Operating Range:** -4°F to 160°F, 5–90% RH (non-condensing)

- **Notifications:** Notifications for sensor failures, damper issues, excess outdoor air, and unsafe temperatures.
- **Storage Temperature:** -20°F — 160°F

Installation Overview

Steps:

1. Plan the installation based on your HVAC system.
2. Turn off power and choose a mounting location.
3. Mount and wire the PEARL to the thermostat.
4. Connect the PEARL to HVAC equipment.
5. Install and connect temperature sensors.
6. Restore power and confirm functionality.
7. Configure the PEARL using the web app.
8. Test and calibrate the economizer damper.

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Economizer Damper Control:
For ventilation and/or economizer control, the air handler typically includes an economizer damper assembly ducted at the mixed air inlet. Three dampers—outside air, return air, and sometimes exhaust air—are synchronized for control. The PEARL adjusts these dampers to regulate outside air intake based on ventilation needs or economizer settings. The outside and exhaust dampers rotate in the same direction, while the return damper rotates in the opposite direction.
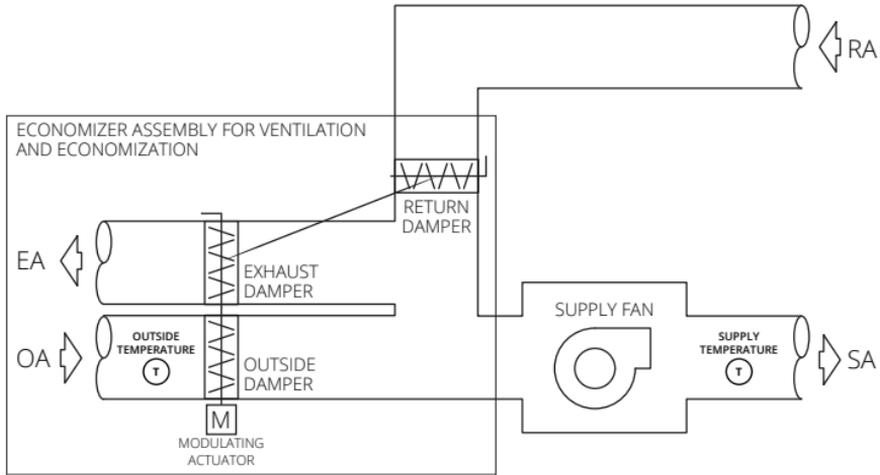
Single Zone Variable Air Volume Control:
For variable speed fan control, the air handler will need a fan that accepts a 0-10V DC control input. The PEARL adjusts the fan speed across five configurations to manage airflow based on different heating, cooling, and ventilation sequences.

7
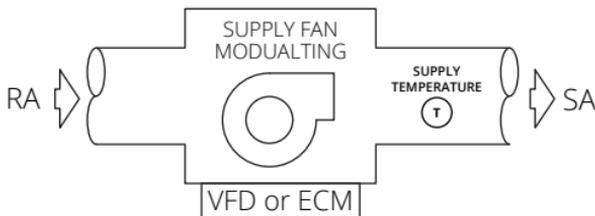
Modulating Heating and Cooling Control:
For equipment with modulating heating and cooling, the PEARL adjusts its outputs to maintain target discharge air temperatures. As heating or cooling demands change, the PEARL controls these elements to ensure comfort and energy efficiency.
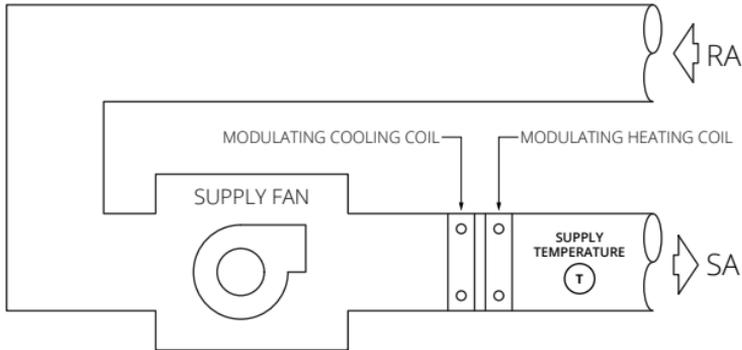
Modulating VAV Box and Reheat Coil Control

For multi-zone applications with a modulating zone damper and/or reheat coil, the PEARL can adjust settings to maintain target discharge temperatures based on zone demand.

For details, refer to the Pelican Zone Damper Control IOM: 37-0003.
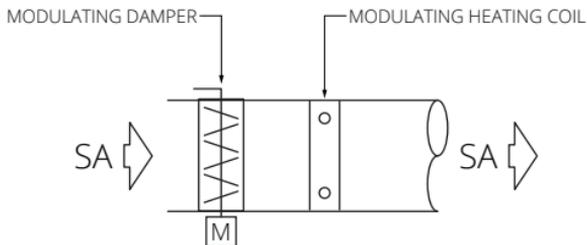
Turn Off Power

Turn OFF the power to the equipment
this device is going to be wired to.
Either power off at the circuit breaker
panel or by turning off the master
power at a local disconnect.
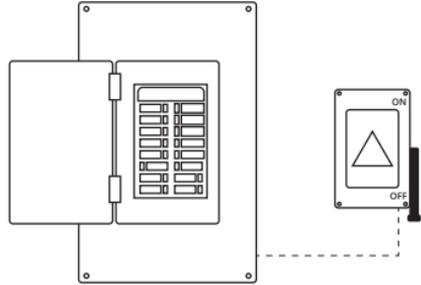
Mounting

- ○ **Location:** Mount in a low-voltage control cavity near equipment.

- ○ **Wiring:** Ensure 3 wires are available to connect to the thermostat.
  Use 18-gauge thermostat wire (maximum length: 500 feet).

- ○ **Power Source:** Verify access to a 24VAC power supply.

- ○ **Securing:** Use the provided screws to secure the PEARL.

    **<u>Important: The PEARL is not waterproof. Mount it in a
    moisture-free location.</u>**

Pelican PEARL

Control Board

Use sheet
metal screws
to secure the
PEARL.
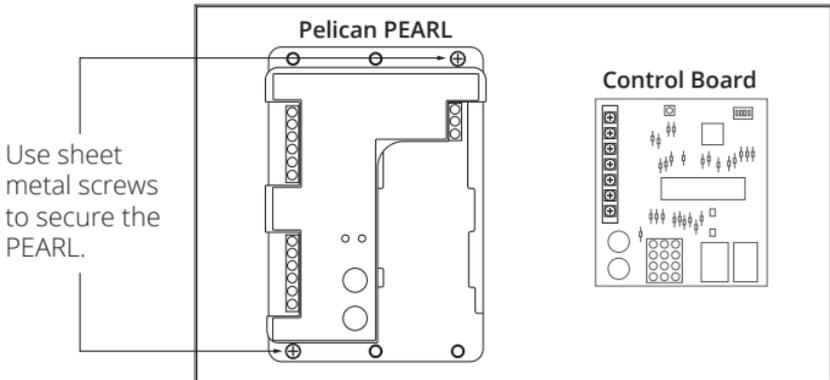
R	⊘	**24 VAC Power**
C	⊘	**Common** (All commons are internally connected)
D	⊘	**Data**

A_1	⊘	**Configurable 0 [2] - 10 Vdc Output:** Modulate outside air damper or, Modulate hot water or chilled water valve or, Modulate mechanical compressor or gas valve.
A_2	⊘	**Configurable 0 [2] - 10 Vdc Output:** Modulate variable speed supply fan or, Modulate hot water or chilled water valve or, Modulate mechanical compressor or gas valve.
E	⊘	**24 Vac Output:** Enables during economizer or demand ventilation cycles.
S_1	⊘	**0 [2] - 10 Vdc Input:** Economizer Fault Detection & Diagnostics.
S_2	⊘	**0 [2] - 10 Vdc Input**

T_1	⊘ ⊘	**Input:** 10K Type 2 thermistor input. or Dry-contact input.
T_2	⊘ ⊘	**Input:** 10K Type 2 thermistor input. or Dry-contact input.
T_3	⊘ ⊘	**Input:** 10K Type 2 thermistor input. or Dry-contact input.

Connect the PEARL to the thermostat using R (24VAC), C (Common), and D (Data) terminals. Use wire nuts if needed.

For HVAC control wiring, follow the Thermostat Installation Manual.

Ensure all connections are tight and wires are not damaged.

Pelican PEARL
Installed at the equipment.

1. Use wire nuts where required. Do not land mulltiple wires into a single terminal.

2. Maximum 500 feet 18G thermostat wire.

Pelican Thermostat Backplate
Installed inside the building.

11
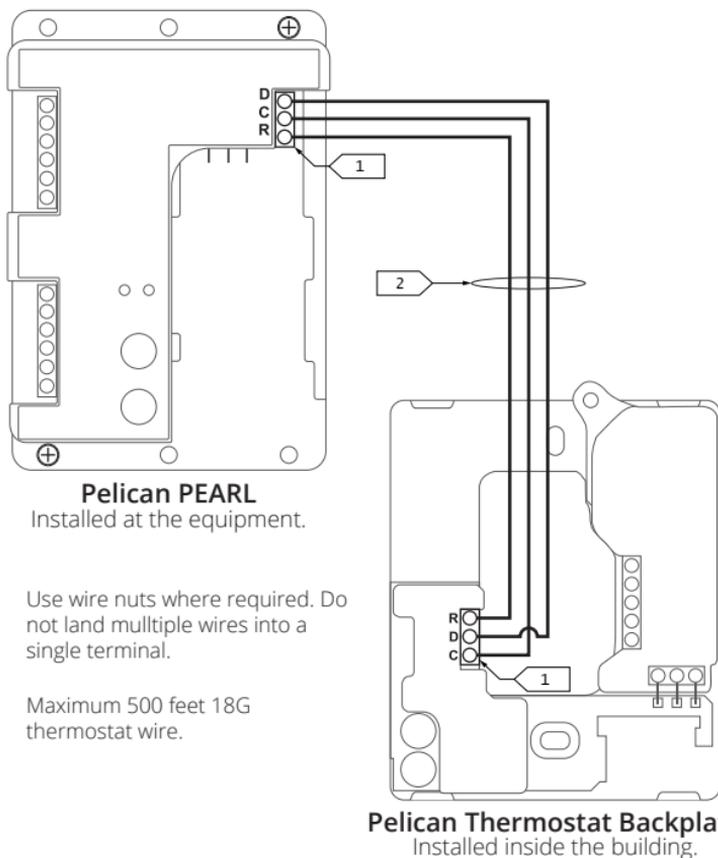
Locate the HVAC equipment's control board. Use new wire to connect the Pelican controller terminals to the corresponding low-voltage input terminals on the HVAC control board. Follow the Thermostat Installation manual for most common HVAC equipment control outputs.

