



SINGLE-ZONE AIR HANDLING UNITS **SYSTEM DESIGN GUIDE**

Guidance for using the ClimaVision Stat Class or Node Class controllers for:

▶ *Packaged RTUs* ▶ *WSHPs* ▶ *CSUs* ▶ *Split Systems* ▶ *Small Air Handlers*

Supporting up to three stages and / or modular heating and cooling elements, stepped and VFD fans, one dehumidification sequence, and modulating outside air sequence

INTRODUCTION TO THE CLIMAVISION DESIGN PHILOSOPHY

Carrier is on a mission to substantially reduce energy consumption in the world's commercial buildings while improving the comfort and health of the people who work there. ClimaVision achieves this through automation that adapts to change and data that engages people with insights they can use to maintain building systems and operations. To make that difference, automation and data must be present in a much greater percentage of the buildings than they are today, and this can only be accomplished by cutting cost and increasing value.

ClimaVision has adopted a works-out-of-the-box philosophy that redefines the state of the art. Instead of a BAS that can be programmed to do anything, we have created a Climate Control System that is pre-programmed to do most things. Within that pre-programmed manifesto, we still need to account for building variations. To account for these variations while keeping our works-out-of-the-box mantra, we have developed a hierarchy of ways to support variations:

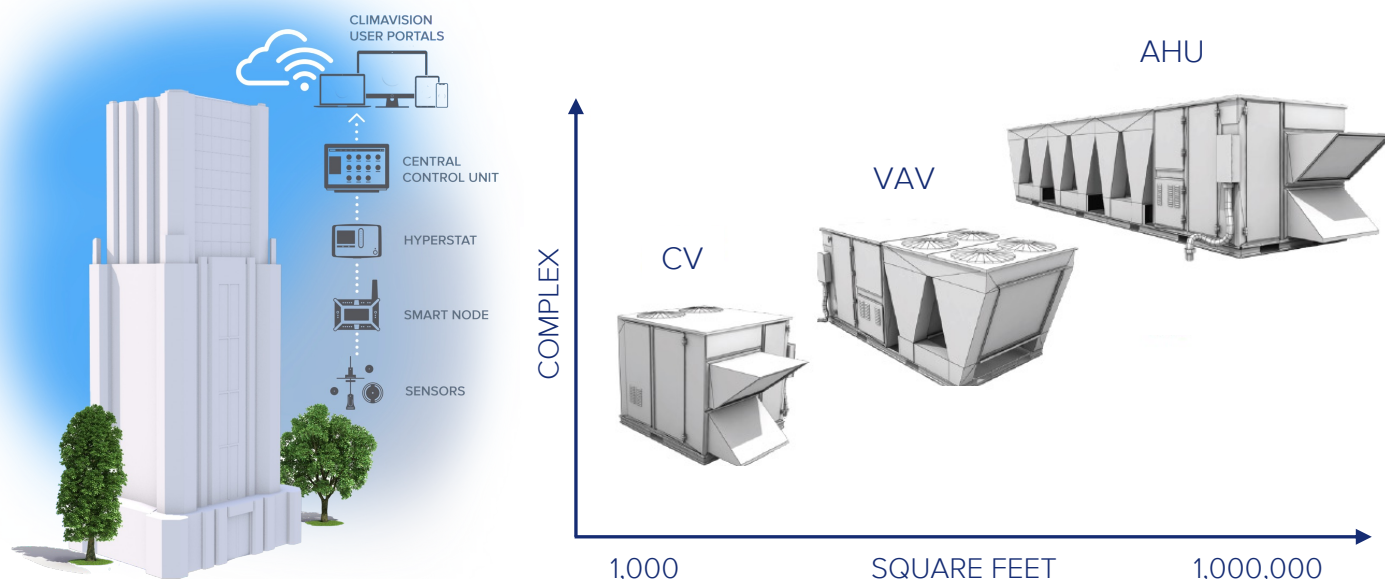
PROFILES — Software and firmware bundles that encapsulate sequences of operation for building systems and terminal equipment.

CONFIGURATIONS — Field settings within each profile that account for equipment differences in systems and terminal equipment.

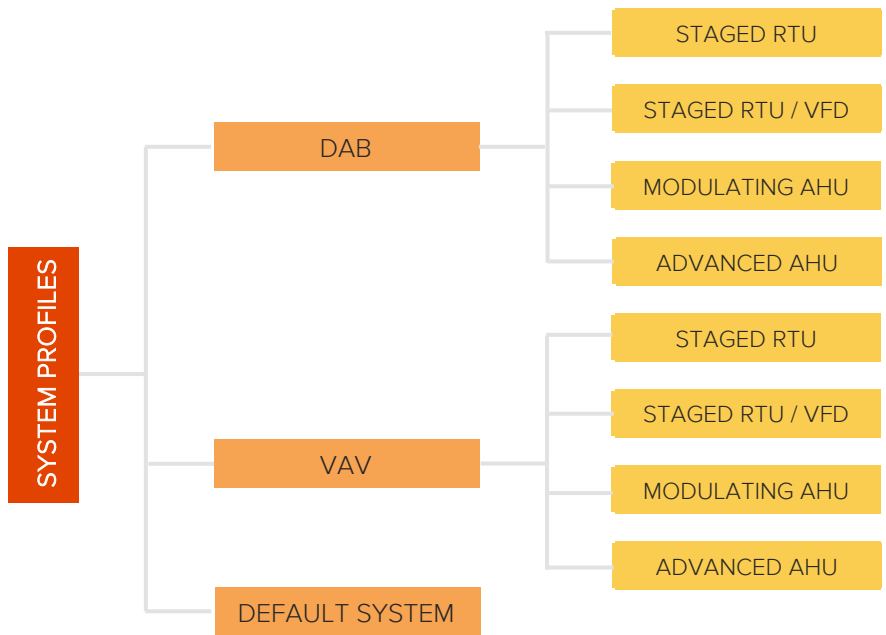
TUNERS — Units and factors within the algorithm supporting sequences of operation that fine-tune the behavior of the system and terminal equipment.

ANALYTICS & NOTIFICATIONS — Predefined analytics and notifications suitable for the selected profiles, and user-defined dashboards and alerts.

