Application 2301 VAV with Hot Water Reheat and Humidity Control

Note: For the latest on Custom Solution Applications and Controllers, visit the Custom Solutions website.

Overview

In Application 2301, the controller modulates the supply air damper of the terminal box for cooling, modulates a reheat valve for heating, and modulates a humidity valve for humidification. When in heating, the terminal box either maintains minimum air flow or modulates the supply air damper. In order for the terminal box to work properly, the central air handling unit must provide supply air. Refer to Figures 2301-1 through 2301-3.

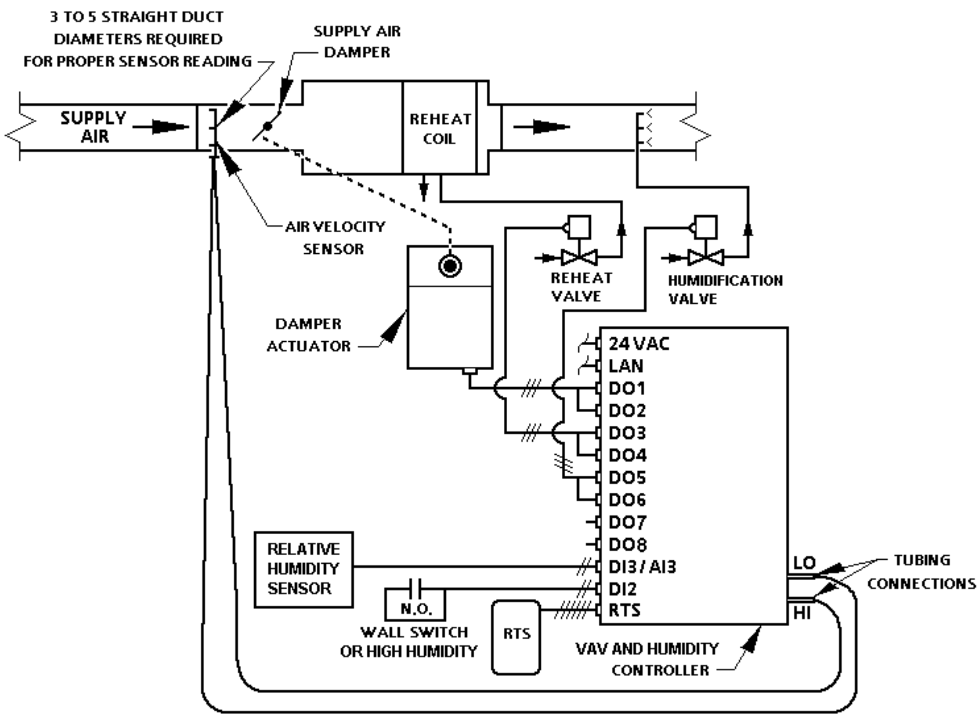
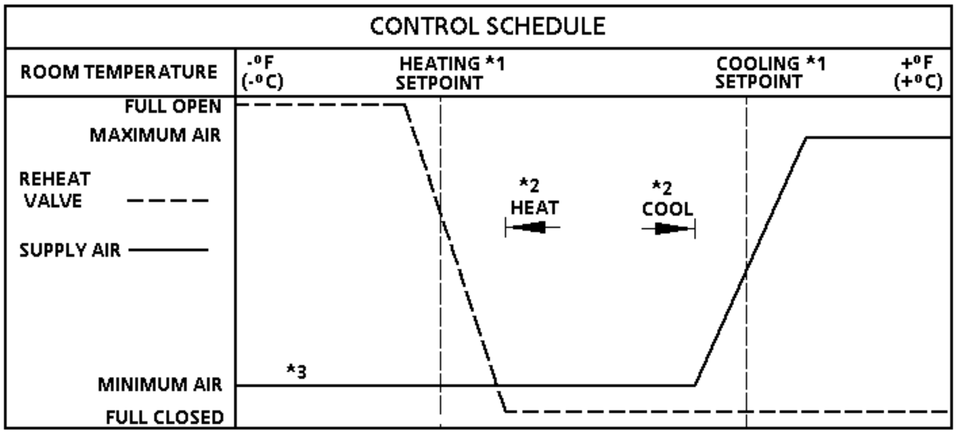
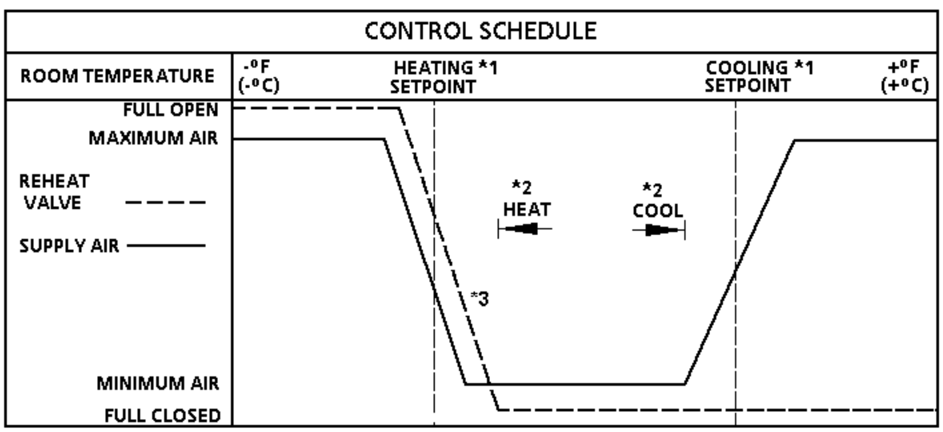


