SIEMENS

Fan Coil BACnet ASC Controller

Application Notes

Application 2545 — 2-Stage Cooling and Hot Water Heat

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Overview

In Application 2545, the controller energizes a maximum of two stages of cooling and a hot water valve for heating in the fan coil unit. The fan coil unit also has a fan to circulate room air. In order for the fan coil unit to work properly, the central plant must provide hot water in the heating season (Figure 1).

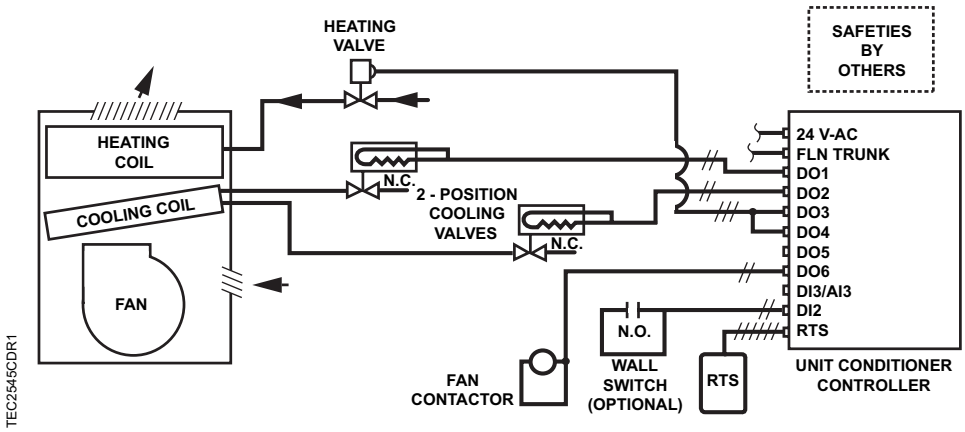

Figure 1. Application 2545 Control Diagram.

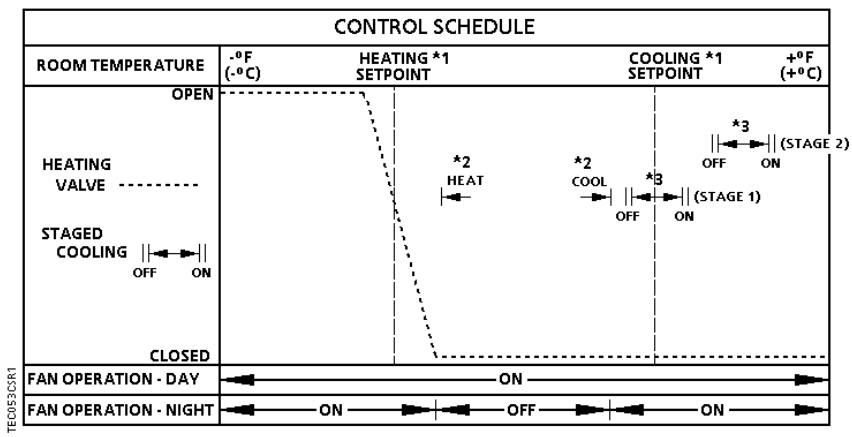

Figure 2. Application 2545 Control Schedule.

See *Sequence of Operation*, *Control Temperature Setpoints*.

See *Sequence of Operation*, *Heating/Cooling Switchover*.

See Sequence of Operation, Cooling Operation.

BACnet

The Fan Coil BACnet ASC Controller communicates using BACnet MS/TP protocol for open communications on BACnet MS/TP networks.

Table 1. Supported BIBBS.

Product	Supported BIBBs	BIBB Name
	DS-RP-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
BTEC	DM-DDC-B	Device Management-Device Communication Control-B

Hardware Inputs

Analog

- Room temperature sensor
- Room temperature setpoint dial (optional)

Digital

- Night mode override (optional)
- Wall switch (optional)

Hardware Outputs

Analog

- None

Digital

- Fan (switched 24 Vac, pilot duty)
- Heating valve actuator
- Stage 1 cooling (2-position valve actuator, or cooling compressor)
- Stage 2 cooling (2-position valve actuator, or cooling compressor)

Ordering Notes

Fan Coil BACnet ASC Controller	550-433

Related Equipment:

Pipe temperature sensor (optional)
Terminal Equipment Controller Room Temperature Sensor
Valve actuator

Point Database

Table 2 presents the point database information for Application 2545.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2545, “Fan Coil BACnet ASC Controller - 2-Stage Cooling and Hot Water Heat”.

