

SIEMENS

BACnet ATEC

**Application 2860 – VAV Cooling
Only**

Application Note

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Overview

In Application 2860, the controller modulates the supply air damper of the terminal box for cooling. In order for it to work properly, the central air-handling unit must provide cool supply air.



Application 2860 Cooling Only Hardware Diagram.

BACnet ATEC Models

Part Number	Description
550-440	BACnet ATEC Model 0001, cooling only (GDE)
550-441	BACnet ATEC Model 0001, cooling only (GLB)
550-445	BACnet ATEC Model 2301, full feature (GDE)
550-446	BACnet ATEC Model 2301, full feature (GLB)

BACnet

The controller communicates using BACnet MS/TP protocol for open communications on BACnet MS/TP networks.

Product	Supported BIBBs	BIBB Name
BTEC	DS-RP-B B	Data Sharing-Read Property-B
	DS-RPM-B	Data Sharing-Read Property Multiple-B
	DS-WP-B	Data Sharing-Write Property-B
	DM-DDB-B	Device Management-Dynamic Device Binding-B
	DM-DOB-B	Device Management-Dynamic Object Binding-B
	DM-DDC-B	Device Management-Device Communication Control-B

Hardware Inputs

Analog

- Airflow sensor
- Room temperature sensor
- Room temperature setpoint dial (optional)
- Spare UI1 (temperature sensor (10K thermistor) or percentage (0-10V/4-20ma)) *
- Spare UI2 (temperature sensor (10K thermistor) or percentage (0-10V/4-20ma)) *

Digital

- Night mode override (optional)
- Wall switch (optional) or Spare UI2 *
- Spare UI1 *

* Feature available on the full feature BACnet ATEC only.

Hardware Outputs

Analog

- none

Digital

- Damper actuator
- Spare DO3, DO4, or (DO3/DO4 Spare floating actuator)*
- Spare DO5 *

* Available on the full feature BACnet ATEC only.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2860, “VAV Cooling Only”.

Control Temperature Setpoints

Depending on the controller's current operational mode (day or night), the control temperature setpoint, CTL STPT holds the value of one of the following setpoints:

Day Mode - In day mode, CTL STPT holds the value of DAY CLG STPT. If the room temperature sensor has a setpoint dial and STPT DIAL is set to YES, then CTL STPT holds the value of RM STPT DIAL.

If the setpoint dial is used and the value of RM STPT DIAL is less than the value of RM STPT MIN, then CTL STPT holds the value of RM STPT MIN. If the value of RM STPT DIAL is greater than the value of RM STPT MAX, then CTL STPT holds the value of RM STPT MAX.

Night Mode - In night mode, CTL STPT holds the value of NGT CLG STPT.

Day and Night Modes

The day/night status of the space is determined by the status of DAY.NGT. The control of this point differs depending on whether the controller is monitoring the status of a wall switch or if the controller is connected to a field panel.

When WALL SWITCH = NO, the controller does not monitor the status of the wall switch, even if one is connected to it. In this case, if the controller is operating stand-alone, then the controller stays in day mode all the time. If the controller is operating with centralized control (that is, it is connected to a field panel), then the field panel can send an operator or PPCL command to override the status of DAY.NGT. See *Powers Process Control Language (PPCL) User's Manual* (125-1896) and *Field Panel User's Manual* (125-3019 or 125-3020) for more information.

For controllers with expanded IO (models 2301):

When a wall switch is physically connected to the termination strip on the controller at UI 2 (see the *Control Diagram* in Overview [→ 4]), and WALL SWITCH = YES, the controller monitors the status of UI 2. When the status of UI 2 is ON (the switch is closed), then DAY.NGT will be set to DAY indicating that the controller is in day mode. When the status of UI 2 is OFF (the switch is open), then DAY.NGT will be set to NIGHT indicating that the controller is in night mode

See also

📖 Overview [→ 4]

Night Mode Override Switch

If an override switch is present on the room temperature sensor and a value (in hours) other than zero has been entered into OVRD TIME, pressing the override switch will reset the controller to day operational mode for the time period that is set in OVRD TIME. The status of NGT OVRD changes to DAY. After the override time elapses, the controller returns to night mode and the status of NGT OVRD changes back to NIGHT.

