



# E-SERIES INTEROPERABLE VAV DIFFUSERS

## BACNET™ OBJECT LIST

**Models:** E-Series BACnet VAV Diffusers

### BACnet OBJECTS

All the input and output Objects for the E-Series diffusers are listed on the following pages. The Objects are divided into three types: Configuration (c), Input (i), and Output (o). Configuration Objects can be thought of as the default settings and are stored in non-volatile memory (will remain after a loss of power). Input and Output Objects exist only in the network. Either they will require re-transmission following a loss of power or the default Configuration Objects will take effect.

### FACTORY SET DEFAULT VALUES

The E-Series diffusers are factory-programmed and fully operational without connection to a network (24VAC supply power is required). It is strongly recommended that only the Objects required for the project be altered.

### UNITS OF MEASURE

The E-Series diffusers operate in the Inch-Pound units of measure. To convert to SI units:

$$\text{Temperature } \Delta^{\circ}\text{C} = \Delta 1.8^{\circ}\text{F}$$

$$^{\circ}\text{C} = 1.8 * (^{\circ}\text{F} - 32)$$

$$\text{Flow Rate } 1 \text{ L/s} = 2.119 \text{ CFM}$$

### MEASURING ENERGY CONSUMPTION

Supply air temperature, room temperature, and flow from the E-Series diffusers can be logged and used to calculate the energy used by each diffuser in BTU/Hr or Watts. This function must be written into a computer connected to the network or a device capable of this computation. The formulas are:

$$\text{BTU/Hr} = (\Delta^{\circ}\text{F between supply and room temperature}) \times (\text{flow in CFM}) \times (1.10)$$

$$\text{Watts} = (\Delta^{\circ}\text{C between supply and room temperature}) \times (\text{flow in L/s}) \times (1.231)$$

### ALTITUDE COMPENSATION

Installation of the E-Series diffusers at altitudes above 1650ft (503m) requires modified settings to compensate for air density effects. The Object AV\_19 (cFlowScaler) may be used to correct the measured air flow for the effects of altitude.

Altitude	cFlowScaler
1,650-3,279ft (503-999m)	91
3,280-4,920ft (1,000-1,499m)	85
4,921-6,561ft (1,500-1,999m)	81
6,562-8,202ft (2,000-2,499m)	76
Above 8,202ft (Above 2,500m)	70

### SUMMARY OF OBJECTS

<b>Types</b>	AI = analog_input AV = analog_value BV = binary_value
<b>Set Points</b>	AV_4 (cOccCoolsp) AV_5 (cUnocCoolsp) AV_6 (cStndbyCoolsp) AV_7 (cOccHeatsp) AV_8 (cUnocHeatsp) AV_9 (cStndbyHeatsp) AV_10 (cStPtLimit) AV_11 (cStPtReset) AV_15 (cVacSpOfst) AV_23 (iTempSetpt) AI_3 (oEffectStpt)

<b>Measurements</b>	AI_0 (oRmTemp) AI_1 (oSATemp) AI_2 (oAirFlow)
<b>Overrides</b>	AV_24 (iFlowSetpt) AV_25 (iOverride) AV_26 (iRmTemp) AV_27 (iSATemp) AV_28 (iFlowRate)
<b>Flow Settings</b>	AV_0 (cMaxFlow) AV_1 (cMinFlow) AV_2 (cMinStbyFlow) AV_12 (cMaxHeatsp)
<b>Mode Settings</b>	BV_0 (iVacancyMode) AV_13 (cHCMMode) AV_21 (iOccMode) AV_22 (iHCMMode)
<b>Special Features</b>	AV_3 (cCO2sp) AV_14 (cBaudrate) AV_29 (iCO2Level) AI_4 (oTmnlLoad)
<b>Diagnostics/ Factory Settings</b>	BV_1 (iPowerDbg) BV_2 (iFlowDbg) AV_16 (cRmOffset) AV_17 (cSAOffset) AV_18 (cFlowOffset) AV_19 (cFlowScaler) AV_20 (cFBoffset) AI_5 (oDbg1) AI_6 (oDbg2) AI_7 (oDbg3) AI_8 (oDbg4) AI_9 (oDbg5) AI_10 (oDbg6)

