Carrier

SINGLE-MODE EQUIPMENT

SYSTEM DESIGN GUIDE

*Guidance for using the **ClimaVision Climate Control System** for:*

- *Unit Heaters*
- *Infrared Heaters*
- *Exhaust Fans*
- *Water, Steam, or Electric Radiators*
- *In-Floor Heat*
- *Evaporative Coolers*
- *De-Icing Systems*

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:

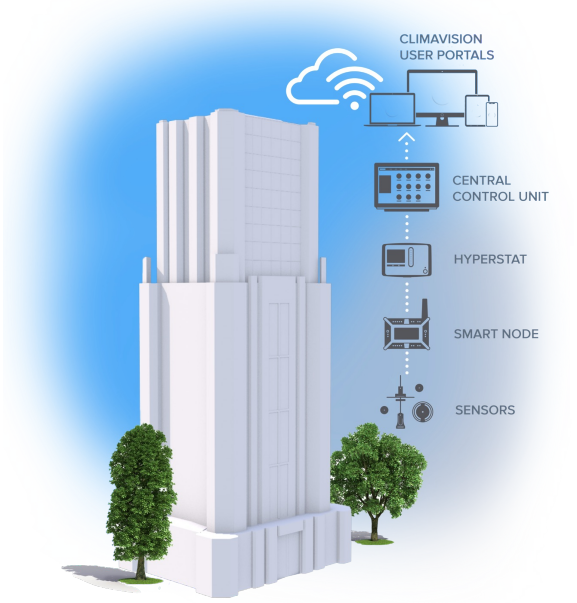
PROFILES — Software and firmware bundles that encapsulate sequences of operation for building systems and terminal equipment.

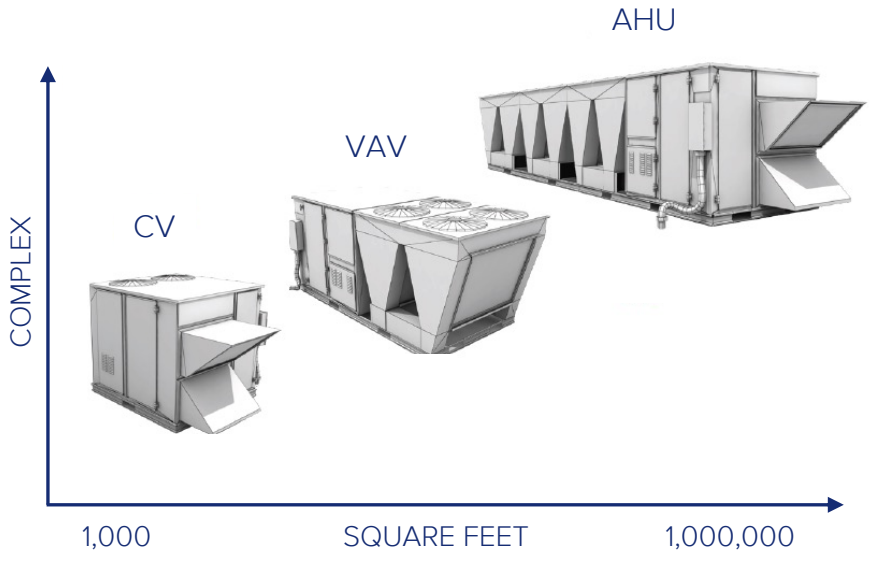
CONFIGURATIONS — Field settings within each profile that account for equipment differences in systems and terminal equipment.

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

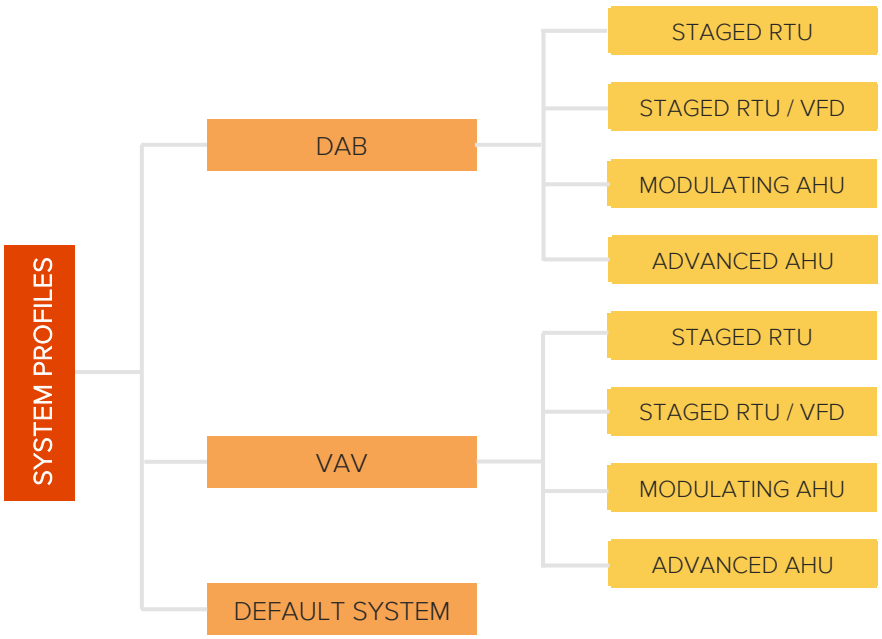
ANALYTICS & NOTIFICATIONS — Predefined analytics and notifications suitable for the selected profiles, and user-defined dashboards and alerts.

