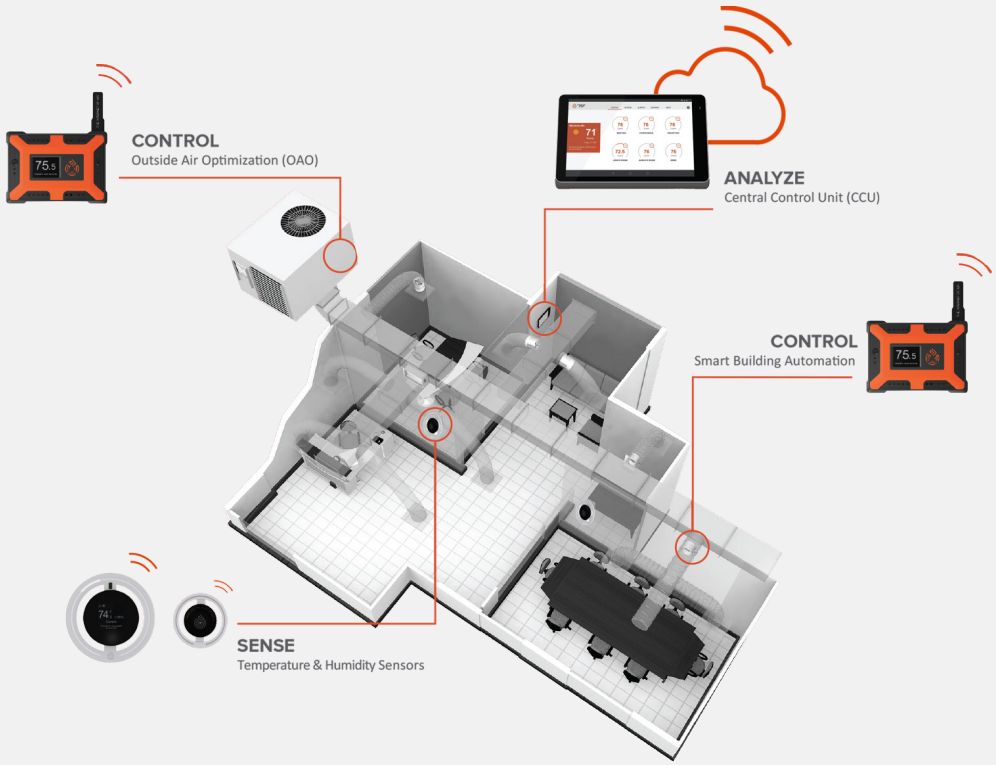
75F® Dynamic Airflow Balancing™

Save energy and provide comfort



APPLICATION OVERVIEW

75F Dynamic Airflow Balancing (DAB) is a proactive zone control system that remotely monitors and controls conditions in individual spaces for superior comfort and efficiency. Predictive machine learning algorithms optimize heating and cooling capacity by redirecting conditioned air to the spaces that need it most, a strategy that multiple third-party, independent tests prove can lower utility cost by between 26 and 45 percent. The DAB design is fine grained, so every space gets its own individual temperature control.

With these tools, building engineers who implement 75F's DAB technology can expect vastly improved energy efficiency, occupant comfort, and productivity. These advantages are accessible to a wide variety of commercial buildings thanks to a full-stack solution that works out of the box, scalability across a range of central plant equipment and site footprints, and intuitive and user-friendly tuners like zone prioritization for hassle-free operation.

FEATURES

- Compatible with equipment from simple RTUs to advanced hybrid AHUs
- Indoor Air Quality (IAQ), CO_2 and occupancy control
- Dynamic Zone Priority setting
- Wireless installation and 900mHz wireless mesh network
- Integration with 75F Facilisight web portal and the 75F Occupant App

