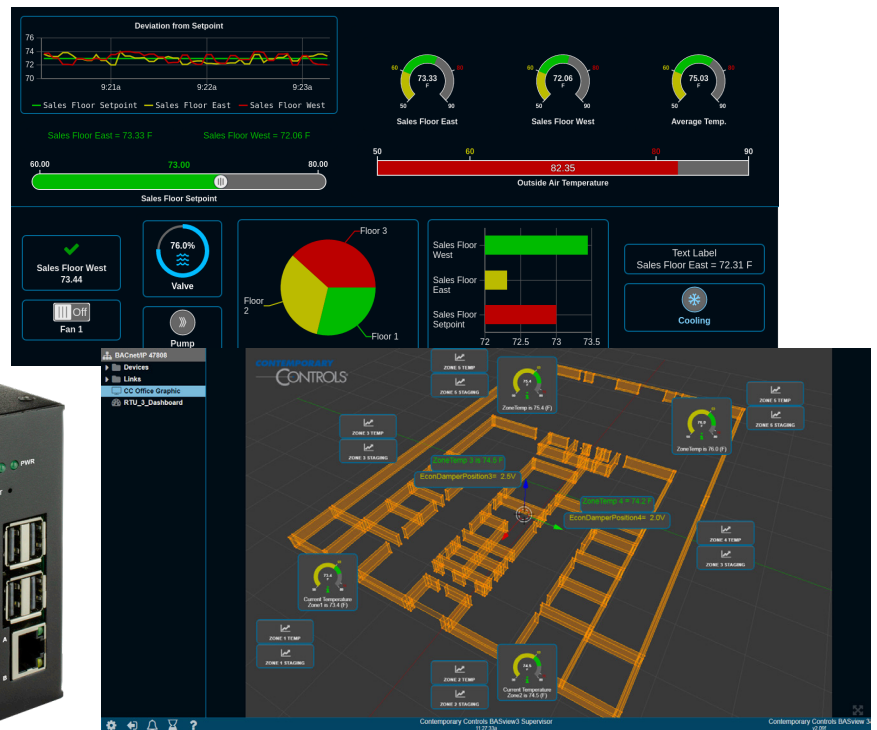# Thermostat Control System with BACnet Supervision

Setting up a distributed thermostat control system with BACnet supervision

Contemporary Controls offers two BACnet-networked communicating thermostat models that provide customers with flexibility when installing a distributed zone thermostat control system. Depending on parameters such as building zone layout, existing EIA-485 cabling, Wi-Fi routers in place, and connection distance requirements between BASstat thermostats and BASview3 supervisory device, each BASstat model offers distinct benefits for convenience of installation.