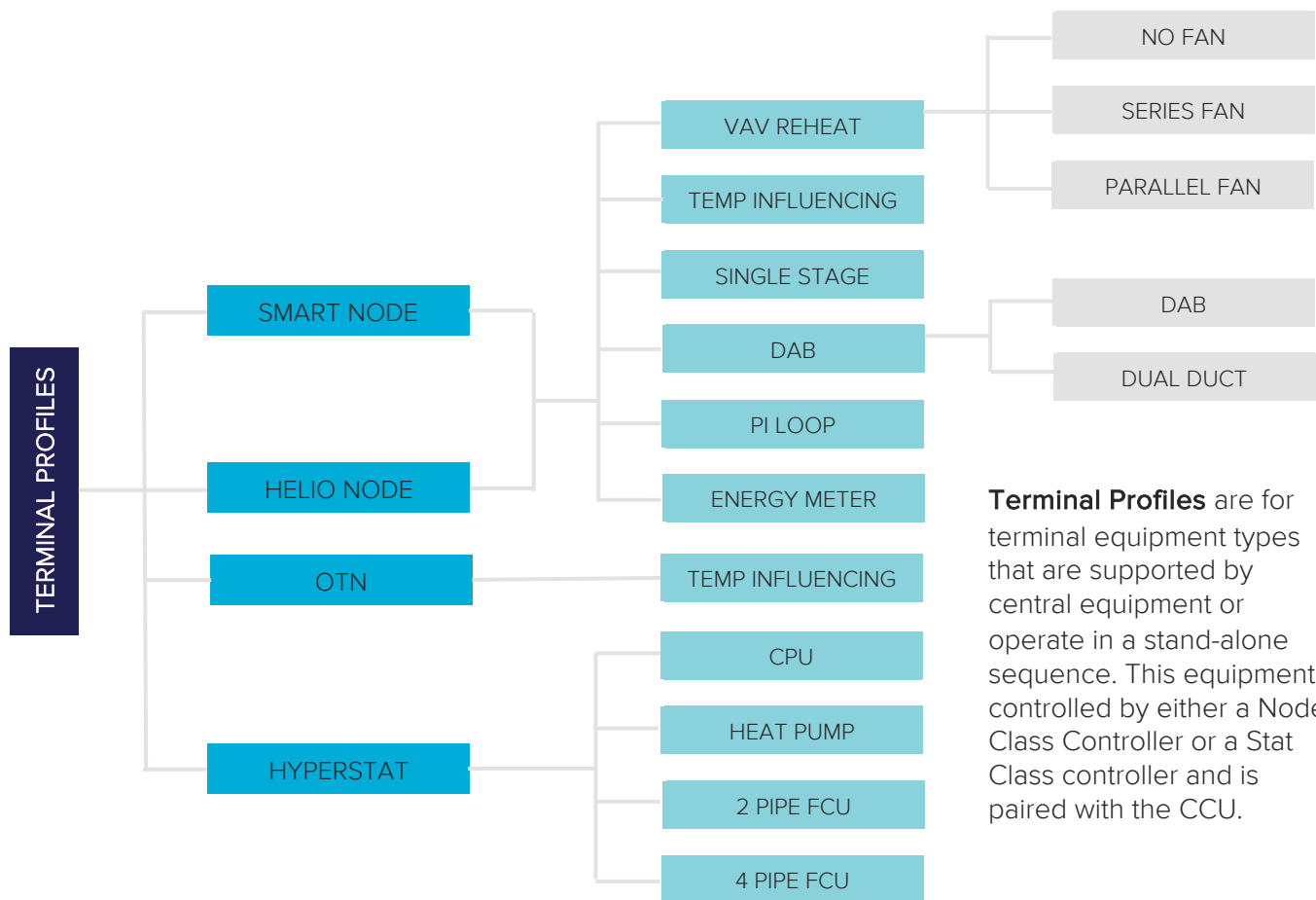
The System Design Guides Carrier has prepared are intended to help designers and sales teams determine which solutions are a fit with the type of systems that need control, and how Carrier provides them. The System Design Guide provides a high-level understanding of the requirements sufficient to prepare an initial design at the Profile level and a quotation for a project. Configurations are not discussed here; these would be found in a Submittal when the project arrives at that stage. Tuners are addressed during startup and ongoing support.



CLIMAVISION SYSTEM & TERMINAL PROFILES



System Profiles are for central HVAC equipment types that are controlled by a ClimaVision Central Control Unit (CCU), such as multi-zone air handlers.



Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.



SINGLE-ZONE AHU APPLICATION OVERVIEW

Most rooftop units (RTUs) and ceiling-suspended units (CSUs) found in small-to-mid-sized commercial buildings do not often benefit from a Building Automation System (BAS) — they are commonly installed with a thermostat. Even a connected thermostat offers little benefit, however, if the supervisory system is not designed for commercial purposes. As a result, these units are commonly overlooked, undermaintained, wasting energy and making occupants uncomfortable.

Air handlers with minimal control requirements — such as cold and hot water coils and variable frequency drives (VFDs) — are typically controlled by traditional BACnet DDC control systems that are expensive to maintain and retrofit. Yet these equipment types are a perfect match for ClimaVision's Climate Control System and can benefit from a big lift in performance powered by more data and advanced sequences. ClimaVision solves the common problems detailed above by providing an out-of-the-box solution with pre-programmed sequences, networking, remote access for multiple users, master systems integrated, analytics and a Project Haystack-native data portal with API.