Pelican PEARL

Low Voltage Terminals

1. Use wire nuts where required. Do not land mulltiple wires into a single terminal.

2. 18G thermostat wire.

3. For thermostat wiring guides, reference the Pelican thermostat installation manual.

4. For power refer to "Wiring - Power" on pages 16 & 17 of this installation guide.

Pelican Thermostat Backplate
Installed inside the building.
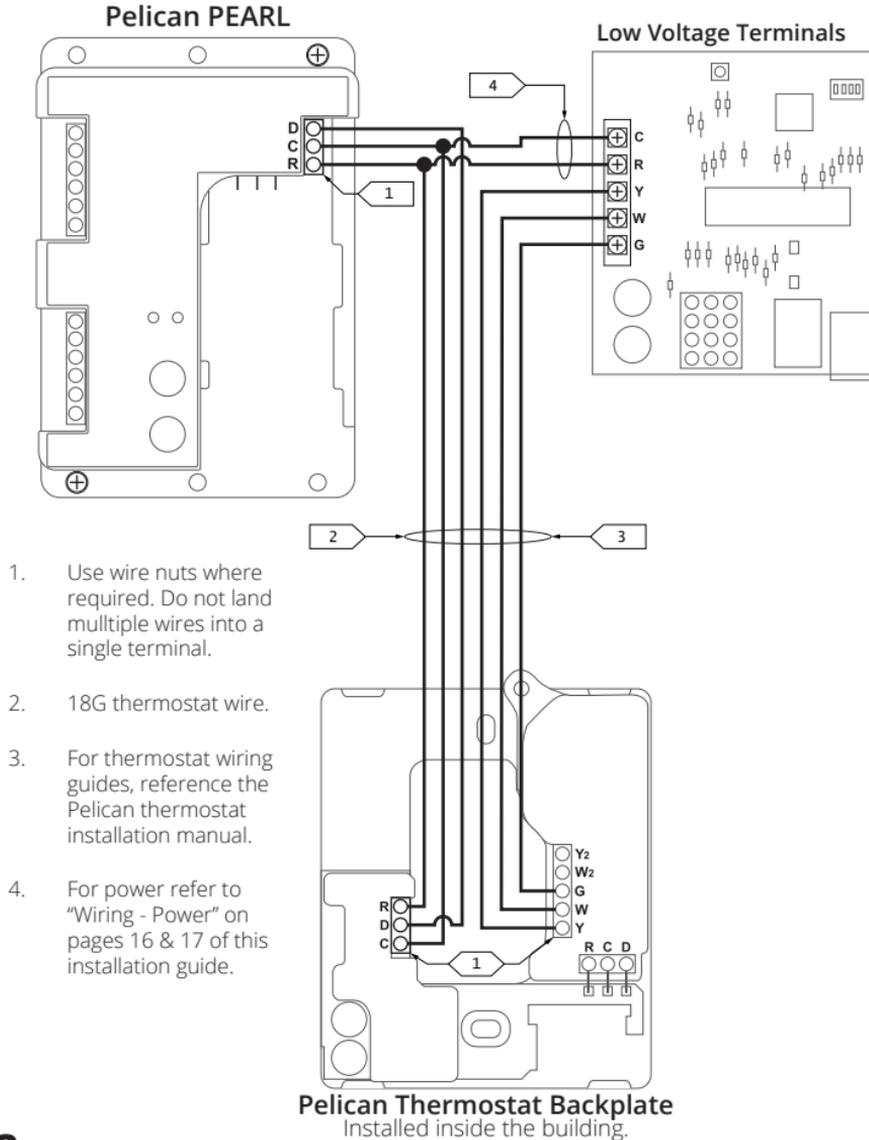
For installations with limited wires between the thermostat and the PEARL, Pelican includes a Limited Wiring Module inside each thermostat, allowing full HVAC control without running additional wire.

Step 1: Remove the Wiring Module from the Pelican Thermostat's Back Plate

1. Loosen the (R), (C), and (D) terminals on the Limited Wiring Module.

2. Gently slide the module upwards (away from the three-pin connector) to detach.

Wiring Module

Loosen terminals.
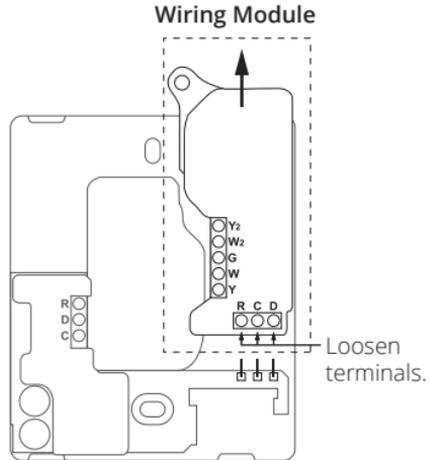
Pelican Thermostat Backplate

Step 2: Install the Wiring Module into the PEARL.

3. Align the wiring module with the opening in the PEARL.

4. Slide the module upwards towards the three-pin connector, ensuring the pins insert cleanly into each terminal.

5. Tighten the (R), (C), and (D) terminals on the wiring module.

Pelican PEARL

Tighten terminals.

Wiring Module

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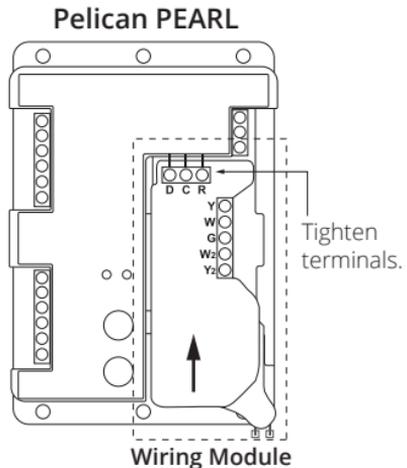
Step 3: Mount & Wire PEARL to its thermostat

1. Securely mount the PEARL inside the HVAC equipment's low voltage cavity. Use existing or new 18-gauge wire to connect the PEARL's power and communication terminals to the corresponding terminals on the Pelican thermostat.

2. Ensure each connection is secure and correctly match:
    ◦ R terminal (24V AC) to the respective R input
    ◦ C terminal (Common) to the respective C input
    ◦ D terminal (Data) to the respective D input

3. Wire to Power & Control Points: Follow the Thermostat Installation manual for most common HVAC equipment control outputs.

Pelican PEARL

Low Voltage Terminals
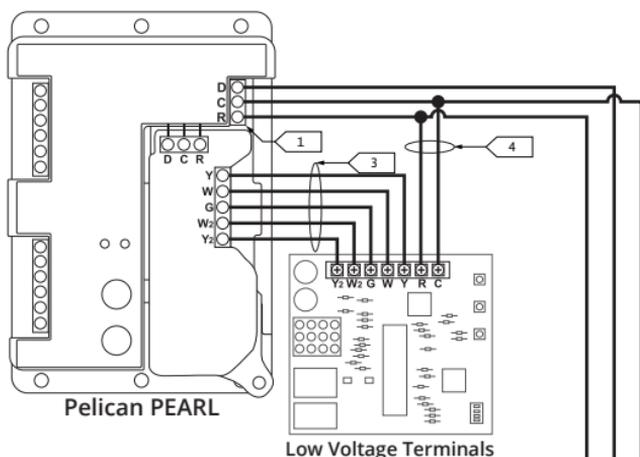
1. Use wire nuts where required. Do not land mulltiple wires into a single terminal.

2. Maximum 500 feet 18G thermostat wire.

3. For equipment control wiring guides, reference the Pelican thermostat installation manual.

4. For power refer to "Wiring - Power" on page 16 & 17 of this installation guide.
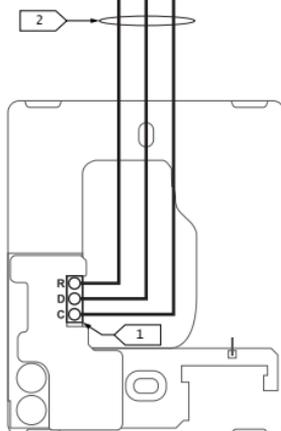
Pelican Thermostat Backplate
Installed inside the building.

Application Wiring Diagrams

The PEARL supports various control applications. This section includes wiring diagrams for the most common applications. For thermostat equipment control output diagrams, see the Thermostat Installation manual.

1) Before wiring Pelican to the rooftop equipment's power source, turn power ON to the rooftop equipment and verified the voltage measured from the transformer is within the PEARL/thermostat's operating range of 23 - 30VAC.

2) Turn power back OFF to the rooftop equipment.

3) Wire (R) to 24VAC and (C) to Common from Pelican to the equipment power source.
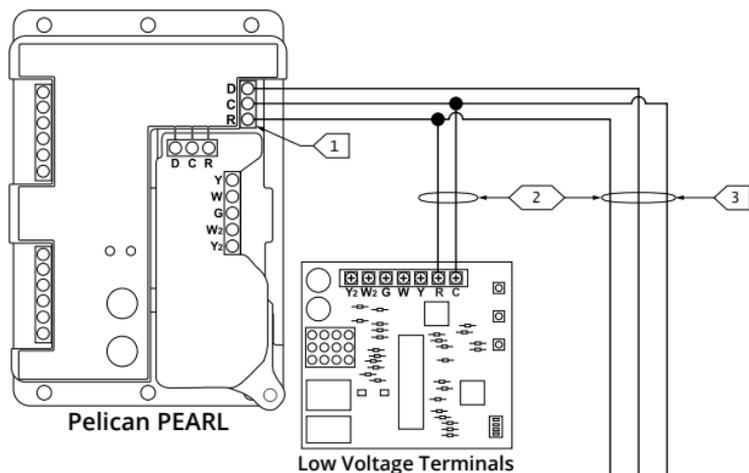
Pelican PEARL

Low Voltage Terminals

1 ⟩ Use wire nuts where required. Do not land mulltiple wires into a single terminal.

2 ⟩ 18G thermostat wire.

3 ⟩ Max wire distance between PEARL and Thermostat is 500 feet.

Pelican Thermostat Backplate
Installed inside the building.
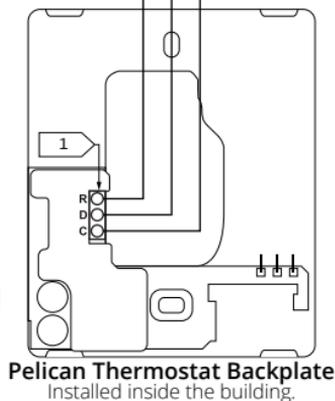
1) Follow the transformer installation manual for directions for intalling the transformer.

2) Before wiring Pelican to the transformer, turn power ON to the transformer and verified the voltage measured is within the thermostat's operating range of 23 - 30VAC.

3) Turn power back OFF to the transformer.

