Application 2502 Constant Volume AHU with 2-Position 100% OA Damper, Supply Air Temperature, Sensor Cold Water Cooling and/ or Hot Water Heating

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Application 2502 Overview

Application 2502 is an Air Handling Unit (AHU) TEC application that controls a constant volume fan, a 2-position 100% OA damper, a heating valve and a cooling valve.

Application 2502 has 4 PID Loops. A cooling PID loop in the room adjusts the setpoint for the cooling loop in the supply air duct. The cooling loop in the supply air duct will then modulate the cooling valve to maintain the setpoint of the supply air duct cooling loop. Similarly, a heating PID loop in the room adjusts the setpoint for the heating loop in the supply air duct. The heating loop in the supply air duct will then modulate the heating valve in order to maintain the setpoint of the supply air duct heating loop. The application also has heating/cooling switchover logic that will prevent the heating valve and cooling valve from modulating at the same time.

Available modes of operation:

- Occupied/Unoccupied
- Unoccupied Heating
- Unoccupied Cooling
- Warm-up/Cool down

Application 2502 also has built in fail-safe ways to respond to various alarms, such as:

- Low Temperature Detection
- Fan Proof Alarm

If any of these fail-safe features are not needed, they can be disabled and the I/O becomes available for other uses.

Also included in application 2502 is an unoccupied override feature that is compatible with tenant billing.

At the end of this document is a list of CSAL applications that application 2502 is capable of supporting. Also included is a table that shows how to adjust points and configure application 2502 to support these CSAL applications.

See Figure 2502-1 through Figure 2502-8.

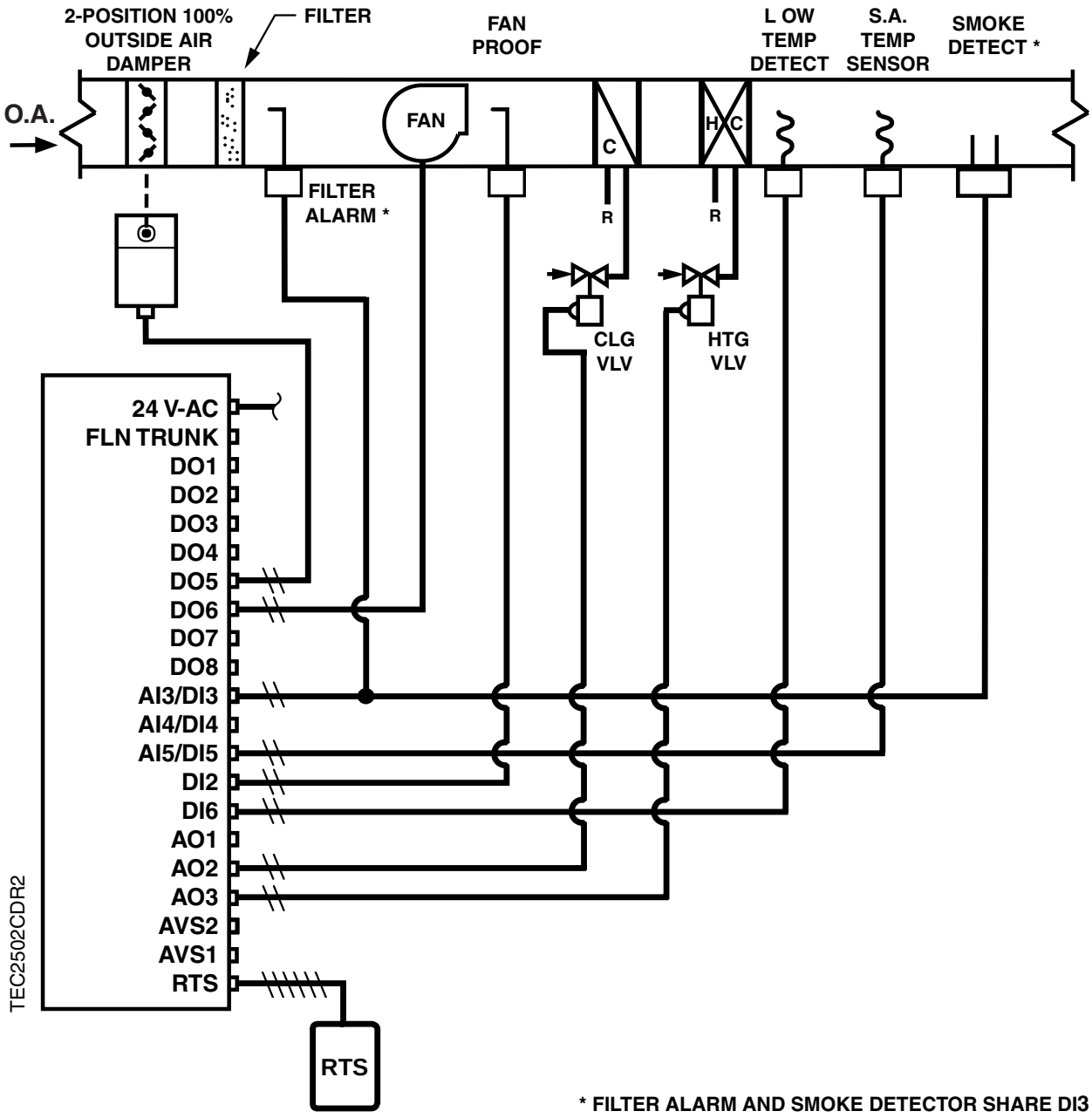


Figure 2502-1. Application 2502 Control Drawing.

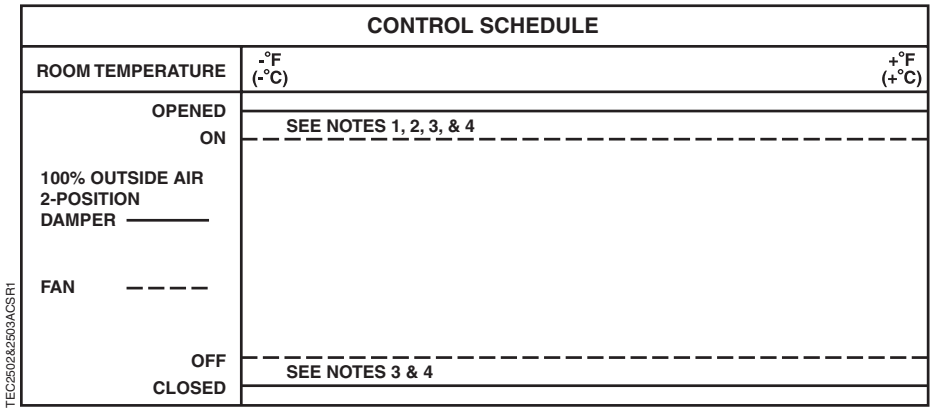


Figure 2502-2. Application 2502 Fan and Damper Control Schedule.

NOTES:

1. Application 2502 always opens the 2-position damper and turns on the fan at the same time. If required, the damper can open before the fan turns on. To accomplish this, install an end switch on the damper whose normally opened contact is wired directly into the fan's start/stop circuitry. When the damper closes, so does the contact, which then starts the fan.

2. The fan is on and the 2-postion damper is opened during Warm-up, Cool down, Occupied Heating, Occupied Cooling, Unoccupied Cooling and unoccupied heating modes.

3. The fan is off and the damper is closed during Unoccupied mode, Supply Air temperature failure mode, low temperature detection failure mode and general alarm failure mode.

4. The control of the fan and the damper is unaffected by a fan proof failure.

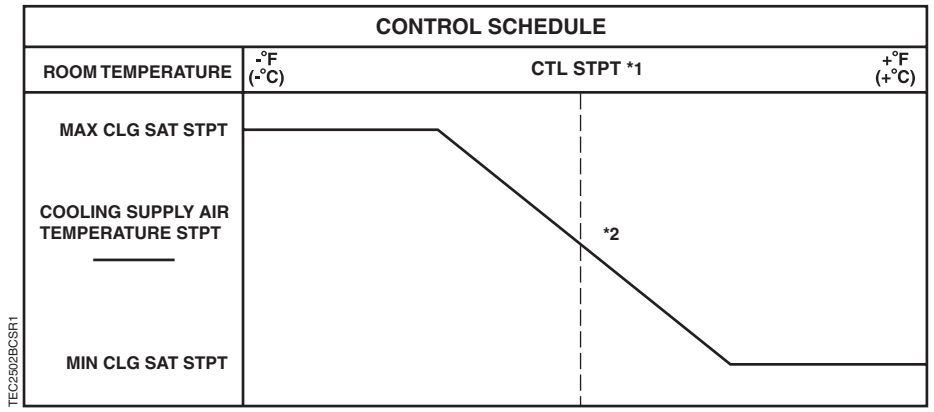


Figure 2502-3. Application 2502 Control Schedule of the Cooling Supply Air Temperature Setpoint Adjustment by the Cooling Room Temperature Control Loop.

NOTES: 1. See the *Control Temperature Setpoint* section.

2. The value of CLG SAT STPT (Point 91) as determined by the room cooling loop is used as the setpoint of the supply air temperature cooling loop during the Cool down, Occupied Cooling and Unoccupied Cooling modes.

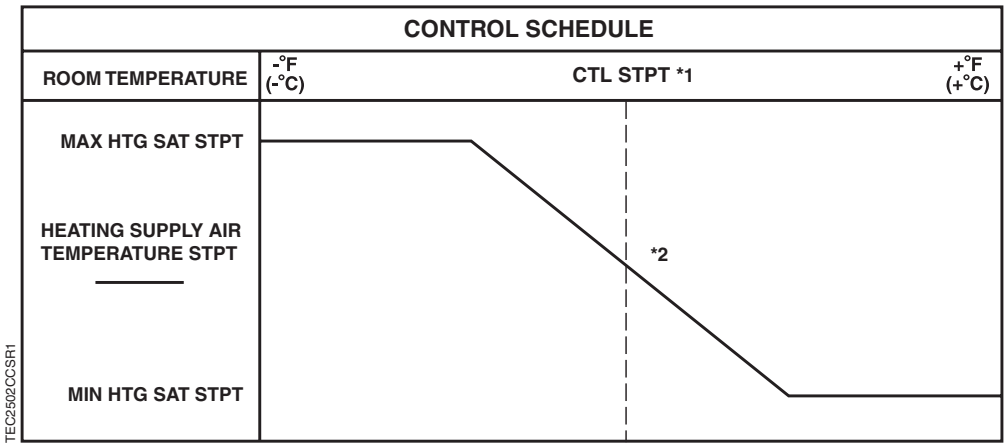


Figure 2502-4. Application 2502 Control Schedule of the Heating Supply Air Temperature Setpoint Adjustment by the Heating Room Temperature Control Loop.

NOTES:

1. See the *Control Temperature Setpoint* section.

2. The value of HTG SAT STPT (Point 93) as determined by the room heating loop is used as the setpoint of the supply air temperature heating loop during the Warm-up, Occupied Heating and Unoccupied Heating modes.