The BASview3 is the centralized supervisory device of the entire system communicating to the thermostats using the BACnet/IP protocol over a wired Ethernet connection. Depending on the requirements of the installation, a wired or Wi-Fi thermostat model can be chosen. A BASrouter BACnet MS/TP to BACnet/IP router or a Wi-Fi to Ethernet router is required to complete thermostat integration to the BASview3 supervisor.
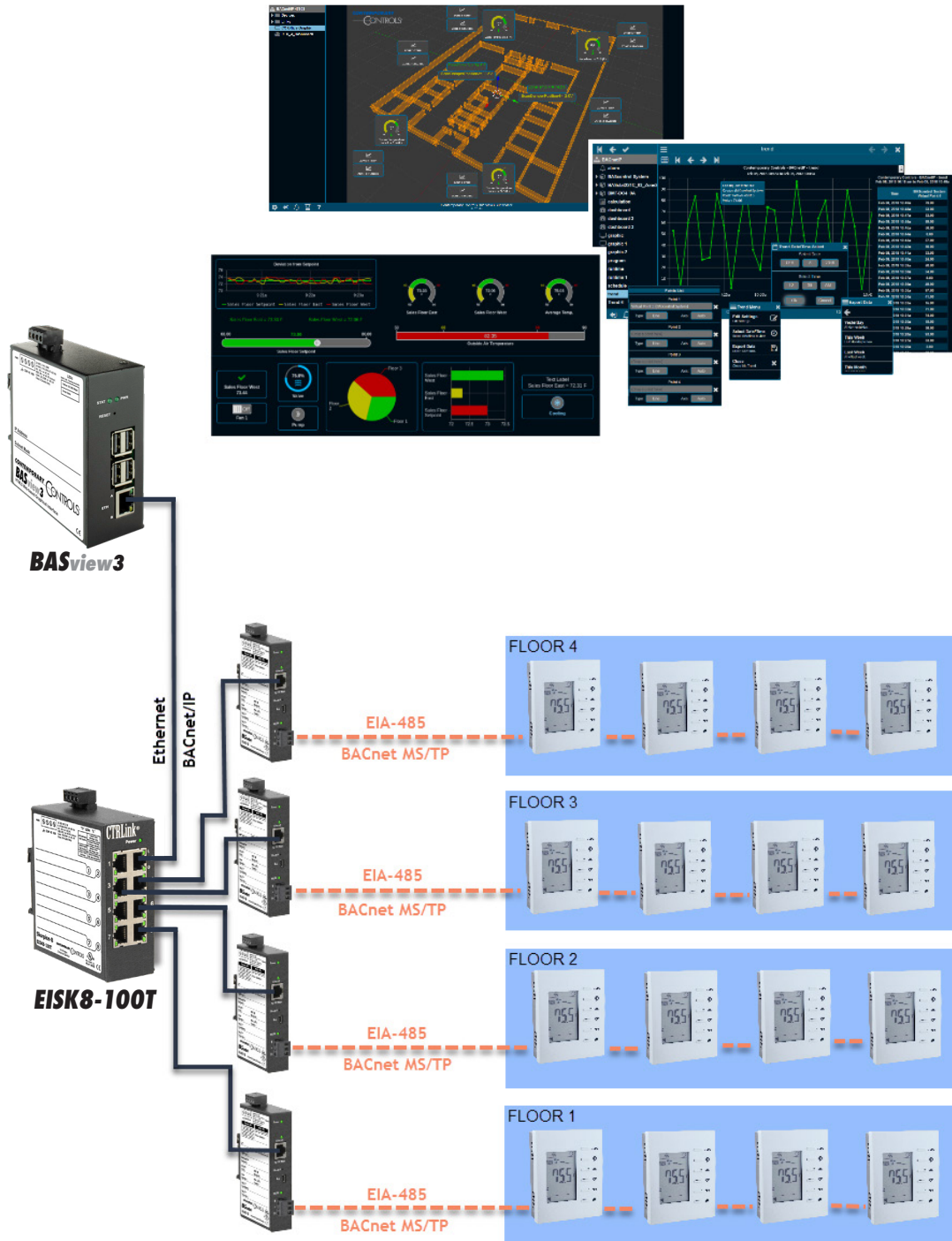
The BASRT-B router is used to convert BACnet MS/TP serial connection from several (up to 32) BAST-221C-B2 wired (EIA-485) thermostats on the same bus to BACnet/IP over Ethernet connection to the BASview3 supervisor.

A Wi-Fi router is used to route the wireless signal from several BAST-221C-BW2 (number of Wi-Fi clients depends on distance and Wi-Fi router performance) wireless thermostats to Ethernet carrying BACnet/IP messages to the BASview3 supervisor.