4) Wire (R) to 24VAC and (C) to Common at the transformer.
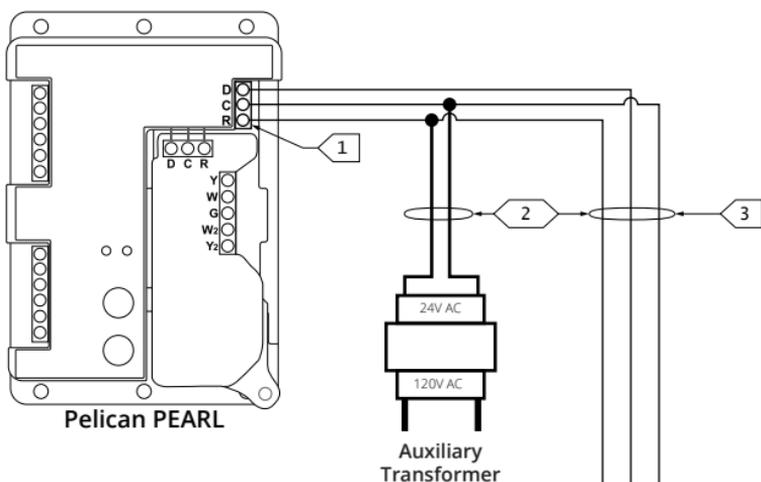
Pelican PEARL

Auxiliary Transformer

24V AC

120V AC

1 ⟩ Use wire nuts where required. Do not land mulltiple wires into a single terminal.

2 ⟩ 18G thermostat wire.

3 ⟩ Max wire distance between PEARL and Thermostat is 500 feet.

Pelican Thermostat Backplate
Installed inside the building.

17
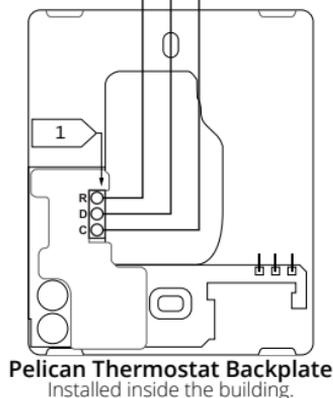
Diagram 1: **Modulating Economizer Damper**

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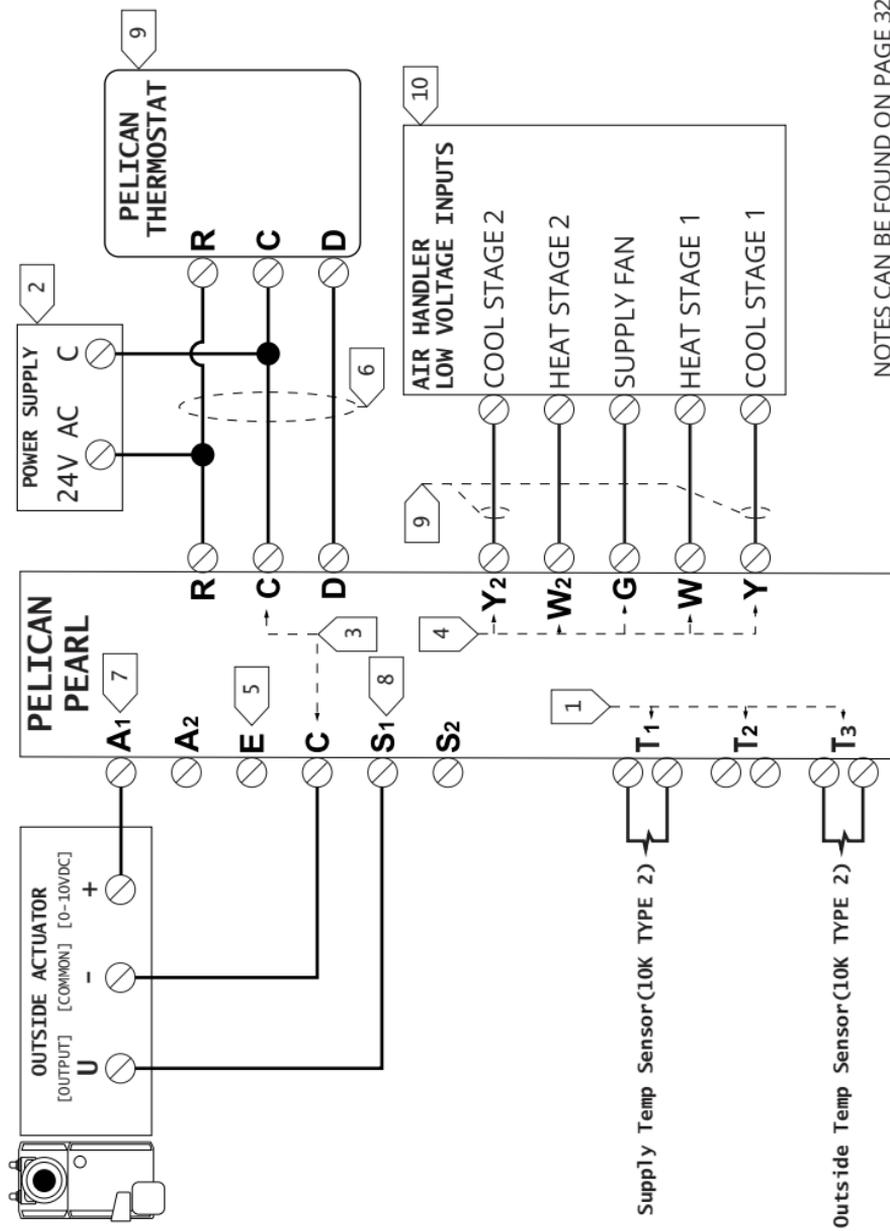
Diagram 2: **Variable Speed Fan**
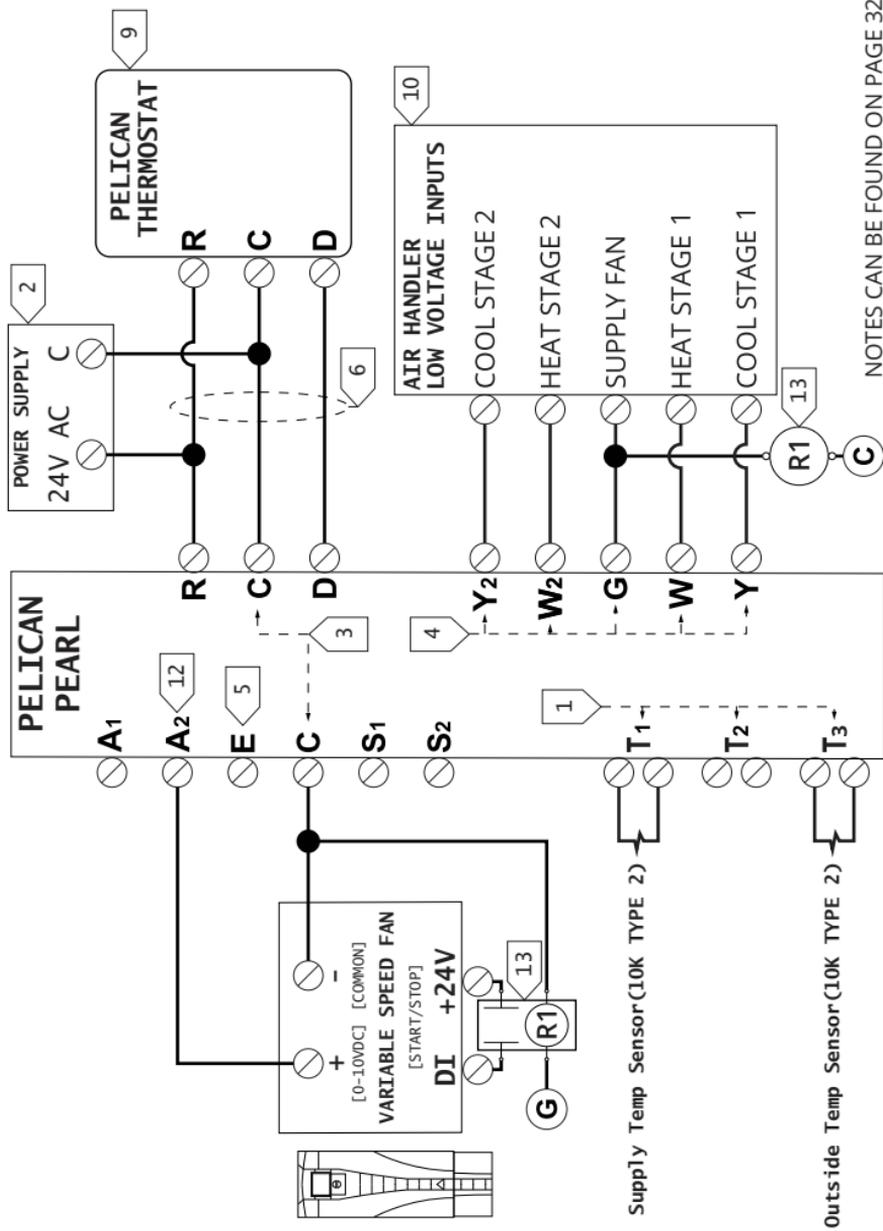
NOTES CAN BE FOUND ON PAGE 32

9 PELICAN THERMOSTAT — R C D

2 POWER SUPPLY 24V AC — C

6

10 AIR HANDLER LOW VOLTAGE INPUTS
- COOL STAGE 2
- HEAT STAGE 2
- SUPPLY FAN
- HEAT STAGE 1
- COOL STAGE 1

13 R1 C

PELICAN PEARL

R C D Y_2 W_2 G W Y

3

4

A_1 A_2 **12** E **5** C S_1 S_2 **1** T_1 T_2 T_3

VARIABLE SPEED FAN
[0-10VDC] [COMMON]
− +
[START/STOP]
DI +24V

13 R1

G

Supply Temp Sensor (10K TYPE 2)

Outside Temp Sensor (10K TYPE 2)

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NOTES CAN BE FOUND ON PAGE 32

