Contents

Introduction (Older Systems)

Typical inexpensive light-commercial systems often consisted of an **RTU (Roof Top Unit)** or **HPU (Heat Pump Unit)** packaged unit with a number of **VVT (Variable Volume and Temperature)** or **CAV (Constant Air Volume)** zones. Such systems were often found in small- to medium-sized office buildings, restaurants, and similar buildings.

CAV systems were challenged by varying conditions. Varying occupancy or outside conditions often led to spaces that became too hot or cold for long periods of time. CAV systems, to maintain a minimum flow across the coils as demands from the local zones varied, were made somewhat "variable volume" by dumping a portion of the air through a pressure-controlled bypass damper into the return air stream.

A better approach was a low-priced **pressure-dependent VAV (Variable Air Volume)** system. It compensated for varying conditions, although consistent control was still a challenge. The operation of one damper was affected by the actions of dampers in other zones, and no minimum air flows into the spaces were maintained. As one zone was satisfied, and its damper closed completely, other zones would suddenly have more air flow. This would often overcool the other spaces before the system would compensate. And without a minimum air flow, the first space could get too warm and stuffy before the system finally responded. Setup of these systems was always a challenge, especially when operating during seasonal changeover and when the spaces were subjected to variations in occupancy and other common tenant conditions.

NOTE: For illustrations and more information about these issues, see the **VAV Zoning Made Easy White Paper**.
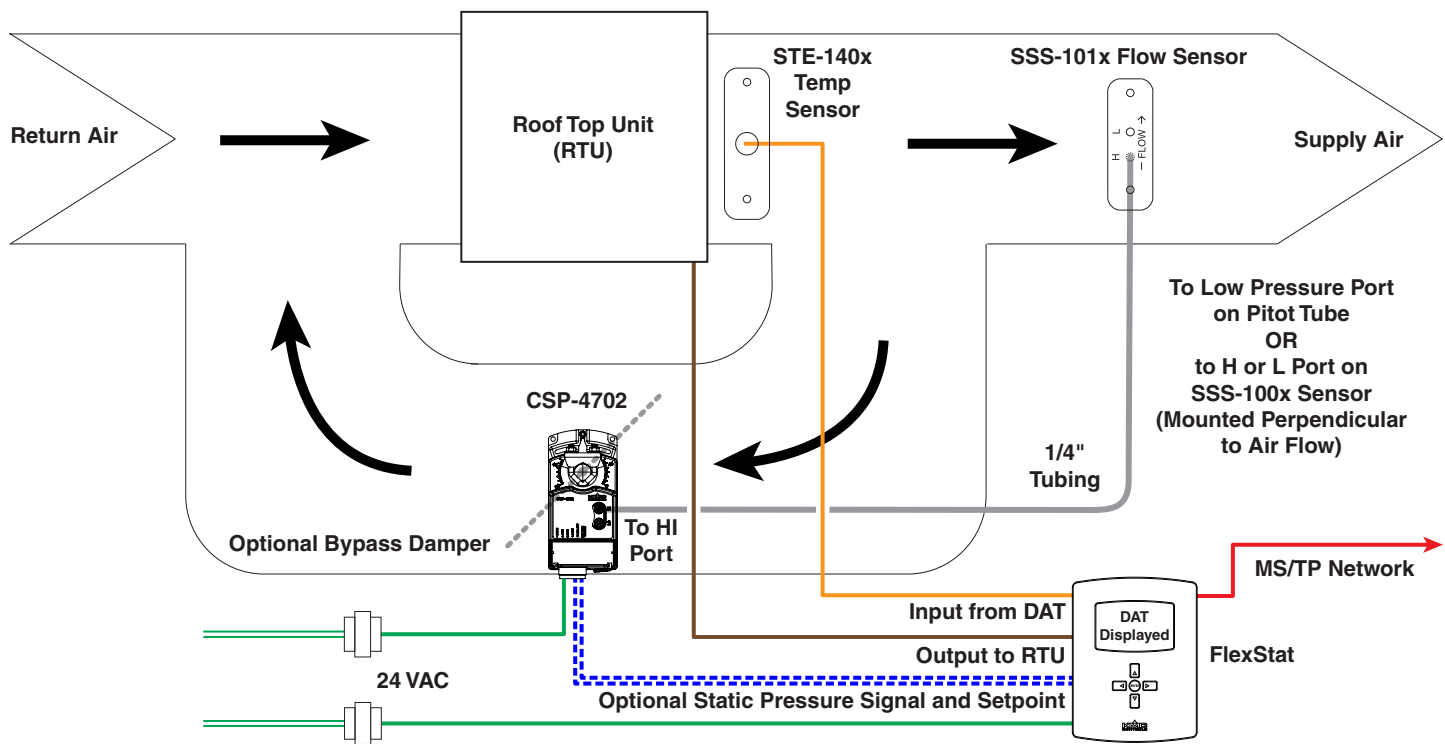
Retrofits for Building Automation