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.

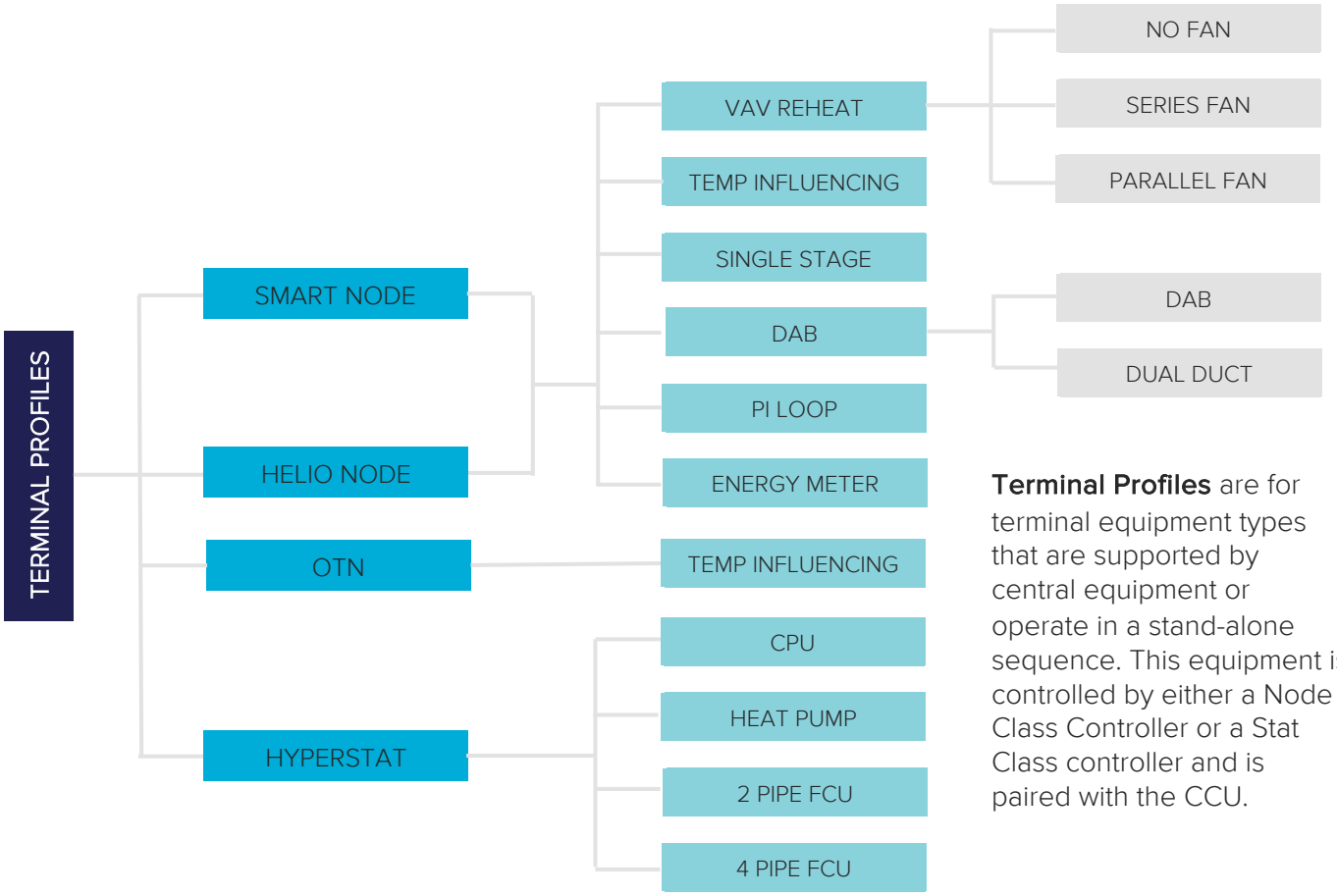




CLIMAVISION SYSTEM & TERMINAL PROFILES



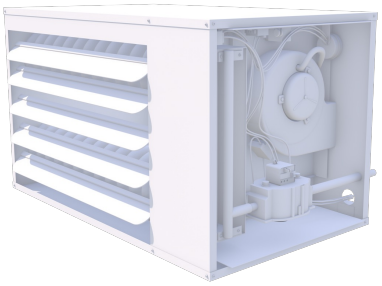
System Profiles are for central HVAC equipment types that are controlled by a ClimaVision Central Control Unit (CCU), such as multi-zone air handlers.