ADVANTAGES

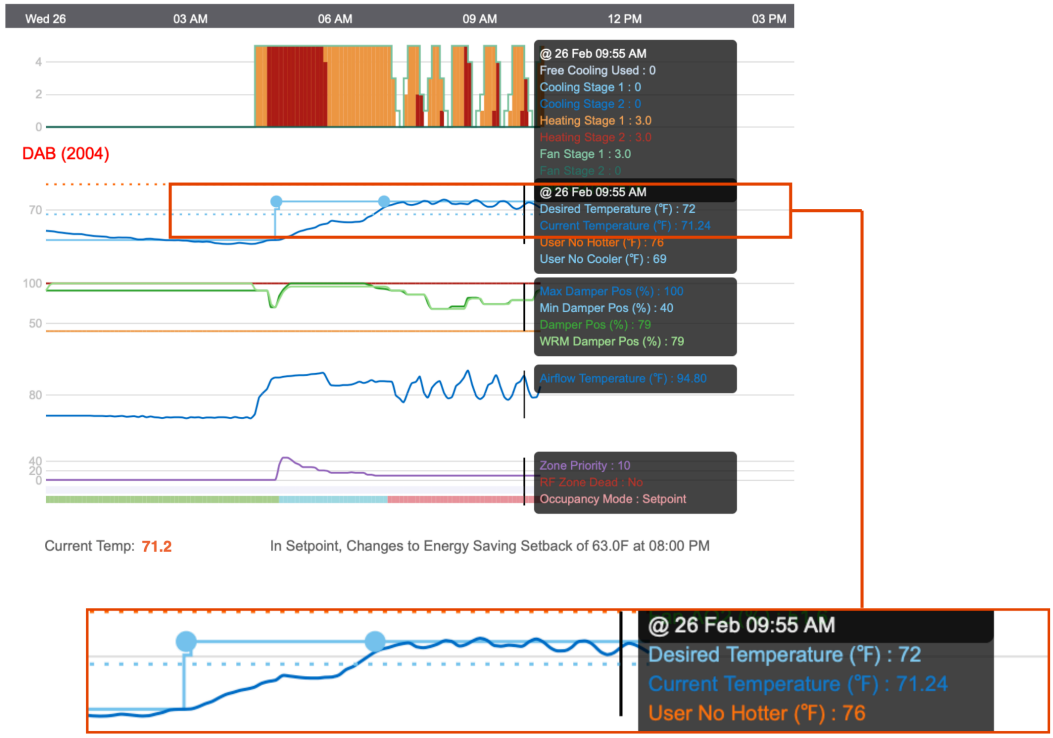
- Energy savings of up to 45 percent compared to traditional systems
- Enhanced IAQ Management and comfort
- Connected sensors eliminate hot and cold spots before they occur
- Easy-to-use interface with zero programming required
- Remote configuration and easy scheduling
- Out-of-the-box install, but advanced zone controls that scale

HOW IT WORKS

Dynamic Airflow Balancing is a full-stack solution, with components that include sensors connecting to 75F Athena for cloud analysis, A 75F Central Control Unit (CCU) as a supervisor with built-in wall interface, 75F Smart Nodes as terminal equipment controllers, 75F Dampers or third-party units in various configurations, and Facilisight, 75F's building intelligence suite of web and mobile apps for secure remote monitoring and control.

75F's wireless sensors, placed in each zone, capture thousands of data points a minute and millions of data points daily on temperature and humidity. Via a 900 MHz wireless mesh network, these sensors upload to 75F Athena and a dynamic thermal model of your space in the cloud. Athena's algorithms include a live weather stream and forecast data so 75F can predict optimal control strategies. Each zone is configured for parameters such as size of damper and the min/max damper positions for tracking in the algorithms. After a few days, the 75F technology can very accurately anticipate heat loads and can use that information to predictively and proactively control the temperature and air volume in the zones or offices of a building.

This information is combined with pre-determined zone priorities and setpoints (such as desired temperature and relative humidity), to make decisions every minute at the 75F Central Control Unit. If Athena determines the optimal scheduling for a building at any point in time, the CCU delivers instructions on how equipment should operate back over the mesh network and monitors the efficiency and comfort of the HVAC system. In addition, the CCU controls the AHU heating, cooling, and fan speeds either physically or via an API.



75F's Smart Nodes receive instructions on damper position and make micro adjustments continuously, redistributing or balancing airflow dynamically to the zones that need it most.