20
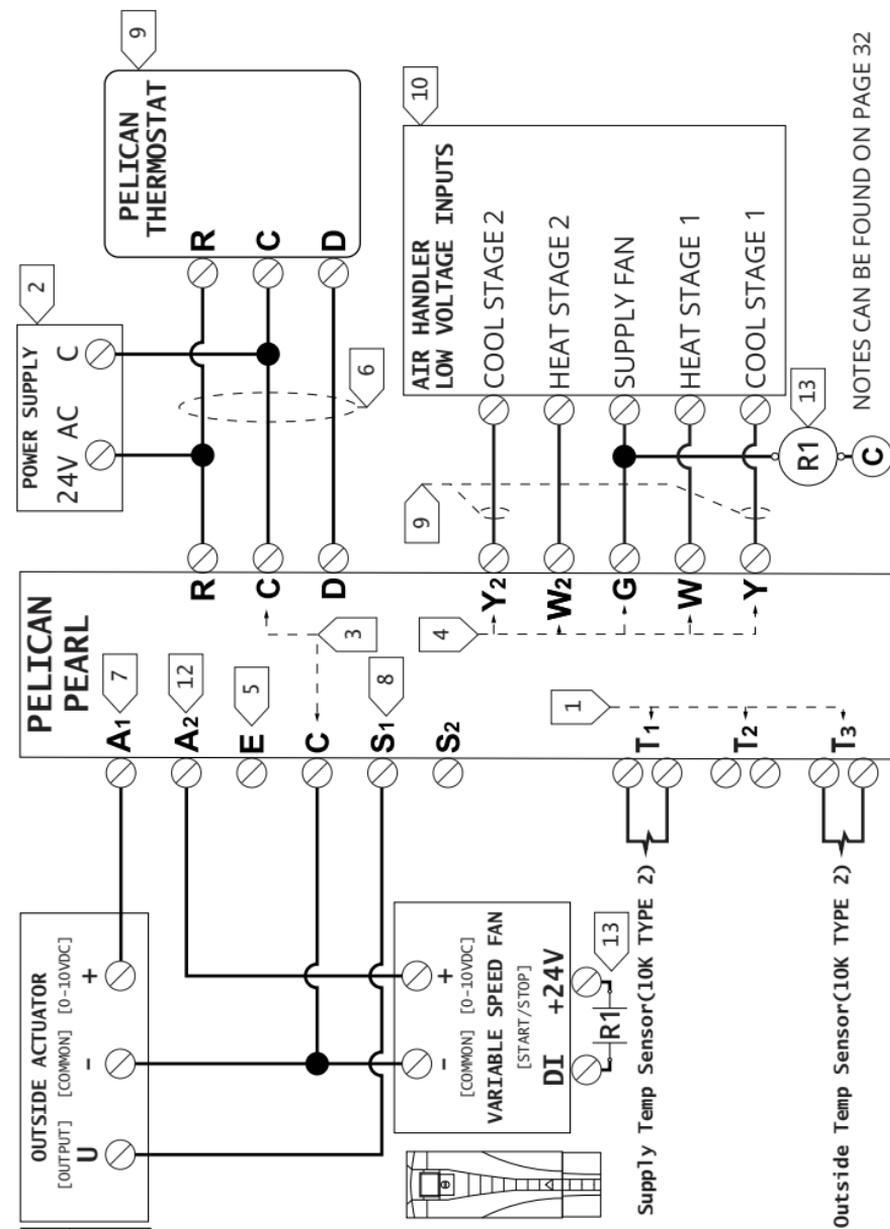
Diagram 4: **Modulating Outside Damper & Variable Heat**

NOTES CAN BE FOUND ON PAGE 32

PELICAN THERMOSTAT [9]

POWER SUPPLY [2]
24V AC

AIR HANDLER LOW VOLTAGE INPUTS [10]

COOL STAGE 2
HEAT STAGE 2
SUPPLY FAN
HEAT STAGE 1
COOL STAGE 1

PELICAN PEARL

OUTSIDE ACTUATOR [OUTPUT] [COMMON] [0-10VDC]

VARIABLE HEAT [COMMON] [0-10VDC]

Supply Temp Sensor(10K TYPE 2)

Outside Temp Sensor(10K TYPE 2)

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Diagram 5: **Modulating Outside Damper & Variable Cool**

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9 PELICAN THERMOSTAT

R
C
D

2 POWER SUPPLY 24V AC
C

6

10 AIR HANDLER LOW VOLTAGE INPUTS

COOL STAGE 2
HEAT STAGE 2
SUPPLY FAN
HEAT STAGE 1
COOL STAGE 1

9

PELICAN PEARL

R
C
D
Y₂
W₂
G
W
Y

7 A₁
11 A₂
5 E
3
4
C
8 S₁
S₂
1
T₁
T₂
T₃

OUTSIDE ACTUATOR [OUTPUT] [0-10VDC] [COMMON]
+
−
U

VARIABLE COOL
+
− [COMMON] [0-10VDC]

Supply Temp Sensor(10K TYPE 2)
Outside Temp Sensor(10K TYPE 2)

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Diagram 7: **Variable Speed Fan & Variable Heat**
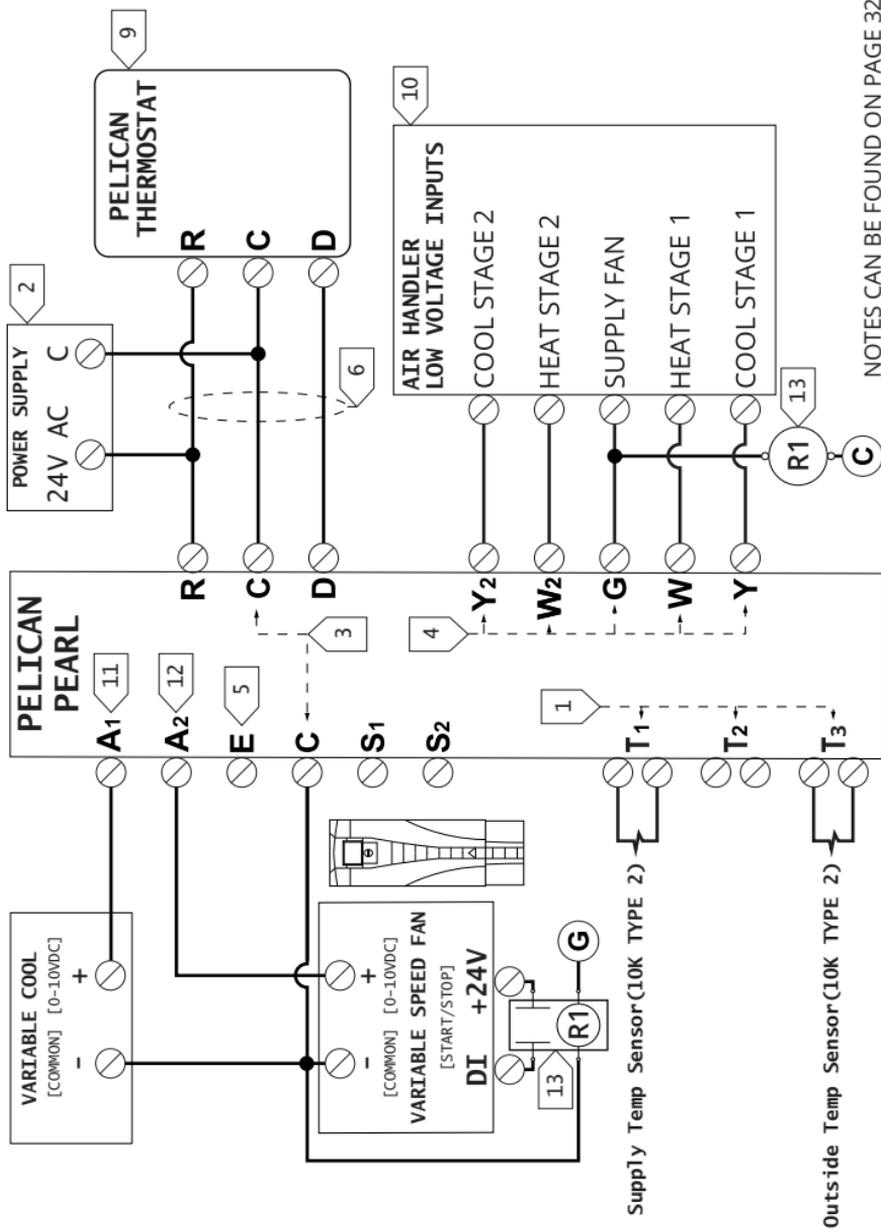
NOTES CAN BE FOUND ON PAGE 32

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NOTES CAN BE FOUND ON PAGE 32

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Supply Temp Sensor(10K TYPE 2)

Outside Temp Sensor(10K TYPE 2)

NOTES CAN BE FOUND ON PAGE 32

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NOTES CAN BE FOUND ON PAGE 32