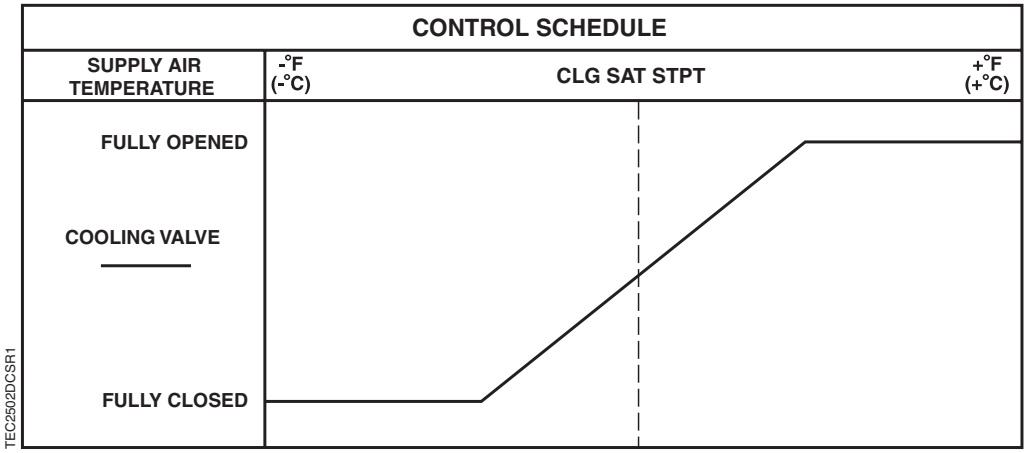


Figure 2502-5. Application 2502 Cooling Valve Control Schedule for Cooldown, Occupied Cooling and Unoccupied Cooling Modes.

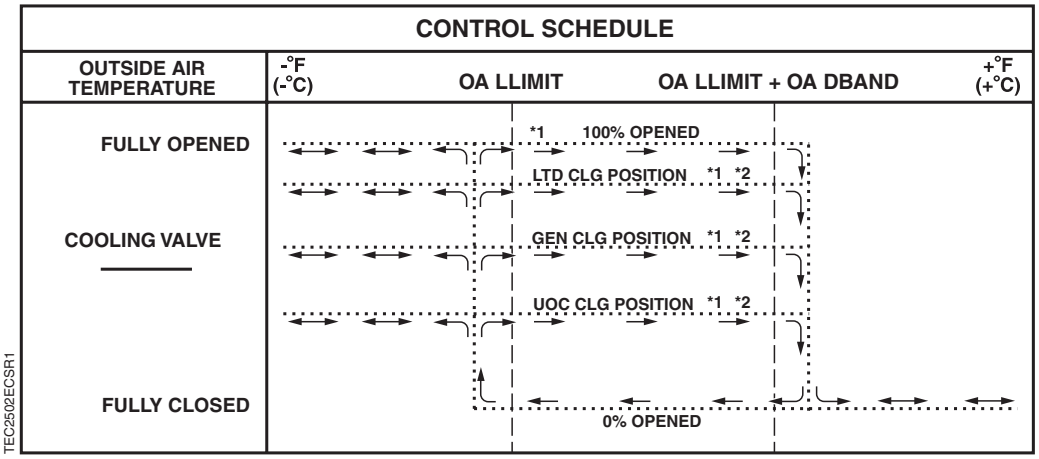


Figure 2502-6. Application 2502 Cooling Valve Control Schedule for Unoccupied *3 and Safety Modes.

NOTES:

1. When the outside air temperature is cold enough, the cooling valve will be:

   - set to LTD CLG POS (Point 60) during a low temperature detection alarm.
   - set to GEN CLG POS (Point 61) during a general alarm (smoke detection or dirty filter)
   - set to UOC CLG POS (Point 62) during the unoccupied mode or a fan proof failure.
   - 100 % opened when the supply air temperature sensor fails.

   When the outside air temperature is warm enough, the cooling valve will be shut during the unoccupied mode and during all of the failure modes.

2. LTD CLG POS, GEN CLG POS and UOC CLG POS can all be set differently from one another, if desired. Any or all of these points can be set to 0 % opened or 100 % opened. (LTD CLG POS is not required to be greater than GEN CLG POS and GEN CLG POS is not required to be greater than UOC CLG POS.)

3. Application 2502 supports 3 unoccupied modes: an unoccupied heating mode, an unoccupied cooling mode and an unoccupied "coast" mode, between heating and cooling. The unoccupied mode referred to in this figure is the unoccupied "coast" mode. During warm weather, this is a shutdown mode, during cold weather this is an equipment protection mode.

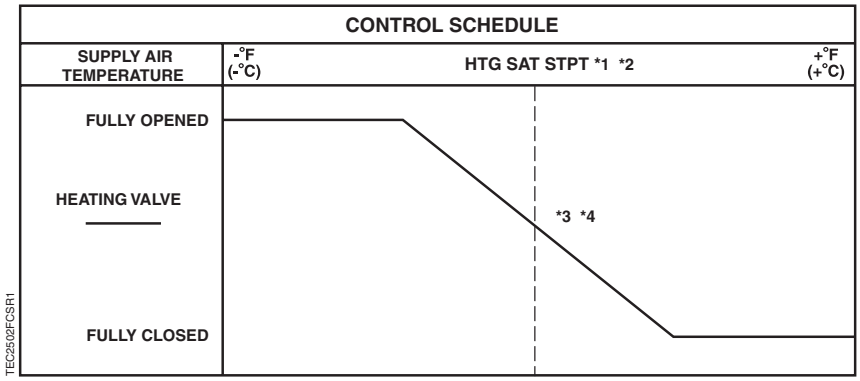


Figure 2502-7. Application 2502 Heating Valve [*5] Control Schedule.

NOTES:

1. The value of HTG SAT STPT (Point 93) is determined by the room heating loop during warm-up, occupied heating and unoccupied heating modes.

2. During unoccupied mode (when neither heating nor cooling is required) or a fan proof failure HTG SAT STPT will equal UOC SAH STPT (Point 18). During a low temperature detection, HTG SAT STPT will equal LTD SAH STPT (Point 17). During a general alarm (such as a smoke or dirty filter alarm), HTG SAT STPT will equal GEN SAH STPT (Point 17).

3. This figure shows exactly how the heating valve is controlled during the warm-up, occupied heating, unoccupied heating and low temperature detection modes.

4. During unoccupied mode (when neither heating nor cooling is required), a general alarm or a fan proof failure, this control figure is modified by an outside air temperature deadband. When the outside air temperature is cold enough, the heating valve is controlled as shown. At warmer outside air temperatures, the heating valve will remain shut.

5. This figure does not show how the heating valve is controlled during a supply air temperature sensor failure, see Figure 2502-8.

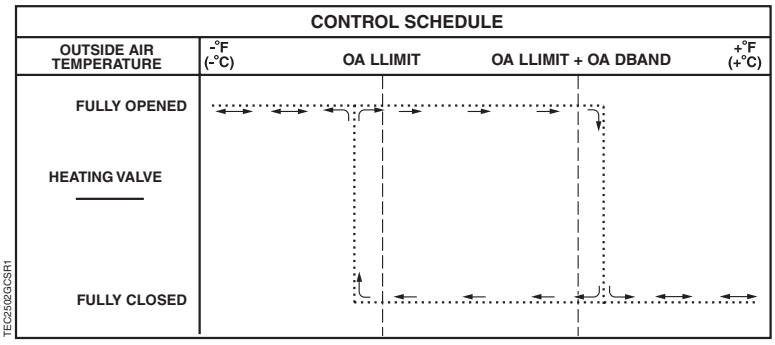


Figure 2502-8. Application 2502 Heating Valve Control Schedule during a Supply Temperature Sensor Failure.

Hardware Inputs

Analog

- Averaging supply air temperature sensor
- Room temperature sensor
- Room temperature setpoint dial (optional)

Digital

- Low temperature detection thermostat (LTDT)
- General Alarm (e.g. smoke detector, dirty filter alarm, etc.)
- Fan proof
- Night mode override (optional)

Hardware Outputs

Analog (0-10V)

- Cooling valve actuator
- Heating valve actuator

Digital

- Fan
- 2-Position, 100% OA Damper

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2502, Constant Volume AHU with 2-Position 100% OA Damper, Supply Air Temperature Sensor, Cold Water Cooling and/or Hot Water Heating.

Application 2502 Action Table

Table 2502-1 is a summary of the actions performed by Application 2502. For a more detailed description, of how Application 2502 works, refer to the remaining sections in this document. There are 3 unoccupied modes; unoccupied heating mode, unoccupied cooling mode and unoccupied mode.

The application goes into unoccupied mode, during the unoccupied period, when unoccupied heating or unoccupied cooling are **not** required.

DIALRM.ENDIS (Point 56), **MODE.ENDIS** (Point 23) and **HC.ENDIS** (Point 22) are enable/disable points. Refer to the *Enable/ Disable Points* section of this document for information on how to set up these points.

Table 2502-1. Application 2502 Action Table.

	OA DMPR	FAN	HTG VLV	CLG VLV
UOC HTG [11, 15]	Opened	On After DMPR Opens[10]	Room HTG Loop Maintains **UOC HTG STPT** by Adjusting **HTG SAT STPT**. HTG VLV Modulated to Maintain **HTG SAT STPT**.	Closed
UOC CLG [12, 16]	Opened	On After DMPR Opens[10]	Closed	Room CLG Loop Maintains **UOC CLG STPT** by Adjusting **CLG SAT STPT**. CLG VLV Modulated to Maintain **CLG SAT STPT**.
Unocc OA > OA Llimit	Closed	Off	Closed	Closed
Unocc OA ≤ OA Limit	Closed	Off	HTG VLV modulated to maintain **UOC SAH STPT**	CLG VLV maintained at **UOC CLG POS**
Warm-up [13, 15]	Opened	On After DMPR Opens[10]	Room HTG Loop Maintains **WRMUP STPT** by Adjusting **HTG SAT STPT**. HTG VLV Modulated to Maintain **HTG SAT STPT**.	Closed

continued on next page. . .

Table 2502-1. Application 2502 Action Table.

