Carrier

FAN COIL UNITS

SYSTEM DESIGN GUIDE

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

- *2-4 Pipe Fan Coil Units*
- *Unit Ventilators*
- *Induction Units*

Supporting hydronic terminal equipment with two-position or modulating valves and three stage or ECM fans.

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:

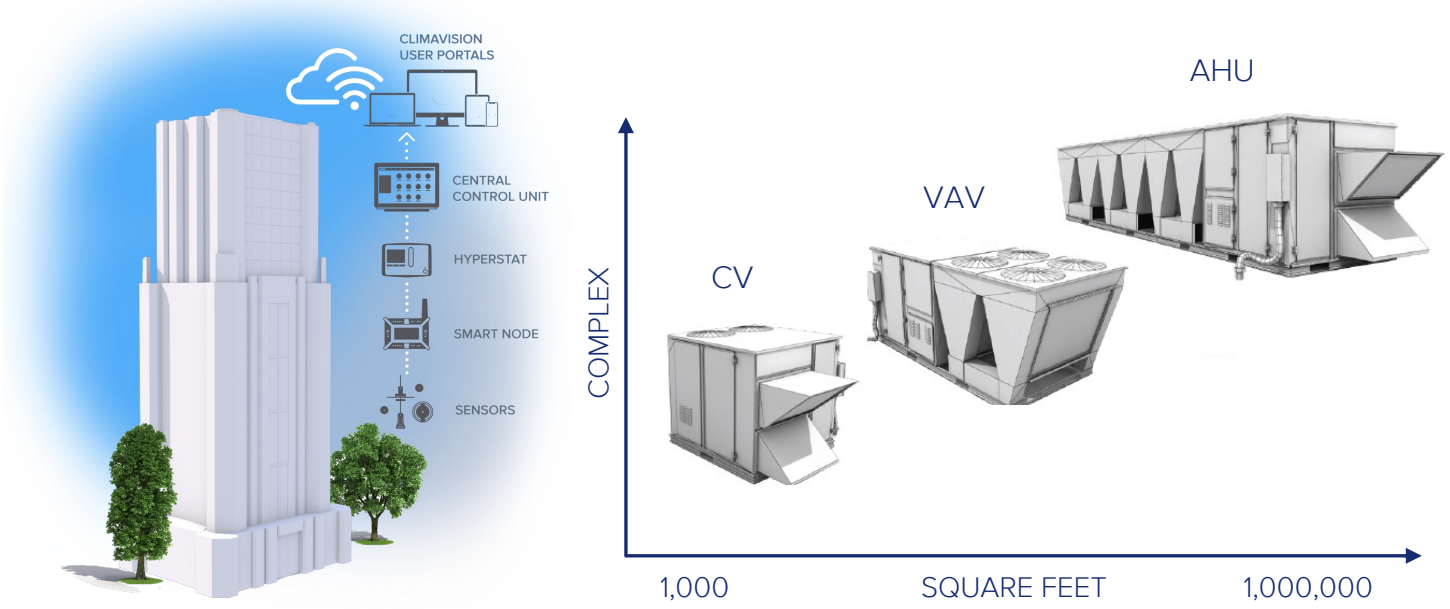
PROFILES — Software and firmware bundles that encapsulate sequences of operation for building systems and terminal equipment.