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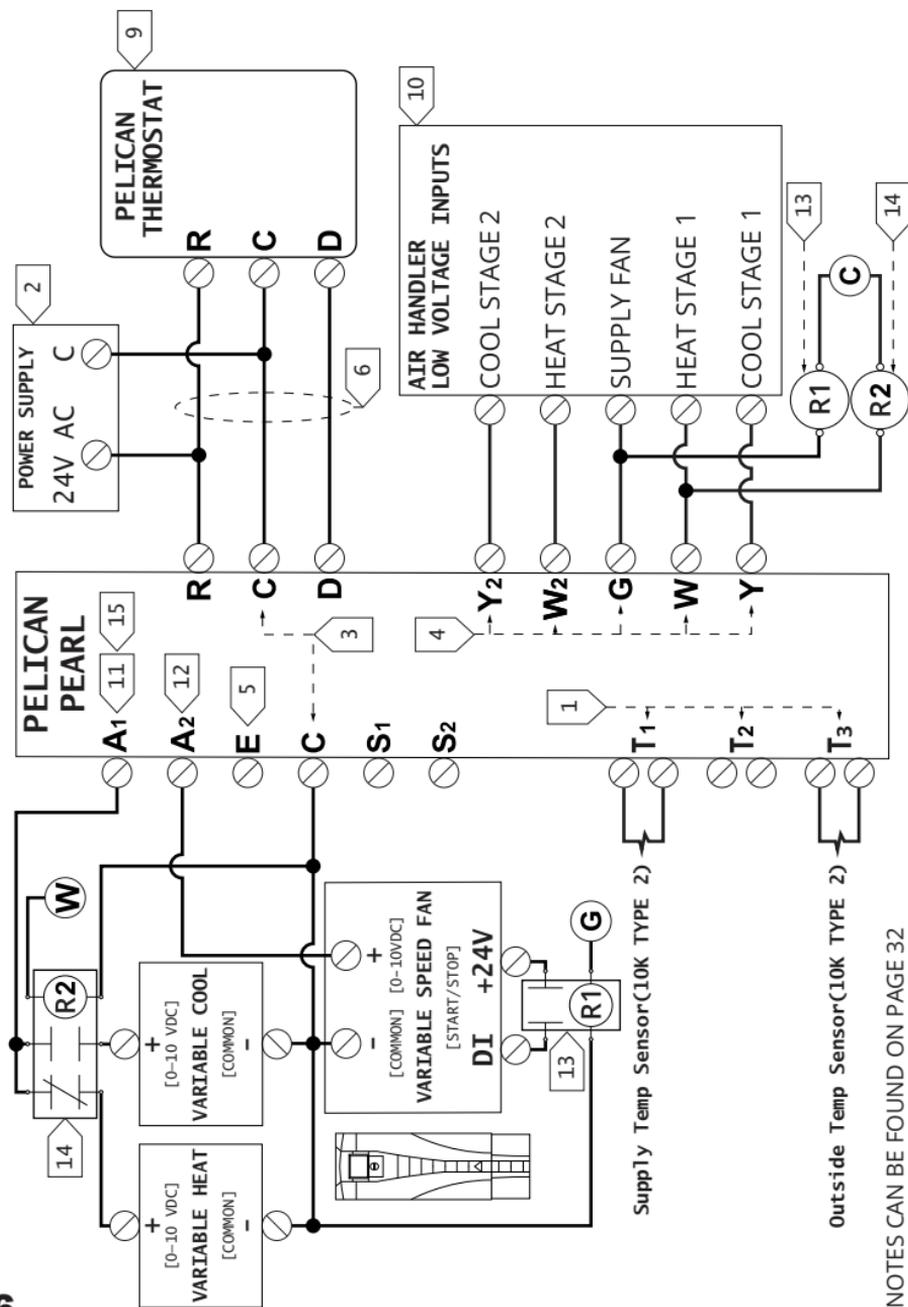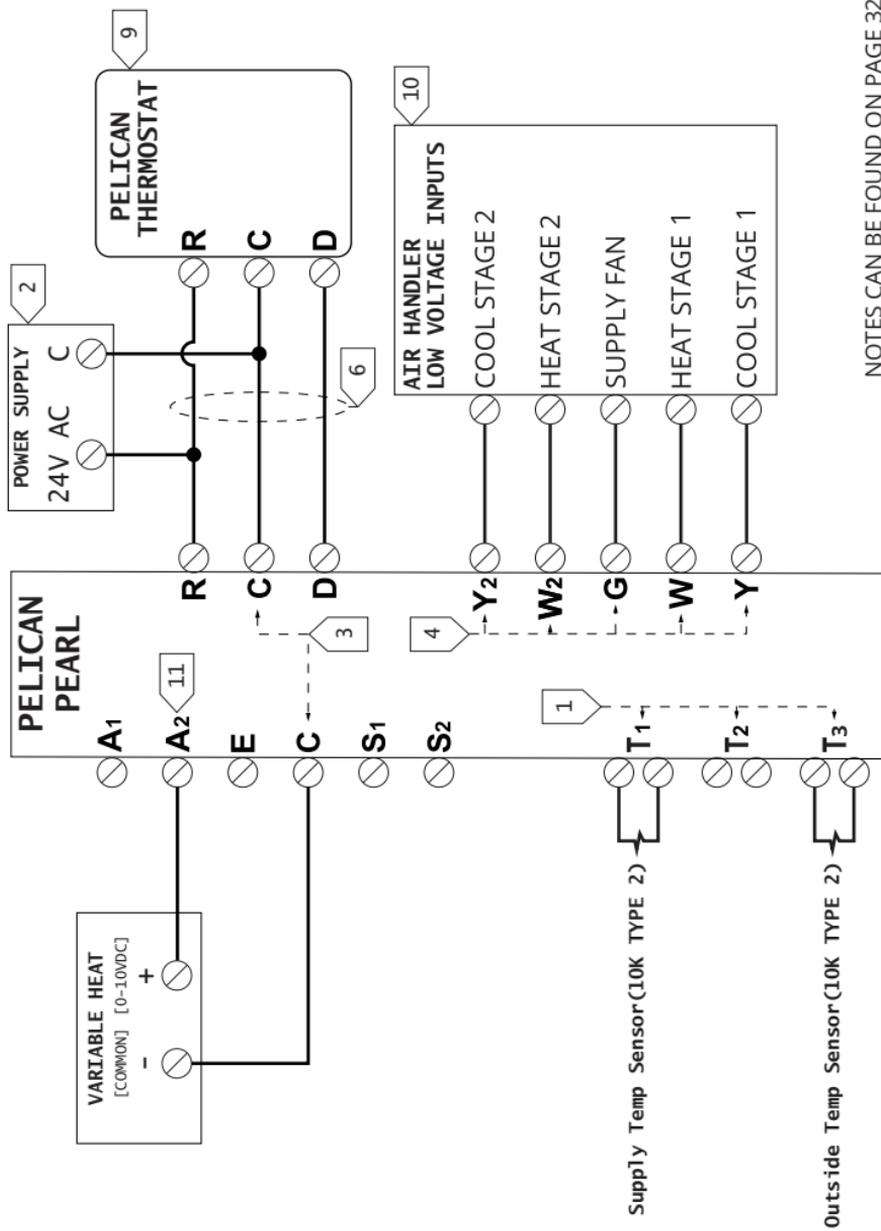
Diagram 11: **Variable Cool**

NOTES CAN BE FOUND ON PAGE 32

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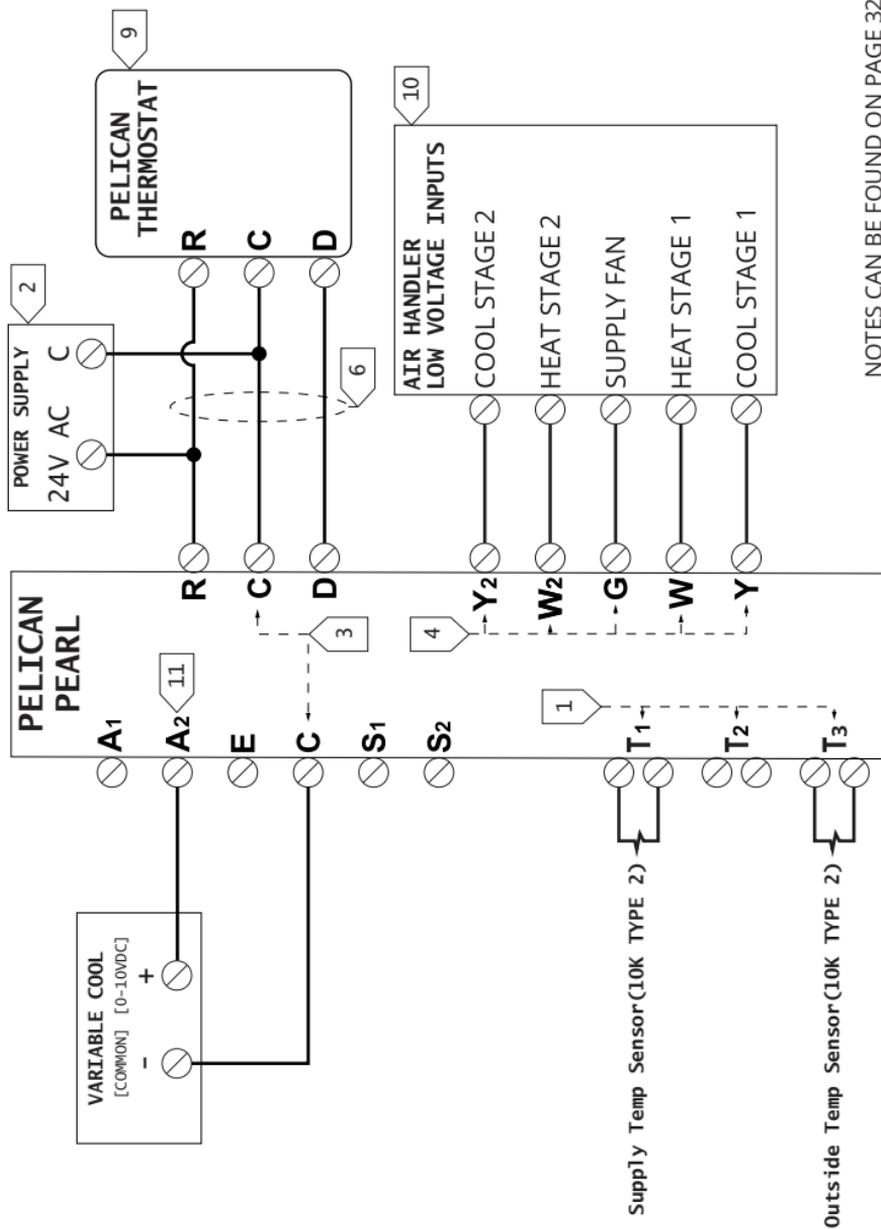
Diagram 12: **Variable Heat & Cool**

Diagram showing wiring connections between:

PELICAN THERMOSTAT (9) — terminals R, C, D

POWER SUPPLY (2) — 24V AC, C

AIR HANDLER LOW VOLTAGE INPUTS (10) — COOL STAGE 2, HEAT STAGE 2, SUPPLY FAN, HEAT STAGE 1, COOL STAGE 1

PELICAN PEARL — terminals R, C, D, Y_2, W_2, G, W, Y, A_1, A_2 (11), E, C, S_1, S_2, T_1, T_2, T_3

VARIABLE HEAT [COMMON] [0-10VDC] — +, −

VARIABLE COOL [COMMON] [0-10VDC] — +, −

Supply Temp Sensor (10K TYPE 2)

Outside Temp Sensor (10K TYPE 2)

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NOTES CAN BE FOUND ON PAGE 32

NOTES CAN BE FOUND ON PAGE 32

PELICAN THERMOSTAT 9

R C D

POWER SUPPLY 2
24V AC
C

6

AIR HANDLER LOW VOLTAGE INPUTS 10

COOL STAGE 2
HEAT STAGE 2
SUPPLY FAN
HEAT STAGE 1
COOL STAGE 1

PELICAN PEARL

R C D Y₂ W₂ G W Y

3

4

A₁ A₂ E C S₁ S₂ T₁ T₂ T₃

4

1

In this application, configure the [E] output to only enable when the outside damper exceed 90% open.

Ventilator
[START/STOP]
DI +24V

13

R1

Supply Temp Sensor (10K TYPE 2)

Outside Temp Sensor (10K TYPE 2)

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Notes

IMPORTANT: All wire to be installed in accordance with state & local electrical codes.

1 > [T1] supply temperature (required), [T2] return temperature (optional), [T3] outside temperature (required). Input accepts 10K Type II thermistors.

2 > Connect to 24VAC class 2 circuits only. Reference pages 16 & 17 for power options.

3 > All Commons are internally connected.

4 > 24VAC output. For the low voltage wiring module outputs reference Thermostat Installation manual.

5 > [E] 24VAC output enables anytime an economizer or demand ventilation (high CO_2) sequence is active.

6 > [R] [C] [D] power & communication terminals shall be wired between the PEARL and its thermostat with a max 500 feet distance; as shown on page 10.

7 > Outside Damper Control Output: Configurable 0[2] – 10VDC range.

8 > Outside Damper Position Feedback for Fault Detection & Diagnostics Input: 0[2] – 10VDC. Required to meet California Title 24.

9 > If replacing an old economizer controller, confirm the [Y] and [Y2] signals make a complete circuit between the low voltage equipment board and the compressor enable signals (install loop back plug when required).

10 > For additional equipment wiring details and control points: reference the Pelican thermostat's installation manual.

11 > Modulating Heating & Cooling Control Output: Configurable 0[2] – 10VDC range.

12 > Variable Speed Fan Control Output: Fixed 0 [0%] – 10 [100%] VDC range.

13 > 24 Vac Single Pole - Double Throw Relay. Field supplied (sold separately).

14 > 24 Vac Single Pole - Single Throw Normally-Open Relay. Field supplied (sold separately).