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-MODE EQUIPMENT APPLICATION OVERVIEW

Terminal HVAC equipment that operates in a single mode for heating, cooling or ventilation is one of the most numerous equipment types found in commercial buildings, yet they are rarely controlled by a BMS. Existing thermostats are controlled by the occupants and typically are set to the wrong temperature and if scheduled, are set to 24x7 hold. When connected to an IoT BMS, we can lower utility costs by schedules and optimized equipment runtimes and improve comfort and productivity with rich IAQ data and advanced sequences of operation.



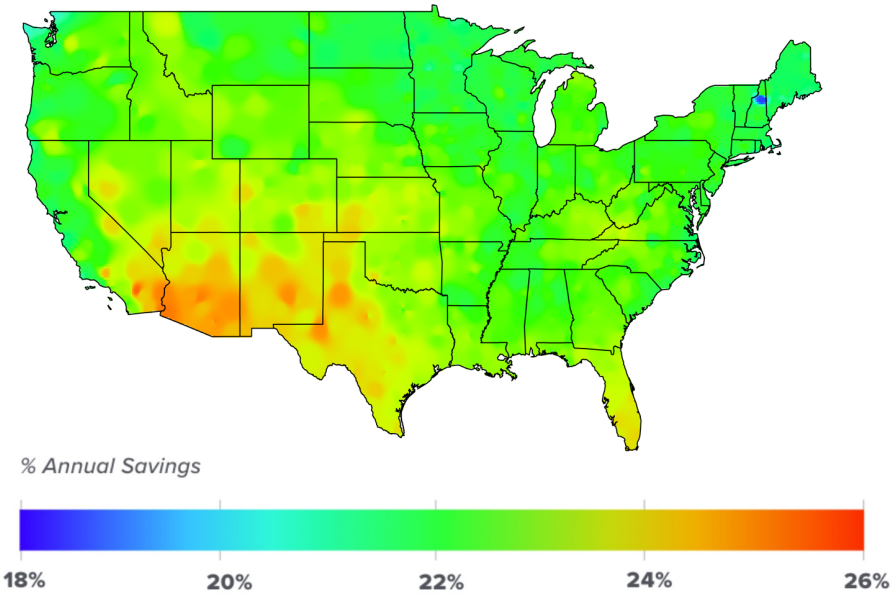
FEATURES

- Up to eight onboard indoor air quality sensors: temperature, humidity, light, sound, volatile organic compounds (VOCs), occupancy, CO_2, and particulate matter
- Preconfigured settings
- 900 MHz wireless mesh network

ADVANTAGES

- Adds indoor air quality management and advanced sequences such as demand-control ventilation
- Fast and easy installation
- No networking, no Wi-Fi necessary

ENERGY EFFICIENCY IN SINGLE-MODE EQUIPMENT

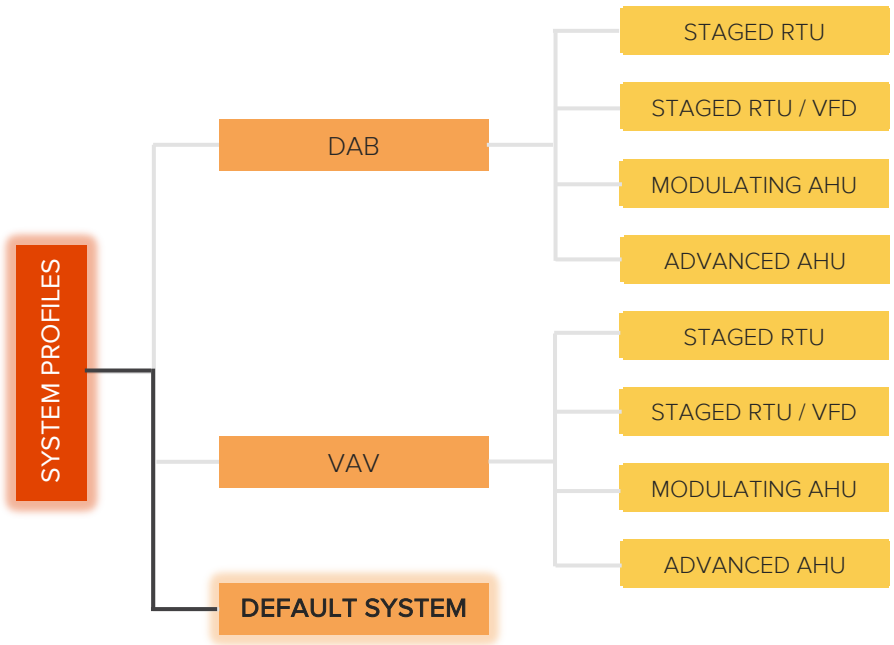


Data from the National Renewable Energy Laboratory detailing energy savings potential of ClimaVision control strategies in small offices.