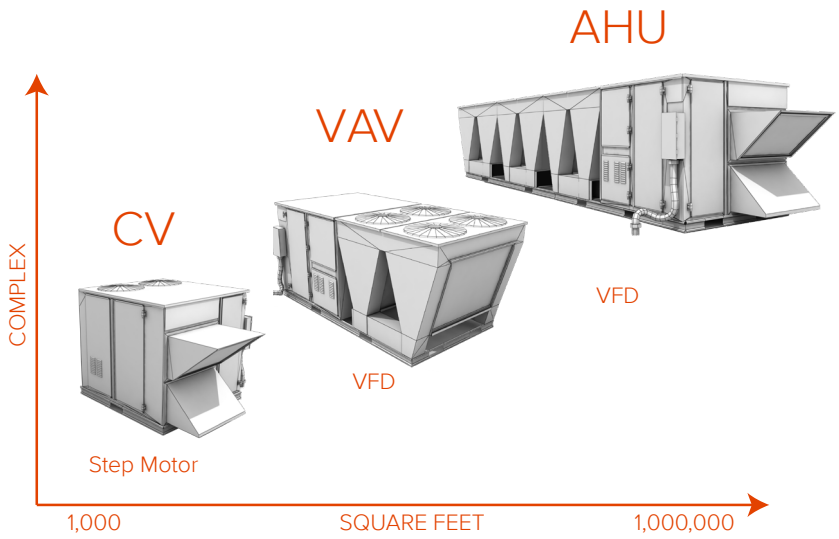
Each building zone contains one damper that controls the flow of conditioned air into that zone. These can be radial, rectangular, or butterfly in configuration, and can have 0-10, 2-10, 10-0, or 10-2 volt modulating actuators. A 10K thermistor is added to provide precise airflow temperature. Each damper receives 24V AC power and sensors for room and duct temperatures. If a 75F Smart Node is connected to a sensor that detects CO_2 and that mode is enabled, damper positions will increase when CO_2 levels are above the threshold automatically.

With Dynamic Airflow Balancing from 75F, heating and cooling capacity is optimized by redirecting conditioned air. No master electrician is needed and no programming is required. Because 75F DAB is a wireless solution, there is no pulling communication lines, and installation is faster and less invasive than other systems on the market today. Dynamic Airflow Balancing is an affordable and effective option for retrofits or other dynamic indoor environments.

ENERGY EFFICIENCY THAT SCALES

Traditional HVAC systems are balanced with manual dampers for peak cooling and peak heating loads. This causes occupant discomfort and inefficient or labor-intensive service for significant portions of the year, and requires constant adjustment in cases of partial or reduced occupancy. Instead of balancing systems twice a year, 75F automatically optimizes airflow to dynamically meet current building conditions. We call this a continuous commissioning process: constantly rebalancing airflow in order to optimize both comfort and energy savings.

Dynamic Airflow Balancing scales from simple rooftop units (RTUs) to air handling units (AHUs) with variable-frequency drive (VFD) fans connected to a central plant. DAB is ideally suited for multizone AHUs and packaged RTUs where zone reheat is not available. Buildings with terminal air handling equipment with reheat capability should use 75F's Variable Air Volume (VAV) application.



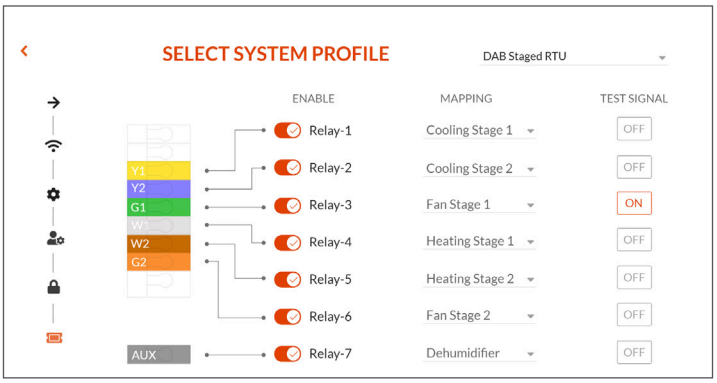
In a unitary system, DAB works out of the box to stage fan speed to airflow requirements in the system based on thermodynamic calculations and continuously redirects air. In a variable air volume system with staged heating or cooling, VFD frequencies are automatically set to best match the required stage. For built-up AHUs with chilled water and/or hot water coils and variable frequency drives, DAB resets temperature at the air handler to an optimum value for load calculations.