A notably improved system for retrofitting older systems or installing new light-commercial zoning systems is the **ZEC (Zone Equipment Control)** system. This consists of a **BAC-120063CW-ZEC** (a special model of KMC's FlexStat™ unitary controller) along with KMC **SimplyVAV™** controllers for **pressure-independent VAV** control in their respective zones. (See the illustrations on the following pages.)
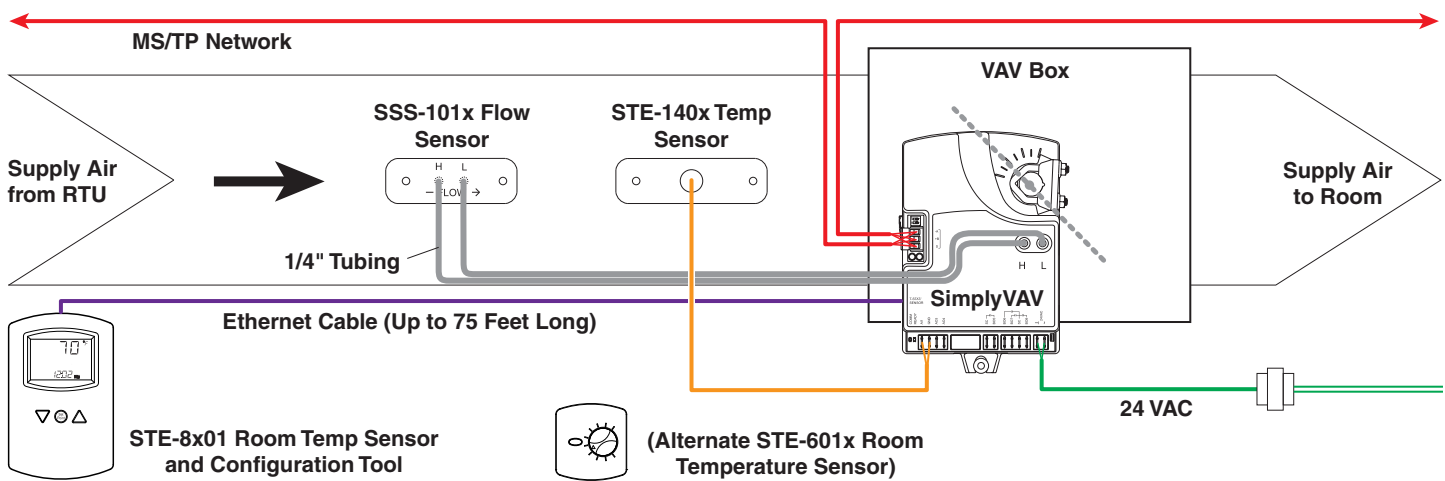
For control of common commercial packaged unitary equipment, up to 16 zones, with 16 SimplyVAV controllers, can work in conjunction with the BAC-120063CW-ZEC model FlexStat controlling an HPU or RTU (or Air Handling Unit, which is wired on the ZEC FlexStat the same as an RTU). The ZEC FlexStat automatically switches between heating and cooling control of the HPU/RTU/AHU based on local zone demands. The ZEC FlexStat automatically discovers and communicates with the associated SimplyVAV controllers via the integral BACnet MS/TP network. This provides integration of the entire system.

Additionally, the ZEC FlexStat controller can provide a 2–10 VDC static pressure setpoint signal to an optional KMC **CSP-4702** pressure controller used with a unitary system that has pressure bypass control.

This model of FlexStat comes preconfigured, and if the defaults describe your equipment, the occupancy schedule is the only required configuration needed after mounting and wiring. The schedule is easily created via the FlexStat's on-screen menu. The FlexStat also provides zone status and trends.

Return Air

Roof Top Unit (RTU)

STE-140x Temp Sensor

SSS-101x Flow Sensor

Supply Air

To Low Pressure Port on Pitot Tube
OR
to H or L Port on SSS-100x Sensor (Mounted Perpendicular to Air Flow)

1/4" Tubing

CSP-4702

Optional Bypass Damper

To HI Port

MS/TP Network

Input from DAT

DAT Displayed

Output to RTU

FlexStat

24 VAC

Optional Static Pressure Signal and Setpoint

RTU (with Optional Bypass) Control

MS/TP Network

VAV Box

SSS-101x Flow Sensor

STE-140x Temp Sensor

Supply Air from RTU

Supply Air to Room

1/4" Tubing

SimplyVAV

H   L

Ethernet Cable (Up to 75 Feet Long)

24 VAC

STE-8x01 Room Temp Sensor and Configuration Tool

(Alternate STE-601x Room Temperature Sensor)

Typical VAV Zone (1 of up to 16)

With no software required, the ZEC system is quick and user-friendly to install and configure. Yet it also communicates with any Building Automation System using a BACnet network for monitoring and additional control options.

An **STE-8000** series digital room sensor reads the varying environmental conditions in that zone, and it is also the only tool needed to configure and balance the SimplyVAV controller.

A local pressure-dependent zone is converted to pressure-**in**dependent operation with the insertion of a KMC **SSS-101x** differential pressure flow sensor, and with the local zone operated by the SimplyVAV terminal unit controller. Pressure-independent operation compensates for the varying needs of the local zones while also compensating for operations in other zones. Damper position is controlled for space environmental conditions **and** differences in duct pressure.

Adding an **STE-140x** DAT (Discharge Air Temperature) sensor provides changeover capability for heating and cooling control.

For more information about easily converting CAVs and VVTs to pressure-independent VAV systems, see the following documents on the **BAC-120063CW-ZEC** product page:

- VAV Zoning Made Easy White Paper
- BAC-120063CW-ZEC Data Sheet
- BAC-120063CW-ZEC Installation and Configuration Guide
- BAC-120063CW-ZEC Operation and Schedules Quick Reference Guide

