



BAC-19xx63-ZEC FlexStat

Touchscreen Zoning Equipment Controller

Sequence of Operation and Wiring Guide

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INTRODUCTION

This guide describes sequences of operation and wiring for different applications of KMC Conquest BAC-19xx63-ZEC FlexStats.

For general installation and configuration procedures, see the **BAC-19xx63-ZEC FlexStat Installation Guide** at kmccontrols.com.

For configuration of settings, passwords, communication options, display customization, wiring considerations, and troubleshooting, see the **BAC-19xx63-ZEC FlexStat Application Guide**.

For specifications and accessories, see the **BAC-19xx63-ZEC Series FlexStat Data Sheet**.

For instructions on custom configuration and programming, see the Help system in the software tool.

APPLICATIONS

- ZAC (Single-zone VAV damper control)
- Heat Pump Units
- Roof Top Units



GENERAL WIRING CONSIDERATIONS

NOTE: See the [BAC-19xx63-ZEC FlexStat Application Guide](#) for more important information about network and other wiring.

⚠ CAUTION

Although typical terminal code letters are shown in the illustrations in this document, check the schematics of your unit for wiring details!

⚠ CAUTION

The BAC-19xx63-ZEC models are **NOT** compatible with the backplates of older BAC-10xxx/12xxxx/13xxxx/14xxxx FlexStats! If replacing an older FlexStat, replace the backplate as well.

⚠ CAUTION

To avoid damage from ground loops and other communication issues in networked FlexStats, correct phasing on MS/TP network and power connections on ALL the networked controllers is critically important.

⚠ CAUTION

Relays are for Class-2 voltages (24 VAC) only. Do not connect line voltage to the relays!

Do not mistakenly connect 24 VAC to an analog output ground.

NOTE: FlexStat relays are **NO, SPST (Form "A")**.
(To emulate binary outputs with the analog outputs, set the output voltage to be either 0 or 12 VDC in Control Basic.)

- Because of the many connections (power, network, inputs, outputs, and their respective grounds or switched commons), **be sure wiring is well planned before installation of conduit!**
- **Make sure that conduit for all wiring has adequate diameter for all necessary wiring.** Using 1-inch conduit and junction boxes is recommended! Use external junction boxes above the ceiling or in another convenient location as needed to make connections that run to the FlexStat's junction box.

- To prevent excessive voltage drop, **use a conductor size that is adequate for the wiring length! Allow plenty of "cushion" to allow for transient peaks during startup.**
- Using **multiple conductor wires** for all inputs (e.g., 8 conductor) and outputs (e.g., 12 conductor) is recommended. Grounds for all the inputs can be combined on one wire.

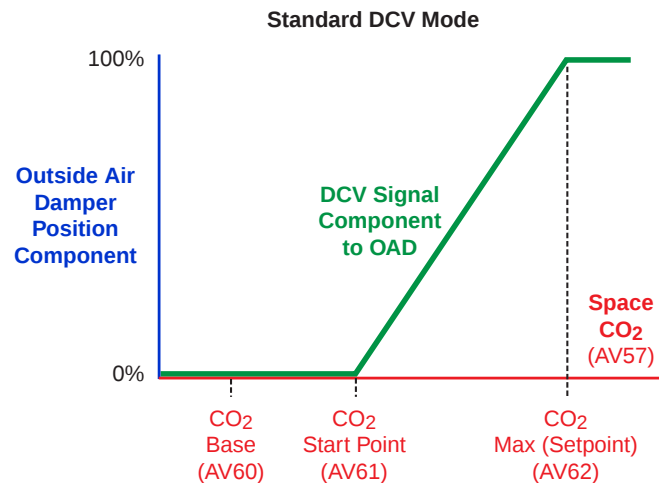
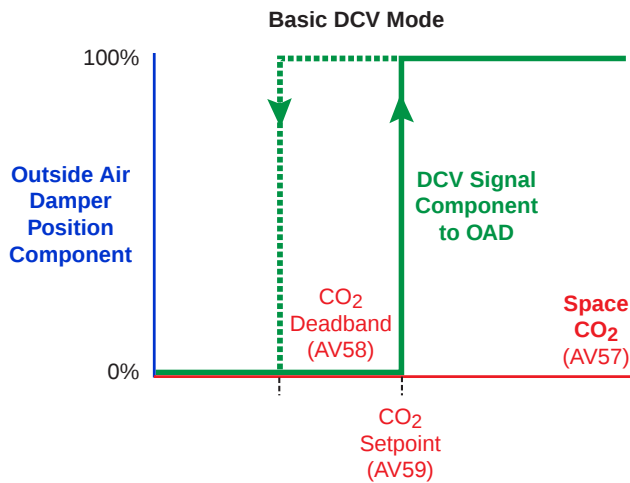
DCV (DEMAND CONTROL VENTILATION)

BAC-193263-ZEC model FlexStats include CO₂ sensors for DCV operation in (6/3) RTU and HPU applications with an outside air damper. See the illustrations and descriptions below of Basic and Standard DCV options and operation.

See the [BAC-19xx63-ZEC FlexStat Application Guide](#) for more information.