Thermostat connection using BACnet MS/TP over EIA-485

The BAST-221C-B2 wired thermostat model is BACnet MS/TP connected utilizing an EIA-485 serial connection. The EIA-485 physical layer can be very effective. It offers the flexibility and convenience of a maximum segment distance of up to 1200 m /4000 ft. allowing for daisy-chaining of equipment on the same bus which makes it the perfect choice when long segments are necessary for the installation. Communicating at lower speeds also gives it the advantage of being more resilient to the noise present in industrial environments. EIA-485 wiring can be found in many existing buildings making it perfect for retrofit upgrades without the need to run new wires. Up to 32 BAST-221C-B2 thermostats can be connected to a BACnet MS/TP to BACnet/IP router such as the BASRT-B which routes the BACnet MS/TP traffic to BACnet/IP to the BASview3 supervisor.
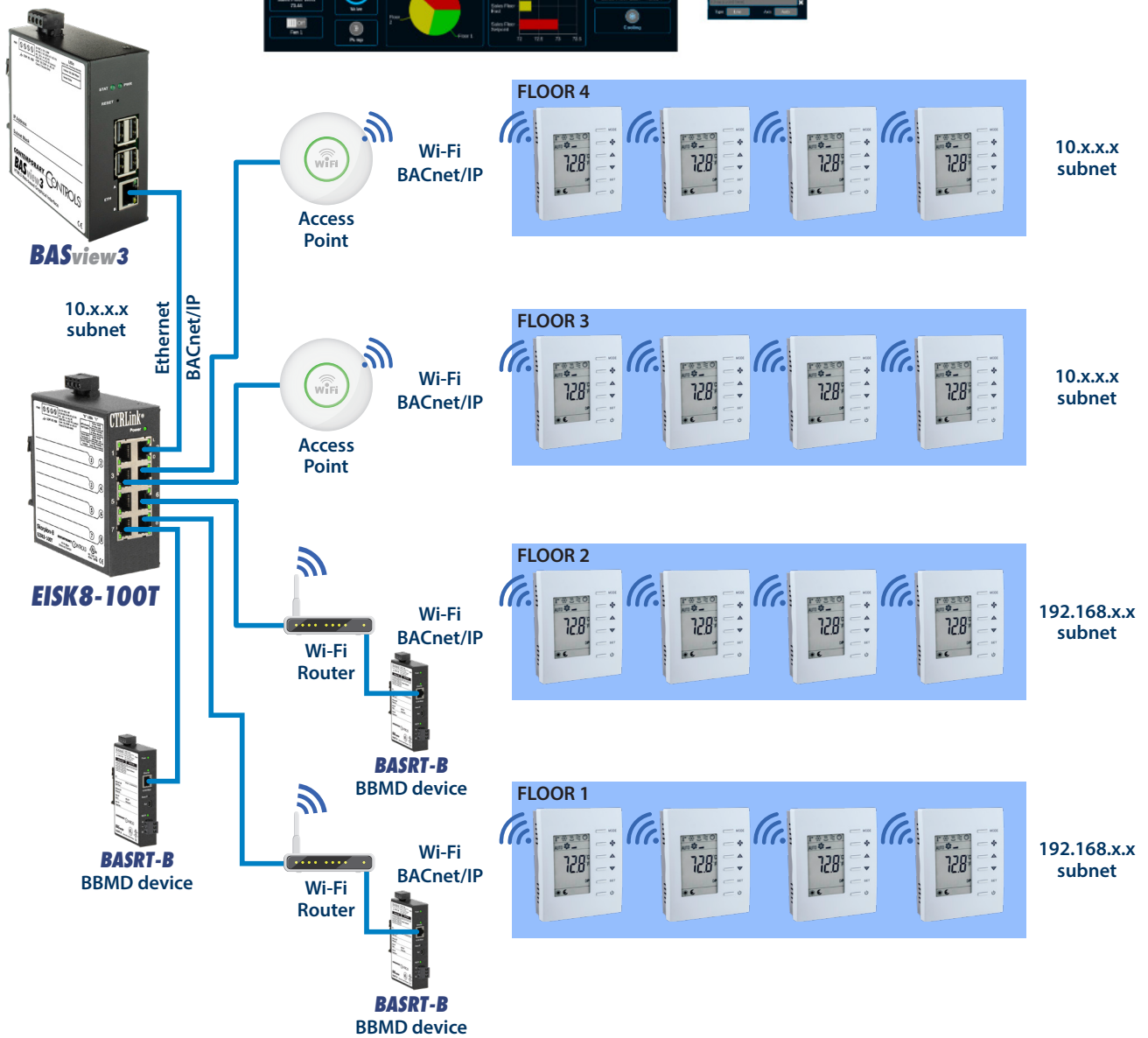
Thermostat connection using BACnet/IP over a wireless Wi-Fi connection

The BAST-221C-BW2 wireless thermostat model is BACnet/IP connected using a wireless connection to a nearby Wi-Fi router/access point which supports IEEE 802.11b/g/n. The respective maximum indoor range is 115 ft. for IEEE 802.11b, 125 ft. for IEEE 802.11g, and 225 ft. for IEEE 802.11n considering there are little to no substantial obstructions between the Wi-Fi router and the thermostats which is the case in most standard buildings. Some building materials rarely found in standard buildings can create obstructions which prevent Wi-Fi radios from communicating such as thick reinforced concrete (at least 200mm with or without metal reinforcement), thick masonry blocks and brick-faced walls, and metal obstructions such as shelving units or dense metal reinforcements. However, most widely used materials such as standard concrete or brick walls (100mm), lumber, plywood, and glass do not impose serious Wi-Fi radio barriers making Wi-Fi a convenient choice for many installations where wireless communication can be conveniently leveraged to avoid running wires. In addition, there are free Wi-Fi signal measuring tools such as Vistumbler which can be helpful to ensure a resilient Wi-Fi connection between the thermostat and the Wi-Fi router/access point. This free tool can be installed on a laptop PC or tablet. Simply connect the laptop/tablet running Vistumbler to the Wi-Fi router/access point. Measure