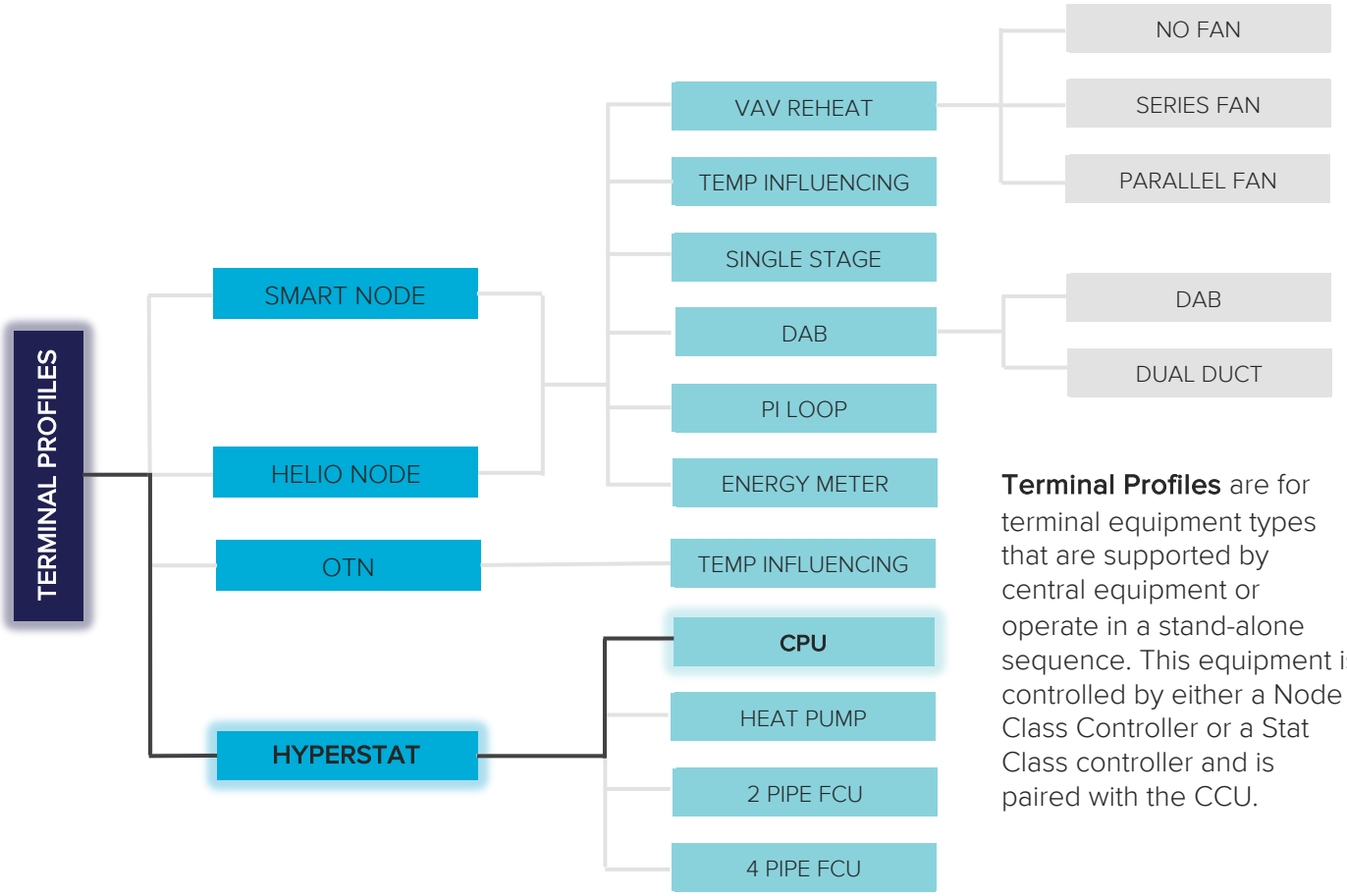
ENERGY CONSERVATION MEASURES

- Setback of temperatures based on an occupied time schedule with optimum start
- Auto-away setback of temperatures based on occupancy sensor
- Forced-occupied setback of temperatures by default with occupant override
- Demand-control ventilation
- Monitoring system runtime

PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION HYPERSTAT



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.

Both analog and 24v relay controls are available to support the required sequences for single-mode equipment types. These points are available on the HyperStat, Smart Node, Helio Node and Smart Stat devices with advantages to each in various cases.

CLIMAVISION HYPERSTAT

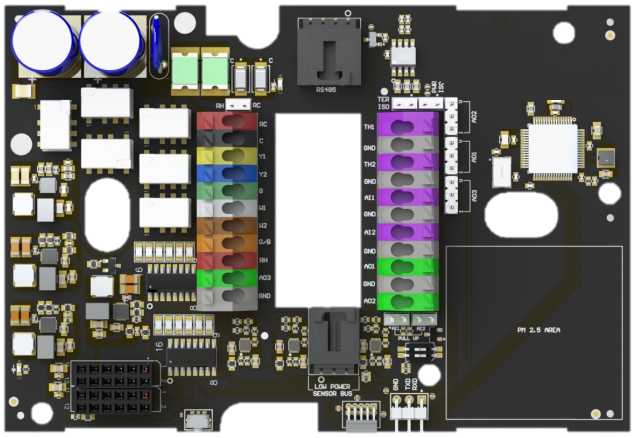
With eight onboard sensors, the HyperStat is an all-in-one thermostat, humidistat, and IAQ sensing station. The HyperStat is part of ClimaVision's vertically-integrated Climate Control System, delivering multi-mode sensing, remote monitoring, and individual zone control for the comfort and productivity of 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 single-mode equipment 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 CO_2 sensor