The following four profiles are available for pre-configured sequences of operation for common HVAC equipment types. All these profiles are compatible with the 75F Outside Air Optimization (OAO) application to upgrade economizers and outside air dampers and exhaust systems.

STAGED RTU

In applications where buildings use a staged RTU, the CCU provides up to seven 24v relays that control the RTU. Relays may be mixed as required with a max of five stages for cooling, heating, or fan each. By default, the system is set up as two-stage cooling, two-stage heating, two-stage fan.

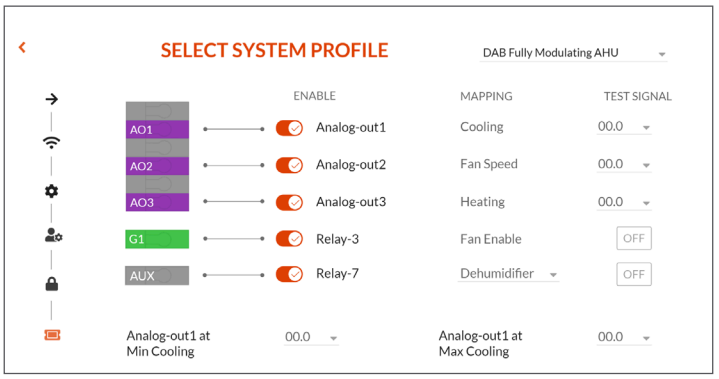
This profile is typically used for packaged RTUs and split systems with up to five stages of DX cooling.



FULLY MODULATING AHU

When applied to a fully modulating AHU, the CCU provides three separate 0-10v analog signals that control the AHU. These separate analog signals include cooling, fan speed, and heating.

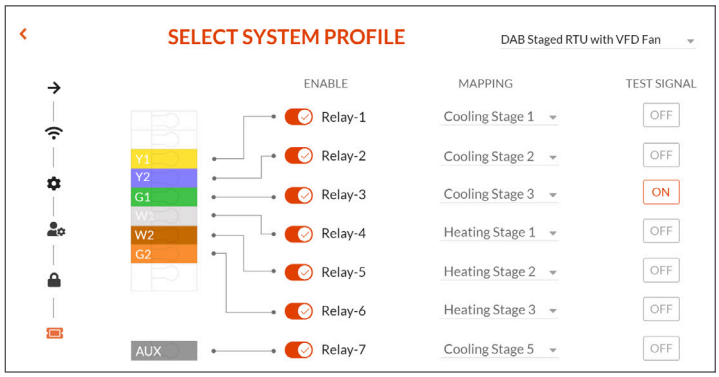
Typical application is a built-up air handler with hot water coil and valve, chill water coil and valve, and VFD fan.



STAGED RTU with VFD FAN

When applied to a staged RTU with VFD fan, the CCU provides up to seven 24v relays that control the RTU. 0-10v analog signals control the speed of the VFD driving the fan.

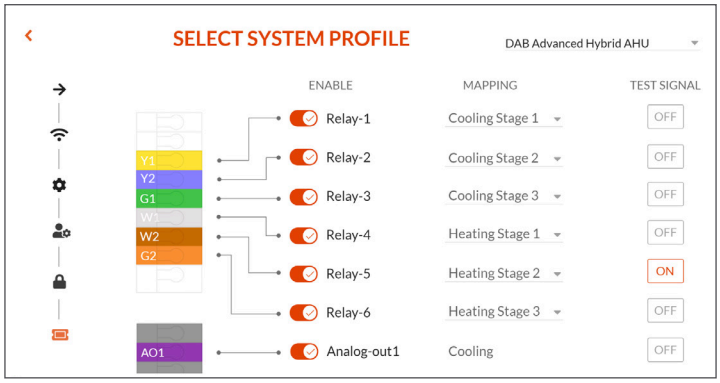
This profile is typically used when a packaged RTU has been upgraded from a step-motor to VFD. The VFD frequency is optimized for each stage of the RTU with an optional minimum fan speed selection.



ADVANCED HYBRID AHU

For the most advanced or hybrid AHU's, the CCU provides up to seven 24V relays that control the AHU itself. In addition, three separate 0-10V analog signals can be used to control the AHU as well. These separate analog signals include cooling, fan speed, and heating.