**BACNET OBJECT LIST**

(Supersedes FORM 091.202 REV 1612)

Object	Name	I/O	Description	Default	Options	Related Objects
BV_0	(iVacancyMode)	i	Vacancy. Used to adjust set point when building is occupied but office is vacant. If 1 (on) then effective set point = set point +cool/-heat AV_15 (cVacSpOfst).	0 (off)	0 (off) 1 (on)	AV_13 (cHCMMode) AV_15 (cVacSpOfst) AV_22 (iHCMMode)
BV_1	(iPowerDbg)	i	Diagnostics	0 (off)	0 (off) 1 (on)	AI_5 (oDbg1) AI_6 (oDbg2) AI_7 (oDbg3) AI_8 (oDbg4) AI_9 (oDbg5) AI_10 (oDbg6)
BV_2	(iFlowDbg)	i	Diagnostics	0 (off)	0 (off) 1 (on)	BV_2 (iPowerDbg) AI_5 (oDbg1) AI_6 (oDbg2) AI_7 (oDbg3) AI_8 (oDbg4) AI_9 (oDbg5) AI_10 (oDbg6)
AV_0	(cMaxFlow)	c	Maximum Flow Set Point. Limits diffuser opening to a maximum air volume.	1000 (CFM)	0 - 1000 (CFM)	AV_12 (cMaxHeatsp) AI_2 (oAirFlow) AI_4 (oTmnlLoad)
AV_1	(cMinFlow)	c	Minimum Flow Set Point. Limits diffuser closing to a minimum air volume. Must be a lower value than AV_0 (cMaxFlow).	0 (CFM)	0 - 1000 (CFM)	AI_2 (oAirFlow)
AV_2	(cMinStbyFlow)	c	Minimum Flow Standby Set Point. If occupancy mode = standby, then limits diffuser closing to minimum air volume. Must be a value lower than AV_1 (cMinFlow).	0 (CFM)	0 - 1000 (CFM)	AI_2 (oAirFlow)
AV_3	(cCO2sp)	c	CO2 Set Point. While AV_29 (iCO2Level) is greater than cCO2sp the unit will move to the open position.	5000 (ppm)	0 - 10000 (ppm)	AV_29 (iCO2Level)
AV_4	(cOccCoolsp)	c	Cooling Set Point Occupied Mode	74 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_5	(cUnocCoolsp)	c	Cooling Set Point Unoccupied Mode	77 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_6	(cStndbyCoolsp)	c	Cooling Set Point Standby Mode	75 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_7	(cOccHeatsp)	c	Heating Set Point Occupied Mode	74 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_8	(cUnocHeatsp)	c	Heating Set Point Unoccupied Mode	71 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_9	(cStndbyHeatsp)	c	Heating Set Point Standby Mode	73 (°F)	55 - 95 (°F)	AV_21 (iOccMode)
AV_10	(cStPtLimit)	c	Set Point Limit. Limits the value that in occupied mode that will be accepted from AV_23 (iTempSetpt). The input is used as a +/- from AV_4 (cOccCoolsp) and AV_7 (cOccHeatsp).	20 (°F)	1 - 20 (°F)	AV_4 (cOccCoolsp) AV_7 (cOccHeatsp) AV_21 (iOccMode) AV_23 (iTempSetpt)

## BACNET OBJECT LIST

(Supersedes FORM 091.202 REV 1612)