See also the video **Performing a VVT Retrofit with KMC Controls** on **KMC's YouTube channel**.
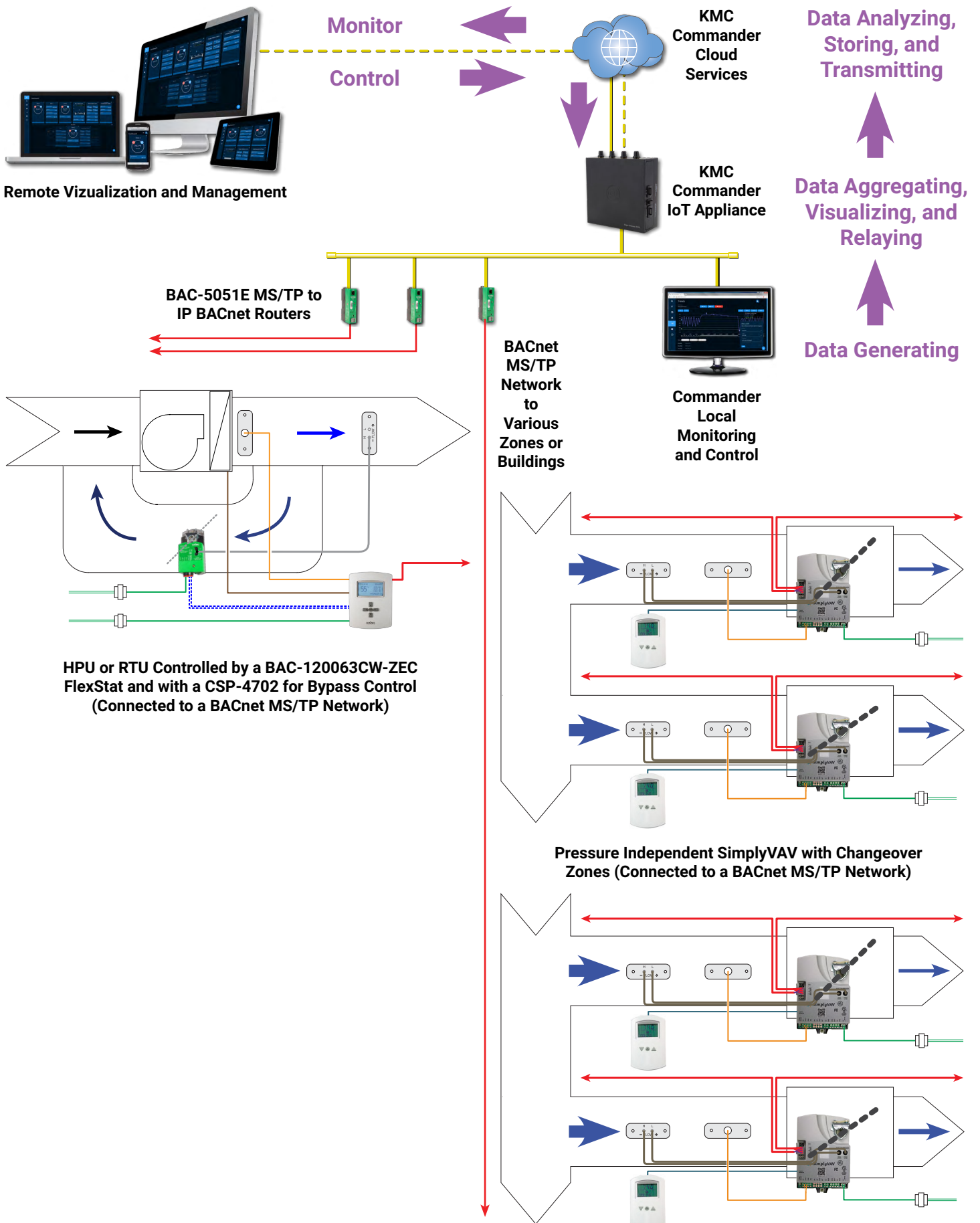
Retrofits for the Information Age

Besides stand-alone or local network operation, KMC also offers an IoT (Internet of Things) solution for advanced analysis, monitoring, and control of a system either locally or remotely. **KMC Commander**® is a next-generation IoT (Internet of Things) solution that connects your building and other devices to the cloud and provides meaningful data in real-time to your PC or mobile device. The KMC Commander platform is an out-of-the-box solution (consisting of IoT enabled hardware plus software and cloud services) to visualize, connect, and manage energy, building, and other systems. From a mobile device in the palm of your hand, you can analyze and act on your building data with this IoT platform, purpose-built for building and industrial automation.

For just one example of a zoning VAV system with IoT connectivity, see **Sample Installation on page 5**. For KMC Commander installation instructions, see **KMC Commander IoT Setup on page 6**.

Sample Installation

Monitor

Control

KMC Commander Cloud Services

Data Analyzing, Storing, and Transmitting

Remote Vizualization and Management

KMC Commander IoT Appliance

Data Aggregating, Visualizing, and Relaying

BAC-5051E MS/TP to IP BACnet Routers

BACnet MS/TP Network to Various Zones or Buildings

Commander Local Monitoring and Control

Data Generating

HPU or RTU Controlled by a BAC-120063CW-ZEC FlexStat and with a CSP-4702 for Bypass Control (Connected to a BACnet MS/TP Network)

Pressure Independent SimplyVAV with Changeover Zones (Connected to a BACnet MS/TP Network)

KMC Commander IoT Setup

Discovery with the Zoning Autobuilder Add-On

In addition to its normal capabilities, KMC Commander has an optional add-on in Network Explorer to further simplify setting up IoT functions for a zoning system. The VAV zoning autobuilder add-on license (**CMDR-LIC-ZONING**) is an additional purchase from KMC Controls. (Contact KMC Controls for information about obtaining the license.)

For the automated features in the add-on to work properly, the zoning system must be installed with the proper addressing. (See the **BAC-120063CW-ZEC FlexStat Installation and Configuration Guide** for instructions.) For example, an RTU/AHU/HPU with 16 zones of SimplyVAV controllers could use device instances of 1000000 (for the ZEC FlexStat controlling the RTU/AHU/HPU) and 1000001 through 1000016 for the SimplyVAV controllers.

Once discovered, the autobuilder will automatically give an **ahu** tag to a device having a bacnetInstanceId with one of these addresses:

- 1000000
- 2000000
- 3000000
- 4000000

Once discovered, the autobuilder will automatically give a **vav** tag to a device having a bacnetInstanceId with one of these addresses:

- 1000001 through 1000016
- 2000001 through 2000016
- 3000001 through 3000016
- 4000001 through 4000016

NOTE: For best performance if multiple ZEC FlexStats are in a project, create a different network for each ZEC FlexStat AHU (and its associated SimplyVAV controllers). The autobuilder supports up to **ten** separate ZEC FlexStat zoning networks. Select the autobuilder on only one network at a time. Deselect the autobuilder on a network after a successful build.

NOTE: **Running a network's autobuilder again will delete the autobuilder's previously discovered network devices and build on that network!** After a successful build with all desired ZEC FlexStat and SimplyVAV controllers, deselect the autobuilder on that network to avoid any accidental deletions. **To add additional, other devices on that network, use the regular discovery** and manual creation of cards, alarms, schedules, and trends, using the autobuilt equivalents as models.