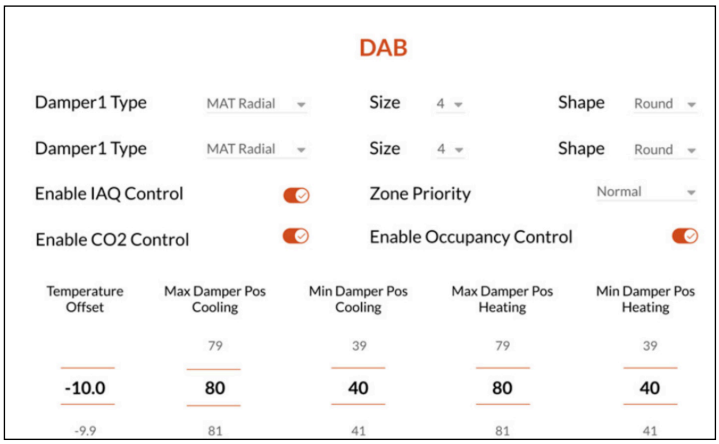
This profile is used anywhere where the AHU has a combination of staged equipment and modulating equipment.



TUNERS AND ADJUSTMENTS

DAB uses weighted averaging to calculate the system load. This factors the difference between a zone's current temperature and desired temperature via weightedAverageLoad which is measured as follows:

weightedAverageLoad =
((zone1CoolingLoad*zone1DynamicPriority
+ zone2CoolingLoad*zone2DynamicPriority …
) - (zone1HeatingLoad*zone1DynamicPriority
+ zone2HeatingLoad*zone2DynamicPriority …)) /
(zone1DynamicPriority + zone2DynamicPriority…)



As you can see above, the parameter of Dynamic Priority is an essential input to the DAB system. Zones may be assigned different priority levels: low, medium, high, or no priority by users, and will change dynamically in normal operation based on the how far the current temperature is from the desired temperature in the space. By default the dynamic priority will multiply by 1.3 for every multiple of zoneLoad. This is because occupants in a zone that is farther away from a desired temperature take priority otherwise and are exponentially more likely to feel uncomfortable.

Just as zones that are farthest away from a desired setpoint have more influence on the load calculation, building engineers or managers can easily influence this same calculation manually using DAB's input parameters in the tuning menu. In addition to zone priority, these inputs include adjustments to desired setpoints for heating and cooling.

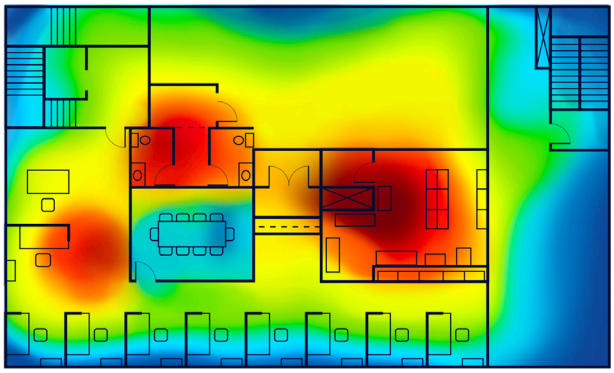
Selections can also be made to enable CO_2 and IAQ control where available. If the Smart Node is connected to a sensor delivering VOC or CO_2 values, minimum damper position will be increased whenever those levels move above a threshold. This results in significant improvements in air quality and productivity. Similarly, if Occupancy Control is enabled and

movement is detected by a sensor during a time when a zone is scheduled to be unoccupied, the system will go into a forced occupancy mode. If instead there is a lack of movement during an occupied period in any zone the system will recognize the partial occupancy or lack of occupancy in the zone or building and will move into a setback of two degrees by default unless otherwise specified.

Should temperatures in any zone surpass preset building limits at any point, an Emergency Breach function will activate and begin cooling the zone regardless of zone priority. Alerts will be sent to facility managers as well.

By adding tuners and preset functions to system load calculations, software does the work of optimizing and adjusting buildings instead of technicians on ladders. Rather than manually trying to balance rooms or zones with changing occupancy and loads throughout the day, facility managers log in from the CCU or any connected device and assign executive offices a higher zone priority than a rarely used conference room. They might enable Occupancy Control to take advantage of OPEX savings when a building is experiencing high turnover or periods of partial use. All these features work out of the box in a DAB application.