See also:

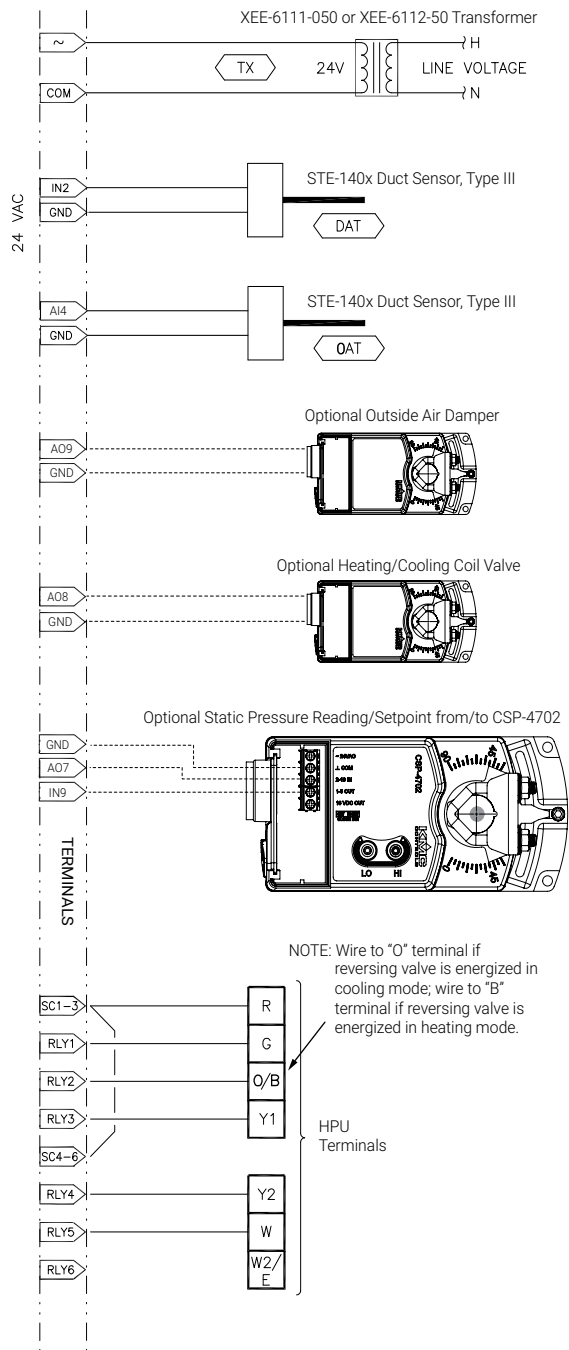
- [Roof Top Unit \(RTU\) \(BAC-19xx63-ZEC\) on page 4](#)
- [Heat Pump Unit \(HPU\) \(BAC-19xx63-ZEC\) on page 7](#)



DEMAND CONTROL VENTILATION					
Description	Menu Options	Notes	Default Value	Object	DCV Mode
CO ₂ Level		Available as a rotation value on the display.	0 ppm	AV57	
Select DCV Mode	DCV Mode	Select None, Basic, or Standard.	None	MSV12	
Basic DCV Setpoint	CO2 Basic Setpoint	In Basic DCV mode, the desired CO ₂ level at which point the economizer damper opens for maximum outside air flow.	1200 ppm	AV59	Basic
Basic DCV Deadband	CO2 Basic Deadband	In Basic DCV mode, the amount the CO ₂ level must drop below the setpoint before DCV control is relinquished (and outside DCV air flow returns to minimum).	200 ppm	AV58	
Standard DCV Baseline (Outside Air CO ₂ Level)*		In Standard DCV mode, the presumed average CO ₂ concentration level of outside air at the building's location. Every week after installation, the lowest detected reading in the previous week is written into AV60 (replacing the original default or previous value).	380 ppm	AV60	Standard
Standard DCV Start Point*		In Standard DCV mode, the CO ₂ level (setpoint) at which the economizer damper begins to modulate open . It equals the DCV CO ₂ baseline plus 200 ppm, and the value is recalculated weekly.	580 ppm	AV61	
Standard DCV Maximum Allowed CO ₂ Level*		In Standard DCV mode, the maximum allowed CO ₂ concentration level during an occupied period. The economizer damper modulates to fully open at this level. It equals the DCV CO ₂ baseline plus 600 ppm, and the value is recalculated weekly.	980 ppm	AV62	
*NOTE: Standard DCV values are self-calculating and are not configurable by the user in the FlexStat menu.					

ROOF TOP UNIT (RTU) (BAC-19XX63-ZEC)

Application Connections



NOTE: Although typical terminal code letters are shown, check the schematics of your unit for wiring details.

NOTE: See also **DCV (Demand Control Ventilation)** on page 3.

NOTE: Binary Output (BO1–BO6) terminals are relays and are used with SC terminals instead of GND terminals.