NOTE: For general installation procedures, customization, and other information about KMC Commander, see the **KMC Commander Installation Guide**.
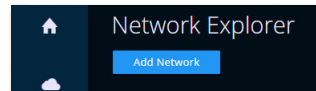
To use the Zoning autobuilder add-on:

1. Log into the project on **app.kmccommander.com**.

NOTE: Although the autobuilder can also be run from the local KMC Commander appliance/gateway, it is optimized to run from the cloud.
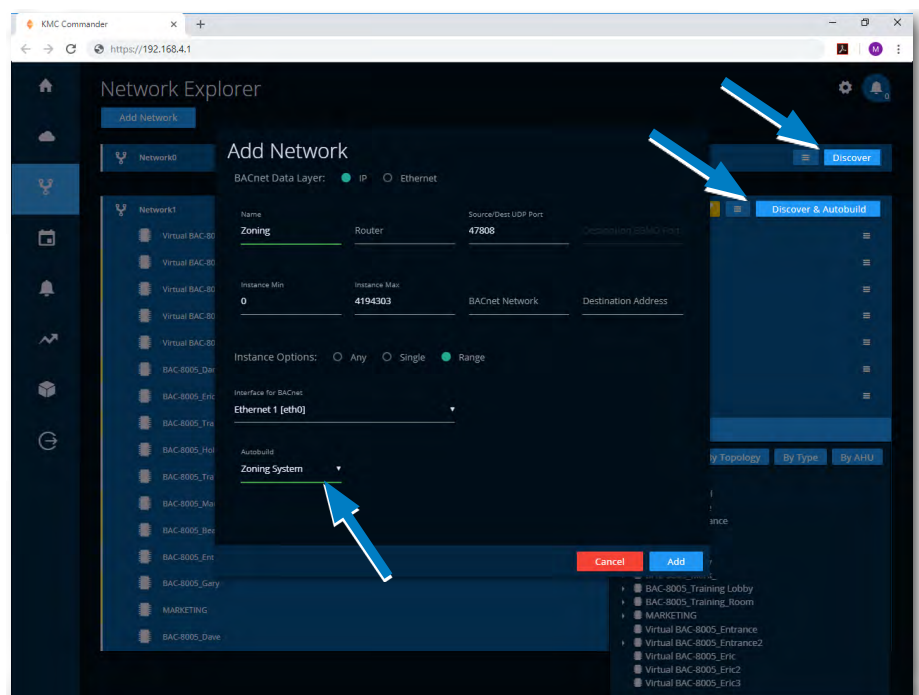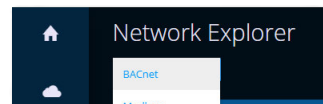
2. Click the **Network Explorer** button (third icon in the left column).
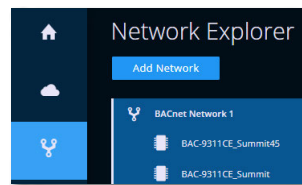
3. Click the **Add Network** button.

4. Click **BACnet**.

NOTE: An Autobuild drop-down selector is at the bottom of the Add Network dialog box. With the additional purchased license and **Zoning System** selected, the usual **Discover** button will be changed to **Discover & Autobuild**. Select Zoning System for automated discovery and building of a zoning system.

NOTE: To add **non-**zoning equipment, create a new network and select **None**. The **Discover** button will remain unchanged.

5. In the Add Network dialog box, select **IP** or **Ethernet**.

6. Enter the network **name** and **address** information.

NOTE: Network information is dependent on the site survey and the building's IT.

7. Select and enter desired Instance Options.

NOTE: **Entering a known range of zoning device instances will speed up the later discovery process and might prevent timing out on a large network.** If devices are not found as expected, try narrowing the range, expanding the range, or selecting Any.

8. Click the **Add** button (or the **Update** button when editing the options).

9. Click the **Discover & Autobuild** button.
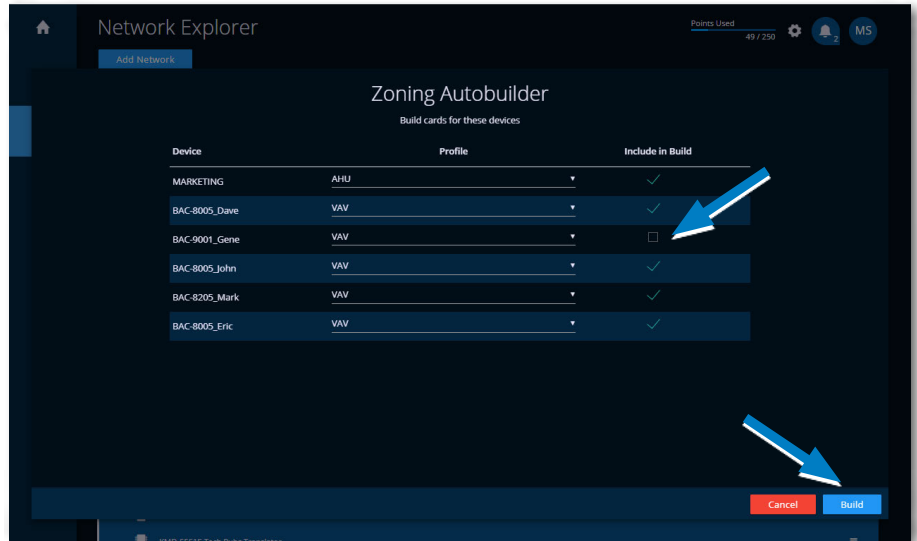
10. For any discovered devices that should **not** be included, **un**check their Include in Build check boxes.

11. Click the **Build** button.

NOTE: Allow plenty of time for the build function. It automatically creates a network with cards, alarms, trend, and schedule. The build for a large network might take many minutes. When the build is complete, "Build finished. Redirecting to dashboard..." will flash in Network Explorer, and (after a moment) the screen redirects to the Dashboard.

NOTE: For information on **editing** the automatically generated cards, trends, alarms, and schedules as well as **creating** additional ones, see the relevant sections in the **KMC Commander Installation Guide**.

12. After a successful build (with all desired ZEC FlexStat SimplyVAV cards, schedule, trend, and alarms created), **deselect** the autobuilder in that network.

NOTE: To add additional, other devices on that network, use the regular discovery and manual creation of cards, alarms, schedules, and trends, using the autobuilt equivalents as models.