	OA DMPR	FAN	HTG VLV	CLG VLV
Cool down [14, 16]	Opened	On After DMPR Opens[10]	Closed	Room CLG Loop Maintains **COOLDN STPT** by Adjusting **CLG SAT STPT**. CLG VLV Modulated to Maintain **CLG SAT STPT**.
OCC HTG [15]	Opened	On After DMPR Opens[10]	Room HTG Loop Maintains **OCC HTG STPT** (or **RM STPT DIAL**) by Adjusting **HTG SAT STPT**. HTG VLV Modulated to Maintain **HTG SAT STPT**.	Closed
OCC CLG [16]	Opened	On After DMPR Opens[10]	Closed	Room CLG Loop Maintains **OCC CLG STPT** (or **RM STPT DIAL**) by Adjusting **CLG SAT STPT**. CLG VLV Modulated to Maintain **CLG SAT STPT**.
Room Temperature Sensor Failure [18]	(Note 18)	(Note 18)	(Note 18)	(Note 18)
Sup Air Temperature Sensor Failure **OA > OA Limit** [17, 18]	Closed	Off	Closed	Closed
Sup Air Temperature Sensor Failure, **OA < OA Limit** [17, 18]	Closed	Off	100 % Opened	100 % Opened
General Alarm, OA > OA Limit [3, 4, 7, 9]	Closed	Off	Closed	Closed
General Alarm, OA < OA Limit [3, 4, 7, 9]	Closed	Off	HTG VLV modulated to maintain **GEN SAH STPT**	CLG VLV maintained at **GEN CLG POS**
LTD ALARM [1, 2, 8, 9]	Closed	Off	HTG VLV modulated to maintain **LTD SAH STPT**	CLG VLV maintained at **LTD CLG POS**
Fan Proof Alarm OA > OA Limit [5, 6, 9]	Normal Control	Normal Control	Closed	Closed
Fan Proof Alarm OA < OA Limit [5, 6, 9]	Normal Control	Normal Control	HTG VLV modulated to maintain **UOC SAH STPT**	CLG VLV maintained at **UOC CLG POS**

continued on next page. . .

Table 2502-1. Application 2502 Action Table.

NOTES:

1. When DIALRM.ENDIS (Point 56) is set to ltdt enabled, the LTD alarm mode behaves as in the table. When DIALRM.ENDIS is not set to ltdt enabled, LTD DI 6 (Point 26) is spare, and that DI state does not trigger the LTD ALARM mode in the application.
2. When the LTD is used, then LTDT CONTACT. (Point 52) determines which state of the LTD DI is the alarm State.
3. When DIALRM.ENDIS is set to gen alarm enabled, the general alarm mode behaves as in the table. When DIALRM.ENDIS is not set to gen alarm enabled, the GEN ALRM DI3 (Point 25) is spare, and that DI state does not trigger the general alarm mode in the application.
4. GEN CONTACT (Point 55) determines which state of the GEN ALRM DI3 is the alarm state. The General Alarm is meant for such things as Smoke Detectors and Dirty Filter Alarms.
5. When DIALRM.ENDIS is set to fan proof enabled, the fan proof alarm mode behaves as in the table. When DIALRM.ENDIS is not set to fan proof enabled, the FAN DI 2 (Point 24) is spare, and that DI state does not trigger the fan proof alarm mode in the application.
6. When the fan fails to proof , an alarm will be given. The OA damper and Fan will be under normal Control (In other words, the fan and damper will be controlled as though the fan proof alarm is not occurring.) Both the Heating Valve and Cooling Valve will do unoccupied mode control when a fan proof alarm occurs. The fan proof has a higher priority in the application than normal control, but has a lower priority than the Supply Air Temperature Failure Mode, the LTD Alarm and the General Alarm.
7. The general alarm operates 24 / 7. It always supersedes the fan proof alarm and normal control. The general alarm has a higher priority in the application than the fan proof alarm and normal control, but has a lower priority than the Supply Air Temperature Failure Mode and the LTD Alarm.
8. If used, the LTD is also a 24 / 7 alarm. It always supersedes the general alarm, the fan proof alarm and normal control, but has lower priority than the Supply Air Temperature Failure Mode.
9. This application will work best when the physical devices connected to the LTD DI and General Alarm DI are all manual reset devices. However, it is not recommended that the physical device connected to the Fan Proof DI be a be a manual reset device.
10. The application actually turns the Fan On at the same time that it Opens the Damper. In order for the fan to turn on only after the damper is opened, the customer will have to install a damper end switch that has a contact in the fan's On / Off circuitry that doesn't close until the damper is opened.
11. The unoccupied heating is only used when MODE.ENDIS (Point 23) is uoc htg enabled.
12. The unoccupied cooling is only used when MODE.ENDIS is uoc clg enabled.
13. The warm-up mode is only used when MODE.ENDIS is warm-up enabled.
14. The cool down mode is only used when MODE.ENDIS is cool down enabled.
15. Not used unless HC.ENDIS (Point 22) heating enabled. If HC.ENDIS is not heating enabled, then AOV3 (Point 40) is a spare.
16. Not used unless HC.ENDIS cooling enabled. If HC.ENDIS is not cooling enabled, then AOV2 (Point 39) is a spare.
17. The supply air temperature sensor failure mode supersedes the low temperature detection alarm, the general alarm, the fan proof alarm and normal control. Unlike other alarms and failure modes in application 2502, the supply air temperature sensor failure mode cannot be disabled.
18. When ROOM TEMP (Point 4) has failed, the application will use the last know good value of ROOM TEMP. The rest of the application will behave as though the room temperature sensor did not fail.

Shared I/O

Application 2502 has AIs and DIs that share the same terminations, one or the other (but not both) can be used. AI 3 shares a termination with DI 3 and AI 4 shares a termination with DI 4. If AI 3 or AI 4 is being used, then DI 3 or DI 4 is unavailable.

In application 2502, the general purpose alarm (DI 3) is meant for such things as a smoke detector or a dirty filter alarm. The general purpose alarm feature must be disabled in order to use AI 3/DI 3 for another purpose, see *Enable/Disable Points*.

Enable/Disable Points

The application has the ability to enable and disable a number of features (making unused I/O available for other uses.) These points are analog values that determine whether certain features are being enabled or disabled.

- DIALRM.ENDIS (Point 56) determines whether or not a DI is being used as an alarm.
- MODE.ENDIS (Point 23) indicates if UOC HTG, UOC CLG, WARMUP or COOLDOWN modes are being used by the application.
- HC.ENDIS (Point 22) determines if the application is heating only, cooling only or if it uses both heating and cooling modes.

The Table shows what is enabled when a particular point is at a particular value. The number in parenthesis is the default value of the point. The default enables everything possible in the point.

	DIALRM.ENDIS (7)	MODE.ENDIS (15)	HC.ENDIS (3)
0	none	none	N/A
1	gen alarm enabled	uoc htg enabled	heating enabled
2	ltdt enabled	uoc clg enabled	cooling enabled
4	fan proof enabled	warmup enabled	--
8	--	cooldown enabled	--

These point are additive, that is, if DIALRM.ENDIS has a value of 6, it means the low temperature detector and the fan proof are enabled, while the general alarm is disabled. When a point has a value of 0, it means that every feature associated with it is disabled.

NOTE: HC.ENDIS has an intercept of 1. HC.ENDIS cannot be set to zero.

HC.ENDIS was defined this way because it makes no sense to disable both heating and cooling on the same job. When HC.ENDIS has a value of 1, the application is heating only. When HC.ENDIS has a value of 2, the application is cooling only. When HC.ENDIS has a value of 3, the application uses both the heating and cooling modes. A -- in a cell means the point doesn't use that value.

Control Temperature Setpoint

Depending on the controller's current operational mode (occupied, unoccupied, warmup or cooldown), the control temperature setpoint, CTL STPT (Point 92) holds the value of one of the following setpoints:

Warm-up Mode – In warmup mode, CTL STPT holds the value of WRMUP STPT (Point 3).

Cool down Mode – In cooldown mode, CTL STPT holds the value of COOLDN STPT (Point 10).

Occupied Mode – In occupied mode, CTL STPT holds the value of OCC CLG STPT (Point 6) or OCC HTG STPT (Point 7). If the room temperature sensor has a setpoint dial and STPT DIAL (Point 14) is set to YES, then CTL STPT holds the value of RM STPT DIAL (Point 13).

If the setpoint dial is used and the value of RM STPT DIAL is less than the value of RM STPT MIN (Point 11), 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 (Point 12), CTL STPT holds the value of RM STPT MAX.

Unoccupied Mode – In unoccupied mode, CTL STPT holds the value of UOC CLG STPT (Point 8) or UOC HTG STPT (Point 9).

The value of CTL TEMP (Point 78) is the same as the value of ROOM TEMP (Point 4), unless CTL TEMP is overridden.

Occupied and Unoccupied Modes

The occupied/unoccupied status of the space is determined by the status of OCC.UNOCC (Point 29). If the controller is operating stand-alone (not connected to a field panel), the controller stays in occupied 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 OCC.UNOCC. See the *Powers Process Control Language (PPCL) User's Manual* (125-1896) and *Field Panel User's Manual* (125-3000) for more information.

Unoccupied 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 (Point 20), a room occupant can reset the controller to occupied mode for the length of time set in OVRD TIME by pressing the override switch. The status of UNOCC OVRD (Point 21) changes to OCC and remains there until OVRD TIME elapses, UNOCC OVRD changes back to UNOCC and the controller returns to unoccupied mode.

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

If OCC.UNOCC (Point 29) changes from UNOCC to OCC during an unoccupied override period, UNOCC OVRD will immediately change from OCC to UNOCC instead of waiting for the amount of time in OVRD TIME to elapse before changing from OCC to UNOCC. This can be useful when UNOCC OVRD is unbundled in a field panel and used for tenant billing. Also, if OVRD time is set to zero during an unoccupied period, UNOCC OVRD will immediately change from OCC to UNOCC.

Heating/Cooling Switchover

This section describes how the heating/cooling switchover feature works when both heating and cooling are enabled (HC.ENDIS (Point 22) = 3).

If **all** of the following conditions are met for the length of time set in SWITCH TIME (Point 86), the controller switches from heating to cooling mode by setting HEAT.COOL (Point 5) to COOL:

- HTG LOOPOUT (Point 80) is below SWITCH LIMIT.

- CTL TEMP (Point 78) > CTL STPT (Point 92) + SWITCH DBAND (Point 90).
- CTL TEMP > the appropriate cooling setpoint - SWITCH DBAND.

If **all** of 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 (Point 79) is below SWITCH LIMIT.
- CTL TEMP < CTL STPT - SWITCH DBAND.
- CTL TEMP < the appropriate heating setpoint + SWITCH DBAND.

NOTES: Application 2502 performs heating/cooling switchover based on room load. To perform heating/cooling switchover based on some other criteria, such as time of year, outside air temperature or supply air temperature, unbundle the HEAT.COOL point at a field panel and use PPCL to control it.

Heating only - set HC.ENDIS = 1, AOV2 (Point 39) is a spare and is available for other uses.

Cooling only - set HC.ENDIS = 2, AOV3 (Point 40) is a spare and is available for other uses.

Control Loops

The air handling unit is controlled by four Proportional, Integral, and Derivative (PID) control loops: a room cooling loop, a room heating loop, a supply air heating loop, and a supply air cooling loop.

Room Cooling Loop – The room cooling loop uses the values of CTL STPT (Point 92) and CTL TEMP (Point 78) to modulate the value of CLG LOOPOUT (Point 79). CLG LOOPOUT is then fed into an embedded table statement that will adjust the value of CLG SAT STPT (Point 91) to be between MAXCLG SATSP (Point 97) and MINCLG SATSP (Point 96). This loop is enabled during cooling mode (HEAT.COOL (Point 5) equals COOL) and disabled during heating mode (HEAT.COOL equals HEAT). When this loop is disabled, CLG LOOPOUT will = 0.