Inputs and Outputs List

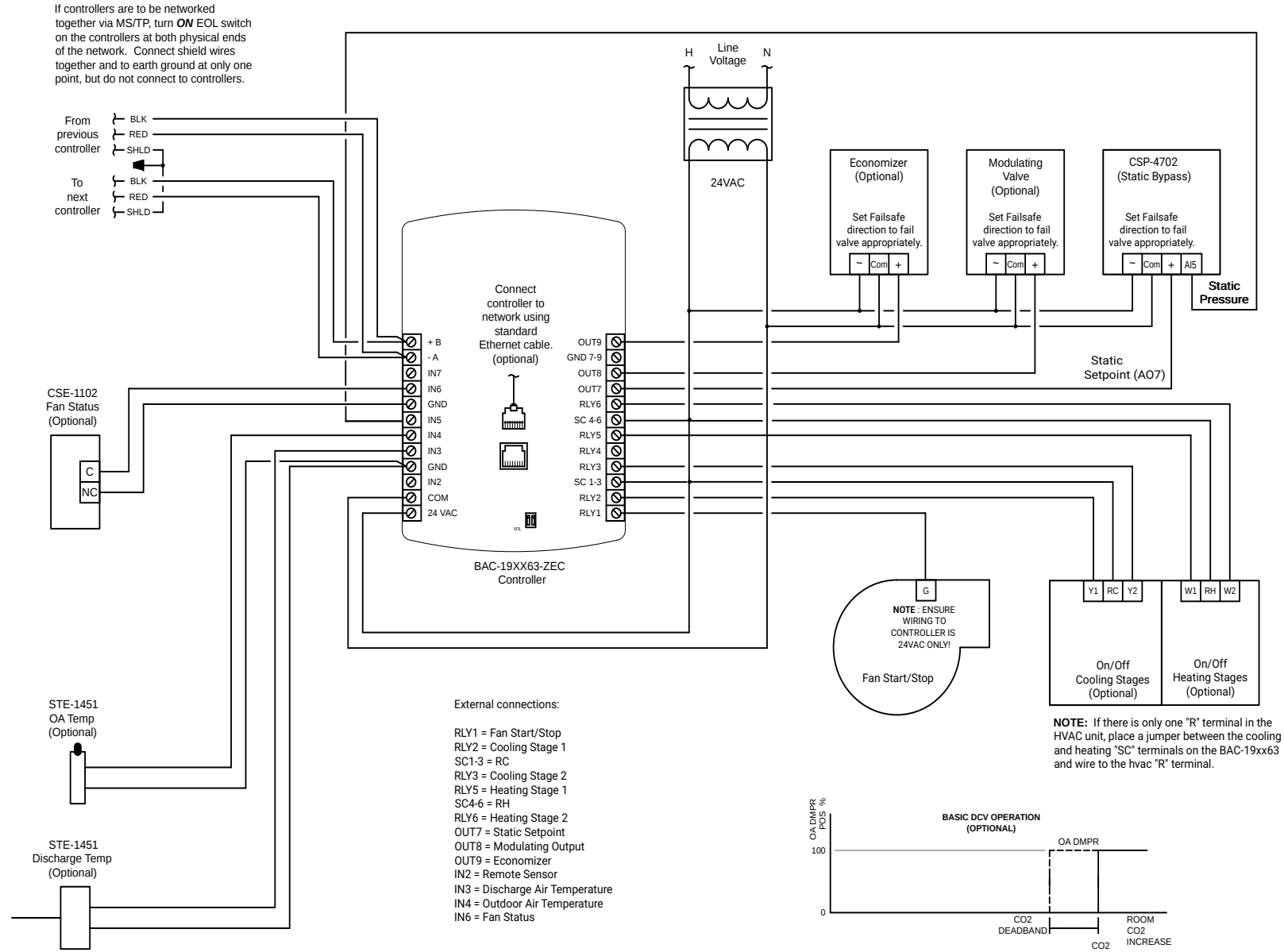
RTU	
Inputs	
Object Identifier	Description
AI1*	Unused in this application
AI2/IN2	Unused in this application
AI3/IN3	Discharge Air Temperature
AI4/IN4	Outside Air Temperature
AI5/IN5	Analog Input #5 (Static Pressure)
BI6/IN6	Fan Status
AI7/IN7	Analog Input #7
AI8	INTERNAL Humidity Sensor**
BI9	INTERNAL MOTION Sensor**
AI10	INTERNAL CO2 Sensor**
*Internal temperature sensor is on all models.	
**Optional internal humidity and CO2 sensors are on applicable models.	
Outputs	
Object Identifier	Description
BO1/RLY1	Fan Start-Stop
BO2/RLY2	Stage 1 Cooling
BO3/RLY3	Stage 2 Cooling
BO4/RLY4	Binary Output #4
BO5/RLY5	Stage 1 Heating***
BO6/RLY6	Stage 2 Heating
A07/OUT7	Static Setpoint to CSP-4702/Bypass Damper
A08/OUT8	Analog Valve***
A09/OUT9	Economizer Output
***A08 and BO5 are controlled simultaneously.	

NOTE: Universal (analog) inputs (AIx/INx) and outputs (AOx/OUTx) are used with GND terminals. They can be configured to emulate binary (on/off or voltage/no-voltage) objects.

NOTE: Universal Input (INx) terminal = Analog Input (AIx) object or Binary Input (BIx). Universal Output (OUTx) terminal = Analog Output (AOx) object. Relay output (RLYx) = Binary Output (BOx) object.

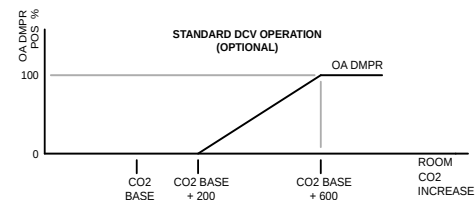
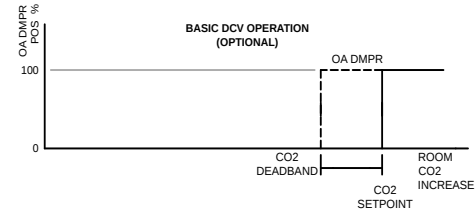
NOTE: Unused inputs and outputs are available for use with custom configuration and programming in KMC software.