The override switch on the room sensor will only affect the controller when in night mode.

Room Temperature Offset (Optional)

TEMP OFFSET is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP and the actual room temperature. This corrected value is displayed in CTL TEMP.

$$\text{CTL TEMP} = \text{ROOM TEMP} + \text{TEMP OFFSET}$$

Example

If the actual room temperature is 72.0°F, and the value of ROOM TEMP is 73.0°F, then the value entered into TEMP OFFSET is -1.0. In this case, the value of ROOM TEMP would read 73.0°F, but the value of CTL TEMP would read 72.0°F.

Control Loops

The terminal box is controlled by two Proportional, Integral, and Derivative (PID) control loops; a temperature loop and a flow loop.

The temperature loop is a cooling loop. The active temperature loop maintains room temperature at the value in CTL STPT. See Control Temperature Setpoints [→ 6].

The terminal box is controlled by three Proportional, Integral, and Derivative (PID) control loops; two temperature loops and a flow loop.

The two temperature loops are a cooling loop and a heating loop. The active temperature loop maintains room temperature at the value in CTL STPT. See Control Temperature Setpoints [→ 6].

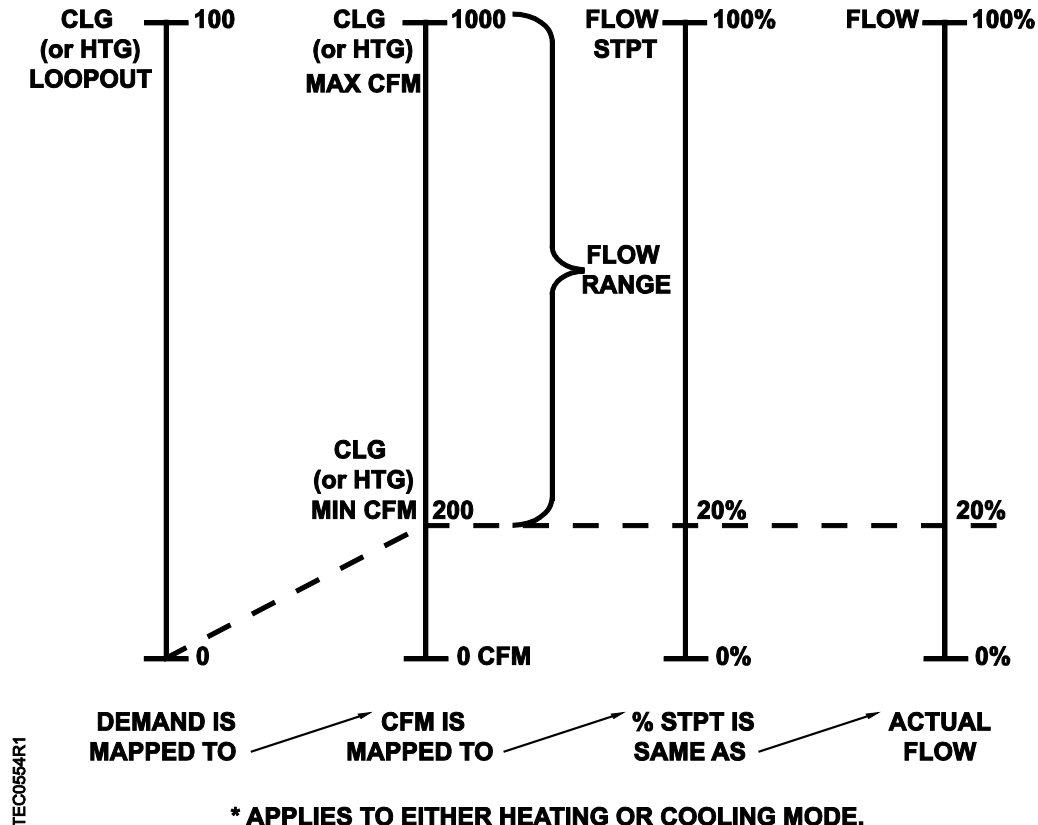
Cooling Loop – Generates cooling loopout which is then used to generate FLOW STPT. FLOW STPT is the result of scaling the cooling loopout to the appropriate range of values determined by CLG FLOW MIN and CLG FLOW MAX.