Cards and Deck on the Dashboard
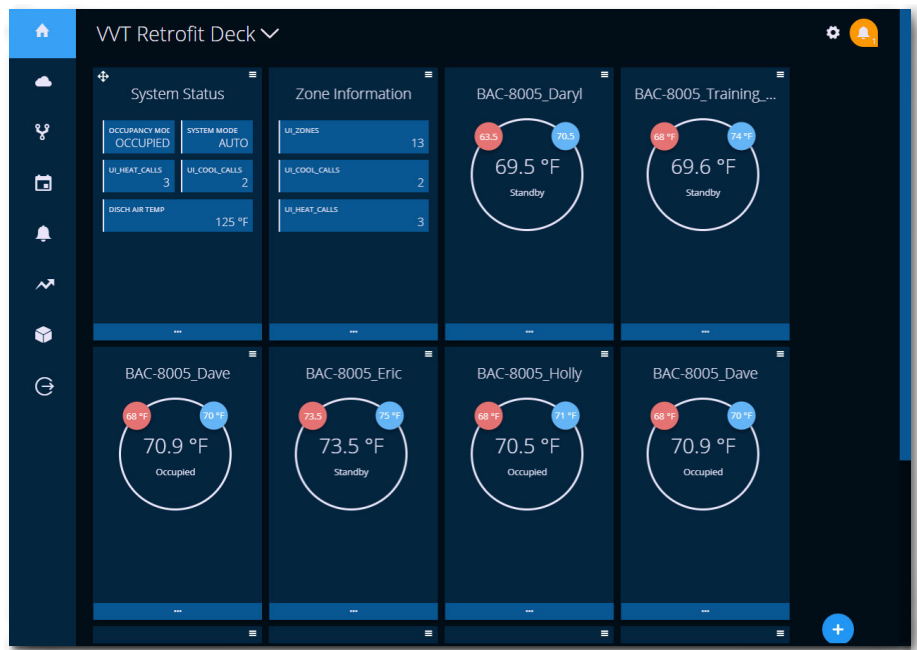
When the build is complete, the following **cards** will be available on the new deck of the Dashboard:

System Status (AHU/RTU/HPU)

- Occupancy Mode (BV1)
- System (heating, cooling, or auto) Mode (MSV7)
- Cooling Calls (AV24)
- Heating Calls (AV25)
- Discharge Air Temperature (AI2)

Zone Information (AHU/RTU/HPU)

- Number of Zones Online (AV22)
- Cooling Calls (AV24)
- Heating Calls (AV25)

Thermostat (each included VAV)

- Space Temperature (AV1)
- Active Cooling Setpoint (AV3)
- Active Heating Setpoint (AV4)
- Occupancy Mode (MSV1)

NOTE: Clicking on a writable point (e.g., setpoint) allows the changing of the value with a specified write priority and timeout.

NOTE: Clicking the ellipses (...) at the bottom of the card, flips the card to show the point IDs, names, and current values of these and additional objects.

NOTE: See the **Dashboard (Home Screen) Configuration** sections in see the **KMC Commander Installation Guide** for more information about cards and decks.

Alarms
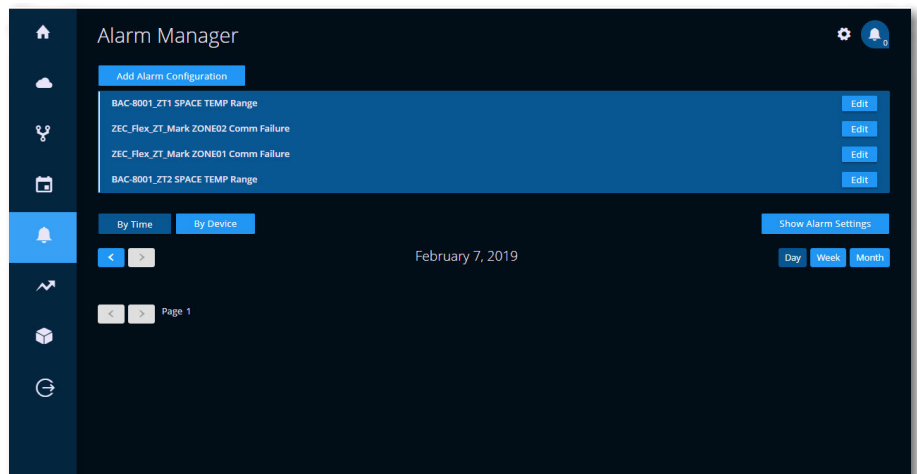
In Alarm Manager, after the build, each SimplyVAV controller will have two **alarms** for:

- **Space temperature** (at the SimplyVAV controller's sensor) outside the allowed range (plus or minus 11 degrees from 70 degrees for 300 seconds or more is the default).
- **Loss of communication** between a SimplyVAV controller and the ZEC FlexStat (for more than 300 seconds is the default).

NOTE: The alarm name begins with the Device Name of the respective ZEC FlexStat or SimplyVAV. The alarms can be edited and renamed as desired.

NOTE: No alarm is automatically created for loss of communication between the ZEC FlexStat and KMC Commander.

NOTE: Network Explorer and the Dashboard also indicate communication failures. In Network Explorer, "Device not communicating" will appear when hovering over a device that is offline. Dashboard cards indicate "Point not communicating" when hovering over a point that is offline or incorrectly configured.