Object	Name	I/O	Description	Default	Options	Related Objects
AV_11	(cStPtReset)	c	Set Point Reset. Clears the input from AV_23 (iTempSetpt) every time the mode AV_21 (iOccMode) changes.	0 (off)	0 (off) 1 (on)	AV_0 (cMaxFlow) AV_21 (iOccMode) AV_23 (iTempSetpt)
AV_12	(cMaxHeatsp)	c	Maximum Air Flow in Heating. Limits the maximum flow when heat/cool mode = heating as a percentage of AV_0 (cMaxFlow). A value of 0 will close the unit in heating.	100 (%)	0 - 100 (%)	AV_0 (cMaxFlow) AV_13 (cHCMode) AV_22 (iHCMode)
AV_13	(cHCMode)	c	Heating/Cooling Mode. Set diffuser for cooling only, heating only or automatic selection of cooling or heating. Automatic uses cooling mode unless supply air temperature is warmer than both the room temperature and the set point.	9 (invalid) <same as automatic>	0 (automatic) 1 (cooling) 2 (heating)	AV_15 (cVacSpOfst) AV_12 (cMaxHeatsp)
AV_14	(cBaudrate)	c	Baud Rate. Adjusts the baud rate of communication. <b>Note:</b> <i>Must cycle power for changes to take effect.</i>	0 (38400)	0 (38400) 1 (9600) 2 (19200) 3 (57600)	(none)
AV_15	(cVacSpOfst)	c	Vacancy Set Point Offset. If BV_0 (iVacancyMode) = 1 (on) and occupancy mode = occupied, then effective set point = set point +cool/-heat cVacSpOfst.	2 (°F)	1 - 20 (°F)	BV_0 (iVacancyMode) AV_13 (cHCMode) AV_22 (iHCMode)
AV_16	(cRmOffset)	c	Factory Calibration (room temperature offset)	(°F x 100)	n/a	AI_0 (oRmTemp)
AV_17	(cSAOffset)	c	Factory Calibration (supply air temperature offset)	(°F x 100)	n/a	AI_1 (oSATemp)
AV_18	(cFlowOffset)	c	Factory Calibration (air flow rate offset)	(CFM)	n/a	AI_2 (oAirFlow)
AV_19	(cFlowScaler)	c	Factory Calibration (air flow multiplier)	(%)	n/a	AI_2 (oAirFlow)
AV_20	(cFBoffset)	c	Factory Calibration (over temp protection offset)	(adc)	n/a	(none)
AV_21	(iOccMode)	i	Override Occupancy Mode. Override the default occupancy mode ('occupied') and command the diffuser into 'unoccupied' or 'standby' modes.	0 (occupied)	0 (occupied) 1 (unoccupied) 2 (standby)	AV_3 (cCO2sp) AV_4 - 9 (set points) AV_11 (cStPtReset)
AV_22	(iHCMode)	i	Override Heating/Cooling Mode. Override the built-in algorithm and command the diffuser into cooling or heating modes. An invalid entry (i.e. 9) will be ignored effectively disabling this input.	9 (invalid)	0 (automatic) 1 (cooling) 2 (heating)	BV_0 (iVacancyMode) AV_13 (cHCMode) AV_22 (iHCMode)
AV_23	(iTempSetpt)	i	Room Temperature Set Point. Input to diffuser of desired room temperature set point in occupied mode. An invalid entry (i.e. 3276) will be ignored effectively disabling this input.	3276 (°F)	55 - 95 (°F)	AV_10 (cStPtLimit) AV_21 (iOccMode)

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(Supersedes FORM 091.202 REV 1612)