Room Heating Loop – The room heating loop uses the values of CTL STPT (Point 92) and CTL TEMP (Point 78) to modulate the value of HTG LOOPOUT (Point 80). HTG LOOPOUT is then fed into an embedded table statement that will adjust the value of HTG SAT STPT (Point 93) to be between MINHTG SATSP (Point 94) and MAXHTG SATSP (Point 95). This loop is enabled during heating mode and disabled during cooling mode. When this loop is disabled, HTG LOOPOUT will = 0.

Supply Air Heating Loop – The heating loop uses the value of HTG SAT STPT and SA TEMP AI 5 (Point 48) to modulate the value of SA HLO (Point 82). HTG VLV CMD (Point 70) is set = SA HLO. This loop is active during heating mode and inactive during cooling mode. The heating valve is closed during cooling mode.

Supply Air Cooling Loop – The cooling loop uses the value of CLG SAT STPT and SA TEMP AI 5 to modulate the value of SA CLO (Point 81). CLG VLV CMD (Point 66) is set = SA CLO. This loop is active during cooling mode and inactive during heating mode. The cooling valve is closed during heating mode.

Morning Warm-up/Cool down Determination

This section focuses on how Application 2502 enters and exists warm-up and cool down mode. Morning warm-up or cool down occurs after the controller switches from unoccupied mode to occupied mode, upon power-up or when the controller is reset. During morning warm-up or cool down, the controller provides heating or cooling until the temperature of the space reaches the value of CTL STPT (Point 92) plus or minus the value of MORN DBAND (Point 89).

The warm-up mode occurs only if all of the following circumstances are true:

- Warmup is enabled (see *Enable/Disable Points*).
- LOW TEMP DET (Point 87) = OFF
- SA TEMP AI 5 (Point 31) has a status of NORMAL
- GEN ALARM (Point 83) and FAN STATUS (Point 84) = NORMAL.
- OCC.UNOCC (Point 29) has just changed from Unoccupied to Occupied (OCC.UNOCC currently equals OCC but equaled UNOCC one LOOP TIME (Point 98) ago).
- HEAT.COOL (Point 5) = HEAT.
- The room temperature is not warm enough.
  CTL TEMP (Point 78) < (CTL STPT (Point 92) – MORN DBAND (Point 74))

When all these circumstances occur, WRUMP.COOLDN (Point 30) is turned ON.

CTL STPT will equal WRMUP STPT (Point 3) during the warmup period. Normal occupied mode heating operation begins when the temperature of the room reaches the value of WRMUP STPT minus MORN DBAND. For example, if CTL STPT is 72°F (22.2°C) and MORN DBAND is 3°F (1.6°C), then normal occupied heating operation begins when the temperature of the room reaches 69°F (20.6°C). The application will go into normal occupied heating by turning WARMUP.COOLDN OFF.

The cool down mode occurs only if all of the following circumstances are true:

- Cooldown is enabled (see *Enable/Disable Points*).
- LOW TEMP DET = OFF
- SA TEMP AI 5 has a status of NORMAL
- GEN ALARM and FAN STATUS = NORMAL.
- OCC.UNOCC (Point 29) has just changed from unoccupied to occupied (OCC.UNOCC currently equals OCC but equaled UNOCC one LOOP TIME (Point 98) ago).
- HEAT.COOL (Point 5) = COOL.
- The room temperature is not cool enough.
  CTL TEMP (Point 78) > (CTL STPT (Point 92) + MORN DBAND (Point 74))

When all these circumstances occur, WRUMP.COOLDN (Point 30) is turned ON.

CTL STPT will equal COOLDN STPT (Point 10) during the cooldown period. Normal occupied cooling operation begins when the temperature of the room reaches the value of COOLDN STPT plus MORN DBAND. The application will go into normal occupied cooling by turning WARMUP.COOLDN OFF.

Once the application commands WRMUP.COOLDN to OFF, WRMUP.COOLDN will remain off for the rest of the occupied period. This means the application cannot go into warm-up or cool down mode more than once per day. It also means the application cannot switch from warm-up mode to cool down mode or vice versa.

NOTE: As an added safety, it is a good idea to command WRMUP.COOLDN to OFF in the field panel when the desired occupancy time occurs. (This can be done in Time of Day Programming.) After commanding WARMUP.COOLDN to OFF, execute a release command at the field panel in order to release control of WRMUP.COOLDN back to the TEC. This will prevent the possibility of the TEC getting stuck in the warm-up or cool down mode all day.

Warm-up Mode Operation

The next 2 sections will focus on what Application 2502 does in warm-up and cool down mode.

The following actions occur during warm-up mode:

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature cooling PID loop and supply air temperature cooling PID loop are disabled and the cooling valve is shut, CLG VLV CMD (Point 66) = 0.
- CTL STPT (Point 92) = WRMUP STPT (Point 3).
- The room temperature heating loop is enabled and adjusts the value of HTG LOOPUT (Point 80) in order to maintain CTL TEMP (Point 78) = CTL STPT. HTG LOOPOUT varies from 0 to 100 depending on the heating load in the room (the heavier the heating load, the larger the value of HTG LOOPOUT).
- HTG LOOPOUT is used in an embedded table statement in order to determine the value of HTG SAT STPT (Point 93). When HTG LOOPOUT = 0, HTG SAT STPT will = MINHTG SATSP (Point 94). When HTG LOOPOUT = 100, HTG SAT STPT will = MAXHTG SATSP (Point 95). When HTG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation to set the value of HTG SAT STPT between MINHTG SATSP and MAXHTG SATSP.
- The supply air temperature heating loop is active and controls the heating valve, HTG VLV CMD (Point 70), in order the maintain the supply air temperature as measured by SA TEMP AI 5 (Point 31) = HTG SAT STPT.

Cool down Mode Operation

The following actions occur during the Cooldown mode:

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature heating PID loop and the supply air temperature heating PID loop are disabled and the heating valve is shut, HTG VLV CMD (Point 70) equals 0.
- CTL STPT (Point 92) will be = COOLDN STPT (Point 10).
- The room temperature cooling loop is enabled and adjusts the value of CLG LOOPUT (Point 79) in order to maintain CTL TEMP (Point 78) = CTL STPT. CLG LOOPOUT varies form 0 to 100 depending on the cooling load in the room (the heavier the cooling load, the larger the value of CLG LOOPOUT).
- CLG LOOPOUT is used in an embedded table statement in order to determine the value of CLG SAT STPT (Point 91). When CLG LOOPOUT is 0, CLG SAT STPT will = MAXCLG SATSP (Point 97). When CLG LOOPOUT is 100, CLG SAT STPT will = MINCLG SATSP (Point 96). When CLG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation in order to set the value of CLG SAT STPT between MAXCLG SATSP and MINCLG SATSP.
- The supply air temperature cooling loop is active and controls the cooling valve, CLG VLV CMD (Point 66), in order to maintain the supply air temperature as measured by SA TEMP AI 5 (Point 31) = CLG SAT STPT.

Both Warmup and Cooldown are pre-conditioning modes. The next two sections will focus on when pre-conditioning is over and normal heating or cooling occurs.

Occupied Heating Operation

In order for the occupied heating mode to occur, the following conditions must hold:

- LOW TEMP DET (Point 87) must = OFF
- SA TEMP AI 5 (Point 31) must have a status of NORMAL.
- GEN ALARM (Point 83) and FAN STATUS (Point 84) must = NORMAL.
- WRMUP.COOLDN (Point 30) must = OFF.
- OCC.UNOCC (Point 29) and/or UNOCC OVRD (Point 21) must = OCC.
- HEAT.COOL (Point 5) must = HEAT.

The following actions occur during the occupied heating mode:

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature cooling PID loop and supply air temperature cooling PID loop are disabled and the cooling valve is shut, CLG VLV CMD (Point 66) equals 0.

- CTL STPT (Point 92) will either = OCC HTG STPT (Point 7), or RM STPT DIAL (Point 13) depending on the value of STPT DIAL (Point 14). If RM STPT DIAL is used, it will be subjected to the limits imposed by RMP STPT MAX (Point 12) and RM STPT MIN (Point 11).
- The room temperature heating loop is enabled and adjusts the value of HTG LOOPUT (Point 80) in order to maintain CTL TEMP (Point 78) = CTL STPT. HTG LOOPOUT varies form 0 to 100 depending on the heating load in the room (the heavier the heating load, the larger the value of HTG LOOPOUT).
- HTG LOOPOUT is used in an embedded table statement in order to determine the value of HTG SAT STPT (Point 93). When HTG LOOPOUT = 0, HTG SAT STPT will = MINHTG SATSP (Point 94). When HTG LOOPOUT = 100, HTG SAT STPT will = MAXHTG SATSP (Point 95). When HTG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation to set the value of HTG SAT STPT between MINHTG SATSP and MAXHTG SATSP.
- The supply air temperature heating loop is active and controls the heating valve (HTG VLV CMD (Point 70)) in order to maintain supply air temperature measured by SA TEMP AI 5 = HTG SAT STPT.

Occupied Cooling Operation

In order for the occupied cooling mode to occur, the following conditions must hold:

- LOW TEMP DET (Point 87) must = OFF.
- SA TEMP AI 5 (Point 31) must have a status of NORMAL.
- GEN ALARM (Point 83) and FAN STATUS (Point 84) must = NORMAL.
- WRMUP.COOLDN (Point 30) must = OFF.
- OCC.UNOCC (Point 29) and/or UNOCC OVRD (Point 21) must = OCC.
- HEAT.COOL (Point 5) must = COOL.

The following actions occur during the occupied cooling mode

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature heating PID loop and the supply air temperature heating PID loop are disabled and the heating valve is shut, HTG VLV CMD (Point 70) = 0.
- CTL STPT (Point 92) will either = OCC CLG STPT (Point 6) or RM STPT DIAL (Point 13) depending on the value of STPT DIAL (Point 14). If RM STPT DIAL is used, it will be subjected to the limits imposed by RMP STPT MAX (Point 12) and RM STPT MIN (Point 11).
- The room temperature cooling loop is enabled and adjusts the value of CLG LOOPUT (Point 79) in order to maintain CTL TEMP (Point 78) = CTL STPT. CLG LOOPOUT varies form 0 to 100 depending on the cooling load in the room (the heavier the cooling load, the larger the value of CLG LOOPOUT).

- CLG LOOPOUT is used in an embedded table statement in order to determine the value of CLG SAT STPT (Point 91). When CLG LOOPOUT = 0, CLG SAT STPT will = MAXCLG SATSP (Point 97). When CLG LOOPOUT = 100, CLG SAT STPT will = MINCLG SATSP (Point 96). When CLG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation to set the value of CLG SAT STPT between MAXCLG SATSP and MINCLG SATSP.