Control Temperature Setpoints

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

Day Mode – CTL STPT holds the value of DAY CLG STPT or DAY HTG STPT. If the room temperature sensor has a setpoint dial and STPT DIAL = YES, CTL STPT holds the value of RM STPT DIAL.

If the setpoint dial is used and RM STPT DIAL < RM STPT MIN, CTL STPT holds the value of RM STPT MIN. If RM STPT DIAL > RM STPT MAX, CTL STPT holds the value of RM STPT MAX.

Night Mode – CTL STPT holds the value of NGT CLG STPT or NGT HTG STPT.

Room Temperature Offset

The Room Temperature Offset feature is optional.

RMTMP 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.

CTL TEMP = ROOM TEMP + RMTMP 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 RMTMP 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.

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 a wall switch is physically connected to the termination strip on the controller at DI 2 (see Figure 1 and Figure 3), and WALL SWITCH = YES, the controller monitors the status of DI 2. When DI 2 is ON (the switch is closed), DAY.NGT will be set to DAY indicating that the controller is in day mode. When DI 2 is OFF (the switch is open), DAY.NGT will be set to NIGHT indicating that the controller is in night mode.

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, the controller is operating stand-alone, it stays in day mode all the time. If the controller is operating with centralized control, connected to a field panel, the field panel can send an operator or PPCL command to override the status of DAY.NGT.

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 mode for the amount of time 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.

Heating/Cooling Switchover

The heating/cooling switchover determines whether the controller is in heating or cooling mode by monitoring the room temperature and the demand for heating and cooling (as determined by the temperature control loops).

If the following conditions are met for the length of time set in SWITCH TIME, the controller switches from heating to cooling mode by setting HEAT.COOL to COOL:

- HTG LOOPOUT < SWITCH LIMIT.
- CTL TEMP > CTL STPT by at least the value set in SWITCH DBAND.
- CTL TEMP > the appropriate cooling setpoint minus SWITCH DBAND.

If the following conditions are met for the length of time set in SWITCH TIME, the controller switches from cooling to heating mode by setting HEAT.COOL to HEAT:

- CLG LOOPOUT < SWITCH LIMIT.
- CTL TEMP < CTL STPT by at least the value set in SWITCH DBAND.
- CTL TEMP < the appropriate heating setpoint plus SWITCH DBAND.

Control Loops

The Fan Coil BACnet ASC Controller is controlled by two Proportional, Integral, and Derivative (PID) temperature loops.

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 *Sequence of Operation, Control Temperature Setpoints* .

Cooling Operation

In cooling mode, the controller uses CTL STPT and CTL TEMP as inputs for the cooling loop. The cooling loop controls up to two stages of cooling as defined by the value of CLG STG CNT.

The staged cooling operates as follows:

- CLG STG 1 will turn ON when CLG LOOPOUT > CLG 1 ON , provided that CLG STG 1 has been OFF for at least the time set in CLG MIN OFF .
- CLG STG 2 will turn ON when CLG LOOPOUT > CLG 2 ON , provided that CLG STG 2 has been OFF for at least the time set in CLG MIN OFF.
- CLG STG 2 will turn OFF, when CLG LOOPOUT < CLG 2 OFF , provided that CLG STG 2 has been ON for at least the time set in CLG MIN ON .
- CLG STG 1 will turn OFF, when CLG LOOPOUT < CLG 1 OFF , provided that CLG STG 1 has been ON for at least the time set in CLG MIN ON.
- HTG LOOPOUT = 0%.

When in heating mode, both stages of cooling are OFF.

Heating Operation

In heating mode, the controller uses CTL STPT and CTL TEMP as inputs for the heating loop. The output of the heating loop is HTG LOOPOUT, which modulates the hot water valve point, VLV COMD, in order to warm up the space. CLG LOOPOUT = 0%.