15 > For separate Variable Heat & Cool outputs, add a PEARL Expansion (PEM-VDC).

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The PEARL can accept up to three inputs, which can be either external 10K Type 2 temperature thermistors or a dry-contact. This section provides wiring diagrams for the most common applications.

Diagram 15: **Supply Temperature Sensor**

Step 1: Drill a 1/4" hole in the supply duct for the provided probe.

Step 2: Insert the probe into the supply duct until it sits firmly against the duct; secure it with the provided screws.

Step 3: Run or use existing 2-18G thermostat wire to connect the probe to the [T1] terminal on the PEARL. Maximum wire length: 100 feet.

For runs longer than 50 feet or in areas with electrical interference, use shielded 2-wire twisted pair and ground the wire at one end.

SUPPLY AIR TO ROOM

T1

33
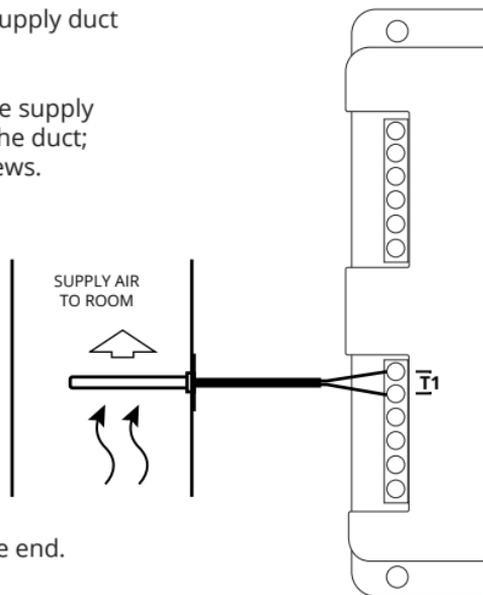
IMPORTANT: Install the outside probe in a location shielded from radiant heat sources to ensure accurate temperature readings.

Step 1: Attach the vinyl-coated probe to the provided stand-off using a zip tie.

Step 2: Mount the probe upright in a location where it can detect the ambient outside temperature near the HVAC equipment.

Step 3: Run or use existing 2-18G thermostat wire to connect the probe to the [T3] terminal on the PEARL. Maximum wire length: 100 feet.

OUTSIDE AIR

T3

For runs longer than 50 feet or in areas with electrical interference, use shielded 2-wire twisted pair and ground the wire at one end.
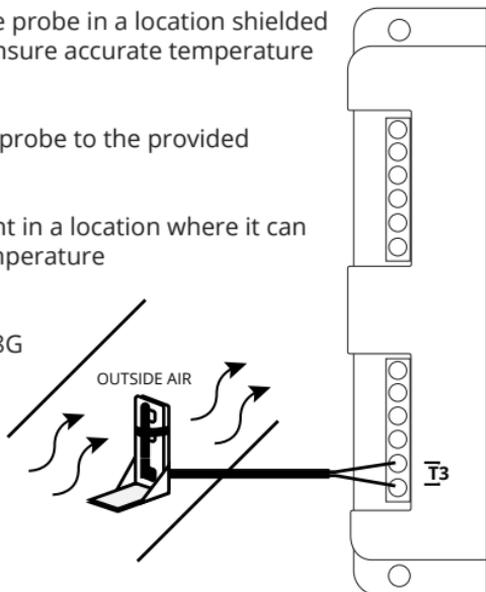
Diagram 17: **Return Temperature Sensor**

Step 1: Drill a hole in the return duct for the vinyl-coated probe.

Step 2: Insert the probe into the return duct.

Step 3: Run or use existing 2-18G thermostat wire to connect the probe to the [T2] terminal on the PEARL. Maximum wire length: 100 feet.

For runs longer than 50 feet or in areas with electrical interference, use shielded 2-wire twisted pair and ground the wire at one end.

RETURN AIR FROM ROOM

T2

34
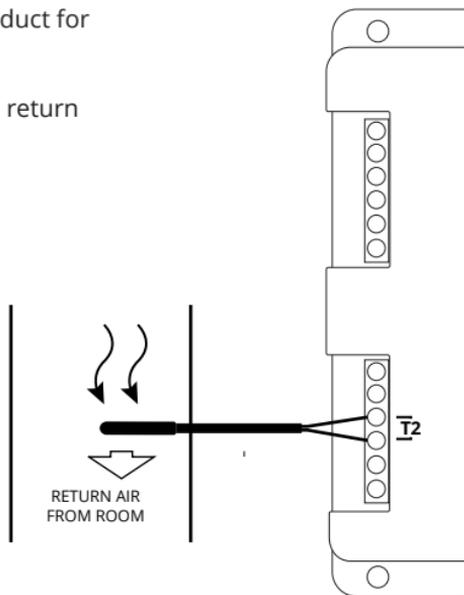
IMPORTANT: In this application, as with all PEARL installations, a Pelican Thermostat is required.

Step 1: Mount the 10K Type 2 sensor on the wall or in the desired room to serve as the thermostat's temperature sensor.

Step 2: Run or use existing 2-18G thermostat wire to connect the room sensor to any available [T] terminal on the PEARL. Maximum wire length: 100 feet.

For runs longer than 50 feet or in areas with electrical interference, use shielded 2-wire twisted pair and ground the wire at one end.

Room Sensor

T2
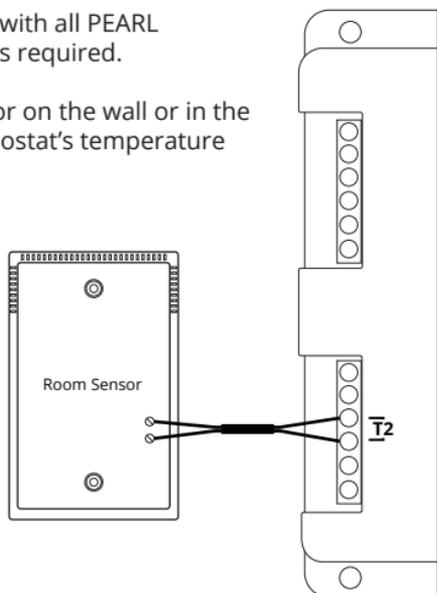
Diagram 19: **Dry-Contact Occupancy Sensor**

Step 1: Mount an occupancy sensor with a dry-contact output on the wall, ceiling, or in the same room as the thermostat.

Step 2: Run or use existing 2-18G thermostat wire to connect the sensor's dry-contact output to any available [T] terminal on the PEARL. Maximum wire length: 150 feet.

occupancy output [dry-contact]

T2

Occupancy Sensor

35
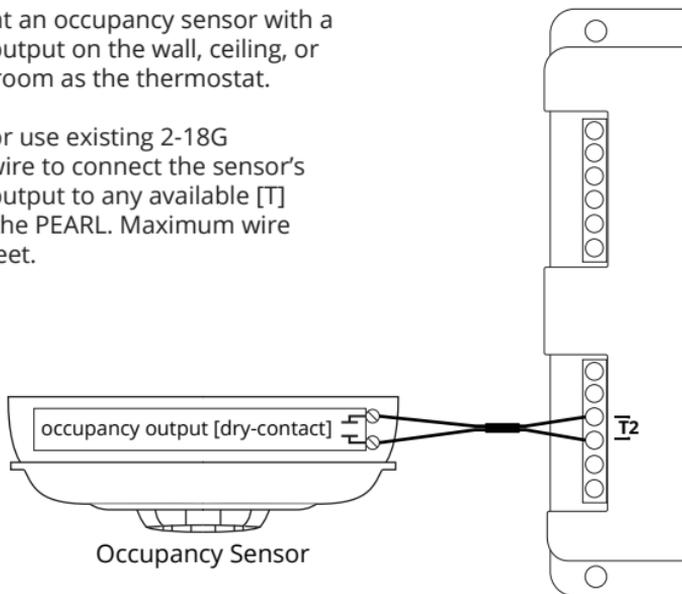
Run or use existing 2-18G thermostat wire to connect the alarm's dry-contact output to any available [T] terminal on the PEARL. Maximum wire length: 150 feet.

Control Board

alarm output [dry-contact]

T2
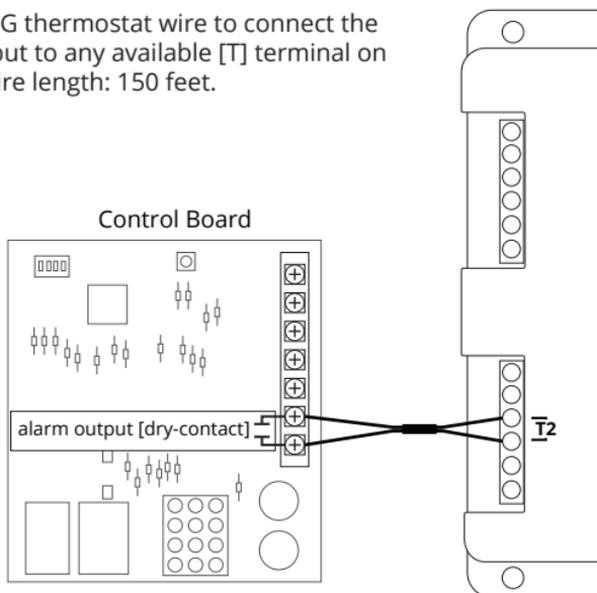
External Input Notes

Important Wiring Guidelines:

- All wiring must comply with state and local electrical codes.

- Use 2-18G wire for most applications. For runs longer than 50 feet or in areas with electrical interference, use shielded 2-wire twisted pair and ground the wire at one end.

- The [T] terminals are universal and can be configured for specific applications through the Pelican web app. The diagram indicates the most commonly used terminal for each application.

Start-Up: Turn On Power

Do not turn power back on until installation is complete and all wire is confirmed to be in the correct terminals.

Before restoring power, ensure all wires are securely connected. Check that no wires are loose, spliced, or in a position that could lead to a bad or shorted connection. Incorrect connections may cause damage.
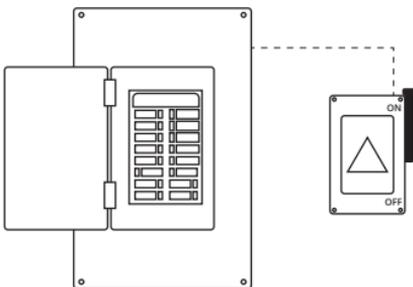
Start-Up: LED Lights

Confirm Power & Communication Status:

1) The PEARL's left status light [1] will blink green slowly to indicate power and synchronization with the thermostat.

2) Once synchronized, the left status light [1] will turn solid green.