Facility managers have portfolio-wide control over all parameters remotely and can view their building performance in real time via 75F's building intelligence suite of web and mobile apps, Facilisight.



Before 75F

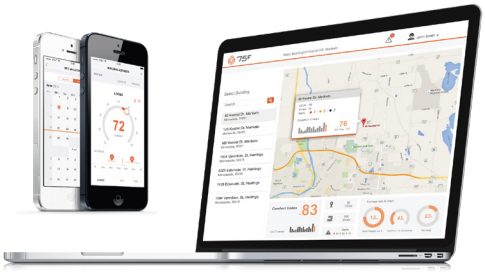
After 75F

Dynamic Airflow Balancing from 75F brings superior comfort and efficiency to customers and predictive and proactive control to commercial buildings in warmer climates or without simultaneous cooling and heating requirements. See Variable Air Volume from 75F for these application types. 75F's Outside Air Optimization can be added to further increase the efficiency of rooftop equipment and maximize the use of fresh outside air inside the building envelope. DAB leverages the power of the cloud as well as the benefits of remote monitoring and control to deliver a uniquely high-value, high-tech solution that is faster to install, easier to operate, and offers better energy savings, IAQ, and scheduling compared to other zone control systems.

COMPONENTS OF DAB

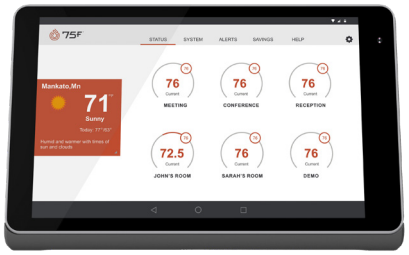
75F Dynamic Airflow Balancing includes the 75F Facilisight & Occupant App, a 75F Smart Node, and a 75F Central Control Unit – plus, one 75F sensor and one 75F damper of your choice from the above options.