**Roof Top Unit with On/Off Fan,
Modulating Output, Economizer, and CO2 Sensors
Model: BAC-190063CE-ZEC, BAC-190063C-ZEC, BAC-193263CE-ZEC,
BAC-193263C-ZEC**



NOTES:

1. If Econ is enabled, OAT and DAT are required.
2. See www.kmccontrols.com for additional details.





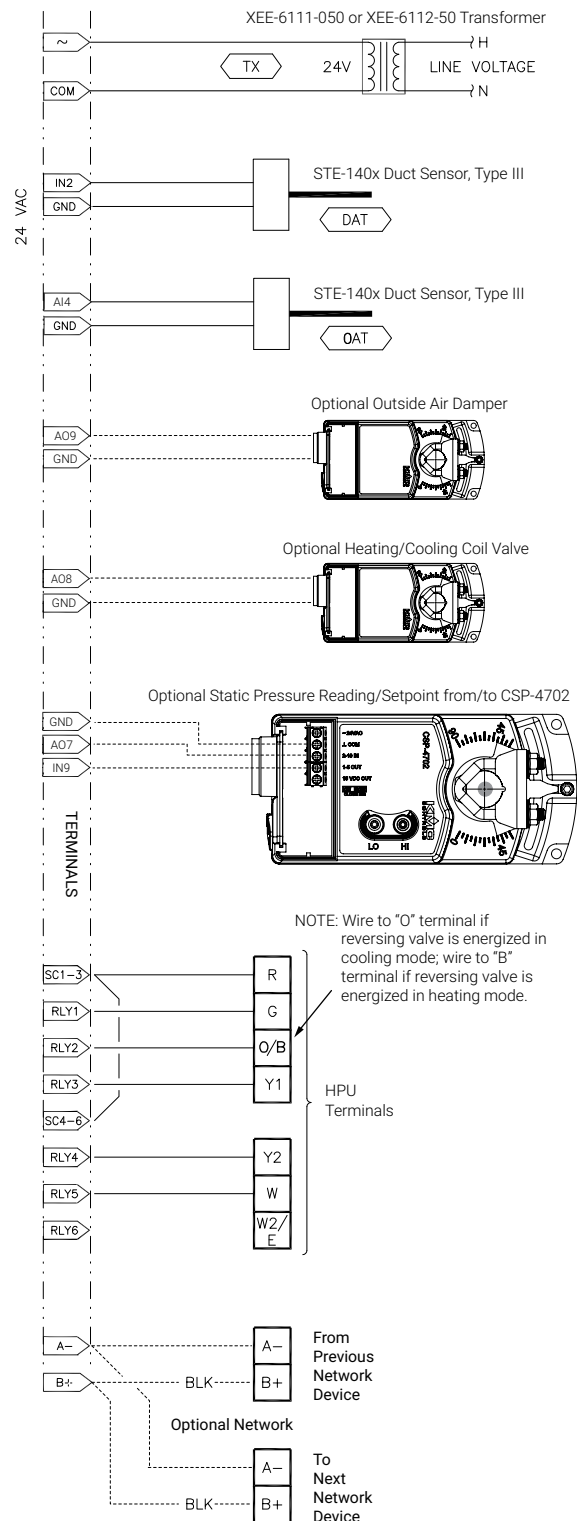
Roof Top Unit with On/Off Fan, Modulating and 2-Stage Heating and Cooling, Economizer and CO2 Sensors Models: BAC-190063CE-ZEC, BAC-190063C-ZEC, BAC-193263CE-ZEC, BAC-193263C-ZEC

SEQUENCE OF OPERATION:

1. Occupancy: The occupancy mode follows the internal schedule. If motion (optional) is not sensed within the standby timer during occupied mode, the unit goes into standby mode until motion is sensed again.
2. On/off fan: When the fan mode is set to **Auto** and heating, cooling or economizer is called for, the fan starts. Once the space temp returns to setpoint, there is no call for heating, cooling nor economizer and the fan-off-delay expires (2 minutes), the fan shuts off. During the occupied and standby modes, the fan output is energized any time the fan mode is set to **ON**.
3. When the fan starts, if the normally closed fan status switch (optional) doesn't open within 10 seconds, all heating, cooling and economizer outputs are de-energized. The fan output remains enabled and heating/cooling/economizer outputs remain disabled until the fan status switch opens.
4. Modulating analog valve (optional): BAC-19xx63-ZEC models have a modulating output that can be customized as either heating or cooling.
5. Staged heating: As discharge air temperature drops below the heating setpoint minus the heating span, heating stage 1 is energized. If the space temp remains below the heating setpoint minus the heating span for the stage delay, heating stage 2 is energized. As the space temp rises above half of the heating span below heating setpoint, stage 2 heating is de-energized. As the space temp rises above the heating setpoint, heating stage 1 is de-energized.
6. Staged cooling: As discharge air temperature rises above the cooling setpoint plus the cooling span, cooling stage 1 is energized if the minimum off time has been met. If the space temp remains above the cooling setpoint plus the cooling span for the stage delay, cooling stage 2 is energized after ensuring its minimum off time. As the space temp drops below half of the cooling span above cooling setpoint, stage 2 cooling is de-energized. As the space temp drops below the cooling setpoint, cooling stage 1 is de-energized.
7. Economizer: During occupied mode, if outside air temp (OAT) drops below the economizer enable temp and there is a call for cooling, econ mode is enabled. Econ mode is disabled if OAT rises 1 deg above the econ enable temp. While economizing, the outside air damper (OAD) modulates to maintain discharge air temp (DAT). As space temp rises above the cooling setpoint, DAT setpoint resets from the space temp to the minimum DAT. While economizing, the OAD is open to the greater of the minimum damper position or DAT control. The OAD is shut during unoccupied mode and any time the fan is off.
8. If the space humidity (optional) rises above the dehumidification setpoint, the cooling valve is opened 100%. Cooling stage 1 is energized if the minimum off time has been met. If the humidity remains high for the stage delay and cooling stage 2's minimum off time has been met, cooling stage 2 is energized. The heating valve and staging then follow their normal operation to maintain the COOLING setpoint. Once the space humidity drops below the dehumidification setpoint minus its span, dehumidification ceases and the heating and cooling valves and staging resume normal operation.
9. In Basic Demand Control Ventilation (DCV), the OA damper opens 100% as the CO2 level rises above the CO2 setpoint. As the CO2 level drops below the CO2 setpoint minus the CO2 deadband, the damper relinquishes to previous control.
10. In Standard DCV, the OA damper modulates from 0% open as the CO2 level rises from the CO2 base level +200 ppm to 100% open at the CO2 base level +600 ppm.
11. When both CO2 and economizer control are enabled, the damper responds to the greater of CO2 or economizer control.