Figure 2301-1. Application 2301 Control Drawing.



NOTES:
1. Refer to Sequence of Operation, "Control Temperature Set Points".
2. Refer to Sequence of Operation, "Heating/Cooling Switchover".
3. The air flow is shown operating at minimum flow throughout the entire heating mode (default setting). Refer to "Sequencing Logic".

Figure 2301-2. Application 2301 Control Schedule.



NOTES:
1. Refer to Sequence of Operation, "Control Temperature Set Points".
2. Refer to Sequence of Operation, "Heating/Cooling Switchover".
3. The air flow is shown operating parallel with the reheat valve (optional). The air flow can operate at minimum flow throughout the entire heating mode (default setting). Refer to "Sequencing Logic".

Figure 2301-3. Application 2301 Control Schedule with Modulating Damper in Heating Mode.

Hardware inputs

analog

- air velocity sensor
- humidity sensor (0-10v or 4-20mA)*
- room temperature sensor
- room temperature set point dial (optional)

digital

- night mode override (optional)
- wall switch or high humidity cut-off (optional)

Hardware outputs

analog

- none

digital

- damper actuator
- humidity valve actuator (or PTS-4 from ACT for controlling pneumatic valve)
- reheat valve actuator

Ordering notes

VAV and Humidity Controller–Electronic Output
Part Number 540-502 Custom Solution #206

Refer to *APOGEE Automation Configuration and Sizing Guidelines* on InfoLink for product numbers.

Damper Actuator
Humidity Sensor
Humidity Valve Actuator
Terminal Equipment Controller Room Temperature Sensor
Reheat Valve Actuator

Point database

Table 2301-1 presents the point database information for Application 2301. Each point number is represented on a line in the point database table.

* A 24 Vdc Power Supply is required to drive the input circuit if a 4-20 mA sensor is used. Refer to the Installation Instructions for this controller.

Sequence of Operation

The following paragraphs present the sequence of operation for Application 2301, "VAV with Hot Water Reheat and Humidity Control".

Control temperature set points

Depending on the controller's current operational mode (day or night), the control temperature set point, CTL STPT (number 92) holds the value of one of the following set points:

Day Mode – In day mode, CTL STPT holds the value of the point DAY CLG STPT (number 6) or DAY HTG STPT (number 7). If the room temperature sensor has a set point dial and the point STPT DIAL (number 14) is set to YES, then CTL STPT holds the value of the point RM STPT DIAL (number 13).

If the set point dial is used and the value of RM STPT DIAL is less than the value of the point RM STPT MIN (number 11), then CTL STPT holds the value of RM STPT MIN. If the value of RM STPT DIAL is greater than the value of the point RM STPT MAX (number 12), then CTL STPT holds the value of RM STPT MAX.

Night Mode – In night mode, CTL STPT holds the value of the point NGT CLG STPT (number 8) or NGT HTG STPT (number 9).

NOTE: The value of the point CTL TEMP (number 78) is the same as the value of the point ROOM TEMP (number 4), unless CTL TEMP is overridden.

Day and night modes

The day/night status of the space is determined by the status of the point DAY.NGT (number 29). 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 (Figures 2301-1 and 2301-5), and the point WALL SWITCH (number 18) equals YES, the controller monitors the status of DI 2. When the status of the point DI 2 (number 24) is ON (the switch is closed), then DAY.NGT will be set to DAY indicating that the controller is in day mode. When the status of DI 2 is OFF (the switch is open), then DAY.NGT will be set to NIGHT indicating that the controller is in night mode.

When WALL SWITCH equals NO, the controller uses DI 2 as a humidity safety cutoff. Refer to *Fail-safe operation.*

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 the point OVRD TIME (number 20), then by pressing the override switch a room occupant can reset the controller to day operational mode of the time period that is set in OVRD TIME. The status of the point NGT OVRD (number 21) changes to DAY. After the override time elapses, the controller returns to night mode and the status of NGT OVRD changes back to NIGHT.

It is only when the controller is in night mode that the override switch on the room sensor will have any effect on the controller.