INCLUDED



75® Facilisight™ & Occupant App™

75F® Smart Node™



75® Central Control Unit™

CHOOSE ONE

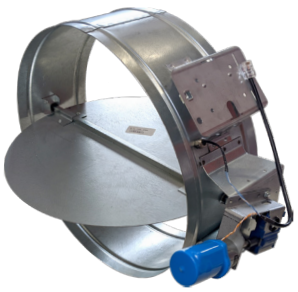
75F® Flush Sensor™

75F® Ceiling Sensor™

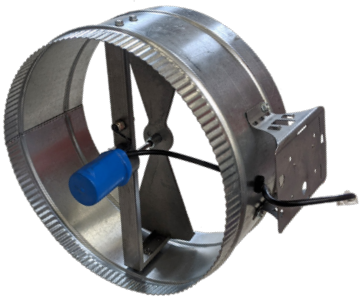
75F® Wall Sensor™

75F® Local Interface Sensor™

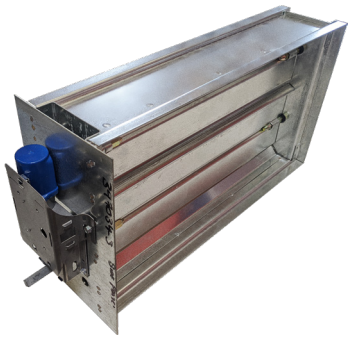
CHOOSE ONE



75F® Single Blade Damper™



75F® Rotary Damper™



75F® Rectangular Damper™

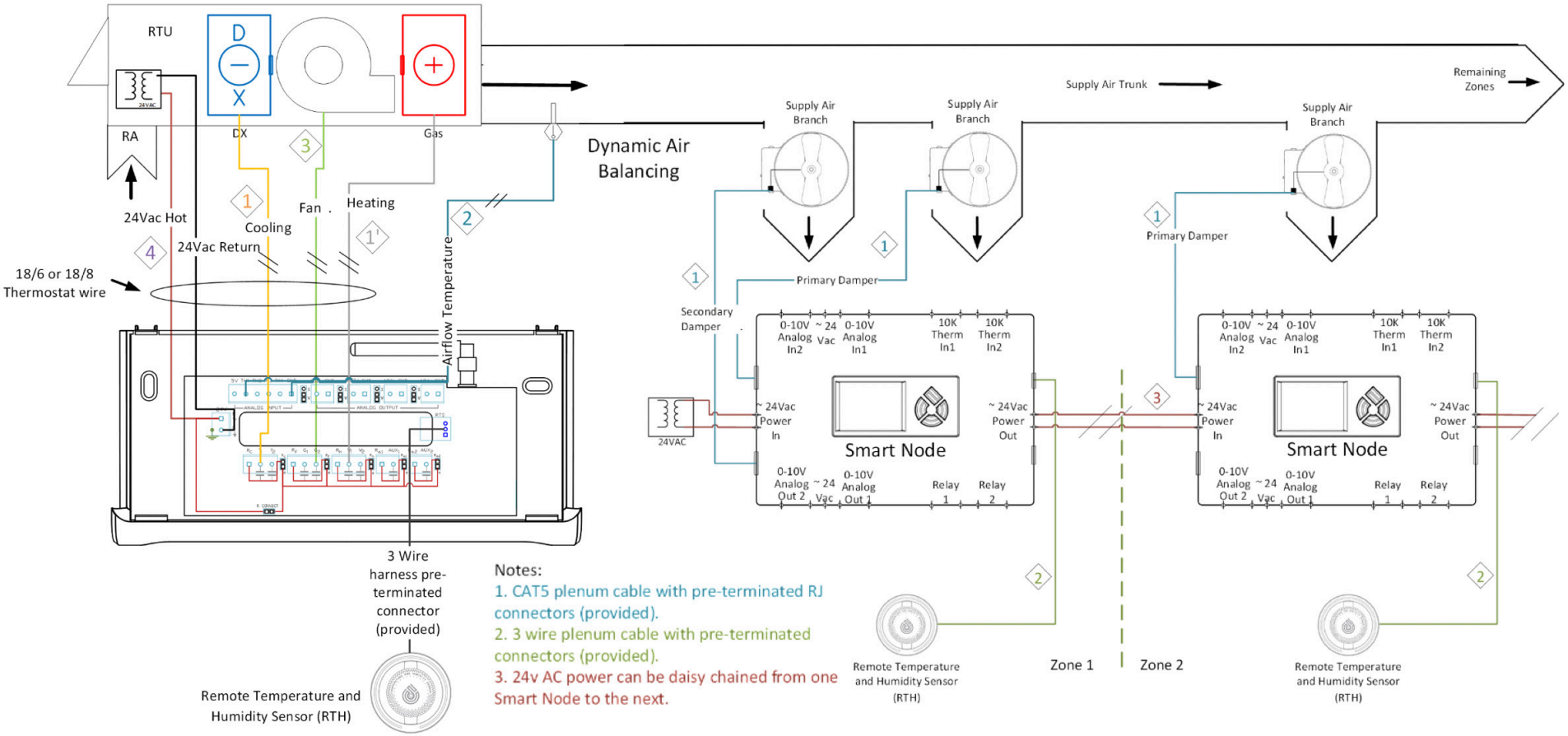
KIT OPTIONS

TYPE	PRODUCT NAME	DESCRIPTION
Standard	Smart VAV, Wall Mount	Smart Node, 30’ cable, Wall Sensor
Alternate	Smart VAV, Ceiling Mount	Smart Node, 30’ cable, Ceiling Sensor
	Smart VAV, Flush Mount	Smart Node, 30’ cable, Flush Mount Sensor
	Smart VAV, Wall Mount, White	Smart Node, 30’ cable, Wall Sensor, White
	Smart VAV, Local Interface Sensor	Smart Node, 30’ cable, Local Interface Sensor
Optional	Actuator	Damper actuator, LMB24-SR-T

CONNECTIVITY

Central Control Unit (CCU) controlling Staged Rooftop Unit

Notes:
1. Cooling stage 1/2 relay as part of 18/8 wire to RTU
1' Heating stage 1/2 relay as part of 18/8 wire to RTU
2. 10k ohm bullet probe and cable (provided by 75F)
3. Fan call relay as part of 18/8 wire to RTU
4. 24v AC power as part of 18/8 wire to RTU



Notes:
1. CAT5 plenum cable with pre-terminated RJ connectors (provided).
2. 3 wire plenum cable with pre-terminated connectors (provided).
3. 24v AC power can be daisy chained from one Smart Node to the next.