When in cooling mode, the heating valve is closed.

Fan Operation

Day Mode – The fan may be set to stay ON at all times or to cycle to save energy. If CYCLE FAN = NO, the fan will be ON during the day. If CYCLE FAN = YES, the fan will cycle according to the following conditions:

1. If the first cooling stage or the second cooling stage is ON or the heating valve point, VLV COMD, is open more than the value of STAGE FAN, the fan will turn ON.
2. If the first and second cooling stages are OFF and have been OFF for the minimum off time and the heating valve is closed below the value of SWITCH LIMIT, the fan will turn OFF.
3. If neither of the above two conditions is met, the condition of the fan remains unchanged.

Night Mode – The fan cycles using the same three conditions described in the day mode section above, regardless of the setting of CYCLE FAN. If NGT OVRD = DAY (indicating that the night mode override button has been pressed), the fan is controlled as in day mode.

Calibration

The controller regularly calibrates the valve based on the value of CAL TIMER. A value of 12 indicates that the controller will calibrate the valve once every 12 hours.

The calibration consists of driving the heating valve closed, and resetting the value of VLV POS to 0. The heating valve is then released to normal control.

Fail-safe Operation

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

Application Notes

1. Fan Coil BACnet ASC Controller , as shipped from the factory, keeps all associated equipment OFF. See the *BACnet Unit Conditioner/Fan Coil Start-up Procedures* for information on how to release the controller and its equipment to application control.

2. Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. If a heating valve is not being controlled by the application, 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 make sure that the motor setup, motor timing, and motor rotation angle are enabled correctly before you unbundle VLV COMD. See *BACnet Unit Conditioner/Fan Coil Start-up Procedures* for more information.

Wiring Diagram

The point wiring for Application 2545 is shown in Figure 3.

CAUTION:

The controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. Use an interposing 220V 4-relay module for any of the following:

- VA requirements higher than the maximum
- 110 or 220 Vac requirements
- DC power requirements
- Separate transformers used to power the load.

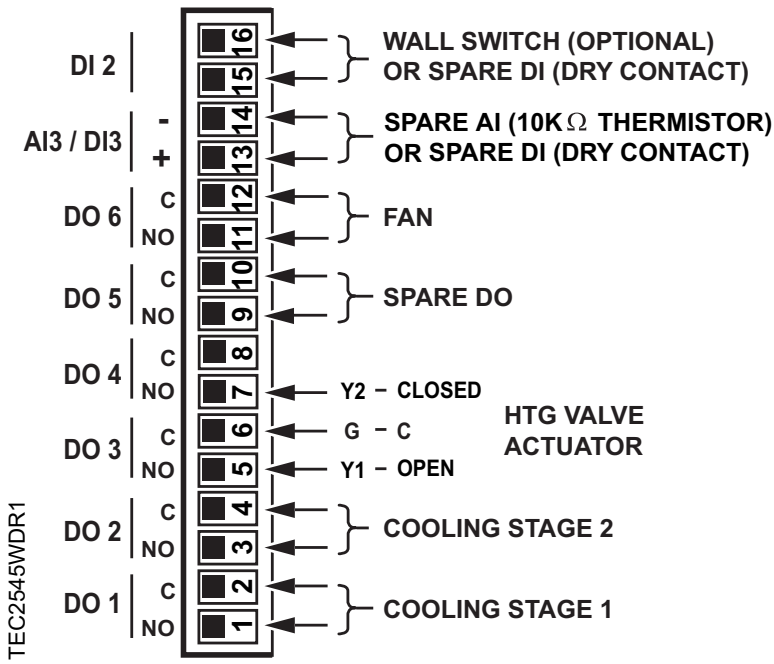

Figure 3. Application 2545 Wiring Diagram.

Table 2. Point Database for Application 2545.