signal strength by moving the laptop away from it in the direction of where the Wi-Fi wireless thermostat host would be installed, and monitor the signal strength graph in the tool. The tool will scan for nearby wireless networks and gives you a comprehensive report including the name, signal strength, kind of encryption, MAC address, channel the network is using, manufacturer, and more. It will also graph the traffic for each network. The performance of the Wi-Fi router/access point determines how many Wi-Fi clients such as the BASstat Wi-Fi thermostat can connect to it at a time. Caution must be used if the same Wi-Fi router is used for IT networking and Internet access of zone occupants. One option is to create a VLAN to isolate the IT network from the OT network. However, not all Wi-Fi routers/access points support VLAN. The Wi-Fi router/access point is used to route the wireless signal from the thermostat carrying BACnet/IP messages to wired Ethernet and effectively to the BASview3 supervisor.

NOTE: Using a Wi-Fi router creates an additional subnet between the wireless network and the wired Ethernet. As is usual for any BACnet communication over subnets, BBMD devices are required on each subnet. BBMDs are not required if a Wi-Fi Access Point, that extends the same subnet as the wired Ethernet, is used to integrate the wireless thermostats.

BASview3

10.x.x.x subnet

Ethernet BACnet/IP

EISK8-100T

Wi-Fi BACnet/IP

Access Point

Wi-Fi BACnet/IP

Access Point

FLOOR 4

10.x.x.x subnet

FLOOR 3

10.x.x.x subnet

FLOOR 2

Wi-Fi BACnet/IP

Wi-Fi Router

BASRT-B
BBMD device

192.168.x.x subnet

BASRT-B
BBMD device

Wi-Fi Router

Wi-Fi BACnet/IP

BASRT-B
BBMD device

FLOOR 1

192.168.x.x subnet

NOTE: Using a Wi-Fi router creates an additional subnet between the wireless network and the wired Ethernet. As is usual for any BACnet communication over subnets, BBMD devices are required on each subnet. BBMDs are not required if a Wi-Fi Access Point, that extends the same subnet as the wired Ethernet, is used to integrate the wireless thermostats.
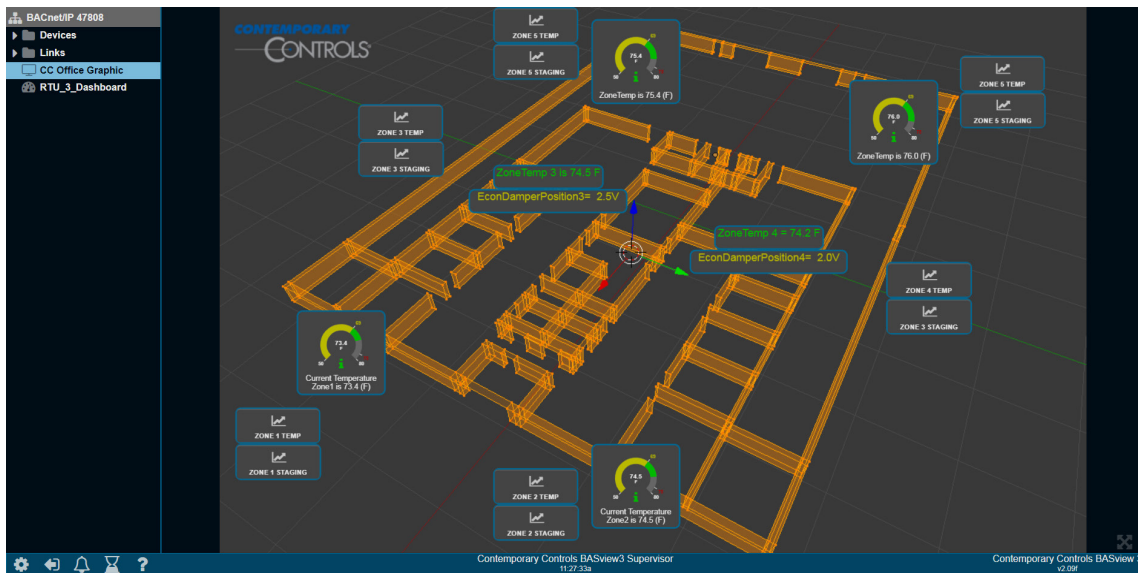
BASview3 supervisor

The BASview3 is a stand-alone, embedded, web-based graphical interface for building automation and process automation systems. It can be accessed from any web browser – providing supervisory functionality to any BACnet/IP system. The BASview3 is simple to install and use. The BASview3 is housed in a DIN rail mounted metal enclosure and it is 24VAC/VDC powered for convenient installation. A 10/100 Mbps Ethernet connection is all that is needed for communication. Supervisory features include animated graphic screens, scheduling, historical trending, runtime accumulation and email alarms. BASview3 will automatically toggle outputs and change setpoints on schedule, collect runtime and trend data, and monitor alarm conditions.