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): BACnet and Modbus interface



TYPICAL BILL OF MATERIAL

- HyperStat
- 10K Type II thermistor on a 30' wire to obtain discharge air temperature
- Dry wall screws

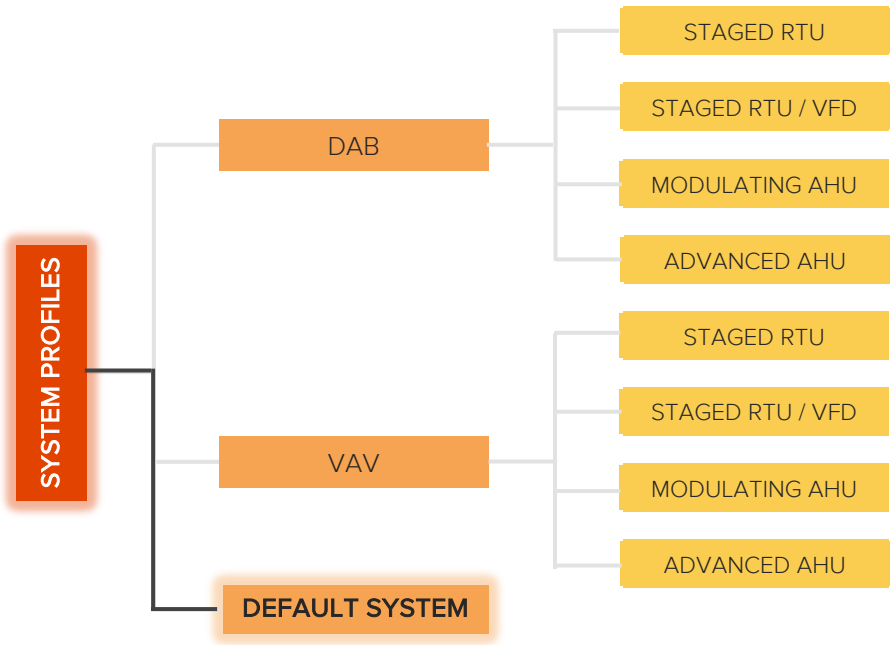
CLIMAVISION HYPERSTAT

WIRING DETAILS

For single-mode equipment, 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 Sensor (setback)
  - 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



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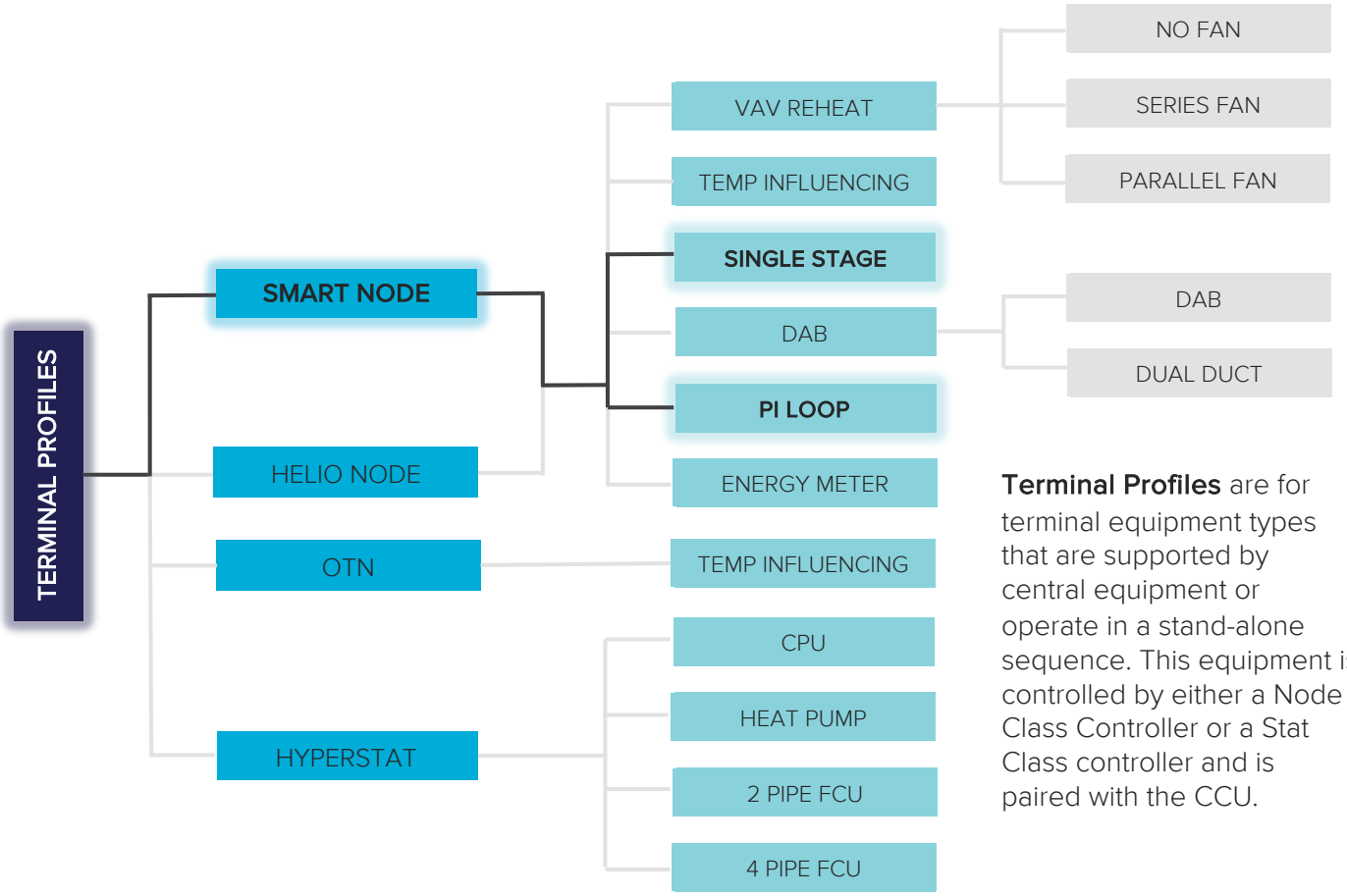


Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.

WIRING DETAILS

CLIMAVISION SMART NODE

The Smart Node is an equipment controller designed to be installed on or near terminal equipment – not in occupied spaces. It offers flexible software-defined configurations which can control a range of single and dual stage equipment across all ClimaVision application solutions.

Each Smart Node is powered by 24V AC or DC and is designed to accept daisy-chain power. This device includes wireless mesh network communication and Bluetooth commissioning. The ClimaVision Smart Node includes a profile for Single-Stage Equipment (SSE), which is ideal for single-mode equipment.

Select the Smart Node for single-mode equipment 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
- Demand-control ventilation (DCV)

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 Wall 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

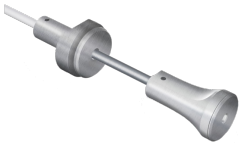
Perfect for drywall or other framed walls. Senses for temperature and humidity.

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 CO_2 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.

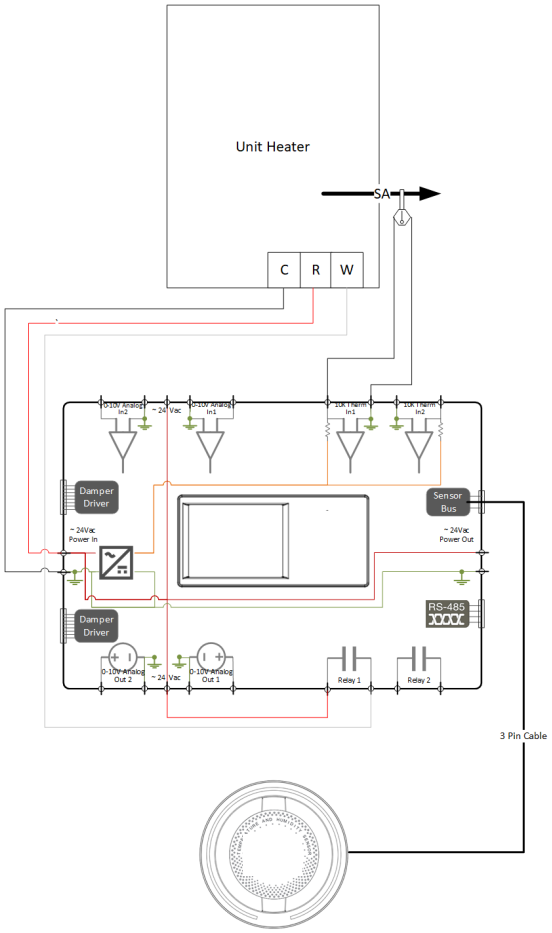
SMART NODE — SSE & PI LOOP PROFILES

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) 3-Pin Digital Bus for ClimaVision digital sensors
- (1) 4-Pin Digital Bus (RS-485) for ClimaVision HyperSense

An alternative to the SSE profile is the PI Loop. The PI Loop Control terminal profile can be used for a wide range of applications by using an input to reset or modulate an output. This profile enables the use of these configurations:

Input Sensor	Unit
Generic 0-10	V
0-2 in. pressure sensor	In wc
0-0.25 DPS	In wc
Airflow sensor	CFM
Humidity	%
CO_2	ppm
CO	ppm
NO_2	ppm
CT 0-10	Amps
CT 0-20	Amps
CT 0-50	Amps
ION Meter 0-1 million	Ions/cc
10k Type II	F
Generic 1-100kohms	F
ClimaVision digital sensor	F or %



Example SSE configured for a unit heater

If your setpoint is not meant to be static and can change based on the output of another device, you can enable this so your target value is no longer used and the value coming in Analog 2 will be used as the target value. The sensor list option is the same as Analog 1. These configurations are field set:

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

PI LOOP DETAILS

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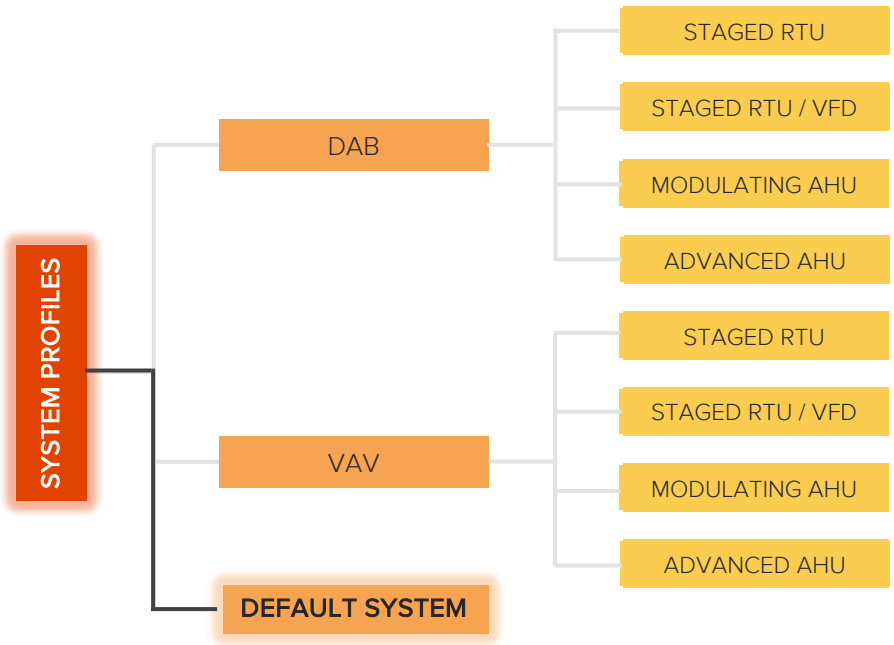
PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION HELIO NODE



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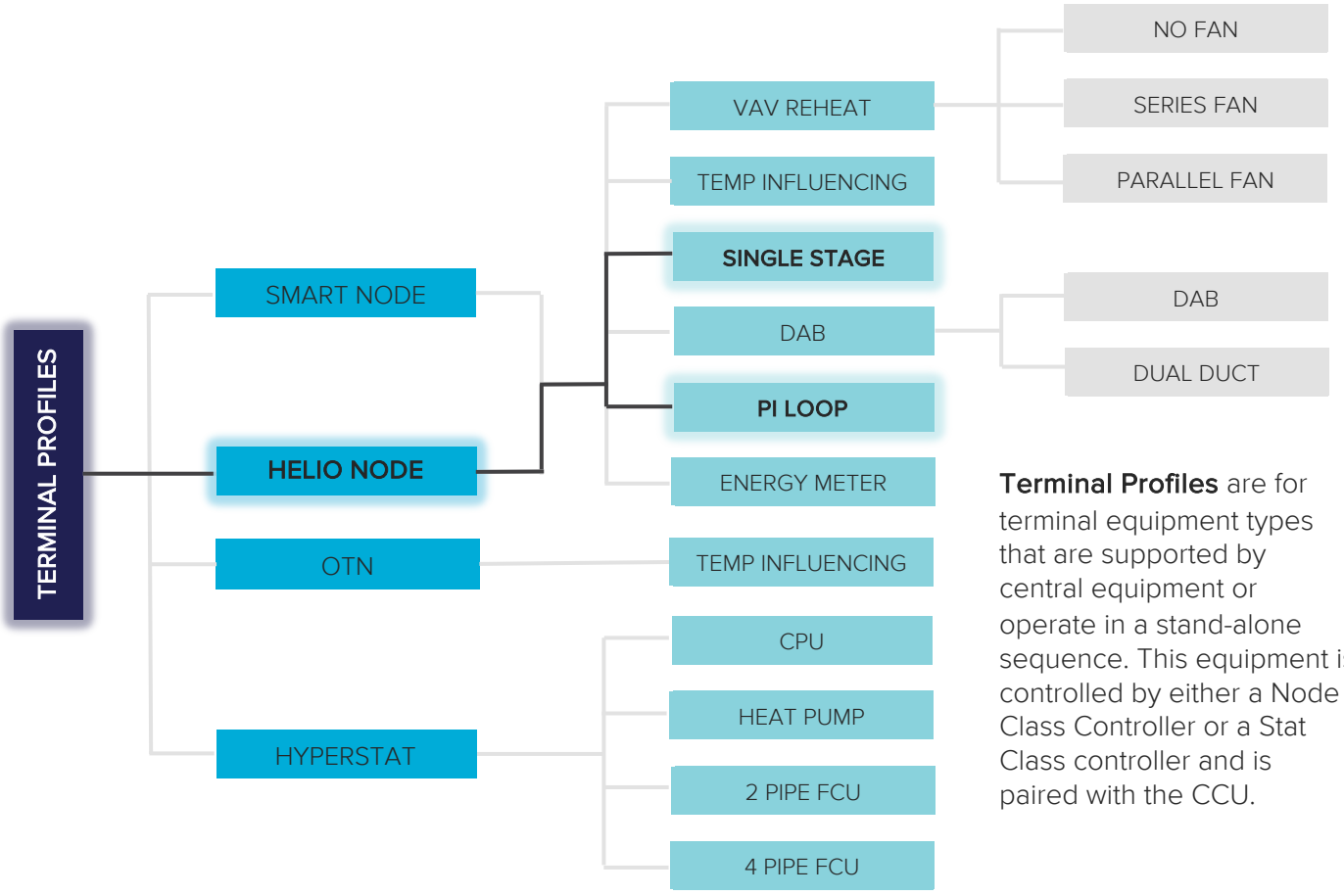


Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.