NOTE: In the ZEC FlexStat, the MSVs **MSV2x ZONE0x_CALL** for each of the SimplyVAVs (e.g., MSV22 for SimplyVAV #2) have four states for No Communication, Cooling Call, Heating Call, and No (Heating or Cooling) Call based on the communication (or failure of communication) with the respective SimplyVAV. If No Communication is detected for more than 5 minutes, the respective alarm in KMC Commander is triggered. The number of Heating, Cooling, and No Calls are displayed on the Dashboard cards. (See the view of MSV22 in the KMC Connect screen below.)
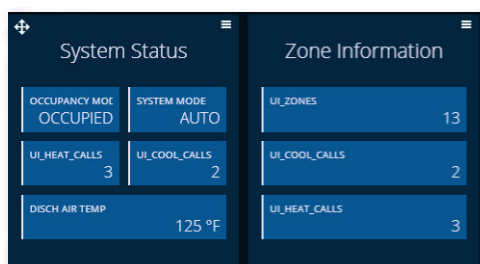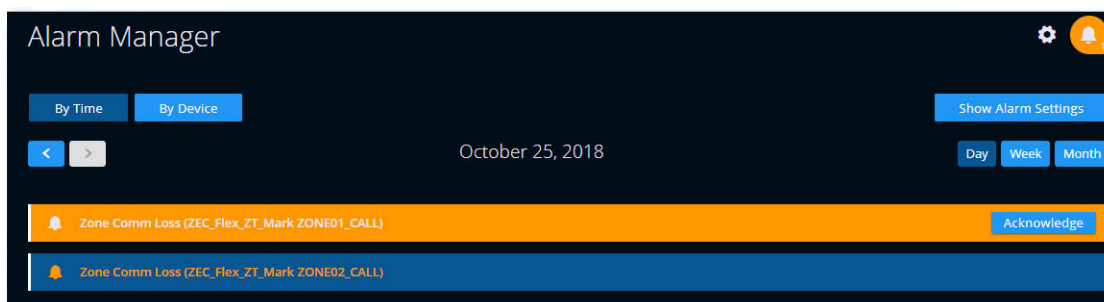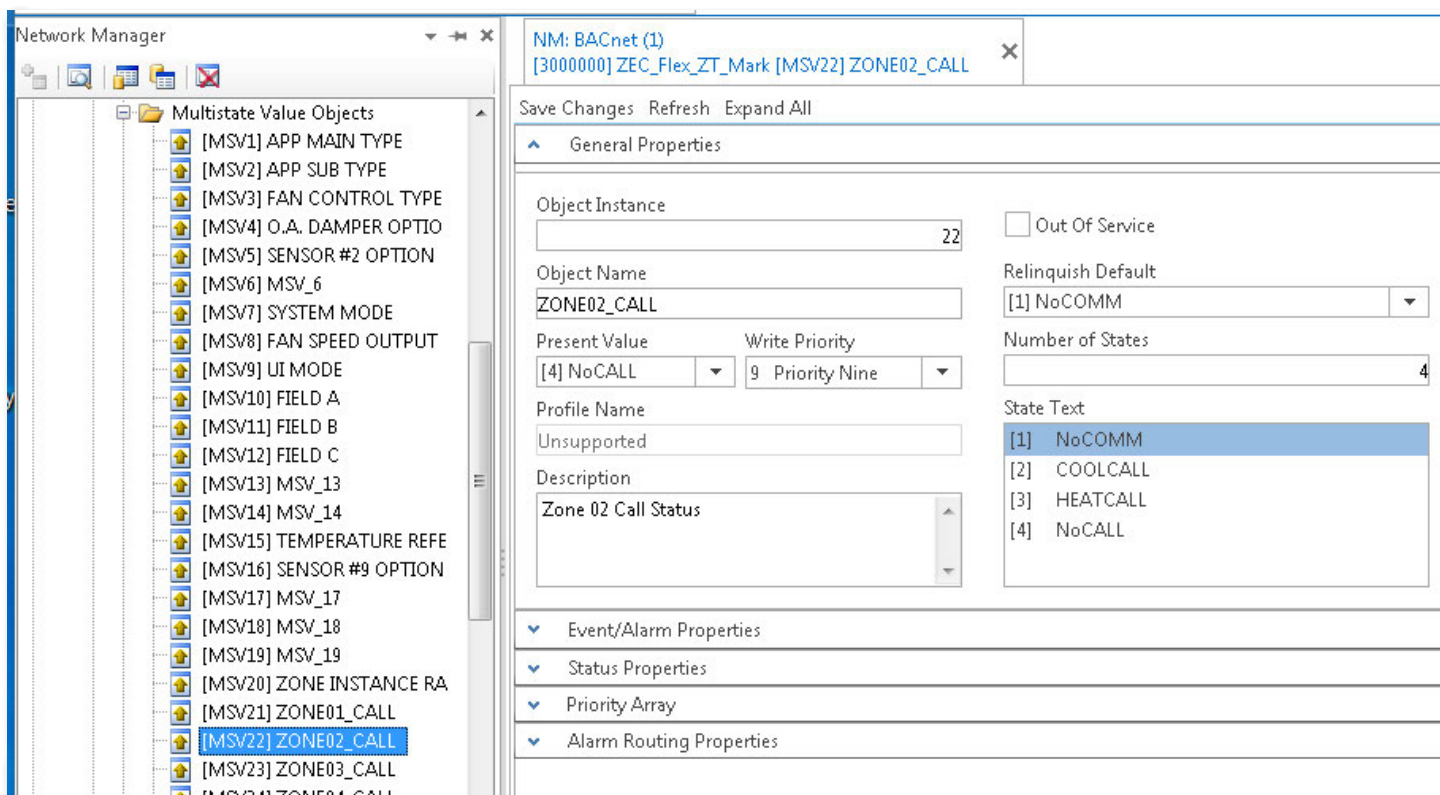
NOTE: Alarms can also be emailed to all users who have been added by an administrator to a selected Notifications Group. See the **Alarm Manager** section in the **KMC Commander Installation Guide** for more information.

Trend
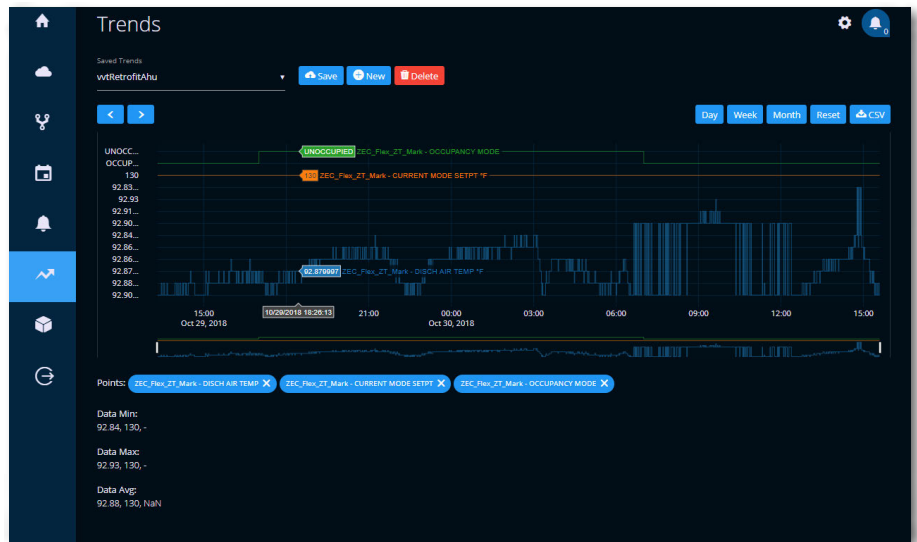
In Trends, an AHU/RTU/HPU **trend** (vvtRetrofitAhu) will be configured with these points:

- Current Mode Setpoint (AV26)
- Discharge Air Temperature (AI2)
- Occupancy Mode (BV1)

See the **Trends** section in the **KMC Commander Installation Guide** for more information.