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

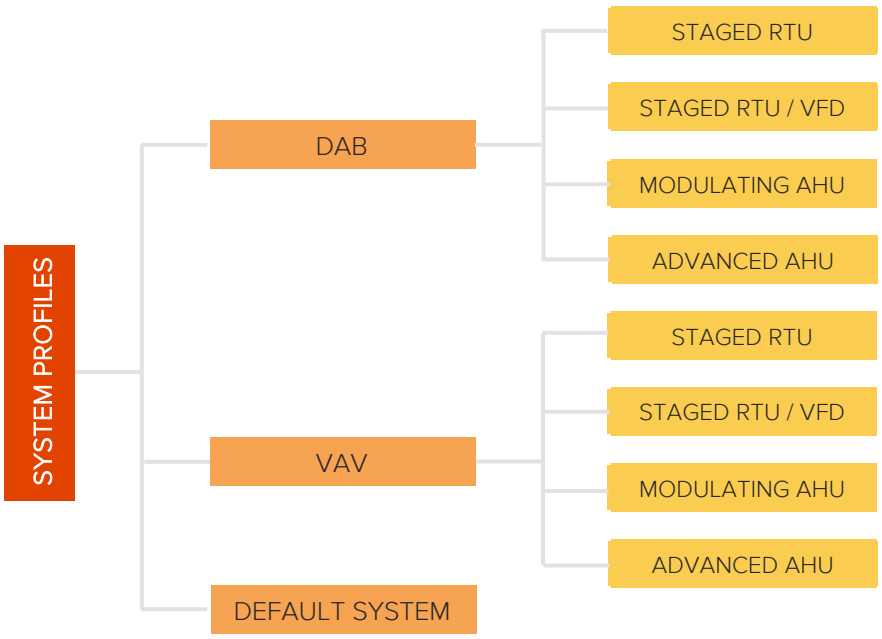
TUNERS — Units and factors within the algorithm supporting sequences of operation that fine-tune the behavior of the system and terminal equipment.

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

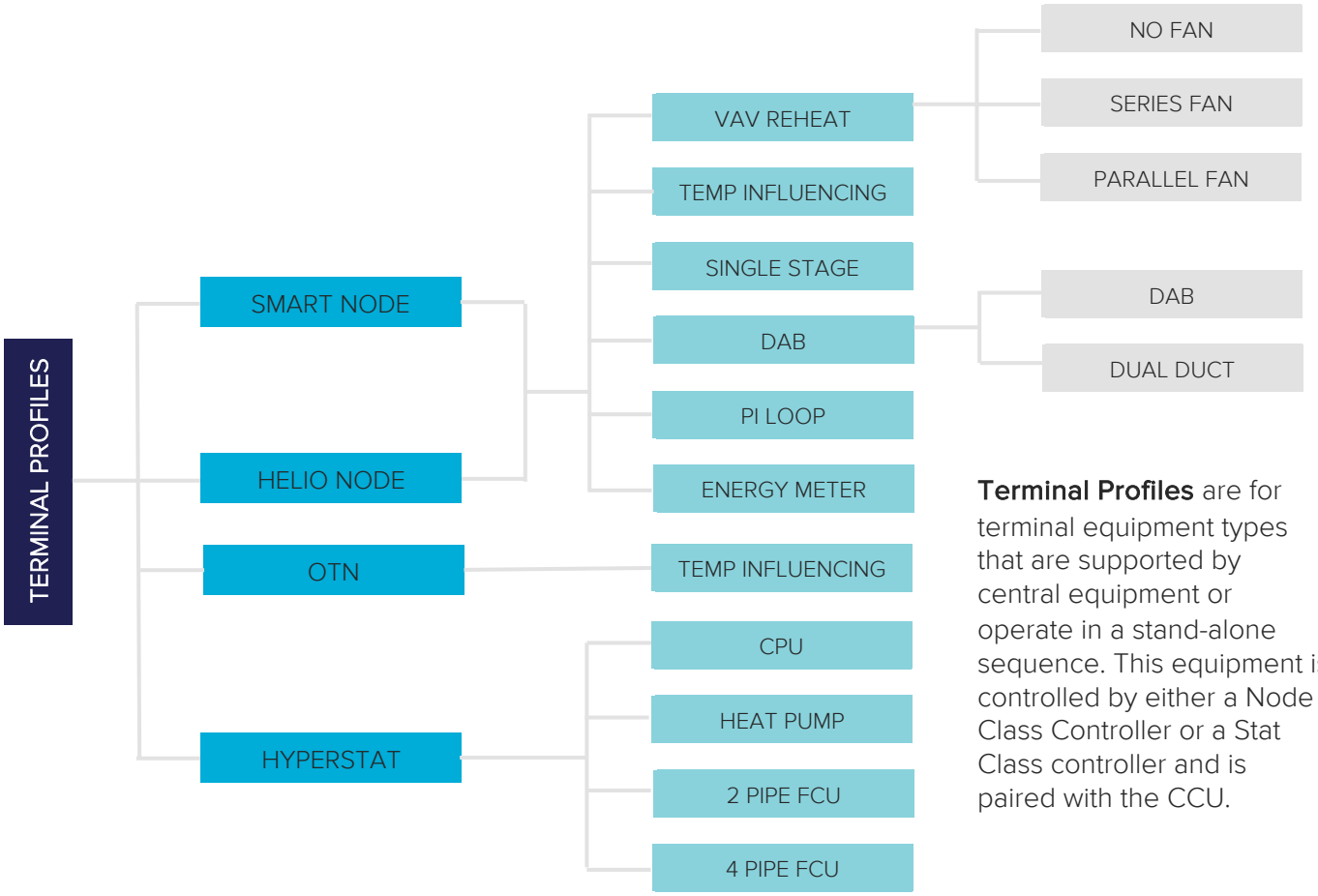
The System Design Guides Carrier has prepared are intended to help designers and sales teams determine which solutions are a fit with the type of systems that need control, and how Carrier provides them. The System Design Guide provides a high-level understanding of the requirements sufficient to prepare 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.