BASview3 supports multiple logins with different user permission levels allowing you to create dashboards and/or graphics for both the service personnel which provide maintenance to the HVAC equipment, as well as the end users/occupants who are interested in comfort parameters such as current temperature and state of operation such as heat/cool/ventilate HVAC modes. Different user permission levels also allow some users to log in and modify (write) parameters such as set points, or only allow viewing (read) of these parameters for other users with lesser permission levels.

BASview3 Graphic example

Graphics differentiate from dashboards because integrators configuring the graphic can upload images (PNG, GIF) such as floor plans, mechanical equipment, zone layout, actual picture of a zone/room, etc. to the BASview3 and then freely position animated graphical elements such as gauges, buttons, labels, charts, etc. on top of the
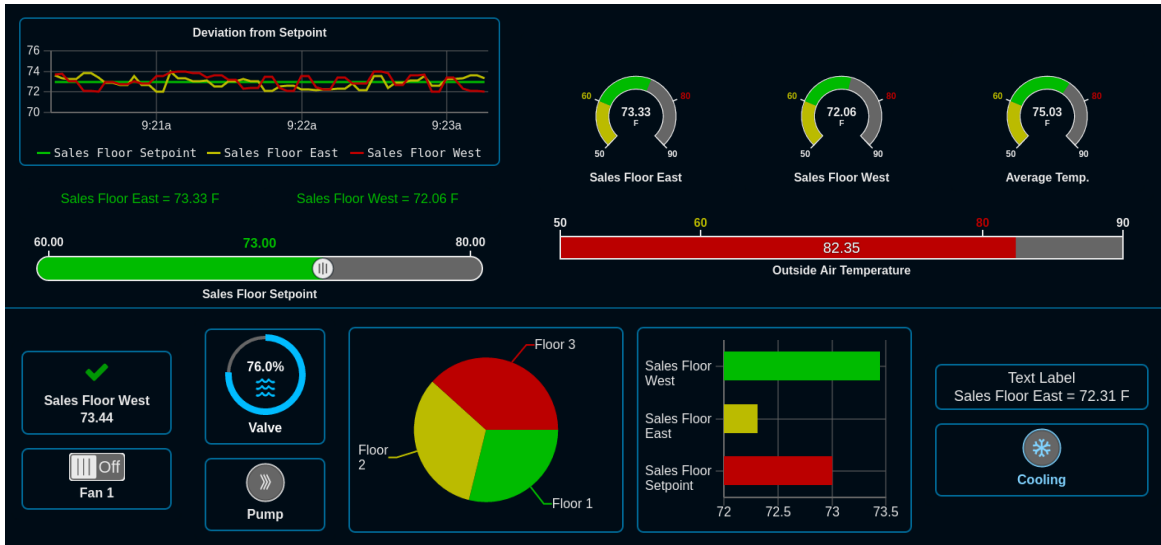
image which give insight to users about zone temperature, zone set point, etc. and some control such as adjusting a setpoint or changing occupancy state. In the example below, a floor plan was generated in a graphical software, saved as a PNG file and then uploaded to the BASview.

BASview3 Dashboard Example

Dashboards differentiate from graphics. In a dashboard, integrators configuring the dashboard cannot upload images or freely position graphical elements but rather graphical elements/widgets such as gauges, charts, trend graphs, buttons, labels, icons are placed in containers and positioned on the screen in desired order. This makes dashboards scalable across devices such as tablets and smart phones as well as PC monitors. This is ideal for monitoring and/or controlling equipment over the BACnet network. A library of built in widgets is provided as seen in the example below.

Ordering Information

Model	RoHS	Description
BAST-221C-B2	✔	BACnet MS/TP Thermostat 2-Heat, 2-Cool, 1-Fan, Wired
BAST-221C-BW2	✔	BACnet/IP Thermostat 2-Heat, 2-Cool, 1-Fan, Wi-Fi
BASV-3	✔	BACnet/IP Supervisor HTML5 Graphical Interface