- The supply air temperature cooling loop is active and controls the cooling valve, CLG VLV CMD (Point 66), in order the maintain the supply air temperature as measured by SA TEMP AI 5 = CLG SAT STPT.

Unoccupied Heating/Cooling Mode Determination

Application 2502 uses the values of UOC HTG (Point 53) and UOC CLG (Point 54) to determine the operational mode; unoccupied heating or unoccupied cooling mode. This section describes how application 2502 determines the values of UOC HTG and UOC CLG.

NOTES: If MODE.ENDIS (Point 23) has unoccupied heating mode disabled, the application will never go into unoccupied heating mode (UOC HTG will remain OFF). Likewise, if MODE.ENDIS has unoccupied cooling mode disabled, the application will never go into unoccupied cooling mode (UOC CLG will remain OFF). (See *Enable/ Disable Points* for information on how to enable and disable unoccupied heating and unoccupied cooling modes). In the remainder of this section, it is assumed that both unoccupied heating and unoccupied cooling mode are enabled.

If OCC.UNOCC (Point 29) and/or UNOCC OVRD (Point 21) = OCC, both UOC HTG and UOC CLG = OFF.

If both OCC.UNOCC and UNOCC OVRD = UNOCC, the values of UOC HTG and UOC CLG are determined as follows:

If HEAT.COOL (Point 5) = HEAT:

- UOC CLG = OFF.

- UOC HTG = ON whenever CTL TEMP (Point 78) ≤ CTL STPT (Point 92). (Note: unless overridden, CTL STPT will equal UOC HTG STPT (Point 9) at this point.)

- UOC HTG = OFF whenever CTL TEMP ≥ CTL STPT + UOC DBAND (88).

- Whenever CTL TEMP > CTL STPT and < CTL STPT + UOC DBAND, UOC HTG will remain in its last commanded state.

If HEAT.COOL (Point 5) = COOL:

- UOC HTG = OFF.

- UOC CLG = ON whenever CTL TEMP (Point 78) ≥CTL STPT. (Note: Unless overridden, CTL STPT = UOC CLG STPT (Point 8) at this point.)

- UOC CLG = OFF whenever CTL TEMP ≤ CTL STPT - UOC DBAND.

- Whenever CTL TEMP < CTL STPT and > CTL STPT - UOC DBAND, UOC CLG will remain in its last commanded state.

The next two sections will focus on what application 2502 does in the unoccupied heating and unoccupied cooling modes.

Unoccupied Heating Operation

In order for the unoccupied heating mode to occur, the following conditions must hold:

- LOW TEMP DET (Point 87) must = OFF.
- SA TEMP AI 5 has a status of NORMAL.
- GEN ALARM (Point 83) and FAN STATUS (Point 84) must = NORMAL.
- unoccupied heating must be enabled. (See *Enable/Disable Points* for information on how to enable or disable unoccupied heating mode).
- WRMUP.COOLDN (Point 30) must = OFF.
- OCC.UNOCC (Point 29) and UNOCC OVRD (Point 21) must **both** = UNOCC.
- UOC HTG (Point 53) must = ON.

The following actions occur during unoccupied heating mode:

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature cooling PID loop and the supply air temperature cooling PID loop are disabled and the cooling valve is shut, CLG VLV CMD (Point 66) = 0.
- CTL STPT (Point 92) = UOC HTG STPT (Point 9).
- The room temperature heating loop is enabled and adjusts the value of HTG LOOPUT (Point 80) in order to maintain CTL TEMP (Point 78) = CTL STPT. HTG LOOPOUT varies from 0 to 100 depending on the heating load in the room (the heavier the heating load, the larger the value of HTG LOOPOUT).
- HTG LOOPOUT is used in an embedded table statement in order to determine the value of HTG SAT STPT (Point 93). When HTG LOOPOUT = 0, HTG SAT STPT will = MINHTG SATSP (Point 94). When HTG LOOPOUT = 100, HTG SAT STPT will = MAXHTG SATSP (Point 95). When HTG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation to set the value of HTG SAT STPT between MINHTG SATSP and MAXHTG SATSP.
- The supply air temperature heating loop is active and controls the heating valve (HTG VLV CMD (Point 70)) to maintain the supply air temperature measured by SA TEMP AI 5 (Point 31) = HTG SAT STPT.

Unoccupied Cooling Operation

In order for unoccupied cooling mode to occur, the following conditions must hold:

- LOW TEMP DET (Point 87) must = OFF.
- SA TEMP AI 5 has a status of NORMAL.
- GEN ALARM (Point 83) and FAN STATUS (Point 84) must = NORMAL.
- unoccupied cooling must be enabled (See *Enable/Disable Points* section for information on how to enable or disable the unoccupied cooling mode).
- WRMUP.COOLDN (Point 30) must = OFF.
- OCC.UNOCC (Point 29) and UNOCC OVRD (Point 21) must **both** = UNOCC.
- UOC CLG (Point 54) must ON.

The following actions occur during unoccupied cooling mode

- FAN DO 6 (Point 46) = ON and OA DMPR DO 5 (Point 45) is OPENED.
- The room temperature heating PID loop and the supply air temperature heating PID loop are disabled and the heating valve is shut, HTG VLV CMD (Point 70) = 0.
- CTL STPT (Point 92) = UOC CLG STPT (Point 8).
- The room temperature cooling loop is enabled and adjusts the value of CLG LOOPUT (Point 79) to maintain CTL TEMP (Point 78) = CTL STPT. CLG LOOPOUT varies form 0 to 100 depending on the cooling load in the room (the heavier the cooling load, the larger the value of CLG LOOPOUT).
- CLG LOOPOUT is used in an embedded table statement in order to determine the value of CLG SAT STPT (Point 91). When CLG LOOPOUT = 0, CLG SAT STPT will = MAXCLG SATSP (Point 97). When CLG LOOPOUT = 100, CLG SAT STPT will = MINCLG SATSP (Point 96). When CLG LOOPOUT is between 0 and 100, the embedded table statement will use linear interpolation to set the value of CLG SAT STPT between MAXCLG SATSP and MINCLG SATSP.
- The supply air temperature cooling loop is active and controls the cooling valve, CLG VLV CMD (Point 66) to maintain the supply air temperature measured by SA TEMP AI 5 (Point 31) = CLG SAT STPT.

Unoccupied Mode Operation

The unoccupied mode occurs during a period when neither unoccupied heating nor unoccupied cooling are needed. The following conditions must hold in order for unoccupied mode to occur:

- LOW TEMP DET (Point 87) must = OFF.
- SA TEMP AI 5 has a status of NORMAL.

- GEN ALARM (Point 83) and FAN STATUS (Point 84) must = NORMAL.
- WRMUP.COOLDN (Point 30) must = OFF.
- OCC.UNOCC (Point 29) and UNOCC OVRD (Point 21) must **both** = UNOCC.
- UOC HTG (Point 53) must = OFF.
- UOC CLG (Point 54) must = OFF.

The following actions occur during unoccupied mode:

- FAN DO 6 (Point 46) = OFF and OA DMPR DO 5 (Point 45) is CLOSED.
- The room temperature heating and cooling PID loops are disabled. Both HTG LOOPOUT (Point 79) and CLG LOOPOUT (Point 80) = 0.
- The cooling valve's position is under deadband control based on the outside air temperature:
    2. If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the cooling valve will be completely shut.
    3. If OA TEMP ≤ OA LLIMIT, the cooling valve's position will be maintained at UOC CLG POS (Point 62).
    4. If OA TEMP > OA LLIMIT and ≤ OA LLIMIT+ OA DBAND, the cooling valve's position will be maintained at its last commanded state (if it was last commanded closed, it will remain closed; if it was last commanded to UOC CLG POS, it will remain at UOC CLG POS).
- If UOC SAH STPT (Point 18) ≤ 40°F, the heating supply air temperature loop is disabled, its output is set to zero, and the heating valve is shut.
- If UOC SAH STPT > 40°F, the enabled/disabled state of the heating supply air temperature loop is under deadband control based on the outside air temperature:
    5. If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the heating supply air temperature loop will be disabled.
    6. If OA TEMP ≤ OA LLIMIT, the heating supply air temperature loop will be enabled and HTG SAT STPT (Point 93) will = UOC SAH STPT.
    7. If OA TEMP > OA LLIMIT and ≤ OA LLIMIT+ OA DBAND, the heating supply air temperature loop will remain in its last commanded state (if it was last enabled, it will remain enabled; if it was last disabled, it will remain disabled).
    8. When the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.
    9. When the heating supply air temperature loop is enabled, it is modulating the heating valve; supply air temperature is maintained at UOC SAH STPT.

Fail-safe Operation

Application 2502 has a number of hierarchy based fail-safe features and can respond differently to each. They will be listed in order of priority, highest priority listed first.

Supply Air Temperature Sensor Failure Mode:

The supply air temperature sensor failure mode has the highest priority and cannot be disabled. When SA TEMP AI 5 (Point 31) fails, the application goes into the supply air temperature sensor failure mode, regardless of other happenings in the application.

The following actions occur when SA TEMP AI 5 has failed:

1. The fan shuts off and OA damper is closed.

2. The cooling and heating supply air temperature loops and room air temperature loops are disabled and the outputs are set to zero.

3. The cooling valve's position is under deadband control based on the outside air temperature:

   - If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the cooling valve will be completely shut.

   - If OA TEMP ≤ OA LLIMIT, the cooling valve's position will be fully opened.

   - If OA TEMP > OA LLIMIT and ≤ OA LLIMIT+ OA DBAND, the cooling valve's position will be maintained at its last commanded state (if it was last commanded closed, it will remain closed; if it was last commanded opened it will remain at opened).

4. The heating valve's position is under deadband control based on the outside air temperature:

   - If OA TEMP (Point 75) is greater than OA LLIMIT (Point 76) + OA DBAND (Point 77), the heating valve will be completely shut.

   - If OA TEMP is less than or equal to OA LLIMIT, then the heating valve's position will be fully opened.

   - If OA TEMP is greater than OA LLIMIT and less than or equal to OA LLIMIT+ OA DBAND, the heating valve's position will be maintained at its last commanded state (if it was last commanded closed, it will remain closed; if it was last commanded opened it will remain at opened).

The supply air temperature sensor failure mode ends when SA TEMP AI 5 returns to NORMAL.

Low Temperature Detection:

The low temperature detection alarm has the 2nd highest priority.

In order for a low temperature detection alarm to occur, it must be enabled using DIALRM.ENDIS (Point 56) (see *Enable/Disable Points* for information on how to enable or disable the low temperature detection alarm). If the low temperature detection alarm is disabled, LTD DI 6 (Point 26) becomes a spare DI available for other uses. For the rest of this section, assume the low temperature detection alarm is enabled.

A low temperature detection thermostat (LTDT) connected to LTD DI 6 (Point 26) can be used to signal the controller when the temperature, sensed by the LTDT, is below the low temperature limit. The LTDT can be either normally opened or normally closed, depending on the value of LTDT CONTACT (Point 52).