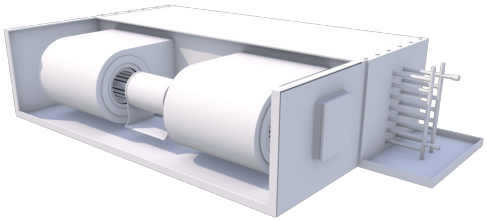
Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.

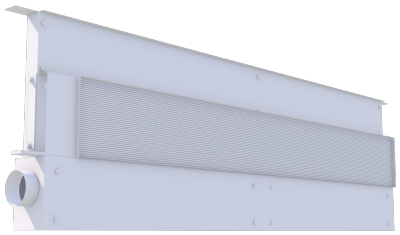
FAN COIL UNIT APPLICATION OVERVIEW

2-4 pipe fan coil units, unit ventilators and induction units take advantage of the energy storage qualities of chilled and hot water and are generally found in larger buildings where chillers and boilers make economic sense.

The terminal units require a controller as most thermostats do not support the required sequence of operation. These controllers are connected to traditional BACnet DDC control systems that are expensive to maintain and retrofit (overkill). Yet these equipment types are a perfect match for ClimaVisions IoT BAS and can benefit from a big lift in performance powered by more data and advanced sequences.

ClimaVision solves these problems by providing a works-out-of-the-box solution with pre-programmed sequences, networking, remote access, master systems integrated, analytics and Haystack-native data portal with API.



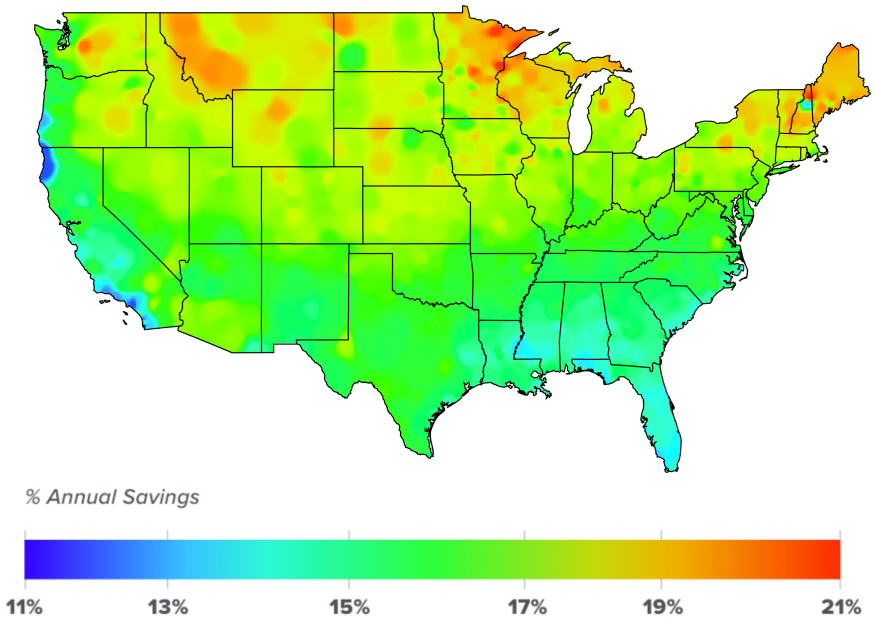


FEATURES

- Up to eight onboard indoor air quality (IAQ) sensors: temperature, humidity, light, sound, CO_2, occupancy, volatile organic compounds (VOCs), and optional particulate matter
- Pre-configured settings
- Communication via 900 MHz wireless mesh network
- Analog outputs