As described in the following figure, the flow setpoint is calculated by:

$$\text{FLOW STPT} = [\text{CLG LOOPOUT} \times (100\% - \% \text{ minimum setpoint})] + \% \text{ minimum setpoint}$$

Where percent minimum setpoint is:

$$\% \text{ minimum setpoint} = (\text{CLG FLOW MIN} / \text{CLG FLOW MAX}) \times 100 \%$$



FLOW STPT and FLOW % are relative to MIN and MAX STPTS of corresponding heating or cooling mode.

Example

If CLG FLOW MIN = 200 cfm, and CLG FLOW MAX = 1000 cfm, the minimum flow setpoint is
 $(200 \text{ cfm} / 1000 \text{ cfm}) \times 100\% \text{ flow} = 20\%$.

When CLG LOOPOUT is 0%, FLOW STPT = 20% flow.

$$[0\% \times (100\% - 20\%)] + 20\% = 20\%$$

This ensures that the airflow out of the terminal box is no less than CLG FLOW MIN.

When CLG LOOPOUT is 50%, FLOW STPT = 60% flow.

$$[50\% \times (100\% - 20\%)] + 20\% = 60\%$$

When CLG LOOPOUT is 100%, FLOW STPT = 100% flow.

$$[100\% \times (100\% - 20\%)] + 20\% = 100\%$$

Flow Loop – Maintains minimum airflow and maximum airflow through CTL FLOW MIN and CTL FLOW MAX.

In Application 2860, you can set CLG FLOW MIN equal to, but not greater than, CLG FLOW MAX, and set HTG FLOW MIN equal to, but not greater than, HTG FLOW MAX. If the minimum and maximum values are set equal, the flow loop becomes a constant volume loop and loses its ability to control temperature.

The flow loop maintains FLOW STPT by modulating the supply air damper, DMPR CMD. The flow loop maintains the airflow between CTL FLOW MIN and CTL FLOW MAX.

FLOW is the input value for the flow loop. It is calculated as a percentage based on where AIR VOLUME is between 0 cfm and CTL FLOW MAX. This percentage is referred to as % flow.

- If AIR VOLUME = 0 cfm, FLOW is 0% flow.
- If AIR VOLUME = CTL FLOW MAX, FLOW is 100% flow.

The low limit of FLOW STPT will be the percentage that corresponds to the volume given in CTL FLOW MIN. This percentage can be calculated as:

$$(\text{CTL FLOW MIN} / \text{CTL FLOW MAX}) \times 100\% \text{ flow}$$


The flow loop ensures that the supply air will not be less than CTL FLOW MIN.

Example

If CTL FLOW MIN = 250 cfm, and CTL FLOW MAX = 1000 cfm,
the low limit of FLOW STPT = $(250 \text{ cfm} / 1000 \text{ cfm}) \times 100\% \text{ flow}$
= $0.25 \times 100\% \text{ flow}$
= 25% flow.

Since 25% of 1000 cfm = 250 cfm, the minimum airflow out of the terminal box will be 250 cfm.

See also

 Control Temperature Setpoints [→ 6]

Calibration

Calibration of the controller's internal air velocity transducers is periodically required to maintain accurate air velocity readings. CAL SETUP is set with the desired calibration option during controller startup.