Application 2502 goes into the low temperature detection mode when LOW TEMP DET (Point 87) is ON. During the low temperature detection mode, the following actions occur:

1. The fan shuts off and the 100% OA damper is closed.

2. The room loops are disabled (they are not needed during this mode and disabling them prevents reset windup) and their outputs are set to zero.

3. The cooling supply air temperature loop is also disabled and its output set to zero.

4. The cooling valve's position is maintained at LTD CLG POS (Point 60).

5. If LTD SAH STPT (Point 16) ≤ 40°F, the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.

6. If LTD SAH STPT > 40°F, the heating supply air temperature loop is active and is modulating the heating valve such that the supply air temperature is maintained at LTD SAH STPT.

When the low temperature condition is no longer occurring, the application will end the low temperature detection mode by setting LOW TEMP DET to OFF.

NOTES:

1. If a low temperature detection is used, it is strongly recommended that it be a manual reset device (if it goes into alarm, the device has to be manually reset for the alarm to clear).

2. If it is desired the cooling valve be shut throughout the entire low temperature detection mode, set LTD CLG POS to 0. If it is desired the cooling valve be completely opened throughout the entire low temperature detection period, the set LTD CLG POS to 100.

General Alarm:

The general alarm has the third highest priority.

In order for a general alarm to occur, the general alarm must be enabled using DIALRM.ENDIS (Point 56) (see *Enable/Disable Points* for information on how to enable or disable the general alarm). If the general alarm is disabled, GEN ALRM DI3 (Point 25) becomes a spare DI available for other uses. For the rest of this section, assume the general alarm is enabled.

A general alarm is smoke detection, dirty filters, high and/or low humidity, etc. When used, these alarming devices have to share the same DI (DI3). There are not enough DIs on the TEC for these alarming devices to have their own individual DI.

- GEN CONTACT (Point 55) = NCLOSE, a general alarm will occur when GEN ALRM DI3 is opened (OFF). If you have multiple devices connected to DI3 when GEN CONTACT is NCLOSE, each of them must be configured to alarm when their contact opens and they must be wired in series to each other.
- GEN CONTACT (Point 55) = NOPEN, a general alarm will occur when GEN ALRM DI3 is closed (ON). If you have multiple devices connected to DI3 when GEN CONTACT is NOPEN, each of them must be configured to alarm when their contact closes and they must be wired in parallel to each other.

When GEN ALRM DI3 is in the alarm state GEN ALARM (Point 83) = ALARM. The following actions occur:

1. The fan shuts off and the 100% OA damper is closed.
2. The room loops are disabled and their outputs are set to zero.
3. The cooling supply air temperature loop is disabled and its output is set to zero.
4. The cooling valve's position is under deadband control based on the outside air temperature:
   - If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the cooling valve will be completely shut.
   - If OA TEMP ≤ OA LLIMIT, the cooling valve's position will be maintained at GEN CLG POS (Point 61).
   - If OA TEMP > OA LLIMIT and ≤ to OA LLIMIT+ OA DBAND, the cooling valve's position will be maintained at its last commanded state (if it was last commanded closed, it will remain closed; if it was last commanded to GEN CLG POS, it will remain at GEN CLG POS).
5. If GEN SAH STPT (Point 17) ≤ 40°F, the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.
6. If GEN SAH STPT > 40°F, the enabled/disabled state of the heating supply air temperature loop is under deadband control based on the outside air temperature:
   - If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the heating supply air temperature loop will be disabled.
   - If OA TEMP ≤ OA LLIMIT, the heating supply air temperature loop will be enabled.
   - If OA TEMP > OA LLIMIT and ≤OA LLIMIT+ OA DBAND, the heating supply air temperature loop will remain in its last commanded state (if it was last enabled, it will remain enabled; if it was last disabled, it will remain disabled).
   - When the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.

- When the heating supply air temperature loop is enabled, it is modulating the heating valve such that the supply air temperature is maintained at GEN SAH STPT.

When the general alarm condition is no longer occurring, the application will end the general alarm by setting GEN ALARM to NORMAL.

NOTES: It is strongly recommended that all of the devices hooked to GEN DI 3 be a manual reset devices (if a device goes into alarm, that device has to be manually reset for the alarm to clear).

If it is desired that the cooling valve be shut throughout the entire general alarm mode set GEN CLG POS to 0. If it is desired that the cooling valve be completely opened when there is a general alarm occurring and the outside air temperature is cold set GEN CLG POS to 100.

Fan Proof Alarm:

The fan proof alarm has the fourth highest priority.

In order for a fan proof alarm to occur, the fan proof alarm must be enabled using DIALRM.ENDIS (Point 56) (see *Enable/Disable Points* for information on how to enable or disable the fan proof alarm). If the fan proof alarm is disabled, FAN DI 2 (Point 24) becomes a spare DI available for other uses. For the rest of this section, assume the fan proof alarm is enabled.

A fan proof alarm occurs whenever the fan has been commanded ON but stays OFF or when the fan is commanded OFF but stays ON. After FAN DO 6 (Point 46) has been turned ON, FAN STATUS (Point 84) will be set to ALARM if FAN DI 2 remains OFF for longer than PROOF TIME (Point 57). After FAN DO 6 has been turned OFF, FAN STAUS will be set to ALARM if FAN DI 2 remains ON for longer than PROOF TIME.

When FAN STATUS equals ALARM, the following actions occur:

1. The fan and the 100% OA damper are normally controlled, controlled as though FAN STATUS = NORMAL. (If the fan doesn't proof on after it has been commanded on, you still want to give it a chance to proof). Everything else in application 2502 is treated as though it is in the unoccupied mode and both UOC HTG (Point 53) and UOC CLG (Point 54) are OFF.

2. The room loops are disabled and their outputs are set to zero.

3. The cooling supply air temperature loop is disabled and its output is set to zero.

4. The cooling valve's position is under deadband control based on the outside air temperature:

   - If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the cooling valve will be completely shut.

   - If OA TEMP ≤ OA LLIMIT, the cooling valve's position will be maintained at UOC CLG POS (Point 62).

- If OA TEMP > OA LLIMIT and ≤ OA LLIMIT+ OA DBAND, the cooling valve's position will be maintained at its last commanded state (if it was last commanded closed, it will remain closed; if it was last commanded to UOC CLG POS, it will remain at UOC CLG POS).

5. If UOC SAH STPT (Point 18) ≤ 40°F, the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.

6. If UOC SAH STPT > 40°F, the enabled/disabled state of the heating supply air temperature loop is under deadband control based on the outside air temperature:

   - If OA TEMP (Point 75) > OA LLIMIT (Point 76) + OA DBAND (Point 77), the heating supply air temperature loop will be disabled.
   - If OA TEMP ≤ OA LLIMIT, then the heating supply air temperature loop will be enabled.
   - If OA TEMP > OA LLIMIT and ≤ OA LLIMIT+ OA DBAND, the heating supply air temperature loop will be remain in its last commanded state (if it was last enabled, it will remain enabled; if it was last disabled, it will remain disabled).
   - When the heating supply air temperature loop is disabled, its output is set to zero and the heating valve is shut.
   - When the heating supply air temperature loop is enabled, it is modulating the heating valve such that the supply air temperature is maintained at UOC SAH STPT.

When the Fan Proof alarm is no longer occurring, the application will end the fan proof alarm condition by setting FAN STATUS to NORMAL.

NOTES: It is strongly recommended that the device that proves the fan and is connected to FAN DI 2 **not** be a manual reset device. This will give the fan a chance to proof without having to manually reset the device connected to DI 2.

If it is desired that the cooling valve be shut throughout the entire fan proof alarm mode, set UOC CLG POS to 0 (this will also keep the cooling valve closed throughout the entire unoccupied mode). If it is desired that the cooling valve be completely opened when there is a fan proof alarm occurring and the outside air temperature is cold, set UOC CLG POS to 100. (the cooling valve will also be controlled this way throughout the entire unoccupied mode.)

Room Temperature Sensor Failure:

If ROOM TEMP (Point 4) is failed, the application will use the last known good value of ROOM TEMP. The rest of the application is unaffected by a room temperature sensor failure.

Fan and Damper Operation

The fan is off and the 2-position, 100% outside air damper is closed whenever the supply air temperature sensor fails, the low temperature detector goes into alarm or there is a general alarm. The fan is also off and the damper is closed during the unoccupied mode provided that both UOC HTG (Point 53) and UOC CLG (Point 54) are equal to OFF.

The fan is on and the damper is opened during the following modes:

- Warmup
- Cooldown
- Occupied Heating
- Occupied Cooling
- Unoccupied Heating
- Unoccupied Cooling

A fan proof alarm does not affect the control of the fan or the damper if the fan was commanded on and the damper commanded opened before the fan proof failure, the fan will be commanded on and the damper will be commanded opened after the fan proof failure. If the fan was commanded off, the damper commanded closed before the fan proof failure, the fan will be commanded off, and the damper will be commanded closed after the fan proof failure. The reason this was done was to give the fan has a chance to proof.

NOTES: Application 2502 always opens the 2-position damper (OA DMPR DO5 (Point 45)) and turns on the fan (FAN DO 6 (Point 46)) at the same time. To open the damper before the fan turns on, install an end switch on the damper whose normally opened contact is wired directly into the fan's start/stop circuitry. When the damper closes, so does it's contact, which then starts the fan.

AOV Control of Hot and Cold Water Valves

Application 2502 controls the hot water valve by adjusting the value of HTG VLV CMD (Point 70) and controls the cold-water valve by adjusting the value of CLG VLV CMD (Point 66). Both of these valves are actually connected to 0-10Volt AOVs. This section explains how the 0-100% valve command signals get converted into 0-10 V.

AO DIR.REV (Point 37) must be set correctly in order to determine which AOs are normally closed (direct acting) and which ones are normally opened (reverse acting). See the Startup documentation for more information on how to set AO DIR.REV to the proper value.

Hot Water Valve AOV Calculations:

The hot water valve resides on AOV3 (Point 40). The application uses AOV3 START (Point 36), AOV3 SPAN (Point 35) and HTG VLV CMD in the following way to determine the proper value of AOV3:

- If the hot water valve is normally closed (direct acting),
  AOV3 = AOV3 START + (HTG VLV CMD / 100) x AOV3 SPAN
- If the hot water valve is normally opened (reverse acting),
  AOV3 = AOV3 START + [1- (HTG VLV CMD / 100)] x AOV3 SPAN

Cold Water Valve AOV Calculations:

The cold-water valve resides on AOV2 (Point 39). The application uses AOV2 START (Point 34), AOV2 SPAN (Point 33) and CLG VLV CMD in the following way to determine the proper value of AOV2:

- If the cold water valve is normally closed (direct acting),
  AOV2 = AOV2 START + (CLG VLV CMD / 100) * AOV2 SPAN

- If the cold water valve is normally opened (reverse acting),
  AOV2 = AOV2 START + [1- (CLG VLV CMD / 100)] * AOV2 SPAN

Application 2502 and CSAL Applications

Application 2502 was designed to perform the functionality of the following 4 CSAL applications:

- CAV 100% OA, CC.
- CAV 100% OA, CC w/o LTD.
- CAV 100% OA, HC.
- CAV 100% OA, HC, CC.