HEAT PUMP UNIT (HPU) (BAC-19XX63-ZEC)

Application Connections



NOTE: Although typical terminal code letters are shown, check the schematics of your unit for wiring details.

NOTE: Binary Output (B01–B06) terminals are relays and are used with SC terminals instead of GND terminals.

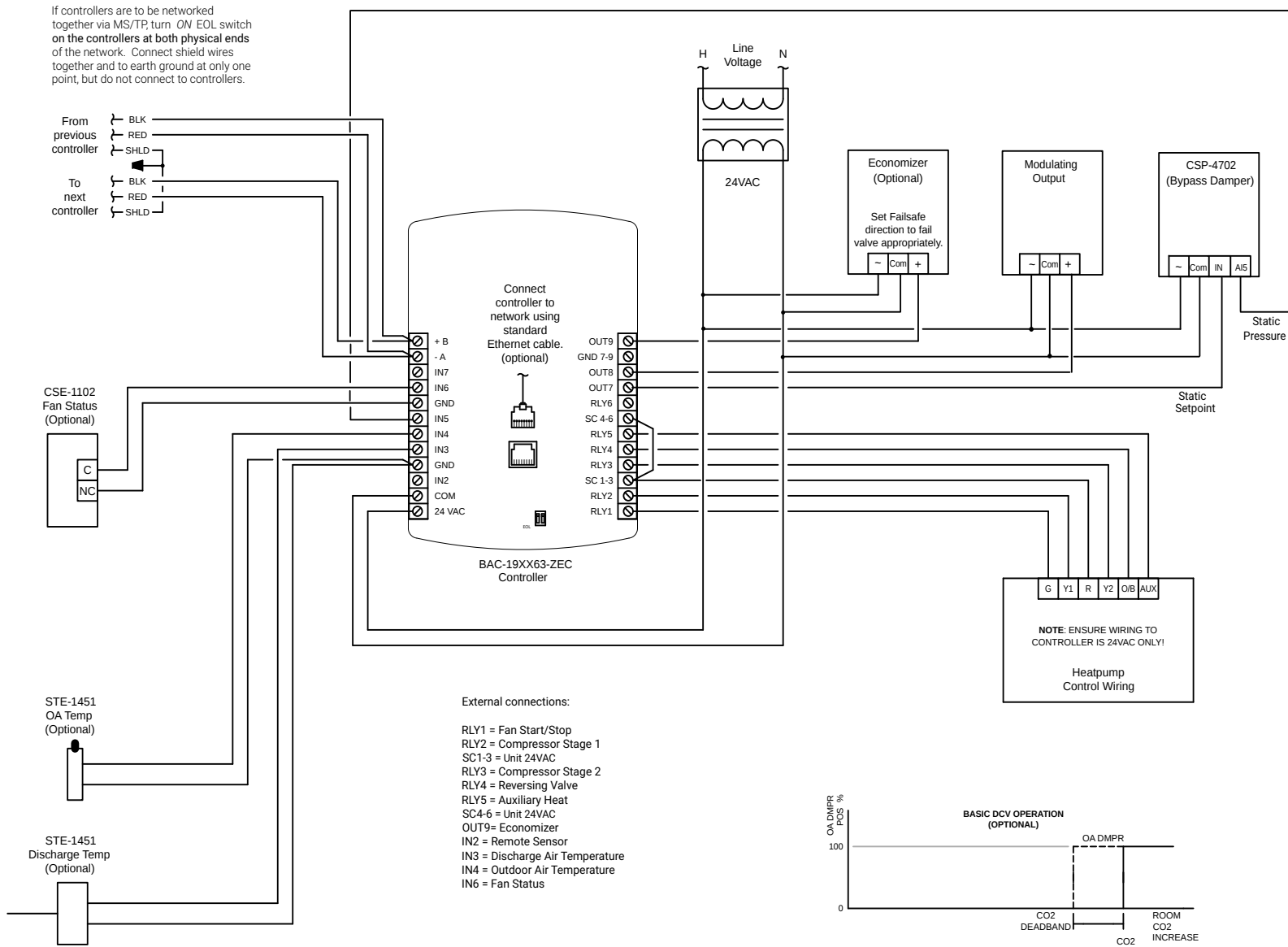
Inputs and Outputs List

HPU	
Inputs	
Object Identifier	Description
AI1*	Unused in this application
AI2/IN2	Unused in this application
AI3/IN3	Discharge Air Temperature
AI4/IN4	Outside Air Temperature
AI5/IN5	Static Pressure from CSP-4702/Bypass Damper
BI6/IN6	Fan Status
AI7/IN7	Analog Input #7
AI8	INTERNAL Humidity Sensor**
BI9	INTERNAL Motion Sensor**
AI10	INTERNAL CO2 Sensor**
*Internal temperature sensor is on all models.	
**Optional internal humidity and CO2 sensors are on applicable models.	
Outputs	
Object Identifier	Description
B01/RLY1	Fan Start-Stop
B02/RLY2	Stage 1 Compressor
B03/RLY3	Stage 2 Compressor
B04/RLY4	Reversing Valve
B05/RLY5	Auxiliary Heat
B06/RLY6	Binary Output #6
AO7/OUT7	Analog Output #7
AO8/OUT8	Binary Output #8
AO9/OUT9	Economizer Output