FEATURES

- ▶ Up to eight onboard indoor air quality (IAQ) sensors: temperature, humidity, light, sound, CO₂, occupancy, volatile organic compounds (VOCs), and optional particulate matter
- ▶ Pre-configured settings
- ▶ Communication via 900 MHz wireless mesh network

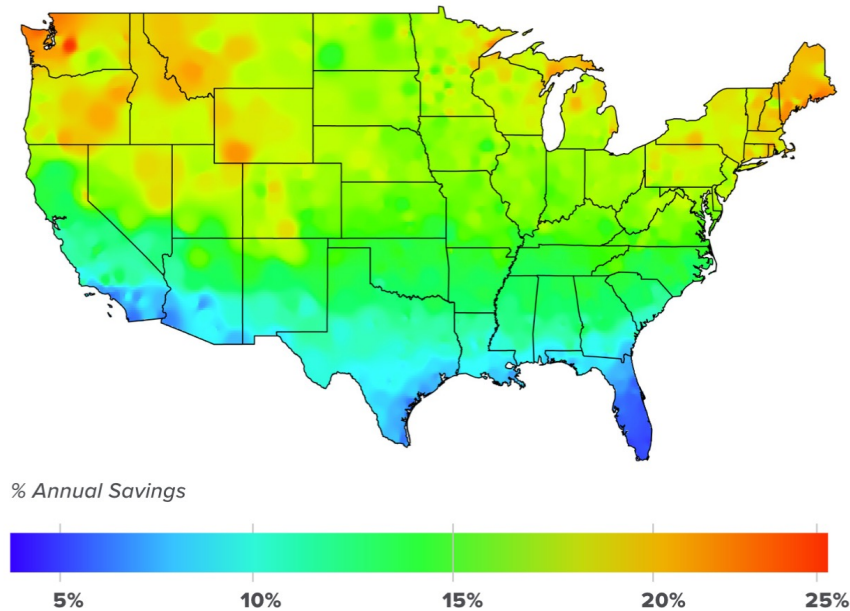


ADVANTAGES

- ▶ Adds IAQ monitoring & advanced sequences such as demand-control ventilation (DCV)
- ▶ Fast and easy installation
- ▶ No networking, no WiFi necessary



ENERGY EFFICIENCY IN SMALL AHUS

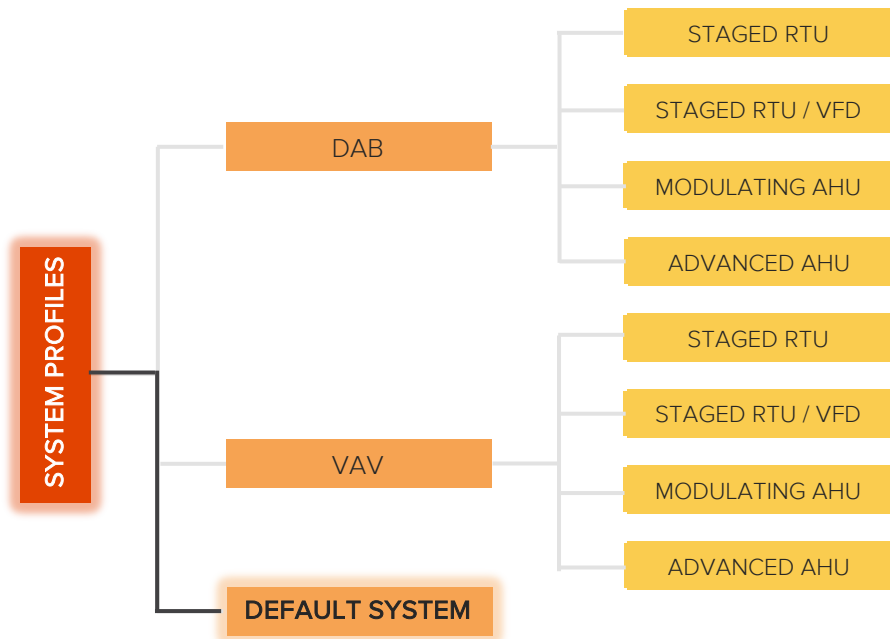


Data from the National Renewable Energy Laboratory detailing energy savings potential of ClimaVision control strategies in strip malls with single-zone rooftop units