Some of the points in Application 2502 need to be configured differently in order for Application 2502 to perform the functionality of the different CSAL applications.

Table 2502-2 shows how to set points in Application 2502 to perform the functionality of the different CSAL Applications. The sequence of operation and the hardware requirements for these CSAL applications are listed at the end of this section.

Table 2502-2. CSAL Application Points.

	100% OA, CC	100% OA, CC w/o LTD	100% OA, HC	100% OA, HC, CC
HC.ENDIS	enable clg (2)	enable clg (2)	enable htg (1)	enable htg & clg (3)
MODE.ENDIS	enable uoc clg (2)	enable uoc clg (2)	enable uoc htg & warmup (5)	enable uoc htg, warmup & cooldown (13)
DIALRM.ENDIS	enable ltdt, gen alarm & fan proof (7)	enable gen alarm & fan proof (5)	enable ltdt, gen alarm & fan proof (7)	enable ltdt, gen alarm & fan proof (7)
LTD SAH STPT	N/A	N/A	Set to 45°F.	Set to 45°F.
GEN SAH STPT	N/A	N/A	Set to 45°F.	Set to 45°F.
UOC SAH STPT	N/A	N/A	Set > 40°F. (Its Active)	Set > 40°F. (Its Active)
LTD CLG POS	Set to 100%	N/A	N/A	Set to 0%
GEN CLG POS	Set to 0%	Set to 100%	N/A	Set to 0%
UOC CLG POS	Set to 0%	Set to 0%	N/A	Set to 0%
OA LLIMIT	N/A	Set to 45°F.	Set to 45°F.	Set to 45°F.

NOTES:

1. A number in parenthesis is the value of the point needed for that particular CSAL application.
2. N/A means not applicable/available.
3. The word "set" means to override the point (Manually command the point and keep it there at operator priority. This will prevent Application 2502 from changing the value of the point).
4. A field panel is needed in order to perform time of day functions. For some of the CSAL applications the field panel will need to send outside air temperature information (as required) to the TEC (OA TEMP (point 75) needs to be unbundled at the field panel).
5. All of the CSAL applications require a smoke detector and a dirty filter alarm. These must share the same DI on the TEC. They are both connected to DI 3, and when they alarm they trigger a general alarm in the TEC (GEN ALARM (Point 83) = ALARM).
6. All of the CSAL applications require the damper to open before the fan turns on, see *Fan and Damper Operation* for details.
7. In the CAV 100% OA, HC, CC CSAL application is the requirement that "The heating and cooling coil valves modulate in sequence without overlap to maintain the supply air temperature setpoint". Application 2502 avoids simultaneous heating and cooling is by using heating/cooling switchover logic, see *Heating/Cooling Switchover* for more information.

CAV 100% OA, CC Sequence of Operation

The constant volume air handling unit consists of an outdoor air damper, pre-filter, cold water cooling coil and supply fan. The unit is DDC controlled using electric actuation.

The air handling unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Unoccupied mode, Night Cooling is available when the space temperature rises above 85°F (29°C). The latest start time is the scheduled occupancy for the space.

The air handling unit operates in Occupied, Unoccupied, Night Cooling and Safety modes as follows (all suggested setpoints and settings are adjustable.):

Occupied

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The cooling coil valve modulates to maintain the supply air temperature setpoint.

Unoccupied

The supply fan is off, the outdoor air damper is closed, and the cooling coil valve is closed.

Night Cooling

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan with the cooling coil valve modulating to maintain supply air setpoint for a maximum space temperature of 85°F (29°C).

Safety

The outdoor air damper actuator auxiliary switch stops the supply fan when the OA damper starts to close.

The smoke detector in the supply air stream de-energizes the supply fan upon activation. All dampers and valves position to their normal position after the fan is de-energized.

A low temperature detector in the outdoor air stream de-energizes the supply fan when temperatures below 38°F (3°C) are sensed. The cooling coil valve opens. All other dampers and valves position to their normal position after the fan is de-energized.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (that is, on or off) and generates an alarm if status deviates from DDC start/stop control.

CAV 100% OA, CC Hardware Requirements

1	Filter Dirty Alarm	DI
1	Supply Fan	DO
1	Supply Fan Proof	DI
1	Supply Smoke Detector	DI
1	Cooling Coil Valve	AO
1	Low Temperature Detection Thermostat	DI
1	Space Temperature	AI
1	Supply Air Temperature	AI

CAV 100% OA, CC w/o LTD Sequence of Operation

The constant volume air handling unit consists of an outdoor air damper, pre-filter, cold water cooling coil and supply fan. The unit is DDC controlled using electric actuation.

The air handling unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied. Within the Unoccupied mode, Night Cooling is available when the space temperature rises above 85°F (29°C). The latest start time is the scheduled occupancy for the space.

The air handling unit operates in Occupied, Unoccupied, Night Cooling and Safety modes as follows (All suggested setpoints and settings are adjustable.):

Occupied

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The cooling coil valve modulates to maintain the supply air temperature setpoint.

Unoccupied

The supply fan is off, the outdoor air damper is closed and the cooling coil valve is closed.

Night Cooling

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan with the cooling coil valve modulating to maintain supply air setpoint for a maximum space temperature of 85°F (29°C).

Safety

The outdoor air damper actuator auxiliary switch stops the supply fan when the OA damper starts to close.

The smoke detector in the supply air stream de-energizes the supply fan upon activation. When the OAT is less than 45°F (7°C), the cooling coil valve opens. When the OAT is 45°F (7°C) or above, the cooling coil valve closes. All other dampers and valves position to their normal position after the fan is de-energized.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (that is, on or off) and generates an alarm if status deviates from DDC start/stop control.

CAV 100% OA, CC w/o LTD Hardware Requirements

1	Supply Fan	DO
1	Supply Fan Proof	DI
1	Supply Smoke Detector	DI
1	Filter Dirty Alarm	DI
1	Cooling Coil Valve	AO
1	Space Temperature	AI
1	Supply Air Temperature	AI

CAV 100% OA, HC LTD Sequence of Operation

The constant volume air handling unit consists of an outdoor air damper, pre-filter, hot water heating coil, and supply fan. The unit is DDC controlled using electric actuation.

The air handling unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below setpoint. The system stays in the Warm-Up mode until the mode setpoint is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65°F (18°C).

The air handling unit operates in Warm-Up, Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested setpoints and settings are adjustable.):

Warm-Up

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The heating coil valve modulates to maintain the supply air temperature setpoint. The system is prevented from entering the Warm-Up mode more than once per day.

Occupied

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The heating coil valve modulates to maintain the supply air temperature setpoint.

Unoccupied (Normal Off)

The supply fan stops and the outdoor air damper closes. If the OAT is less than 45°F (7°C), the heating coil valve modulates to maintain the unoccupied supply air setpoint. If the OAT is 45°F (7°C) or above, the heating coil valve closes.

Night Heating

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan with the heating coil valve open to maintain a minimum night setpoint of 65°F (18°C).

Safety

The outdoor air damper actuator auxiliary switch stops the supply fan when the OA damper starts to close.

The smoke detector in the supply air stream de-energizes the supply fan upon activation. When the OAT is less than 45°F (7°C), the heating coil valve modulates to maintain the supply air temperature at 45°F (7°C). When the OAT is 45°F (7°C) or above, the heating coil valve closes. All other dampers and valves position to their normal position after the fan is de-energized.

A low temperature detector in the discharge of the heating coil de-energizes the supply fan when temperatures below 38°F (3°C) are sensed. The heating coil valve modulates to maintain the supply air temperature at 45°F (7°C). All other dampers and valves position to their normal position after the fan is de-energized.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (that is, on or off) and generates an alarm if status deviates from DDC start/stop control.

CAV 100% OA, HC Hardware Requirements

1	Supply Fan Proof	DI
1	Filter Dirty Alarm	DI
1	Supply Fan	DO
1	Supply Smoke Detector	DI
1	Heating Coil Valve	AO
1	Low Temperature Detection Thermostat	DI
1	Space Temperature	AI
1	Supply Air Temperature	AI

CAV 100% OA, HC, CC Sequence of Operation

The constant volume air handling unit consists of an outdoor air damper, pre-filter, hot water heating coil, cold water cooling coil, and supply fan. The unit is DDC controlled using electric actuation.

The air handling unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below setpoint or the Cool-Down mode when the space temperature is above setpoint. The system stays in the Warm-Up or Cool-Down mode until the mode setpoint is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65°F (18°C).

The air handling unit operates in Warm-Up, Cool-Down, Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested setpoints and settings are adjustable.):

Warm-Up

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The cooling coil valve remains closed. The heating coil valve modulates to maintain the supply air temperature setpoint. The system is prevented from entering the Warm-Up mode more than once per day.

Cool-Down

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The heating coil valve remains closed. The cooling coil valve modulates to maintain the supply air temperature setpoint. The system is prevented from entering the Cool-Down mode more than once per day.

Occupied

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan. The heating coil valve and cooling coil valve modulate in sequence without overlap to maintain the supply air temperature setpoint.

Unoccupied (Normal Off)

The supply fan stops, the cooling coil valve closes and the outdoor air damper closes. If the OAT is less than 45°F (7°C), the heating coil valve modulates to maintain the unoccupied supply air setpoint. If the OAT is 45°F (7°C) or above, the heating coil valve closes.

Night Heating

The outdoor air damper opens and, after fully open, a damper actuator auxiliary switch starts the supply fan with the heating coil valve open to maintain a minimum night setpoint of 65°F (18°C). The cooling coil valve remains closed.

Safety

The outdoor air damper actuator auxiliary switch stops the supply fan when the OA damper starts to close.

The smoke detector in the supply air stream de-energizes the supply fan upon activation. When the OAT is less than 45 °F (7 degrees C), the heating coil valve modulates to maintain the supply air temperature at 45 degrees F (7 °C). When the OAT is 45 °F (7 °C) or above, the heating coil valve closes. All other dampers and valves position to their normal position after the fan is de-energized.

A low temperature detector in the discharge of the heating coil de-energizes the supply fan when temperatures below 38 °F (3 °C) are sensed. The heating coil valve modulates to maintain the supply air temperature at 45 °F (7 °C). All other dampers and valves position to their normal position after the fan is de-energized.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (that is, on or off) and generates an alarm if status deviates from DDC start/stop control.

CAV 100% OA, HC, CC Hardware Requirements

1	Filter Dirty Alarm	DI
1	Supply Fan	DO
1	Supply Fan Proof	DI
1	Supply Smoke Detector	DI
1	Cooling Coil Valve	AO
1	Heating Coil Valve	AO
1	Heating Discharge Temperature	AI
1	Low Temperature Detection Thermostat	DI
1	Space Temperature	AI
1	Supply Air Temperature	AI

Application Notes

1. If the temperature swings in the room are excessive, or if there is trouble maintaining the room setpoint, either the room cooling loop, the room heating loop or both need to be tuned.