Object	Name	I/O	Description	Default	Options	Related Objects
AV_24	(iFlowSetpt)	i	Override to Air Flow or Damper Position Set Point. This object's value is used when AV_25 (iOverride) is equal to 5 (override to CFM set point) or 6 <sup>1</sup> (override to % open damper position). An invalid entry (i.e. 3276) will disable this input.	3276	0 - 1000	AV_25 (iOverride)
AV_25	(iOverride)	i	Override Diffuser Damper Position. Override the built-in algorithm positioning the damper to a full open/closed, flow, or % damper position setting. For options 3 (AV_0 cMaxFlow), 4 (AV_1 cMinFlow), and 5 (AV_24 iFlowSetpt), the diffuser will adjust the damper position to achieve the air flow rate equivalent to the referenced object's value. For option 6 <sup>1</sup> (AV_24 iFlowSetpt), the diffuser will adjust its damper to the % open position equivalent to the value set in AV_24 iFlowSetpt.	0 (automatic)	0 (automatic) 1 (full open) 2 (full closed) 3 (cMaxFlow) 4 (cMinFlow) 5 (iFlowSetpt) CFM 6 (iFlowSetpt) % <sup>1</sup>	AV_0 (cMaxFlow) AV_1 (cMinFlow) AV_24 (iFlowSetpt)
AV_26	(iRmTemp)	i	Override Room Temperature. Override the built-in room temperature sensor. Diffuser will use this input to operate control algorithm. An invalid entry (i.e. 327) will effectively disable this input.	327 (°F)	32 - 200 (°F)	AI_0 (oRmTemp)
AV_27	(iSATemp)	i	Override Supply Air Temperature. Override the built-in supply air (duct) temperature sensor. Diffuser will use this input to operate control algorithm. An invalid entry (i.e. 327) will be ignored effectively disabling this input.	327 (°F)	32 - 200 (°F)	AI_1 (oSATemp)
AV_28	(iFlowRate)	i	Override Air Flow Rate. Override the built-in air flow rate sensors and use this input to operate the control algorithm. An invalid entry (i.e. 3276) will be ignored effectively disabling this input.	3276 (CFM)	0 - 1000 (CFM)	AI_2 (oAirFlow)
AV_29	(iCO2Level)	i	Input from CO2 Sensor. Used to open diffuser to purge room. While the iCO2Level is greater than AV_3 (cCO2sp), the unit will open.	0 (ppm)	0 - 10000 (ppm)	AV_3 (cCO2sp)
AI_0	(oRmTemp)	o	Room Temperature. Output of effective room temperature used by control algorithm.	(°F)	n/a	AV_16 (cRmOffset) AV_26 (iRmTemp)
AI_1	(oSATemp)	o	Supply Air Temperature. Output of effective supply air (duct) temperature used by control algorithm.	(°F)	n/a	AV_17 (cSAOffset) AV_27 (iSATemp)
AI_2	(oAirFlow)	o	Air Flow Rate. Output of effective air flow rate used by control algorithm.	(CFM)	n/a	AV_18 (cFlowOffset) AV_19 (cFlowScaler) AV_28 (iFlowRate)

<sup>1</sup> AV\_24 iFlowSetpt damper position option is only applicable to E-Series Motorized diffusers.

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(Supersedes FORM 091.202 REV 1612)

Object	Name	I/O	Description	Default	Options	Related Objects
AI_3	(oEffectStpt)	o	Room Temperature Set Point. Output of effective room temperature set point used by control algorithm.	(°F)	n/a	BV_0 (iVacancyMode) AV_4-9 (set points) AV_10 (cStPtLimit) AV_11 (cStPtReset) AV_13 (cHCMMode) AV_15 (cVacSpOfst) AV_21 (iOccMode) AV_22 (iHCMMode) AV_23 (iTempSetpt)
AI_4	(oTmnlLoad)	o	Terminal Load is '+' in cooling and '-' in heating. For thermal-electric units, it is equal to oAirFlow/cMaxFlow (%). For motorized units, it is equal to target damper position (%).	(%)	n/a	AV_0 (cMaxFlow) AV_13 (cHCMMode) AV_22 (iHCMMode) AV_28 (iFlowRate)
AI_5	(oDbg1)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)
AI_6	(oDbg2)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)
AI_7	(oDbg3)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)
AI_8	(oDbg4)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)
AI_9	(oDbg5)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)
AI_10	(oDbg6)	o	Diagnostics (output dependent upon iFlowDbg and iPowerDbg)	(none)	n/a	BV_1 (iFlowDbg) BV_2 (iPowerDbg)

## Wiring Notes

For wiring diagrams, please consult the diffuser Installation & Operation Manuals (IOM) available at [Acutherm.com](http://Acutherm.com). All wiring shall follow ASHRAE Standard 135 for isolated devices on three-conductor cable with shield.