If the right status light [2] is active it indicates an issue. For additional status light information, reference page 38.
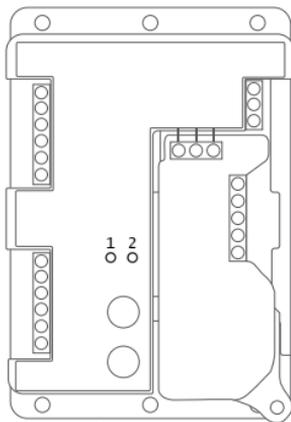
Pelican PEARL

	Left Light 1 (Green)	Right Light 2 (Red)
Normal Operation The PEARL has power and it is communicating with the thermostat.	● Solid	○ Off
No Power The PEARL has no power. Check the [R] and [C] terminals for 24VAC. Check the power source for 24VAC.	○ Off	○ Off
Connecting The PEARL has power and is trying to establish connection to its thermostat over the [R], [C], [D] (data and communication).	● ○ ● ○ Blinking	○ Off
No Communication The PEARL is unable to communicate with its thermostat. Check the [R], [C], [D] (data and communication) wires are correctly installed.	○ Off	● ○ ● ○ Blinking
Damper Position Error The feedback damper position does not match (±5%) the damper output signal. Check the outside damper position and [S1].	● Solid	● Solid
Supply Temperature Error The PEARL is unable to read a supply temperature. Check the [T1] terminals, the supply probe and wires.	● Solid	● ○ ○ ● ○ ○ 1 Blink Every 2 Seconds
Outside Temperature Error The PEARL is unable to read an outside temperature. Check the [T3] terminals, the supply probe and wires.	● Solid	● ● ● ○ ○ ○ 3 Blink Every 2 Seconds
Reseting The PEARL just reset. Check for power fault at the [R] and [C] terminals or at the power source. Verify 24VAC power.	● ○ ● ○ ● ○ Flashing	○ Off

Setting Configurations

The PEARL is configured using the the Pelican Connect™ web-app. On the web-app, the PEARL is considered an accessory to its Pelican thermostat. To configure the PEARL, log into the web-app and navigate to the thermostat it is wired to's configuration page:

Step 1 : Select Admin.
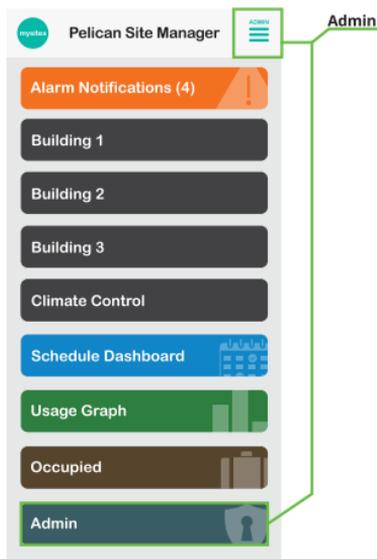
Step 2: Select Thermostat Configuraiton.
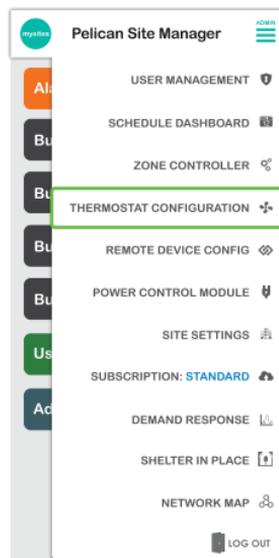
Step 3: Select the Thermostat the PEARL is wired to.

Quick Tip: If you have multiple thermostats, you can quickly locate a specific thermostat by selecting the search icon in the upper right-hand corner and entering the thermostat's name or serial number.

‹ Back	**Thermostat Setup** 🔍
(no name)	**2S9-1Q65**
Thermostat 1	**2S9-T5F5**
Thermostat 2	**2S9-FF34**
Thermostat 3	**2S9-DED2**
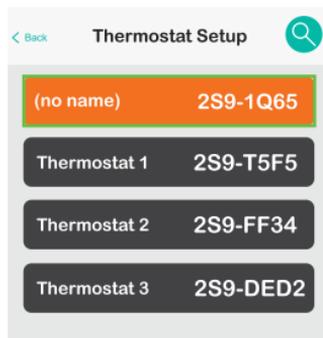
Step 4: Scroll down until you see Economizer and/or Variable Speed Fan Configurations.

Note: For Variable Temperature control contact Pelican technical support for configuration assistance.

Economizer	ON
Auto Configuration	Off
High Limit Shut Off	80°
Fixed Enthalpy Limit	Yes
Variable Damper	Yes
Damper Voltages	Open 10.0
	Closed 2.0
Minimum Damper Position	10%
Track Damper Position	Yes
Demand Venitilation	Yes
Max Ventilation Position	100%

Variable Speed Fan	ON
Cooling Fan Speed	100%
Heating Fan Speed	100%
Ventilation Fan Speed	100%
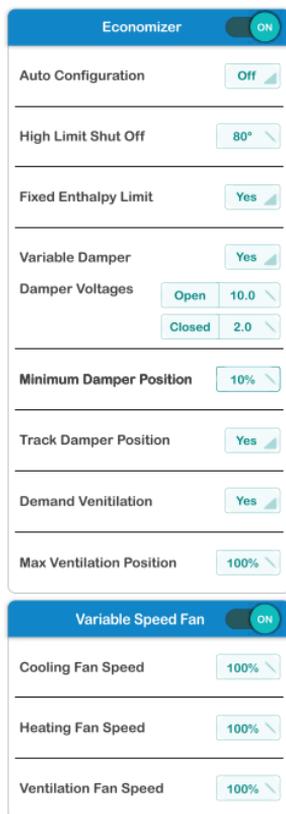
By default, Economizer will be "On" with Auto Configure to "Yes". To set custom configurations, change Auto Configuration to "No".

Configuration Name/Description	Settings/Range
Auto Configure - This utilizes default economizer configurations. The Damper Voltages can be set using the PEARL's Test & Calibration function, which is detailed on page 51.	(D) Yes No
High Limit Shut Off - Disables economization if the outside air temperature exceeds the set limit. When set to "Auto," a self-learning algorithm adjusts this threshold based on environmental conditions and room temperature patterns, optimizing efficiency without manual intervention.	(D) Auto (R) 0°F to 180°F
Activation Differential - Configures economization to deactivate if the outside air temperature surpasses the room temperature by the set differential. This ensures efficient operation by only utilizing outside air for cooling when advantageous compared to room air.	(D) 2°F 0°F 4°F 6°F
Fixed Enthalpy Limit - Enables outdoor enthalpy by combining data from the wired outside air dry-bulb temperature sensor and humidity & barometric pressure levels accessed via internet connection. This calculation assesses the suitability of outside air for economizing based on temperature and moisture content, optimizing ventilation and cooling.	(D) Yes No
Variable Damper - Set to "Yes" if the outside damper actuator operates with a 0[2]-10VDC signal, allowing modulating control. This enables precise control over air intake through the damper's modulation.	(D) Yes No

Configuration Name/Description	Settings/Range
Damper Voltages - Defines the voltage range for fully open and fully closed positions of the outside damper. Proper calibration (see Auto Calibration on page 51) ensures accurate damper operation, adjusting outside air intake in response to control signals.	Open: (D) 10.0 VDC (R) 0.0 to 10.0 Closed: (D) 2.0 VDC (R) 0.0 to 10.0
Minimum Damper Position - Adjusts the damper to a specific position to maintain required minimum ventilation airflow during occupied hours. This setting supports indoor air quality standards during regular operational periods. Note: When Demand Ventilation is enabled, the minimum damper position matches the ventilation rate when CO_2 levels are below the configured threshold.	(D) 10% (R) 0% to 100%
Track Damper Position: Enables damper feedback for California Title 24 compliance, which requires fault detection and diagnostics. If the feedback varies by more than 5% from the desired damper position, an economizer fault alarm is triggered.	(D) Yes No
Demand Ventilation: Activates CO_2-based ventilation adjustment, using the thermostat's CO_2 sensor to optimize ventilation rates based on indoor CO_2 levels for energy efficiency.	(D) On Off
Maximum Ventilation Position - Sets the maximum allowed damper position as per building code, preventing excessive ventilation and supporting energy efficiency. Note: This maximum ventilation setting applies during Demand Ventilation cycles, when CO_2 levels are above the threshold. It does not affect economization sequences.	(D) 100% (R) 0% to 100%

Advanced Economizer and Ventilation Configurations

Advanced configurations have limited access. Contact Pelican Technical Support for further assistance.

Configuration Name/Description	Settings/Range
Low Limit Temperature - Sets the minimum mixed air temperature during economizer operation. When the system starts, the PEARL calculates an outside damper position to prevent this low limit based on the difference between the outside and room temperature. If the mixed air temperature drops below this limit, the outside damper adjusts to a more closed position to increase the mixed air temperature.	(D) 56°F (R) 0°F to 180°F
Exhaust Enable Damper Position - Sets the outside damper position percentage at which the [E] output will activate during an economizer or demand ventilation cycle. This setting allows for control over when exhaust systems engage based on the position of the outside damper.	(D) 0% (R) 0% to 100%

Variable Speed Fan Configurations

By default, Variable Speed Fan is set to "Off". To enable multiple fan speed options and access further configurations, switch Variable Speed Fan to "On."

Note: The available fan speed configurations will automatically adjust based on the number of heating and cooling stages set in the thermostat. For instance, with one heating stage and two cooling stages, four fan speeds will be available: Cool Fan Speed, Cooling Speed - Stage 2, Heating Fan Speed, and Ventilation Fan Speed.

Configuration Name/Description	Settings/Range
Cool Fan Speed - Sets the fan speed for the first stage or moderate cooling cycles, ensuring balanced airflow during initial or less intense cooling demands.	(D) 70% (R) 0% to 100%
Cooling Speed - Stage 2 - Sets the fan speed for the second stage or aggressive cooling cycles, providing increased airflow to meet higher cooling needs effectively.	(D) 90% (R) 0% to 100%
Heating Fan Speed - Sets the fan speed for the first stage or moderate heating cycles, ensuring balanced airflow during initial or less intense heating demands.	(D) 70% (R) 0% to 100%
Heating Speed - Stage 2 - Sets the fan speed for the second stage or aggressive hating cycles, providing increased airflow to meet higher heating needs effectively.	(D) 90% (R) 0% to 100%
Ventilation Fan Speed - Sets the fan speed for ventilation/fan only cycles.	(D) 50% (R) 0% to 100%

Ensuring Minimum Ventilation Rate with Fan Speed Adjustments
The "Minimum Ventilation Position" configuration, found under Economizer Configurations, designates what the outside damper position will be when the fan is operating at the **highest configured speed**.

As the fan speed decreases, Pelican will automatically increase the damper position proportionally to the fan speed change. This ensures minimum ventilation rates are maintained, regardless of fan speed variations.

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These configurations affect modulating heating and cooling sequences. Advanced configurations have limited access. Contact Pelican Technical Support for further assistance.