ADVANTAGES

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



Data from the National Renewable Energy Laboratory detailing energy savings potential of ClimaVision control strategies in retrofit mid-rise apartment buildings

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

SEQUENCE OF OPERATION

Both analog and 24V relay controls are available to support the required sequences for Fan Coil Units. Dual setpoints, deadbands, hysteresis, and PI are all built into the sequence with configurations and tuners exposed for the sequences to be fine-tuned. The ClimaVision HyperStat has profiles for 2 and 4-pipe FCUs. Induction units use the same sequence as a 2-pipe FCU.

2-pipe FCUs include cutoff valves to isolate the equipment as well as a 2-position actuated valve that will stop the flow of water through the coil when the zone has no load. There are 3 stages of fan speed according to the zone load. Modulating valves and ECM fans are options in this sequence. For buildings equipped with both hot water and chill water supply, the ClimaVision HyperStat includes a remote temperature sensor for the supply water temperature and a supporting sequence that will disable the fan when the supply water temperature does not improve the zone condition. For example, if the building has cut over to hot water for the season and a zone is warm, the supply water temperature point in the sequence of operation will disable the fan until the zone cools down and requires heating.

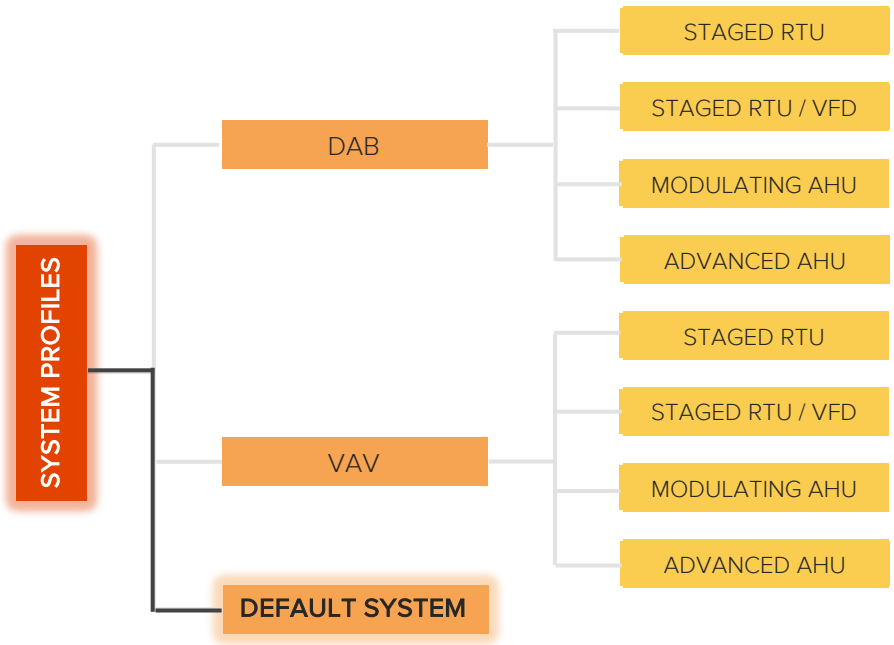
Unit ventilators are typically 2-pipe FCUs with an outside air damper to provide ventilation for a single zone. The ClimaVision sequence of operation for the FCU is the same as the 2-pipe sequence described above plus an analog point for modulating the actuator on the outside air damper.

A **4-pipe FCU** has 2 coils; one for heating and another for cooling with 2-position actuators on each supply. There are 3 stages of fan speed according to the zone load. The ClimaVision sequence of operation will sense the mode (heating or cooling) and load, then energize the appropriate coil supply water valve and set the fan to low, medium, or high speed. Modulating valves and ECM fans are options in this sequence. This profile can work for units with heating only or cooling only options as well.

An **induction unit** uses the 2-pipe fan coil unit sequence and profile.

For all FCU types, the fan and water valve are modulated in a PI loop with the zone Desired Temp as the target and the Current Temp as the input.