Object Type[a]	Object Instance (Point Number)[b]	Object Name and Description	Factory Default (SI Units)[c]	Eng Units (SI Units)[c]	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-255	–	–
AO	2	APPLICATION	2585	–	2528, 2529 and 2542 through 2546	–	–
AO	3	RMTMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-31.75-32	–	–
AI	{04}[d]	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
BO	{05}	HEAT.COOL	COOL	–	Binary	HEAT	COOL
AO	6	DAY CLG STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AO	7	DAY HTG STPT	70.0 (21.20888)	DEG F (DEG C)	48- 111.75	–	–
AO	8	NGT CLG STPT	82.0 (27.92888)	DEG F (DEG C)	48- 111.75	–	–

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Table 2. Point Database for Application 2545. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name and Description	Factory Default (SI Units)[c]	Eng Units (SI Units)[c]	Range	Active Text	Inactive Text
AO	9	NGT HTG STPT	65.0 (18.40888)	DEG F (DEG C)	48- 111.75	–	–
AO	11	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	48- 111.75	–	–
AO	12	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	48- 111.75	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	–	–
BO	14	STPT DIAL	NO	–	Binary	YES	NO
AI	{15}	AUX TEMP AI3	74.0 (23.495556)	DEG F (DEG C)	37.5- 165	–	–
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}	DI 2	OFF	–	Binary	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	NIGHT	DAY
BO	{41}	CLG STG 1	OFF	–	Binary	ON	OFF
BO	{42}	CLG STG 2	OFF	–	Binary	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	ON	OFF
BO	{46}	FAN	OFF	–	Binary	ON	OFF
AO	{52}	VLV COMD	0	PCT	0- 102	–	–
AO	{53}	VLV POS	0	PCT	0- 102	–	–
AO	55	MTR 2 TIMING	130	SEC	0- 511	–	–
AO	57	MTR2 ROT ANG	90	–	0- 255	–	–
AO	58	MTR SETUP	0	–	0- 255	–	–
AO	59	DO DIR. REV	0	–	0- 255	–	–
BO	60	CYCLE FAN	NO	–	Binary	YES	NO

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Table 2. Point Database for Application 2545. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name and Description	Factory Default (SI Units)[c]	Eng Units (SI Units)[c]	Range	Active Text	Inactive Text
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	–	–
AO	66	CLG BIAS	0	PCT	0- 102	–	–
AO	67	HTG P GAIN	10.0 (18.0)	–	0- 63.75	–	–
AO	68	HTG I GAIN	0.01 (0.018)	–	0- 1.023	–	–
AO	69	HTG D GAIN	0 (0.0)	–	0- 510	–	–
AO	70	HTG BIAS	0	PCT	0- 102	–	–
AO	71	CLG 1 ON	40	PCT	0- 102	–	–
AO	72	CLG 1 OFF	20	PCT	0- 102	–	–
AO	73	CLG 2 ON	80	PCT	0- 102	–	–
AO	74	CLG 2 OFF	60	PCT	0- 102	–	–
AO	75	CLG STG CNT	2	–	0- 255	–	–
AO	76	CLG MIN ON	120	SEC	0- 255	–	–
AO	77	CLG MIN OFF	120	SEC	0- 255	–	–
AO	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	–	–
AO	{79}	CLG LOOPOUT	0	PCT	0- 102	–	–
AO	{80}	HTG LOOPOUT	0	PCT	0- 102	–	–
AO	84	STAGE FAN	10	PCT	0- 102	–	–
AO	85	SWITCH LIMIT	5.2	PCT	0- 102	–	–
AO	86	SWITCH TIME	10	MIN	0- 255	–	–
AO	90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0- 63.75	–	–
AO	{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	48- 111.75	–	–

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Table 2. Point Database for Application 2545. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name and Description	Factory Default (SI Units)[c]	Eng Units (SI Units)[c]	Range	Active Text	Inactive Text
AO	96	CAL TIMER	12	HRS	0- 255	–	–
AO	98	LOOP TIME	5	SEC	0- 255	–	–
AO	{99}	ERROR STATUS	0	–	0- 255	–	–

[a] Object Types are; Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).

[b] Points not listed are not used in this application.

[c] A single value in a column means that the value is the same in English units and in SI units.

[d] Point numbers that appear in brackets {} may be unbundled at the field panel.