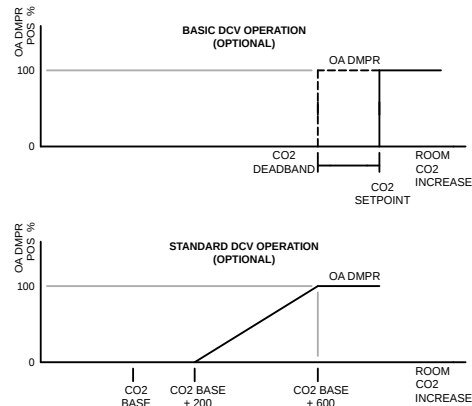
NOTE: Universal (analog) inputs (AIx/INx) and outputs (AOx/OUTx) are used with GND terminals. They can be configured to emulate binary (on/off or voltage/no-voltage) objects.

NOTE: Universal Input (INx) terminal = Analog Input (AIx) object or Binary Input (BIx). Universal Output (OUTx) terminal = Analog Output (AOx) object. Relay output (RLYx) = Binary Output (BOx) object.

NOTE: Unused inputs and outputs are available for use with custom configuration and programming in KMC software.



- NOTES:
1. If Econ is enabled, OAT and DAT are required.
 2. See www.kmcccontrols.com for additional details.





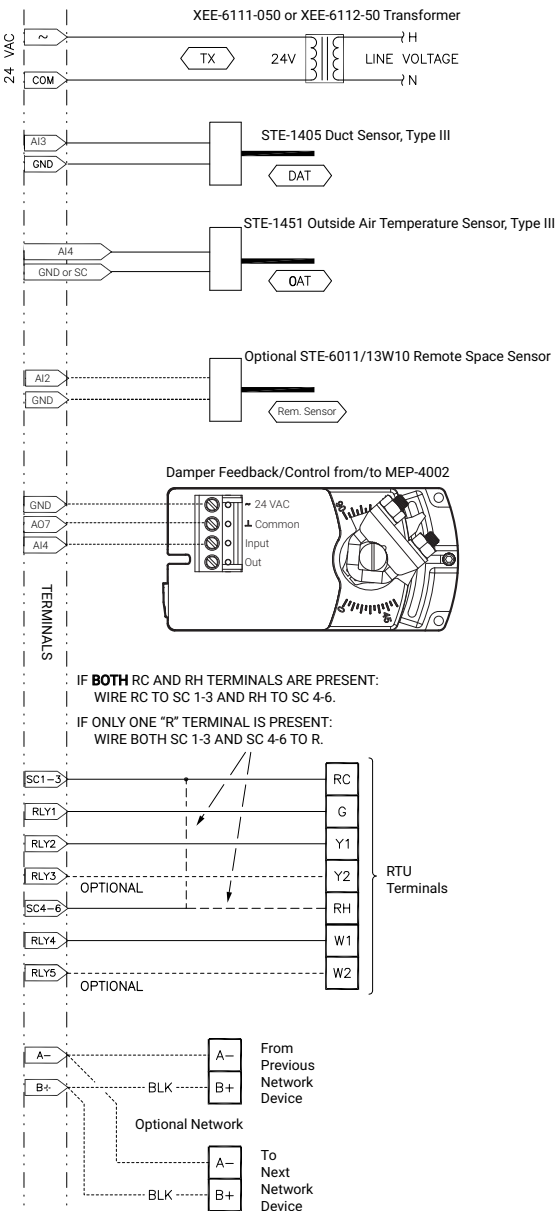
Heat Pump Unit with Auxiliary Heat, Optional Humidity and CO2 Sensors Models: BAC-190063CE-ZEC, BAC-190063C-ZEC, BAC-193263CE-ZEC, BAC-193263C-ZEC

SEQUENCE OF OPERATION:

1. Occupancy: The occupancy mode follows the internal schedule.
2. On/off fan: When the fan mode is set to *Auto* and heating (any form), cooling or economizer is called for, the fan starts. Once the space temp returns to setpoint, there is no call for any heating, cooling nor economizer and the fan-off-delay expires (2 minutes), the fan shuts off. During the occupied and standby modes, the fan output is energized any time the fan mode is set to *On*.
3. When the fan starts, if the normally closed fan status switch (optional) doesn't open within 10 seconds, all heating, cooling and economizer outputs are de-energized. The fan output remains enabled and heating/cooling/economizer outputs remain disabled until the fan status switch opens.
4. Reversing valve: The reversing valve output is energized on a call for cooling (adjustable).
5. Modulating analog valve (optional): BAC-19xxxx-ZEC models have a modulating output that can be customized as either heating or cooling.
6. Cooling: As the discharge air temperature (DAT) rises above the cooling setpoint plus the cooling span, compressor 1 is energized if the minimum off time has been met. If the DAT remains above the cooling setpoint plus the cooling span for the stage delay, compressor 2 is energized after ensuring its minimum off time. As the DAT drops below half of the cooling span above the cooling setpoint, compressor 2 is de-energized. As the DAT drops below the cooling setpoint, compressor 1 is de-energized.
7. Compressor heating: As the DAT drops below the heating setpoint minus the heating span, compressor 1 is energized if the minimum off time has been met. If the DAT remains below the heating setpoint minus the heating span for the stage delay, compressor 2 is energized after ensuring its minimum off time. As the DAT rises above half of the heating span below heating setpoint, compressor 2 is de-energized. As the DAT rises above the heating setpoint, compressor 1 is de-energized.
8. Auxiliary heat/third stage: When auxiliary heat is configured for *Third Stage*, the unit is in heating mode and compressor 2 has been on for the stage delay, the aux heat output is energized. As the DAT rises above 65% of the heating span below heating setpoint, aux heat is de-energized.
9. Auxiliary heat/compressor lockout: When auxiliary heat is configured for *Comp Lockout*, both compressors are locked out and the auxiliary heat output follows the compressor 1 heating sequence.
10. Emergency heat: When the system mode is manually set to *Emergency Heat*, all outputs besides fan are locked out and aux heat is energized as DAT drops below heating setpoint minus heating span. As the DAT rises above the heating setpoint, the aux heat output is de-energized.
11. Economizer: During occupied mode, if the outside air temperature (OAT) drops below the economizer enable temp and there is a call for cooling, Econ mode is enabled. Econ mode is disabled if OAT rises 1 deg above the econ enable temp. While economizing, the outside air damper (OAD) modulates to maintain the DAT. As the DAT rises above the cooling setpoint, the DAT setpoint resets from the DAT to the minimum DAT. While economizing, the OAD is open to the greater of the minimum damper position or DAT control. The OAD is shut during unoccupied mode and any time the fan is off.
12. If the space humidity (optional) rises above the dehumidification setpoint, compressor 1 is energized if the minimum off time has been met. If the humidity remains high for the stage delay and compressor 2's minimum off time has been met, compressor 2 is energized. Auxiliary heat is then cycled to maintain the *COOLING* setpoint. Once the space humidity drops below the dehumidification setpoint minus its span, dehumidification ceases and the compressors resume normal space temp control.
13. In Basic Demand Control Ventilation (DCV), the OA damper opens 100% as the CO2 level rises above the CO2 setpoint. As the CO2 level drops below the CO2 setpoint minus the CO2 deadband, the damper relinquishes to previous control.
14. In Standard DCV, the OA damper modulates from 0% open as the CO2 level rises from the CO2 base level +200 ppm to 100% open at the CO2 base level +600 ppm.
15. When both CO2 and economizer control are enabled, the damper responds to the greater of CO2 or economizer control.

ZONE ACTUATOR CONTROLLER (ZAC) (BAC-19XX63-ZEC)

Application Connections



NOTE: Binary Output (BO1–BO6) terminals are relays and are used with SC terminals instead of GND terminals.

NOTE: Universal (analog) inputs (AIx/INx) and outputs (AOx/OUTx) are used with GND terminals. They can be configured to emulate binary (on/off or voltage/no-voltage) objects.

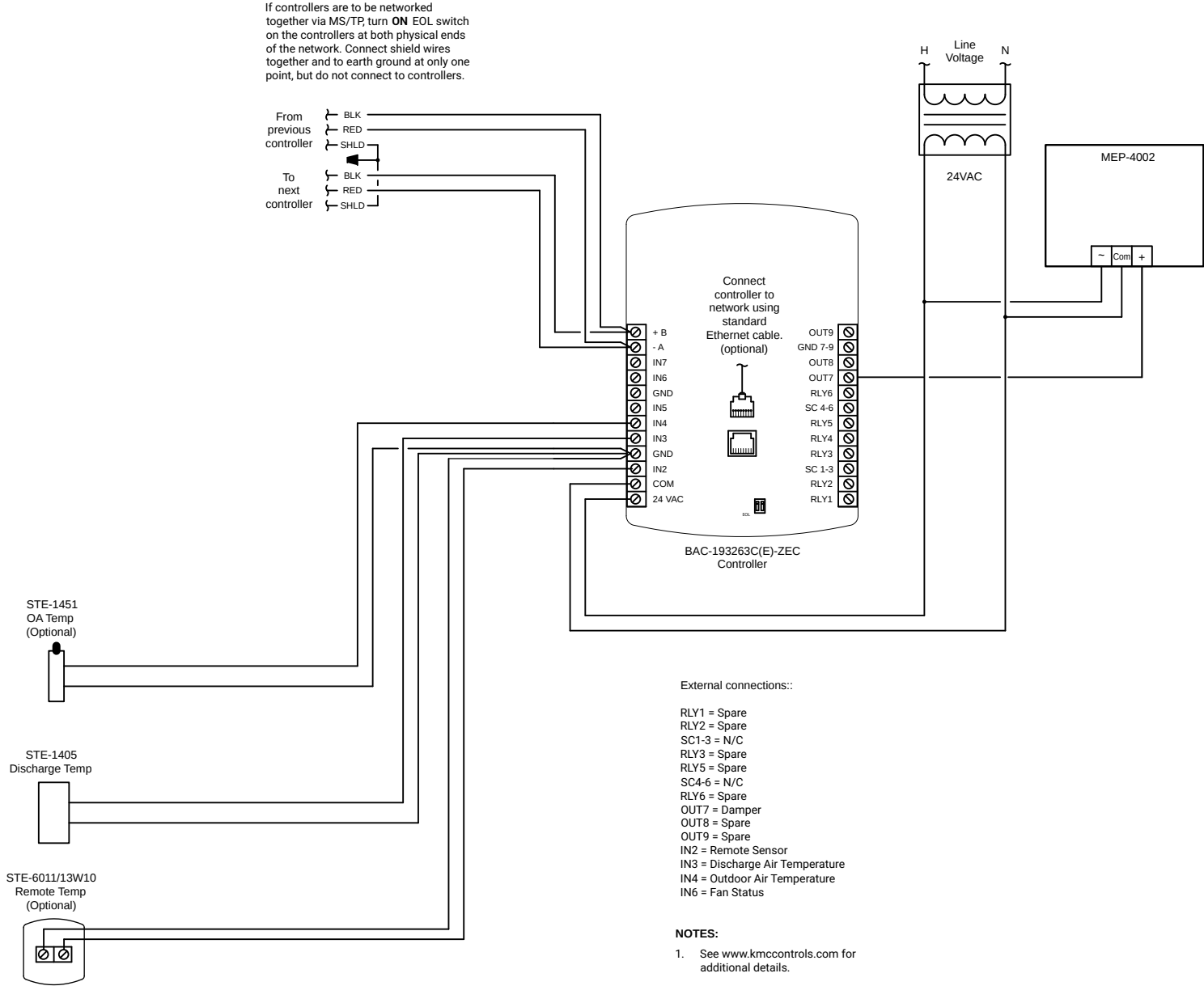
NOTE: Unused inputs and outputs are available for use with custom configuration and programming in KMC software.