Configuration Name/Description	Settings/Range

Type - Configures which modulating sequences are active. This option specify the sequences that the system will utilize, ensuring optimal modulation based on the operational requirements.	(D) None
	    Heat
	    Cool
	    Heat & Cool

Modulating Heat Configurations:	

Heat Actuator Voltages – Configures the DC voltage range for the modulating heating source.
   • Open: Corresponds to maximum heating.
   • Closed: Corresponds to no heating.
	Open: (D) 10.0 VDC
	      (R) 0.0 to 10.0
	
	Closed: (D) 2.0 VDC
	      (R) 0.0 to 10.0

Heat Signal Output – Specifies the analog output terminal used for heat modulation. Only outputs that have not been assigned to other functions are available for selection. Note: Outputs A3 and A4 become available if the PEARL expansion module (sold separately) is installed.	(D) A1 A2
Heat Always Active – When enabled, the controller will continuously modulate the heating source to maintain the moderate heating target.	(D) No Yes
Initial Heat Actuator Position – Configures the starting DC voltage output for the heating actuator at the beginning of a heating cycle.	(D) 30% (R) 0% TO 100%
Change Heat Actuator Delay Minutes – Sets the time interval between each modulation adjustment calculation for the heating actuator. This ensures that the actuator continually recalibrates to maintain optimal heating output.	(D) 1 minute (R) 1 to 10 minutes

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Configuration Name/Description	Settings/Range
Moderate Heat Target – Specifies the target supply temperature for moderate heating. This setting ensures that the heating system maintains a baseline temperature during minimum thermostat heating cycles.	(D) 100°F (R) -22°F to 180°F
Aggressive Heat Target – Sets the maximum target supply temperature for aggressive heating. This setting ensures that the heating system maintains a more aggressive temperature during greater thermostat heating demands.	(D) 115°F (R) -22°F to 180°F
Temper Air During Ventilation – This setting modulates heating to temper the supply air temperature during ventilation cycles, ensuring adequate heating to offset any cooling from ventilation. Note: When set to "Yes," the controller will keep the [W] output disabled and engage only the modulating heat DC output during ventilation tempering cycles. **Ventilation Delta Degree** – Sets the target degrees above the thermostat's heating set point for tempering during ventilation cycles.	(D) Off On Ventilation Delta Degrees: (D) 3°F (R) 0°F to 30°F
Face/Bypass Damper – Enables control of a floating Face/Bypass Damper. During heating cycles, the [W] terminal opens the damper to the heating coil (Maximum Position), while [W2] redirects air to bypass the heating coil (Ventilation Position).	(D) Off On Actuator Travel Time (D) (blank) (R) 1 sec to 160 sec Ventilation Position: (D) 100% (R) 0% to 100% Maximum Position: (D) 100% (R) 0% to 100%

Configuration Name/Description	Settings/Range
Modulating Cool Configurations:	
Cool Actuator Voltages – Configures the DC voltage range for the modulating cooling source. • Open: Corresponds to maximum cooling. • Closed: Corresponds to no cooling.	Open: (D) 10.0 VDC (R) 0.0 to 10.0 Closed: (D) 2.0 VDC (R) 0.0 to 10.0
Cool Signal Output – Specifies the analog output terminal used for cool modulation. Only outputs that have not been assigned to other functions are available for selection. Note: Outputs A3 and A4 become available if the PEARL expansion module (sold separately) is installed.	(D) A1 A2
Cool Always Active – When enabled, the controller will continuously modulate the Cool source to maintain the moderate cooling target.	(D) No Yes
Initial Cool Actuator Position – Configures the starting DC voltage output for the cooling actuator at the beginning of a cooling cycle.	(D) 30% (R) 0% TO 100%
Change Cool Actuator Delay Minutes – Sets the time interval between each modulation adjustment calculation for the cooling actuator. This ensures that the actuator continually recalibrates to maintain optimal cooling output.	(D) 1 minute (R) 1 to 10 minutes
Moderate Cool Target – Specifies the target supply temperature for moderate cooling. This setting ensures that the cooling system maintains a baseline temperature during minimum thermostat cooling cycles.	(D) 60°F (R) -22°F to 180°F

Variable Temperature (Advanced Configurations)

Configuration Name/Description	Settings/Range
Aggressive Cool Target – Sets the maximum target supply temperature for aggressive cooling. This setting ensures that the cooling system maintains a more aggressive temperature during greater thermostat cooling demands.	(D) 55°F (R) -22°F to 180°F

Input Configurations

IMPORTANT

This section goes over the T1, T2, & T3 configurations. For analog inputs, S1 will automatically correlate with the economizer feedback terminal.

S1 & S2 provide some advanced configurations options which can be used by Pelican Application Engineers and are project specific.

Temperature Configuration Definitions:

Temperature – Identifies the input as an additional room sensor. This sensor will be averaged with the thermostat's temperature sensor. Averaging sensor weighted percentages are set using the Pelican Connect web-app.

Temp Monitor – When an input is set to Temp Monitoring, the sensor receives its own custom label and its own graphics for viewing real-time and historical temperature readings.

Supply Temperature (most commonly used) – Identifies the temperature reading as the discharge air temperature leaving the equipment. Will be referenced when targeting discharge temperatures for modulation sequences.

Return Temperature – Identifies the temperature reading as a return air temperature.

Outside Temperature – Identifies the temperature reading as an outside air temperature. Required for Economizer sequences.

Alarm – When an input is set for Alarm, it becomes a dry-contact input. Additional configurations become available to define when this alarm is active:

- ◦ **Always** - If the dry-contact changes states, a notification will be generated.

- ◦ **During: Heating** - If the dry-contact is not in the correct state during a heating cycle, a notification will be generated.

- ◦ **During: Cooling** - If the dry-contact is not in the correct state during a cooling cycle, a notification will be generated.

- ◦ **During: Fan** - If the dry-contact is not in the correct state during a fan active cycle, a notification will be generated.

Occupancy Sensor– When an input is set for Occupancy sensor, it becomes a dry-contact input to identify if the room is occupied or unoccupied. A third-party occupancy sensor must be wired to the thermostat.

- ◦ **Contact Open** - Room is unoccupied and the thermostat sets backed the temperature set points.

- ◦ **Contact Closed** - Room is occupied and the thermostat sets the temperature set points to the scheduled set points.

Input Sensor T1
When set to ON, this input can be configured for any of the following:

Configuration Name/Description	Settings/Range
Function – Sets what function this input will be used for.	(D) Supply Temperature Temperature Temp Monitor Return Temperature Outside Temperature Alarm Occupancy Sensor

Input Sensor T2
When set to ON, this input can be configured for any of the following:

Configuration Name/Description	Settings/Range
Function – Sets what function this input will be used for.	(D) Return Temperature Temperature Temp Monitor Supply Temperature Outside Temperature Alarm Occupancy Sensor

Input Sensor T3
When set to ON, this input can be configured for any of the following:

Configuration Name/Description	Settings/Range
Function – Sets what function this input will be used for.	(D) Outside Temperature Temperature Temp Monitor Supply Temperature Return Temperature Alarm Occupancy Sensor

Overview:

If the PEARL is wired to control the outside damper with its [A1] output and the actuator provides a feedback voltage to the [S1] input. You can test and auto-calibrate the economizer actuator voltage ranges. It is important to visually observe the damper rotating during the Test & Calibration.

Steps for Test & Calibration at the PEARL:

1. **Confirm Initial Status:** Ensure the PEARL's left status light is solid GREEN. If blinking or flashing, refer to "Indicator Status Lights" on Page 38.

2. **Verify Outdoor Damper Movement:** Before starting the test sequence, press the "MOVE" button on the PEARL to verify that the outdoor damper is moving freely and in the correct directions.

3. **Start Calibration:** On the PEARL, press the "TEST" button. The left STATUS light will blink green slowly, and the right STATUS light will blink blue slowly to indicate the start of the reset. This controller initiation process may take 1 to 5 minutes. Y

   You can also start the test by pressing the Start button found in the Economizer Test & Calibration section of the Pelican Connect web app at the bottom of the thermostat's configuration page.

4. **Temperature Detection:** The PEARL will confirm it is reading a supply temperature from the (T1) terminal, or the terminal configured as Supply Temperature, and an outside temperature from the (T3) terminal, or the terminal configured as Outside Temperature. If the right STATUS light blinks red, one or both temperatures were not detected, and the calibration will stop. Refer to "Indicator Status Lights" on Page 38.

5. **Close Damper Position Calibration:** When the left STATUS light turns OFF and the right STATUS light flashes blue quickly, the PEARL is outputting 0 VDC on the (A1) terminal, prompting the outside air damper to move to 100% closed. If the outside damper remains open, pressing the "MOVE" button on the PEARL or the "REVERSE" button on the Pelican web app will switch the controller to output 10 VDC as the new Close position signal.

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6. **Open Damper Position Calibration:** Once the closed position is verified, the left STATUS light flashes green quickly, and the right STATUS light turns OFF. The PEARL is now outputting the opposite voltage from the Close voltage, defaulted as 10 VDC, on the (A1) terminal, prompting the outside air damper to move to 100% open.

7. **Saving and Returning to Normal Operation:** Once the PEARL verifies the open and close positions, it saves the results and resumes normal operation. The left status light will be solid green, and the right status light will be off.

Troubleshooting: If the status lights do not match the above descriptions or the PEARL fails to complete its calibration process, refer to the "Status Light Indicators" on Page 38 or "Power and Wiring" on pages 11 to 36, to troubleshooting connectivity between the thermostat, PEARL, the outside damper actuator(s), and any temperature probes.

The Pelican Connect web app provides thermostat's signal outputs and analog input/output through a manual override page. This page is primarily designed for information purposes but can also be used to troubleshoot signals through manual changes.

IMPORTANT

The Signal Output page is a MASTER OVERRIDE feature of the thermostat and PEARL's 24 VAC signals. Neither the thermostat nor PEARL know when these 24 VAC signals are being manually changed. It is extremely important that these 24 VAC outputs are only changed during equipment testing and not used if not well understood. If one or more 24 VAC signals are manually changed, they must be changed back to the correct state.

IF THESE WARNINGS ARE CONFUSING, STOP WHAT YOU ARE DOING AND CONTACT PELICAN TECHNICAL SUPPORT FOR FURTHER ASSISTANCE.

Relay Outputs:

Each 24 VAC Relay Output shows the current output state from that terminal of the zone thermostat .

- ◦ **Gray** means the output is disabled.
- ◦ **Green** means the output is enabled.

If the output button is pressed, a signal will be sent to the thermostat to change the selected output's state. The Pelican web app will update the output when the app receives confirmation from the thermostat that it has received and changed the signal.

Analog Signals:

Each Analog Output shows the current voltage (VDC) output from that terminal. Analog output sliders will only allow for manual control if the modulation logic linked to that output is disabled. If modulation logic is enabled, the slider might move temporarily, but the PEARL will ignore the change within a few minutes.

Each Analog Input shows the current voltage either being inputted into that terminal of the PEARL.

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