PROFILE MAP — TERMINAL CONTROL WITH CLIMAVISION HYPERSTAT



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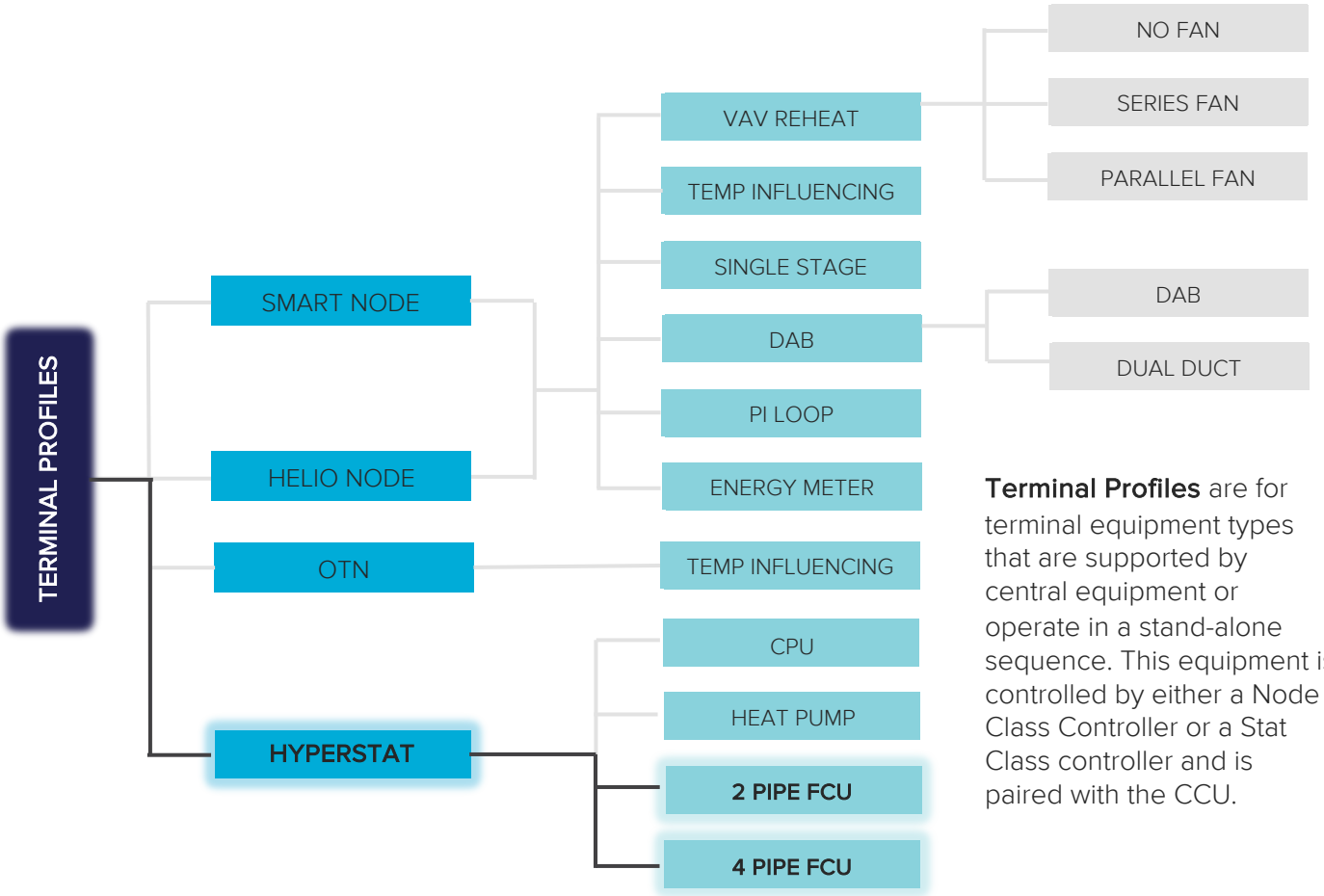


Terminal Profiles are for terminal equipment types that are supported by central equipment or operate in a stand-alone sequence. This equipment is controlled by either a Node Class Controller or a Stat Class controller and is paired with the CCU.