2. Override the value of CLG SAT STPT (Point 93) to a constant value while the application is in the occupied cooling mode. If the cold water valve cycles excessively, or if the supply air temper has excessive swings, or if there is trouble in maintaining CLG SAT STPT, then the cooling supply air temperature loop needs to be tuned. See the *APOGEE Automation Service Procedures Manual* (125-3013) for more information. After tuning the cooling supply air temperature loop, release CLG SAT STPT to normal control.

3. Override the value of HTG SAT STPT (Point 91) to a constant value while the application is in the occupied heating mode. If the hot water valve cycles excessively, or if the supply air temper has excessive swings, or if there is trouble in maintaining HTG SAT STPT, then the heating supply air temperature loop needs to be tuned. See the *APOGEE Automation Service Procedures Manual* on InfoLink for more information. After tuning the heating supply air temperature loop, release HTG SAT STPT to normal control.

4. The AHU TEC Controller – 0-10V Output, as shipped from the factory, keeps all associated equipment OFF. See the Equipment Controllers tab in *APOGEE Automation Start-up Procedures* for information on how to release the controller and its equipment to application control.

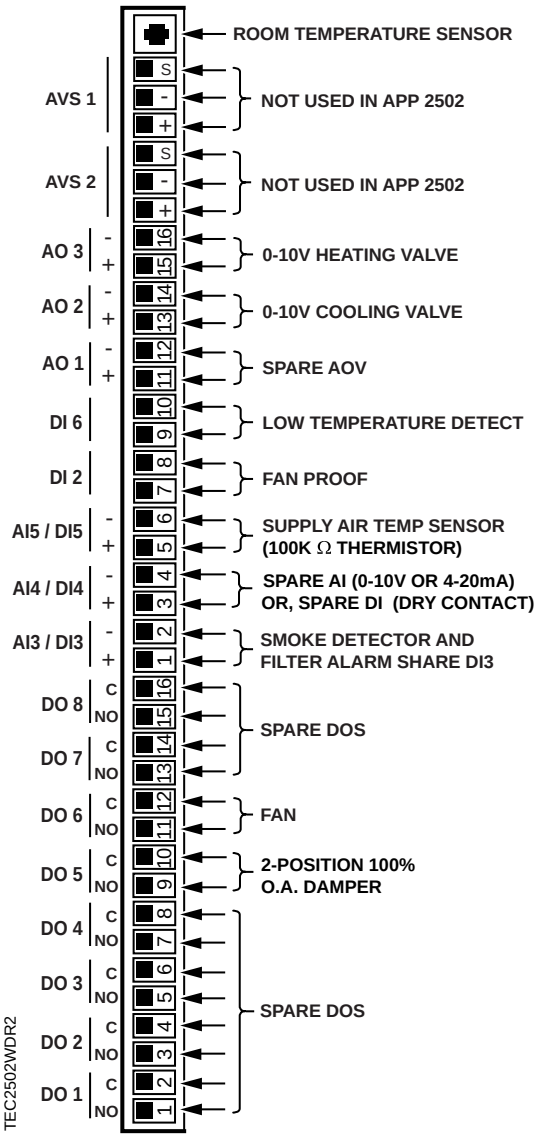
5. Some of the actions of application 2502 depend on the outside air temperature. However, the TEC does not have an outside air temperature sensor connected to it. The way to get outside air temperature sensor information into application 2502 is to unbundle OA TEMP (Point 75) and adjust its value in a field panel.

Wiring Diagrams

The point wiring for Application 2502 is shown in Figure 2502-9.

CAUTION:

The Controller's Digital Outputs (DOs) control 24 Vac loads only. The maximum rating is 12 VA for each DO. For higher VA requirements, 110 or 220 Vac requirements, DC power requirements or separate requirements used to power the load, use an interposing 220 V 4-relay module.



NOTES:

- A dip-switch behind AI 3 on the controller's circuit board (under the controller assembly's cover) must be set to the left (voltage position) or to the right (current position) if AI 3 is used to monitor a 0-10 V or a 4-20 mA sensor.
- SMOKE DETECTOR / FILTER ALARM - Point will shutdown unit when DIALRM.ENDIS is enabled, Disable DIALRM.ENDIS for spare DI monitoring.

Figure 2502-9. Application 2502 Wiring Diagram.

Table 2502-1. Point Database for Application 2502.

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99	--	1	0	--	--
02	APPLICATION	2588	--	1	0	--	--
03	WRMUP STPT	70.0 (21.20888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
{05}	HEAT.COOL	COOL	--	--	--	HEAT	COOL
06	OCC CLG STPT	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
07	OCC HTG STPT	70.0 (21.20888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
08	UOC CLG STPT	82.0 (27.92888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
09	UOC HTG STPT	65.0 (18.40888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
10	COOLDN STPT	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
11	RM STPT MIN	52.5 (11.40888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
12	RM STPT MAX	74.25 (23.58888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
14	STPT DIAL	NO	--	--	--	YES	NO
{15}	AI 3	0.0	PCT	0.4	0.0	--	--
16	LTD SAH STPT	45.0 (7.256)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
17	GEN SAH STPT	45.0 (7.256)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
18	UOC SAH STPT	40.0 (4.456)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
20	OVRD TIME	0	HRS	1	0	--	--
{21}	UNOCC OVRD	UNOCC	--	--	--	UNOCC	OCC
22	HC.ENDIS	3	--	1	1	--	--

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

continued on the next page…

Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
23	MODE.ENDIS	15	--	1	0	--	--
{24}	FAN DI 2	OFF	--	--	--	ON	OFF
{25}	GEN ALRM DI3	OFF	--	--	--	ON	OFF
{26}	LTD DI 6	OFF	--	--	--	ON	OFF
{27}	DI 4	OFF	--	--	--	ON	OFF
{29}	OCC.UNOCC	UNOCC	--	--	--	UNOCC	OCC
{30}	WRMUP.COOLDN	ON	--	--	--	ON	OFF
{31}	AI 4	0.0	PCT	0.4	0.0	--	--
{32}	SA TEMP AI 5	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
33	AOV2 SPAN	10.0	VOLTS	0.01	0.0	--	--
34	AOV2 START	0.0	VOLTS	0.01	0.0	--	--
35	AOV3 SPAN	10.0	VOLTS	0.01	0.0	--	--
36	AOV3 START	0.0	VOLTS	0.01	0.0	--	--
37	AO DIR.REV	0	--	1	0	--	--
{38}	AOV1	0.0	VOLTS	0.01	0.0	--	--
{39}	AOV2	0.0	VOLTS	0.01	0.0	--	--
{40}	AOV3	0.0	VOLTS	0.01	0.0	--	--
{41}	DO 1	OFF	--	--	--	ON	OFF
{42}	DO 2	OFF	--	--	--	ON	OFF
{43}	DO 3	OFF	--	--	--	ON	OFF
{44}	DO 4	OFF	--	--	--	ON	OFF
{45}	OA DMPR DO 5	CLOSE	--	--	--	OPEN	CLOSE
{46}	FAN DO 6	OFF	--	--	--	ON	OFF
{47}	DO 7	OFF	--	--	--	ON	OFF
{48}	DO 8	OFF	--	--	--	ON	OFF
52	LTDT CONTACT	NCLOSE	--	--	--	NCLOSE	NOPEN
{53}	UOC HTG	OFF	--	--	--	ON	OFF
{54}	UOC CLG	OFF	--	--	--	ON	OFF
55	GEN CONTACT	NCLOSE	--	--	--	NCLOSE	NOPEN
56	DIALRM.ENDIS	7	--	1	0	--	--

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
57	PROOF TIME	30	SEC	1	0	--	--
59	DO DIR.REV	0	--	1	0	--	--
60	LTD CLG POS	100.0	PCT	0.4	0.0	--	--
61	GEN CLG POS	100.0	PCT	0.4	0.0	--	--
62	UOC CLG POS	0.0	PCT	0.4	0.0	--	--
63	CLG P GAIN	10.0 (18.0)	--	0.25 (0.45)	0.0	--	--
64	CLG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
65	CLG D GAIN	0 (0.0)	--	2 (3.6)	0	--	--
{66}	CLG VLV CMD	0.0	PCT	0.4	0.0	--	--
67	HTG P GAIN	10.0 (18.0)	--	0.25 (0.45)	0.0	--	--
68	HTG I GAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
69	HTG D GAIN	0 (0.0)	--	2 (3.6)	0	--	--
{70}	HTG VLV CMD	0.0	PCT	0.4	0.0	--	--
71	SA CLG PGAIN	10.0 (18.0)	2.0 (3.6)	0.25 (0.45)	0.0	--	--
72	SA CLG IGAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
73	SA HTG PGAIN	10.0 (18.0)	2.0 (3.6)	0.25 (0.45)	0.0	--	--
74	SA HTG IGAIN	0.01 (0.018)	--	0.001 (0.0018)	0.0	--	--
{75}	OA TEMP	38.5 (3.616)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
76	OA LLIMIT	45.0 (7.256)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
77	OA DBAND	2.0 (1.12)	DEG F (DEG C)	0.5 (0.28)	0.0	--	--
{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
{79}	CLG LOOPOUT	0.0	PCT	0.4	0.0	--	--
{80}	HTG LOOPOUT	0.0	PCT	0.4	0.0	--	--
{81}	SA CLO	0.0	PCT	0.4	0.0	--	--

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.

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Point Number	Descriptor	Factory Default (SI Units)	Eng Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{82}	SA HLO	0.0	PCT	0.4	0.0	--	--
{83}	GEN ALARM	NORMAL	--	--	--	ALARM	NORMAL
{84}	FAN STATUS	NORMAL	--	--	--	ALARM	NORMAL
85	SWITCH LIMIT	4.8	PCT	0.4	0.0	--	--
86	SWITCH TIME	10	MIN	1	0	--	--
{87}	LOW TEMP DET	OFF	--	--	--	ON	OFF
88	UOC DBAND	2.0 (1.12)	DEG F (DEG C)	0.25 (0.14)	0.0	--	--
89	MORN DBAND	2.0 (1.12)	DEG F (DEG C)	0.25 (0.14)	0.0	--	--
90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0.25 (0.14)	0.0	--	--
{91}	CLG SAT STPT	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	0.25 (0.14)	48.0 (8.88888)	--	--
{93}	HTG SAT STPT	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
94	MINHTG SATSP	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
95	MAXHTG SATSP	86.0 (30.216)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
96	MINCLG SATSP	57.0 (13.976)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
97	MAXCLG SATSP	74.0 (23.496)	DEG F (DEG C)	0.5 (0.28)	37.5 (3.056)	--	--
98	LOOP TIME	5	SEC	1	0	--	--
{99}	ERROR STATUS	0	--	1	0	--	--

1. Points not listed are not used in this application.
2. A single value in a column means that the value is the same in English units and in SI units.
3. Point numbers that appear in brackets {} may be unbundled at the field panel.