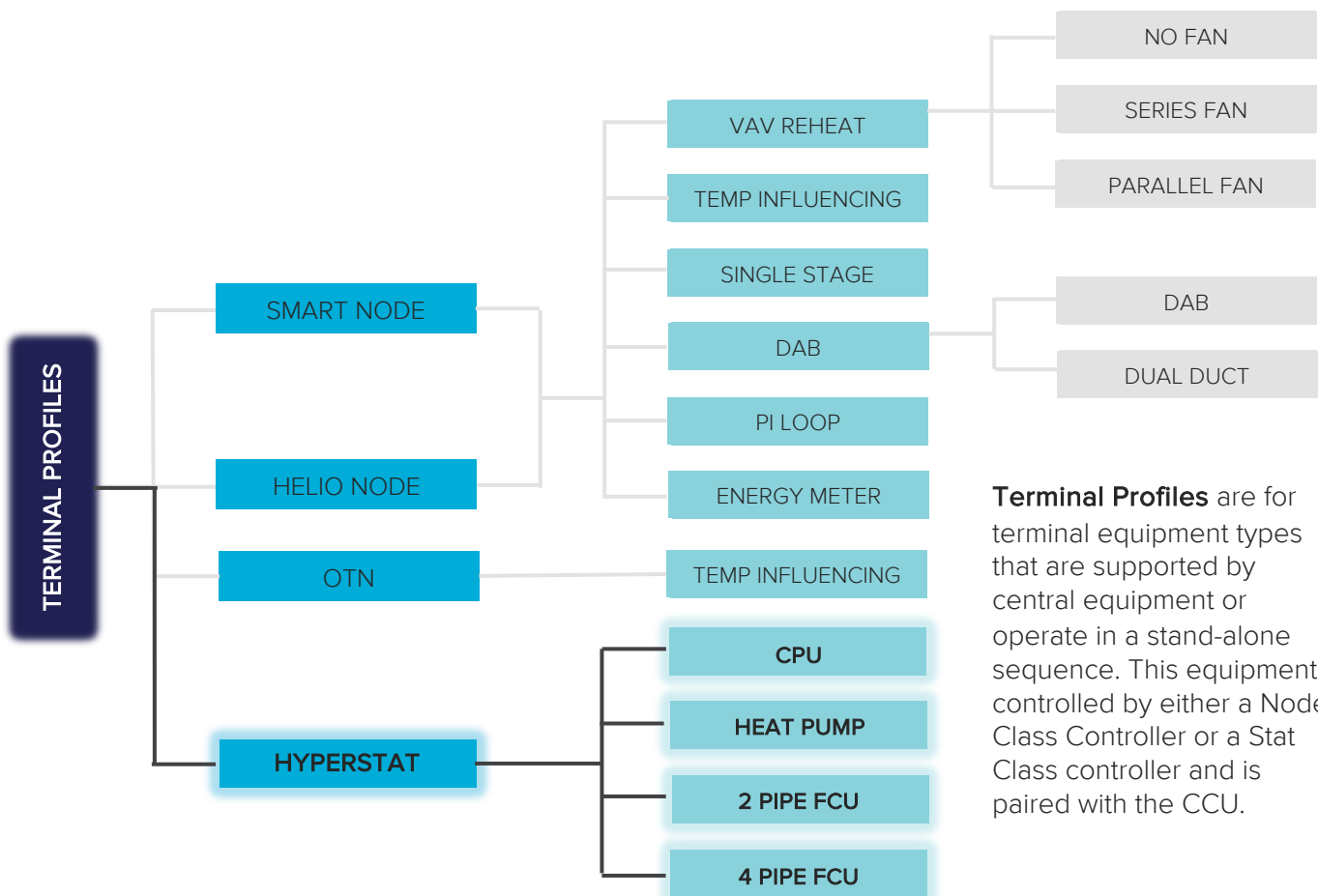
ENERGY CONSERVATION MEASURES

- ▶ Temperature setbacks based on an occupied time schedule with optimum start
- ▶ Auto-away temperature setbacks based on occupancy sensor
- ▶ Forced-occupied temperature setbacks by default with occupant override
- ▶ Demand-control ventilation (DCV)
- ▶ Monitoring system runtime
- ▶ Discharge air temperature (DAT) reset

PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION HYPERSTAT



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CLIMAVISION HYPERSTAT

Both analog and 24V relay controls are available to support the required sequences for small AHUs. Dual setpoints, deadbands, hysteresis, and PI loops are all built into the sequence with configurations and tuners exposed for the sequences to be fine-tuned as needed. The most common device for this equipment is the ClimaVision HyperStat. The Smart Node™ and the Helio Node can also be used for simpler equipment types in some applications.

CLIMAVISION HYPERSTAT

With eight onboard sensors, the HyperStat is an all-in-one thermostat, humidistat, and IAQ sensing station. The HyperStat is part of ClimaVision's vertically-integrated, Climate Control System delivering multi-mode sensing, remote monitoring, and individual zone control for the comfort and productivity of building occupants. This device includes wireless mesh network communication and Bluetooth commissioning. The HyperStat can also be controlled with a third-party BMS via BACnet or Modbus via its RS-485 port.

Select the HyperStat for small AHUs for these applications when occupant display and wall input are desired:

- ▶ Dual setpoints control
- ▶ Auto-away energy savings
- ▶ Forced occupied comfort / energy savings
- ▶ DCV with onboard CO₂ sensor for offices hotel rooms, guest rooms, and more

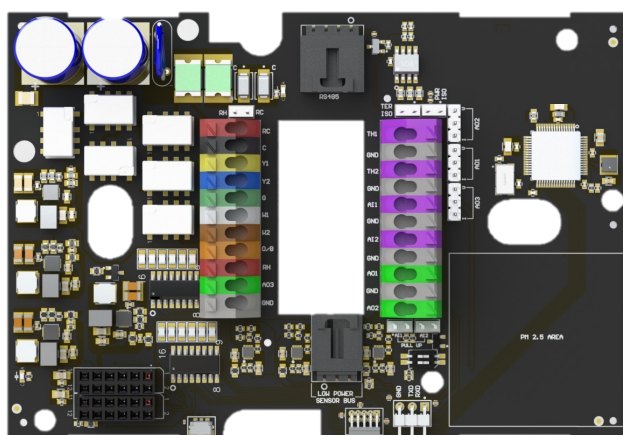


HYPERSTAT I/O

- ▶ (6) 24V AC Relays
- ▶ (2) 0-10K Type II Thermistor Terminals
- ▶ (2) Analog In
- ▶ (3) Analog Out
- ▶ (1) 3-Pin Digital Bus
- ▶ (1) 4-Pin Digital Bus (RS-485)

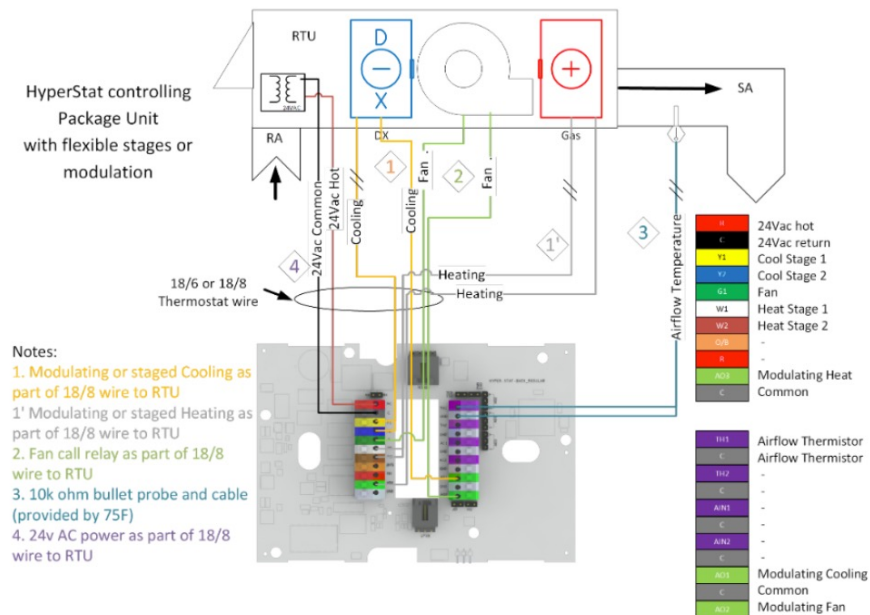
TYPICAL BILL OF MATERIAL

- ▶ HyperStat
- ▶ 10K Type II thermistor on a 30' wire to obtain discharge air temperature
- ▶ Dry wall screws
- ▶ Optional current sensor and others as required.