NOTE: After the zoning discovery and build, trends may take over an hour to begin displaying meaningful data.
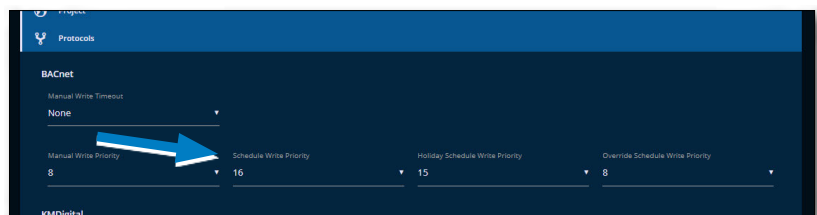
Schedule
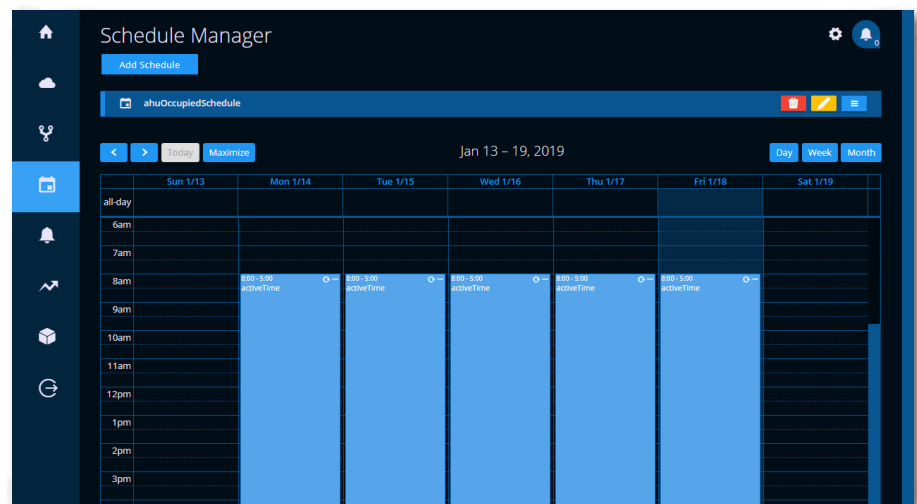
In Schedule Manager, a **schedule** (ahuOccupiedSchedule) is created for optionally controlling the occupancy mode of the ZEC FlexStat and setpoints of the SimplyVAV controllers.
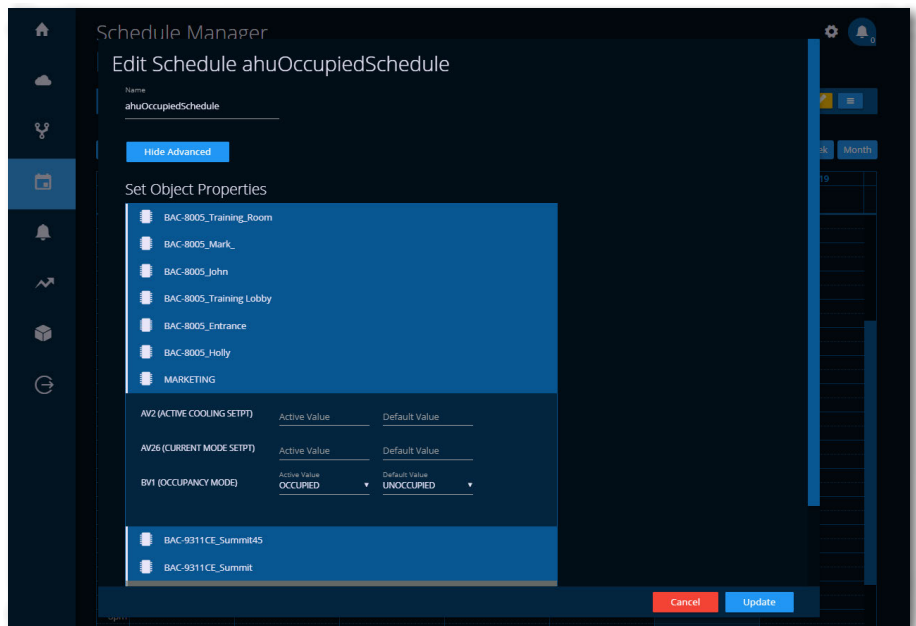
NOTE: The **ZEC FlexStat will control the occupancy schedule unless it and the KMC Commander are configured** as described below. Using the schedule function in KMC Commander allows changing the occupancy schedule remotely. This is especially useful for adding new holidays and special events.

To use the optional KMC Commander schedule **to control the ZEC FlexStat's occupancy schedule**:

- Change the KMC **Commander**'s default **Schedule Write Priority** level (of 16) to **8** (or higher) and **Holiday Schedule Write Priority** level (of 15) to **7** (or higher). See the **Protocols (Settings)** and **Schedule Manager** sections in the **KMC Commander Installation Guide** for more information.

- Also change the **Schedules** within the ZEC **FlexStat** to **NULL** for every day (MAIN MENU > SCHEDULES > ENTIRE WEEK [MON-SUN] in the FlexStat's menu system). See the **BAC-120063CW-ZEC FlexStat Installation and Configuration Guide** and the **FlexStat Zoning Equipment Controller Operation and Schedules** for more information.