Inputs and Outputs List

VAVZEC (ZONE ACTUATOR CONTROLLER)	
Inputs	
Object Identifier	Description
AI1*	Space Sensor
AI2/IN2	Remote Sensor
AI3/IN3	Discharge Air Temperature
AI3/IN3	Outside Air Temperature
AI4/IN4	Damper Feedback from MEP-4002
BI5/IN5	Fan Status
AI7/IN7	Analog Input #7
AI8	INTERNAL Humidity Sensor**
BI9	INTERNAL Motion Sensor**
AHO	INTERNAL CO2 Sensor**
*Internal temperature sensor is on all models.	
**Optional internal humidity and CO2 sensors are on applicable models.	
Outputs	
Object Identifier	Description
BO1/RLY1	Binary Output #1
BO2/RLY2	Binary Output #2
BO3/RLY3	Binary Output #3
BO4/OUT4	Binary Output #4
BO5/OUT5	Binary Output #5
BO6/OUT6	Binary Output #6
AO7/OUT7	Damper Control to MEP-4002
AO8/OUT8	Analog Input #8
AO9/OUT9	Analog Input #9

NOTE: Universal Input (INx) terminal = Analog Input (AIx) object or Binary Input (BIx). Universal Output (OUTx) terminal = Analog Output (AOx) object. Relay output (RLYx) = Binary Output (BOx) object.

NOTE: Unused inputs and outputs are available for use with custom configuration and programming in KMC software.





**ZAC (Zone Actuator Controller) Pressure-Dependent VAV
with Optional Humidity and CO2 Sensors**
**Models: BAC-190063CE-ZEC, BAC-190063C-ZEC, BAC-193263CE-ZEC,
BAC-193263C-ZEC**

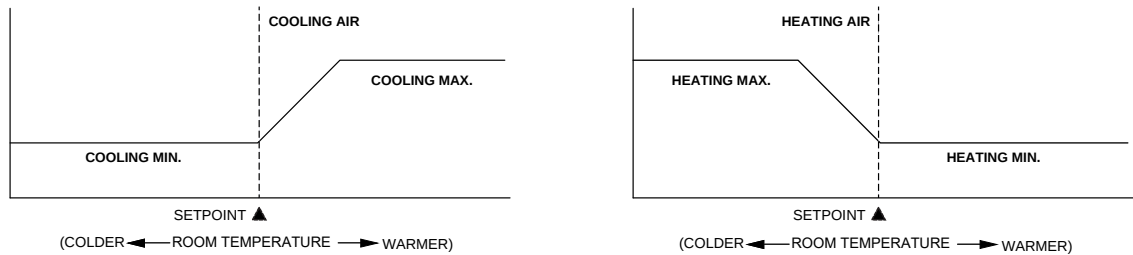
SEQUENCE OF OPERATION:

- 1. Occupancy: Occupancy mode follows the zoning equipment controller (ZEC) schedule. If desired, the zone actuator controller (ZAC) can be configured to use its internal schedule as the primary schedule for the space.
- 2. Heating/Cooling: The heating and cooling mode is transmitted over the network to the zone actuator control. If the room temperature deviates from the room setpoint, the damper will modulate from minimum to maximum position, delivering air from the heating and air conditioning equipment to control the temperature of the space. The heating or cooling mode can be determined according to the temperature of the air supplied to the space by connecting a DAT sensor to the BAC-19xx63-ZEC controller.

ZAC thermostats are designed to use an MEP-4002 actuator to operate damper boxes in a pressure-dependent VAV system as shown in the diagram below. A voltage signal (AO7) is connected to the MEP-4002 to adjust airflow from minimum to maximum according to space demand. Minimum and maximum position limits are set in the ZAC application menu.

The MEP-4002 is set at the factory as CW to open or CW with increasing voltage. This can be reversed by installing a switch during installation and configuration. See the *MEP-4002 Series Installation Guide* for more information.

Pressure-Dependent VAV Controller Operation



IMPORTANT NOTICES

NOTE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. A BAC-19xx63-ZEC Class A digital apparatus complies with Canadian ICES-003.

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