Depending on the value of CAL SETUP, calibration may be set to take place automatically or manually. If CAL AIR = YES, calibration is in progress.

The damper is commanded closed to get a zero airflow reading during calibration.

At the end of a calibration sequence, CAL AIR automatically returns to NO. A status of NO indicates that the controller is not in a calibration sequence.

During normal operation: To ensure that the damper closes fully, the controller will provide additional closing time when the DMPR POS = 0%.

Fail Mode Operation

If the air velocity sensor fails, the controller uses pressure dependent control. The temperature loop controls the operation of the damper.

If the room temperature sensor fails, the controller operates using the last known temperature value.

Application Notes

- If temperature swings in the room are excessive or there is trouble maintaining the setpoint, the cooling loop needs to be tuned. If FLOW is oscillating while FLOW STPT is constant, the flow loop requires tuning. See *iKnow Troubleshooting Tool* for more information.
- Siemens BACnet Actuator, as shipped from the factory, keeps all associated equipment OFF. See the *BACnet Actuator Start-up Procedures* for information on how to release the controller and its equipment to application control.

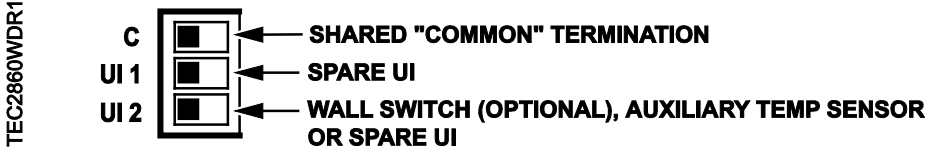
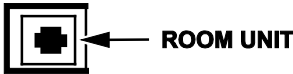
For controllers with expanded IO (model 2301):

- Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. DO 3 and DO 4 may be used as auxiliary motor points. If using a pair of spare DOs to control a motor, you must unbundle the corresponding motor command point.
- Spare UIs can be used as temperature inputs, percentage inputs (for example, humidity) or digital inputs. See the *BACnet Actuator Start-up Procedures* for information on how to setup these inputs for analog or digital use.

Wiring Diagram

Application 2860 point wiring.

	<p>⚠ CAUTION</p> <p>The controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. An external interposing relay is required for any of the following:</p> <ul style="list-style-type: none">• VA requirements higher than the maximum• 110 or 220 Vac requirements• DC power requirements• Separate transformers used to power the load. <p>(for example part number 540-147, Terminal Equipment Controller Relay Module)</p>
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Application 2860 – Cooling Only.



NOTE:

Spare DOs and UIs are only available on the full feature controller.

Application 2860 Point Database

Object Type ^{a)}	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ^{b)}	Eng Units (SI Units)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	--	0-255	--	--
AO	2	APPLICATION	2897	--	0-32767	--	--
AO	3	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-255.75	--	--
AI	{04} ^{c)}	ROOM TEMP	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
AO	6	DAY CLG STPT	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
AO	8	NGT CLG STPT	82.0 (27.8)	DEG F (DEG C)	-255.75	--	--
AO	11	RM STPT MIN	55.0 (12.68)	DEG F (DEG C)	-255.75	--	--
AO	12	RM STPT MAX	90.0 (32.28)	DEG F (DEG C)	-255.75	--	--
AI	{13}	RM STPT DIAL	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
BO	{14}	STPT DIAL	NO	--	Binary	YES	NO
AI	{15}	AUX TEMP UI1	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
BO	{18}	WALL SWITCH	NO	--	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	--	Binary	ON	OFF
AO	20	OVRD TIME	0	HRS	0-255	--	--
BO	{21}	NGT OVRD	NIGHT	--	Binary	NIGHT	DAY
BI	{24}	DIGITAL UI2	OFF	--	Binary	ON	OFF
BI	{25}	DIGITAL UI1	OFF	--	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	--	Binary	NIGHT	DAY
AO	31	CLG FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	--	--
AO	32	CLG FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	--	--
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	--	--
AO	36	FLOW COEFF	1	--	0-2.55	--	--
BO	{43}	DO 3	OFF	--	Binary	ON	OFF
BO	{44}	DO 4	OFF	--	Binary	ON	OFF
BO	{45}	DO 5	OFF	--	Binary	ON	OFF
AO	48	DMPR COMD	0	PCT	0-102	--	--
AO	49	DMPR POS	0	PCT	0-102	--	--