CLIMAVISION HELIO NODE

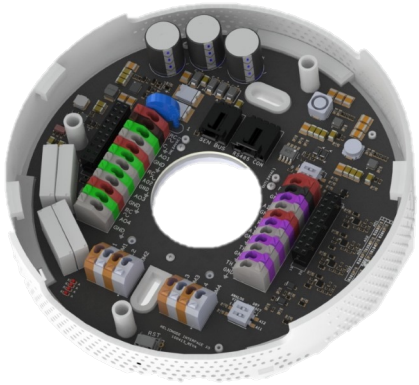
With five onboard sensors for temperature, humidity, CO_2, occupancy and light, the Helio Node is an all-in-one controller and IAQ sensing station. The Helio Node is part of ClimaVision's vertically-integrated, Climate Control System, delivering multi-mode sensing, remote monitoring, and individual zone 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 single-mode equipment. Select Helio Node for single-mode equipment 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 for ClimaVision digital sensors
- (1) 4-Pin Digital Bus (RS-485) for ClimaVision HyperSense
- (4) 24V DC Relays
- (2) 0-10K Type II Thermistor Terminals
- (2) Analog In
- (4) Analog Out
- Temperature and humidity sensor
- Dedicated CO_2 sensor
- Occupancy sensor
- Light sensor



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

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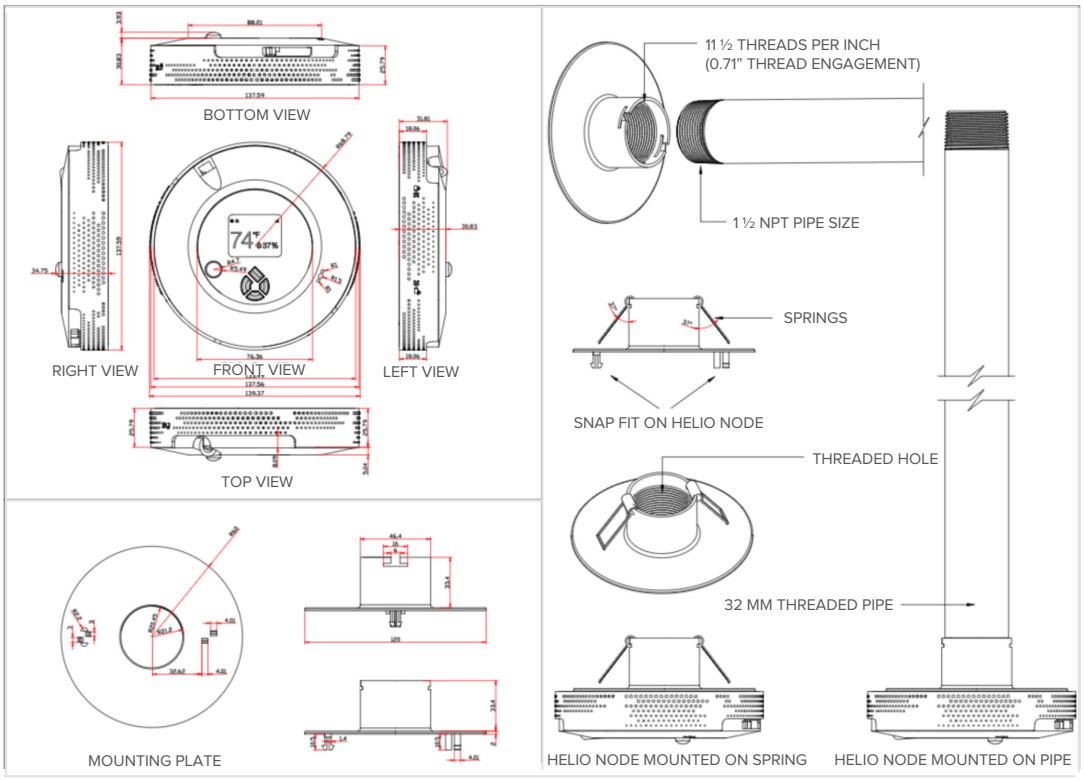
WIRING DETAILS



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 3rd party sensors needed to support the desired sequence. Other sensors can also be used in the analog-in or 10k Type II thermistor points. Configure the Helio 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) 3-Pin Digital Bus for ClimaVision digital sensors
- (1) 4-Pin Digital Bus (RS-485) for ClimaVision HyperSense

The Helio Node also supports PI Loop control, as explained in the Smart Node section.