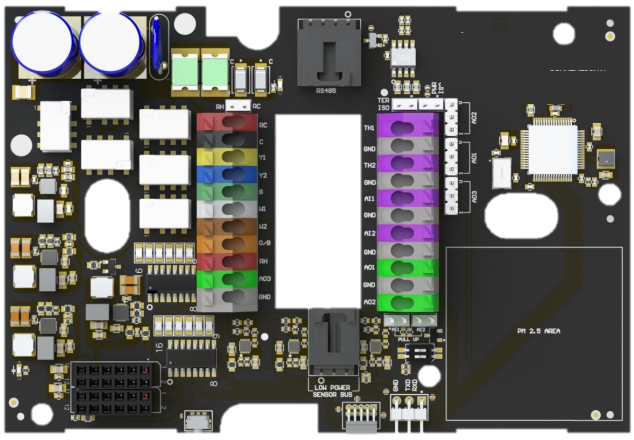
With eight onboard sensors, the HyperStat is an all-in-one thermostat, humidistat, and IAQ sensing station. The HyperStat is part of ClimaVision's vertically-integrated Climate Control System, delivering multi-mode sensing, remote monitoring, and individual zone control for the comfort and productivity 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 the type of FCU to obtain these applications:

- Dual setpoint control
- Auto-away energy savings
- Forced occupied comfort / energy savings
- Demand-control ventilation with onboard CO_2 sensor

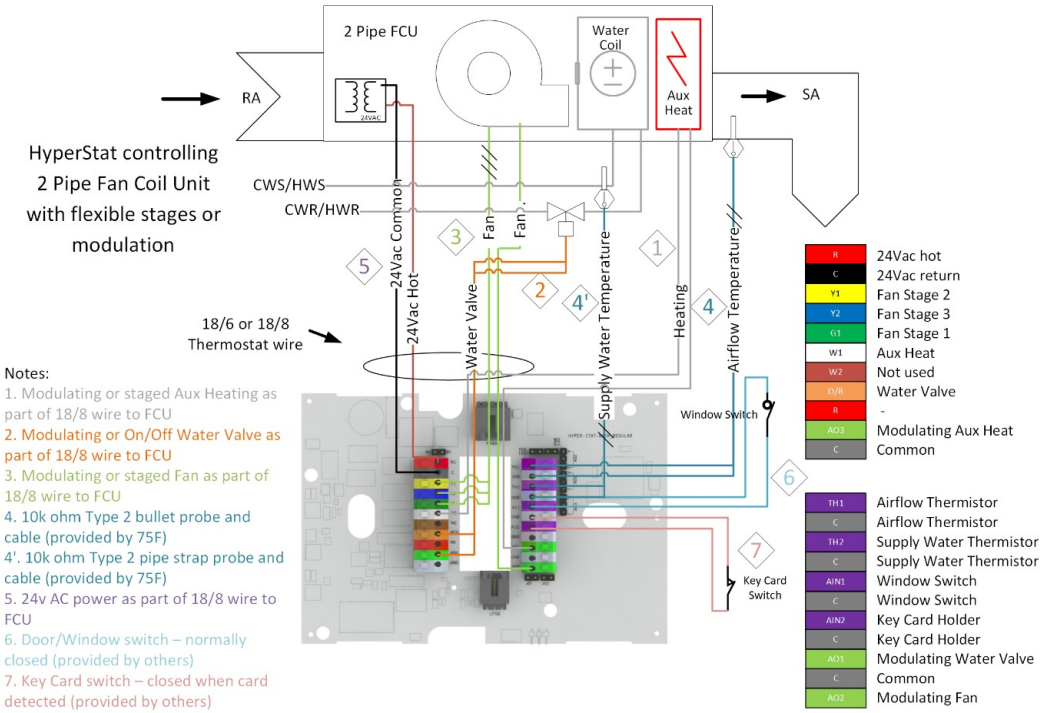
HYPERSTAT I/O

- (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)