Object Type ^{a)}	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ^{b)}	Eng Units (SI Units)	Range	Active Text	Inactive Text
AO	51	MTR1 TIMING	95	SEC	0-511	--	--
AO	52	MTR2 COMD	0	PCT	0-102	--	--
AO	53	MTR2 POS	0	PCT	0-102	--	--
AO	55	MTR2 TIMING	130	SEC	0-511	--	--
AO	56	DMPR ROT ANG	90	--	0-255	--	--
AO	58	MTR SETUP	1	--	0-255	--	--
AO	59	DO DIR. REV	0	--	0-255	--	--
AO	63	CLG P GAIN	20.0 (36.0)	--	0-63.75	--	--
AO	64	CLG I GAIN	0.01 (0.018)	--	0-1.023	--	--
AO	65	CLG D GAIN	0 (0.0)	--	0-510	--	--
BO	{66}	CHK OUT	NO	--	Binary	YES	NO
AO	70	CHK STATUS	-1	--	-32767	--	--
AO	71	FLOW P GAIN	0	--	0-51.15	--	--
AO	72	FLOW I GAIN	0.01	--	0-1.023	--	--
AO	73	FLOW D GAIN	0	--	0-510	--	--
AO	74	FLOW BIAS	50	PCT	0-102	--	--
AO	75	FLOW	0	PCT	0-1023.75	--	--
AO	76	CTL FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	--	--
AO	77	CTL FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	--	--
AO	78	CTL TEMP	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
AO	79	CLG LOOPOUT	0	PCT	0-102	--	--
AO	92	CTL STPT	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
AO	93	FLOW STPT	0	PCT	0-255.75	--	--
BO	{94}	CAL AIR	NO	--	Binary	YES	NO
AO	95	CAL SETUP	4	--	0-255	--	--
AO	96	CAL TIMER	12	HRS	0-255	--	--
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	--	--
AO	98	LOOP TIME	5	SEC	0-255	--	--
AO	99	ERROR STATUS	0	--	0-255	--	--
AO	102	UI1 CFG	1	--	0-255	--	--
AI	{103}	PERCENT UI1	0	PCT	0-6.375	--	--
AO	104	UI2 CFG	1	--	0-255	--	--
AI	{105}	PERCENT UI2	0	PCT	0-6.375	--	--
AO	106	AIR ALTITUDE	700	FEET	0-16383	--	--

Object Type ^{a)}	Object Instance (Point Number)	Object Name (Descriptor)	Factory Default (SI Units) ^{b)}	Eng Units (SI Units)	Range	Active Text	Inactive Text
			(213.36)	(METERS)			
AO	107	TUBE LEN	6.0 (1.8288)	FEET (METERS)	0-102.3	--	--
AO	108	TUBE DIAMETE	0.187 (0.47498)	INCH (CM)	0-0.255	--	--
AI	{109}	AUX TEMP UI2	74.0 (23.32)	DEG F (DEG C)	-255.75	--	--
AO	126	STAT SUPV	0	--	0-255	--	--
AO	127	RM RH	50	PCT	0-102	--	--

^{a)} Object Types are; Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).

^{b)} A single value in a column means that the value is the same in English units and in SI units.

^{c)} Point numbers that appear in brackets { } may be unbundled at the field panel.

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