CLIMAVISION HYPERSTAT

WIRING DETAILS

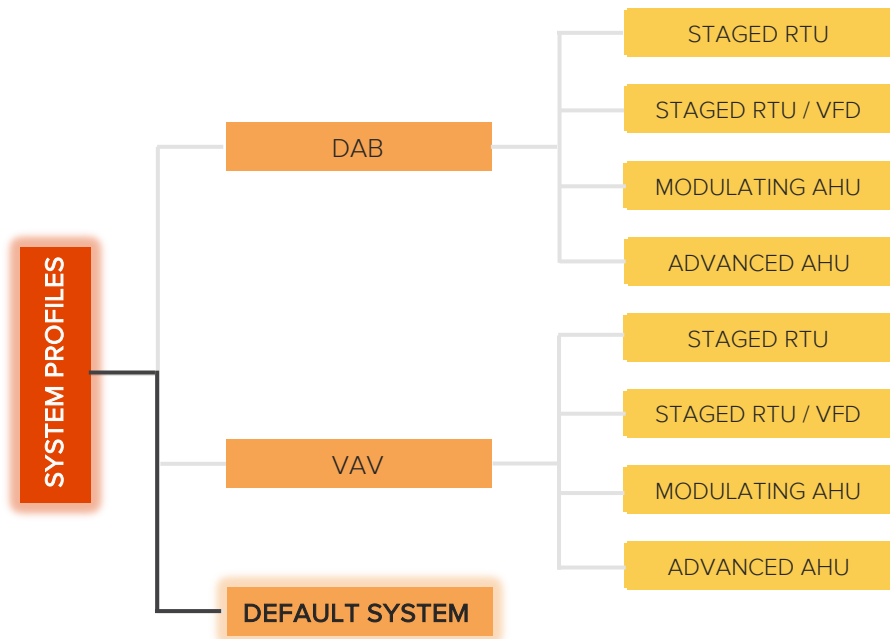


For small AHUs, select the Conventional Package Unit (CPU) profile to obtain the required sequence configured to any of these points:

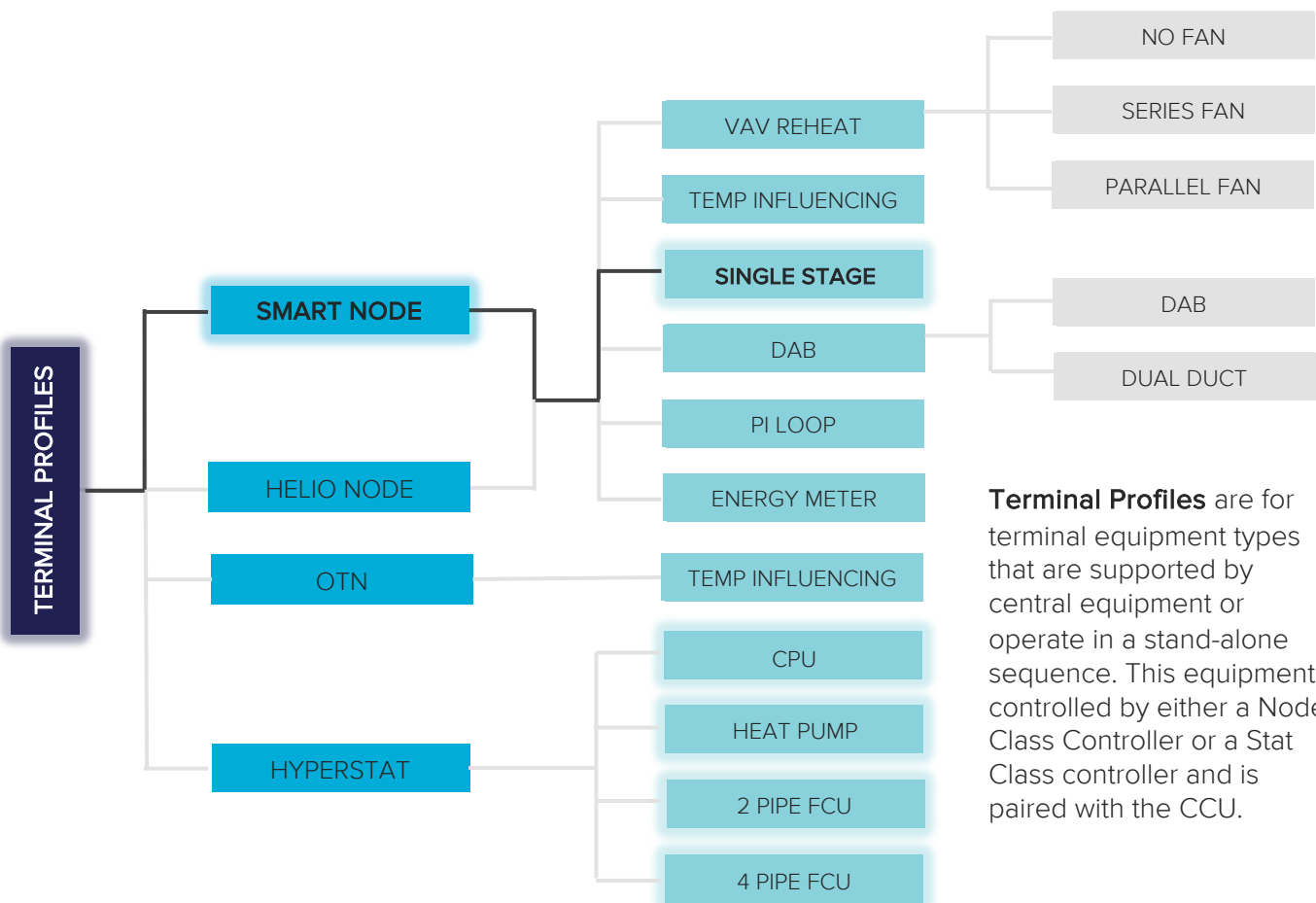
- ▶ (2) Analog In
 - ▶ Current Transformer (0-10Amps)
 - ▶ Current Transformer (0-20Amps)
 - ▶ Current Transformer (0-50Amps)
 - ▶ Key Card Sequence (setback – requires key card reader adder)
 - ▶ Door / Window Sensor (system off)
- ▶ (6) 24V AC Relays
 - ▶ Cooling Stage1
 - ▶ Cooling Stage2
 - ▶ Cooling Stage3
 - ▶ Heating Stage1
 - ▶ Heating Stage2
 - ▶ Heating Stage3
 - ▶ Fan Low Speed
 - ▶ Fan High Speed
 - ▶ Fan Enable
 - ▶ Occupied Enable
 - ▶ Humidifier
 - ▶ Dehumidifier
- ▶ (2) 10K Type II Thermistor Terminals
 - ▶ TH1 Thermistor: monitor
 - ▶ supply air / water temperature
 - ▶ TH2 Thermistor:
 - ▶ window / door sensor; (system off)
- ▶ (1) 4-Pin Digital Bus (RS-485)
 - ▶ BACnet MSTP or Modbus RTU interface
- ▶ (1) 3-Pin Digital Bus
 - ▶ ClimaVision digital sensors such as Wall Sensor (up to four daisy chained)
- ▶ (3) 0-10V Analog Out
 - ▶ Cooling
 - ▶ Fan Speed
 - ▶ Heating
 - ▶ DCV Damper Actuator



PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION SMART NODE



System Profiles are for central HVAC equipment types that are controlled by a ClimaVision Central Control Unit (CCU), such as multi-zone air handlers.



Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.



CLIMAVISION SMART NODE

CLIMAVISION SMART NODE

The Smart Node is an equipment controller designed to be installed on or near terminal equipment — not in occupied spaces. For small AHUs with only a single stage — such as a small cool-only RTU or CSU — a Smart Node can be installed with rooftop access only. Required sensors can be installed in the supply and return ducts, and the Smart Node can be installed directly in the control cabinet and wired to the unit controller.

It offers flexible, software-defined configurations controlling a range of single equipment across all ClimaVision application solutions. Each Smart Node is powered by 24V AC or DC and accepts daisy-chain power. This device includes wireless mesh network communication and Bluetooth commissioning. The Smart Node includes a profile for single-stage equipment (SSE), which is ideal for small air handlers with a single stage.

Select the Smart Node for small AHUs for these applications when occupant display and input on the wall is not desired:

- ▶ Dual setpoints control
- ▶ Auto-away energy savings
- ▶ Forced occupied comfort / energy savings

SMART NODE I/O

- ▶ (2) 24V DC Relays
- ▶ (2) 0-10K Type II Thermistor Terminals
- ▶ (2) Analog In
- ▶ (2) Analog Out
- ▶ (1) 3-Pin Digital Bus
- ▶ (1) 4-Pin Digital Bus (RS-485)

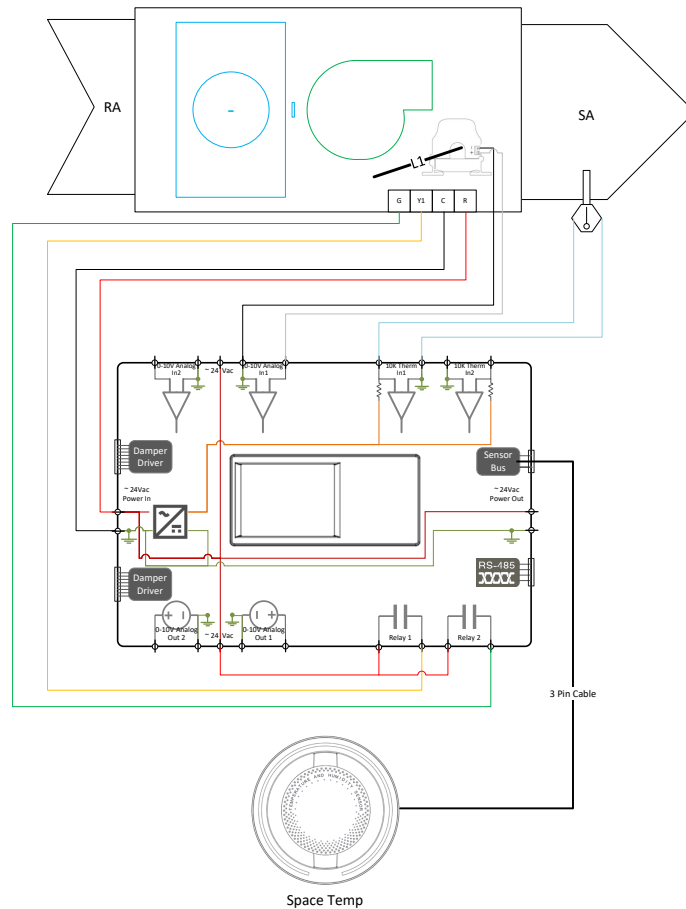
TYPICAL BILL OF MATERIAL

- ▶ Smart Node
- ▶ Mounting bracket with screws
- ▶ Digital ClimaVision **Duct Sensor**
- ▶ **10K Type II thermistor**
- ▶ **Optional current sensor**



CLIMAVISION SMART NODE

WIRING DETAILS



Example SSE configured for a cool-only RTU or CSU

SMART NODE I/O

Select the single-stage equipment (SSE) profile to obtain the required sequence. Configure the Smart Node I/O as needed for the type of equipment to be controlled:

- ▶ TH1 — Discharge Air Temp
- ▶ TH2 — Entering Air Temp
- ▶ R1 — Heating or Cooling Dry Contact
- ▶ R2 — Fan Dry Contact
- ▶ (1) 4-Pin Digital Bus (RS-485)
- ▶ (1) 3-Pin Digital Bus for ClimaVision HyperSense
- ▶ AI1 — optional current sensor



SMART NODE SENSOR OPTIONS

Sensors are wired to the Smart Node to support desired sequence of operation, monitoring and notifications. Any analog sensor may also be connected to the Smart Node, such as current transformers and third-party pressure transducers. The following ClimaVision digital sensors can be wired via digital and analog inputs:



WALL SENSOR

Perfect for drywall or other framed walls. Senses for temperature and humidity.



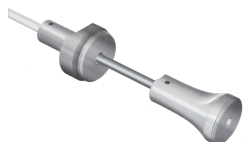
DUCT SENSOR

Placed in the return duct and senses for temperature and humidity.



FLUSH MOUNT
SENSOR

Perfect for beams and concrete where sensor wire must be exposed. Senses for temperature and humidity.



CEILING SENSOR

For installs with limited wall space or zones with a lot of solar gain. Senses for temperature and humidity.