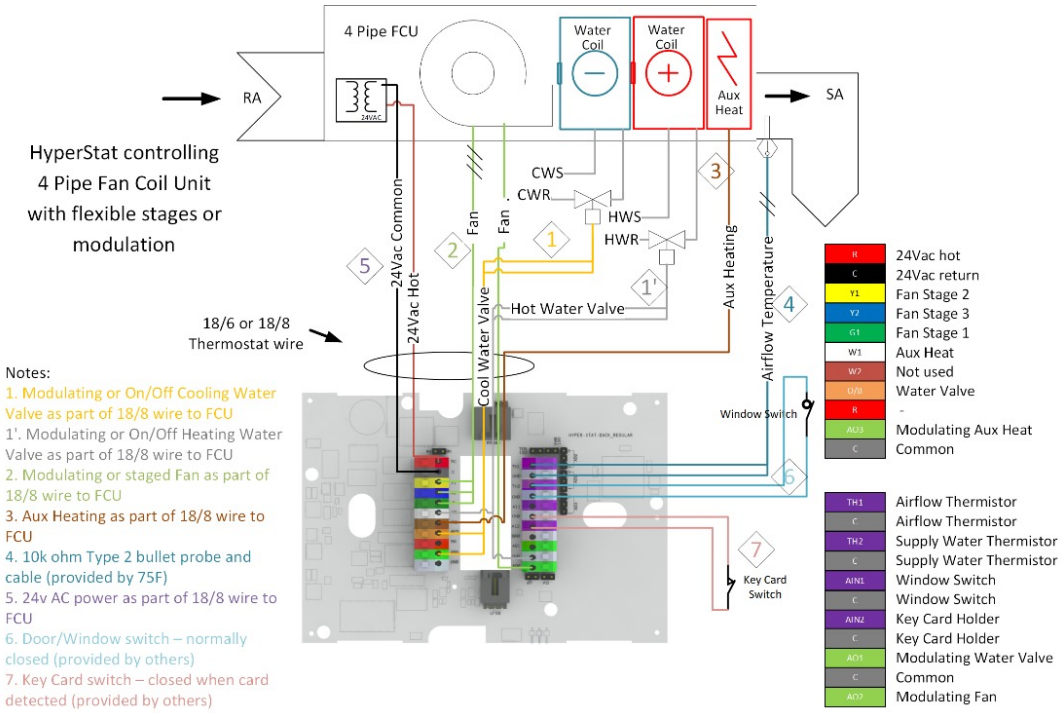
TYPICAL BILL OF MATERIAL

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



For 2-pipe FCUs, unit ventilators, and induction units select the 2-pipe FCU profile to obtain the required sequence:

- (6) 24V AC Relays, assigned to any of these:
  - Fan low speed
  - Fan medium speed
  - Fan high speed
  - Auxiliary heating
  - Water valve
  - Fan enable
  - Occupied enable
  - Humidifier
  - Dehumidifier
- (3) 0-10V DC Analog Outputs, assigned to any of these:
  - Demand-control ventilation
  - Cooling water valve
  - Fan speed
  - Heating water valve
- (2) Connectors
  - (1) 4-Pin Digital Bus (RS-485) interface: BACnet MSTP or Modbus RTU interface
  - (1) 3-Pin Digital Bus: ClimaVision digital sensors such as Wall Sensor (up to four daisy chained)
- (2) Thermistors
  - TH1: monitor supply air temperature
  - TH2: monitor supply water temperature
- (2) Analog Inputs
  - Current transformer (0-10Amps)
  - Current transformer (0-20Amps)
  - Current transformer (0-50Amps)
  - Key card sensor (setback)
  - Door / window sensor (system off)



For 4-pipe FCUs, select the 4-pipe FCU profile to obtain the required sequence:

- (6) 24V AC Relays, assigned to any of these:
  - Fan low speed
  - Fan medium speed
  - Fan high speed
  - Hot water valve — energize in heating
  - Chill water valve — energize in cooling
- (3) 0-10V DC Analog Outputs:
  - Cooling
  - Fan speed
  - Heating
- (2) Connectors
  - (1) 4-Pin Digital Bus (RS-485) interface: BACnet MSTP or Modbus RTU interface
  - (1) 3-Pin Digital Bus: ClimaVision digital sensors such as Wall Sensor (up to four daisy chained)
- (2) Thermistors
  - TH1: monitor supply air temperature
  - TH2: monitor supply water temperature
- (2) Analog Inputs
  - Current transformer (0-10Amps)
  - Current transformer (0-20Amps)
  - Current transformer (0-50Amps)
  - Key card sensor (setback)
  - Door / window sensor (system off)