NOTE: During an unoccupied period, KMC Commander's schedule (at priority 8) disables the timed occupancy override (at priority 9) using the ZEC FlexStat's buttons. See the **Heat/Cool, Fan, Occupancy, and Override** section in the **FlexStat Zoning Equipment Controller Operation and Schedules**.
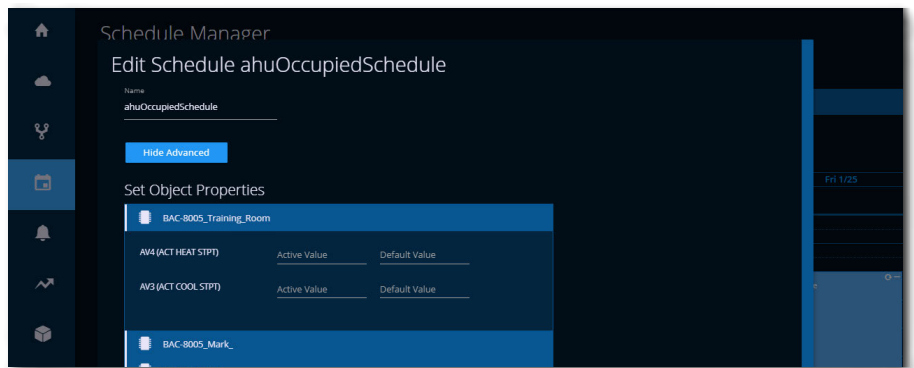
NOTE: Optionally, Occupied (Active Value) and Unoccupied (Default Value) **setpoints** in the SimplyVAV controllers may also be configured to override the default setpoint values (at priority 9).

In the created schedule event, edit the time on and off for the desired days. See the **Schedule Manager** section in the **KMC Commander Installation Guide**.

Data Explorer Objects and Troubleshooting

NOTE: After a successful build, **vavDeckAuto** (see **Cards and Deck on the Dashboard on page 9**), **vvtAhuAlarm** (see **Alarms on page 10**), **vvtAhuTrend** (see **Trend on page 12**), **vvtAutoSchedule** (see **Schedule on page 12**), and **vvtRetrofitStatus** will be new searchable objects in Data Explorer (under Add-ons). Viewing the objects might be helpful for troubleshooting issues. See the **Data Explorer** section in the **KMC Commander Installation Guide**.

NOTE: Do **NOT** delete the objects.
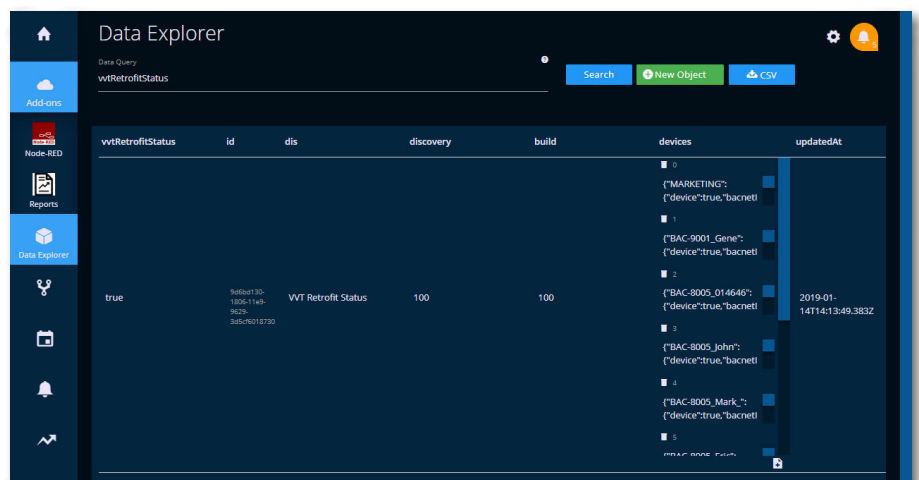
NOTE: For additional troubleshooting information, see the **Troubleshooting** section in the **KMC Commander Installation Guide**.

Equipment Information

NOTE: For the equipment below, follow the blue hyperlinks to the product information pages and see the data sheets for detailed product specifications. See the respective installation and other guides for information about mounting, wiring, configuration, and applications.

HPU/RTU Control

- **HPU/RTU Controller**—**BAC-120063CW-ZEC** FlexStat.
- **Duct Temperature Sensor**—**STE-1401/1402/1404/1405** (installed before the bypass damper in the supply air).
- **24 VAC transformer**—**XEE-6111-050** or **XEE-6112-050** or equivalent.

NOTE: For optional FlexStat (dry-bulb) **economizer** control— MAT (Mixed Air Temperature) **STE-1416** Duct Averaging Sensor (or equivalent) and OAT (Outside Air Temperature) **STE-1451**.

Bypass Damper Control (Optional)

- **Bypass Controller**—**CSP-4702** Analog Differential-Pressure VAV Controller/Actuator.
- **Pressure Sensor**—**SSS-101x** Differential Pressure Flow Sensors for measuring duct static pressure if no pickup already exists. **Install according to the bypass instructions in the CSP-4702** Static Pressure (Bypass) Control Application Guide.
- **24 VAC transformer**—**XEE-6111-050** or **XEE-6112-050** or equivalent.

VAV Zone Control

- **VAV Controller/Actuator**—**SimplyVAV (BAC-8001/8005/8205)**.
- **Room Temperature Sensor**—**STE-8001/8201** and/or **STE-6010/6014/6017**. If STE-601x sensors are used, at least one STE-8x01 is need to configure each VAV controller. These sensors are wired to the controller using standard Ethernet cables of suitable length.
- **Duct Temperature Sensor**—**STE-1401/1402/1404/1405** (install before the VAV box damper).
- **Differential Pressure Sensor**—SimplyVAV controllers require an air flow measurement for proper operation. If a flow pickup is not present on the VAV box, install an **SSS-101x Differential Pressure Flow Sensors** on the inlet side of the zone damper.
- **24 VAC transformer**—**XEE-6111-050** or **XEE-6112-050** or equivalent.

Internet of Things Platform

- **IoT Platform**—**KMC Commander**.
- **MS/TP to IP BACnet Router**—**BAC-5051E**.

Handling Precautions

For **digital and electronic** sensors, thermostats, and controllers, take reasonable precautions to prevent electrostatic discharges to the devices when installing, servicing, or operating them. Discharge accumulated static electricity by touching one's hand to a securely grounded object before working with each device.

NOTICE

OBSERVE PRECAUTIONS
FOR HANDLING
**ELECTROSTATIC
SENSITIVE DEVICES**

Important Notices

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Support

Additional KMC product information and resources are available on the web at **www.kmccontrols.com**. To see all available files, log-in to the KMC Partners site.