MULTI SENSOR

A digital multi-sensor with PIR occupancy and CO₂ in addition to temperature and humidity.



HYPERSENSE

Offers every sensor the HyperStat does, but connects to the Smart Node via the ClimaVision 4-pin digital sensor input for control.

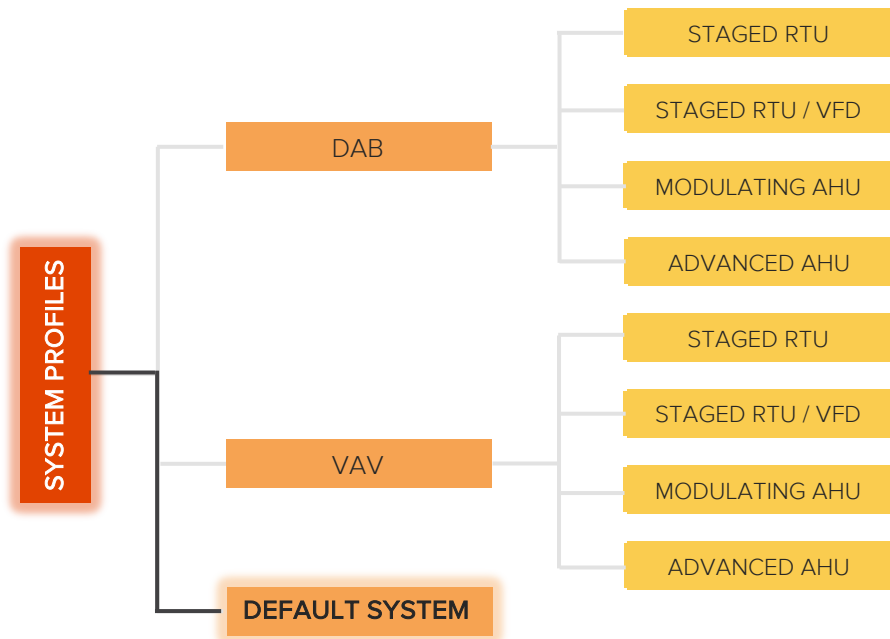


DIFFERENTIAL
PRESSURE SENSOR

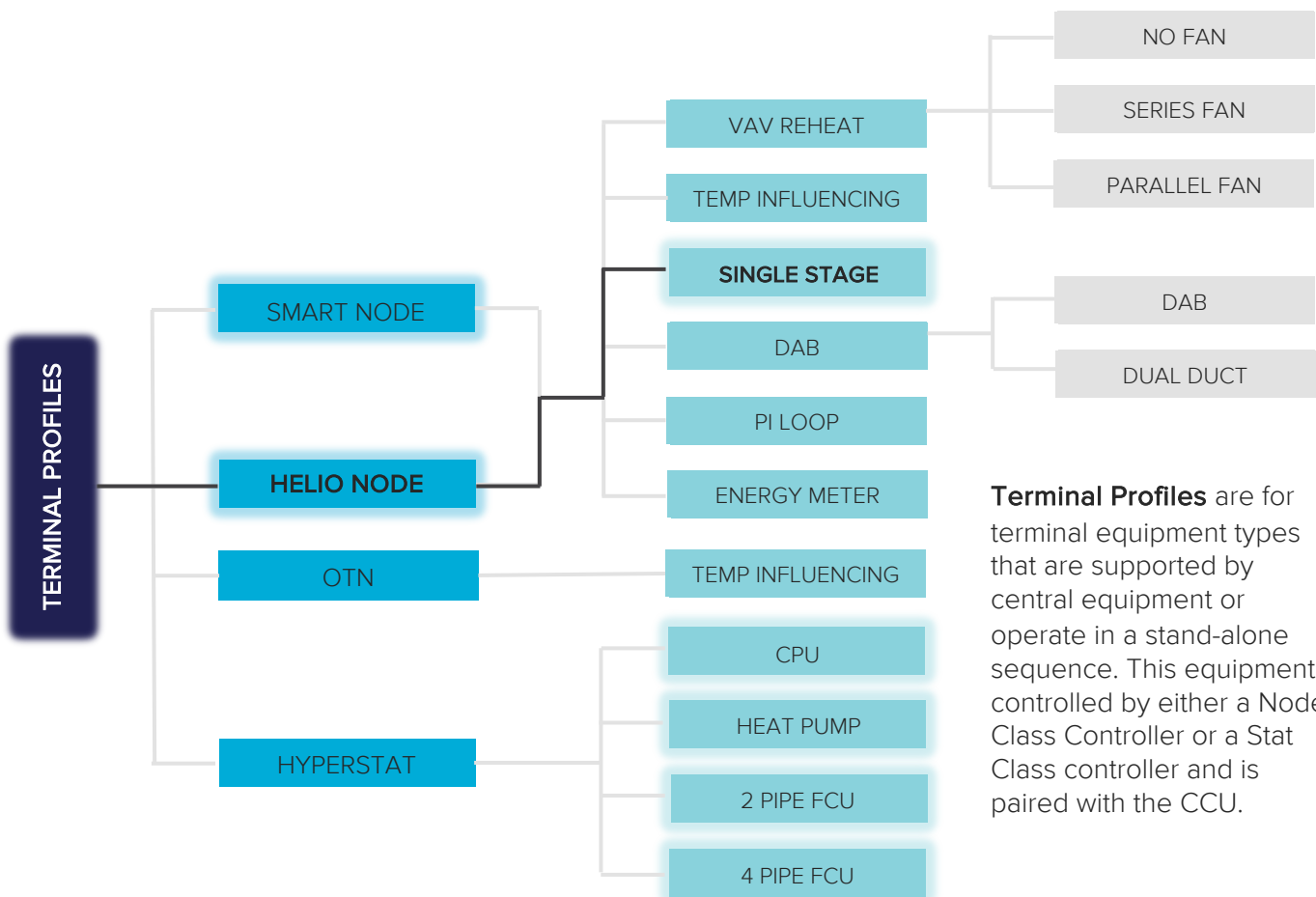
Digital pressure transducer connected to the 3-pin digital bus. Compatible with Wall Sensors and Multi-Sensors on the same bus.



PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION HELIO NODE



System Profiles are for central HVAC equipment types that are controlled by a ClimaVision Central Control Unit (CCU), such as multi-zone air handlers.



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CLIMAVISION HELIO NODE

CLIMAVISION HELIO NODE

With five onboard sensors for temperature, humidity, CO₂, occupancy and light, the Helio Node is an all-in-one controller and IAQ sensing station. The Helio Node is part of ClimaVision's vertically-integrated Climate Control System, delivering multi-mode sensing, remote monitoring, and individual zone control for the comfort and productivity of building occupants. The Helio Node is an equipment controller designed to be installed below the ceiling or on the walls of occupied spaces. It offers flexible, software-defined configurations that can control a range of single and dual-stage equipment across all ClimaVision application solutions. Each Helio Node is powered by 24V AC or DC and accepts daisy-chain power. This device includes wireless mesh network communication and Bluetooth commissioning.

The Helio Node includes a profile for single-stage equipment (SSE), which is ideal for small cooling-only RTUs or CSUs where it is desirable to have occupancy input in spaces where there are no walls. Select Helio Node for small AHUs for these applications when it is useful to have extra IAQ points added to your equipment control:

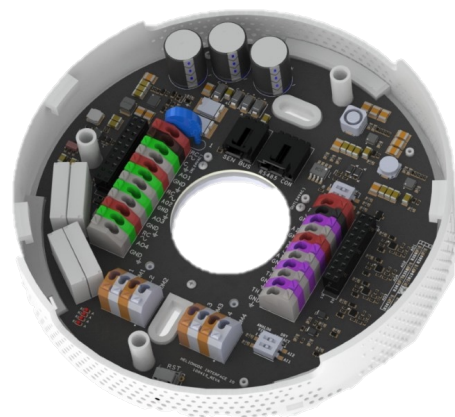
- ▶ Dual setpoint control
- ▶ Auto-away energy savings
- ▶ Forced occupied comfort / energy savings
- ▶ Demand-Control Ventilation (DCV)

HELIO NODE I/O

- ▶ (1) 3-Pin Digital Bus
- ▶ (1) 4-Pin Digital Bus (RS-485) for ClimaVision Smart Sense
- ▶ (4) 24V DC Relays
- ▶ (2) 0-10K Type II Thermistor Terminals
- ▶ (2) Analog In
- ▶ (4) Analog Out

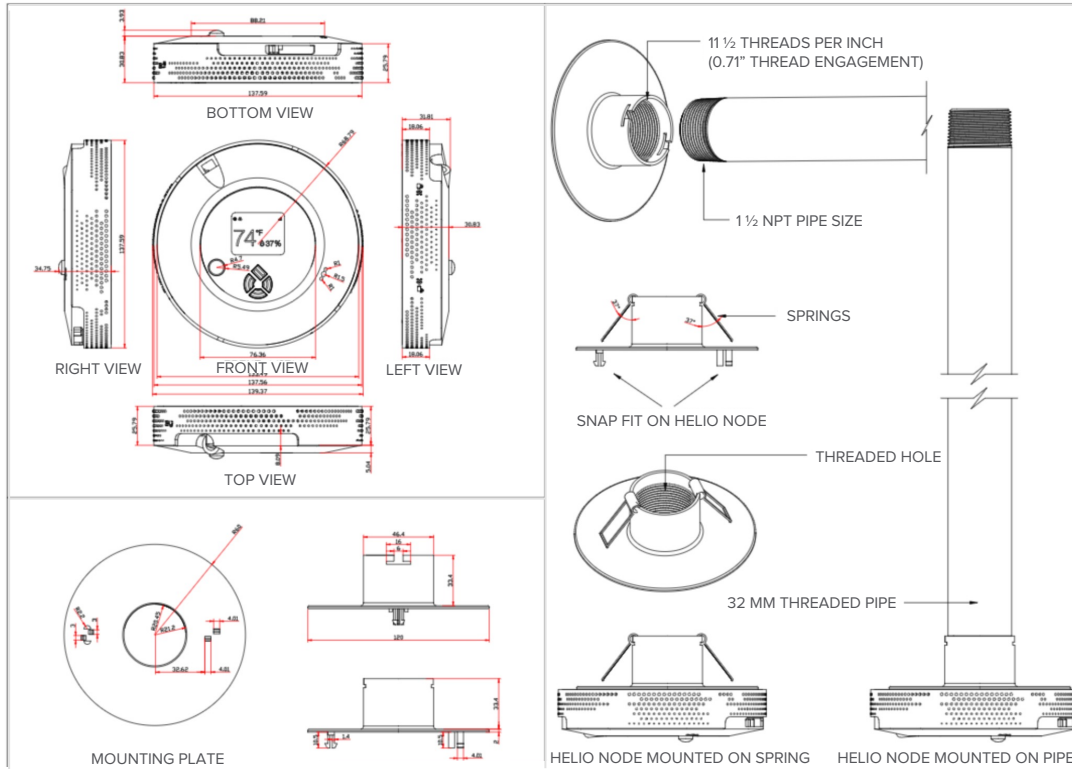
TYPICAL BILL OF MATERIAL

- ▶ Helio Node
- ▶ Mounting plate for suspended ceiling tile
- ▶ Not included: 1-1/4" NPT pipe or junction boxes needed for hanging from a bare ceiling



CLIMAVISION HELIO NODE

WIRING DETAILS



The Helio Node is designed to be installed either mounted in an acoustic tile in a suspended ceiling, or on a PVC pipe from a bare ceiling

HELIO NODE I/O

Select the single-stage equipment (SSE) profile to obtain the required sequence. Helio Node typically does not need an external sensor, but in some applications, it is an advantage. If it is an advantage, choose from the ClimaVision sensor options or third-party sensors need to support the desired sequence. Other sensors can also be used in the analog-in or 10K Type II thermistor points. Configure the i/o as needed for the type of equipment:

- ▶ TH1 — Discharge Air Temp
- ▶ TH2 — Entering Air Temp
- ▶ R1 — Heating or Cooling Dry Contact
- ▶ R2 — Fan Dry Contact
- ▶ (1) 3-Pin Digital Bus for a ClimaVision digital sensor
- ▶ (1) 4-Pin Digital Bus (RS-485) for a ClimaVision HyperSense