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 the point SWITCH TIME (number 86), then the controller switches from heating to cooling mode by setting the point HEAT.COOL (number 5) to COOL:

- The point HTG LOOPOUT (number 80) is less than the point SWITCH LIMIT (number 85).
- The point CTL TEMP (number 78) is above the point CTL STPT (number 92) by at least the value set in the point SWITCH DBAND (number 90).
- CTL TEMP is greater than the appropriate cooling set point minus SWITCH DBAND.

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

- The point CLG LOOPOUT (number 79) is less than SWITCH LIMIT.
- CTL TEMP is below CTL STPT by at least the value set SWITCH DBAND.
- CTL TEMP is less than the appropriate heating set point plus SWITCH DBAND.

Modulate damper during heating mode (optional)

CAUTION:
This heating/cooling switchover mechanism is not affected by the air temperature in the supply duct.

To change the value of the point HEAT.COOL (number 5) based on the supply air temperature, you must command HEAT.COOL through PPCL. This is required when the flow loop will be used as a source of cooling in cooling mode and a source of heat in heating mode. (Refer to Examples 1-3 in “Sequencing Logic”.) If the flow loop is used in heating mode just to meet minimum air requirements, then the heating/cooling switchover mechanism operates as described in this section to control HEAT.COOL. (Refer to Example 4 in “Sequencing Logic”.)

Control loops

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

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 the point CTL STPT (number 92). Refer to “Control Temperature Set Points”.

The cooling temperature loop generates cooling loopout which is then used to generate the point FLOW STPT (number 93). FLOW STPT is the result of scaling the cooling loopout to the appropriate range of values determined by the points CLG FLOW MIN (number 31) and CLG FLOW MAX (number 32). In order to scale it, the loopout is multiplied by the range (MAX–MIN) and then added to the minimum set point.

When CLG FLOW MIN does not equal 0 CFM, then FLOW STPT does not equal the point CLG LOOPOUT (number 79). The minimum flow set point is (CLG FLOW MIN÷CLG FLOW MAX)×100% flow. And FLOW STPT is [CLG LOOPOUT×(100%–minimum set point)]+minimum set point.

For example:

If CLG FLOW MIN=200 CFM and CLG FLOW MAX=1000 CFM

then, the minimum flow set point is
(200 CFM÷1000 CFM)×100% flow=20%

When CLG LOOPOUT is 0%, FLOW STPT equals 20% flow.
[0%×(100%–20%)]+20%=20%
This ensures that the air flow out of the terminal box is no less than CLG FLOW MIN.

When CLG LOOPOUT is 50%, FLOW STPT equals 60% flow.
[50%×(100%–20%)]+20%=60%

When CLG LOOPOUT is 100%, FLOW STPT equals 100% flow.
[100%×(100%–20%)]+20%=100%

If the controller is in heating mode, then the operation of the flow loop is flexible. It can be set up to do one of the following:

- Constantly maintain an air flow out of the terminal box equal to the point HTG FLOW MIN (number 33).
- Operate in sequence with the hot water valve.
- Operate parallel with the hot water valve.
- Have its operation overlap with the operation of the hot water valve. Refer to “Sequencing Logic” for more information.

If the first option described above is chosen, then the point HTG LOOPOUT (number 80) will control the hot water valve in order to maintain the room temperature. If any one of the last three options is chosen, then HTG LOOPOUT will control both the flow loop set point (FLOW STPT) and the hot water valve in order to maintain the room temperature. Refer to “Sequencing Logic” for more information.

HTG LOOPOUT will adjust the value of FLOW STPT differently depending on which flow loop setup is chosen. However, the following rule applies no matter what setup is chosen:

In heating mode, FLOW STPT will never be set below (HTG FLOW MIN÷HTG FLOW MAX)×100% flow or above 100% flow.

Flow Loop – The flow loop maintains the minimum air flow and maximum air flow through the points CTL FLOW MIN (number 76) and CTL FLOW MAX (number 77).

When the controller is in cooling mode, CTL FLOW MIN equals CLG FLOW MIN and CTL FLOW MAX equals CLG FLOW MAX.

When the controller is in heating mode, CTL FLOW MIN equals HTG FLOW MIN and CTL FLOW MAX equals HTG FLOW MAX.

In Application 2301, you can set CLG FLOW MIN equal to, but not greater than, CLG FLOW MAX and set HTG FLOW MIN equal to, but not greater than, HTG FLOW MAX. If the minimum and maximum values are set equal, then the flow loop becomes a constant volume loop and its ability to control temperature is lost.

The flow loop maintains FLOW STPT by modulating the supply air damper point, DMPR COMD (number 48). The flow loop maintains the air flow between CLG FLOW MIN and CLG FLOW MAX in cooling mode and between HTG FLOW MIN and HTG FLOW MAX in heating mode.

The point FLOW (number 75) is the input value for the flow loop. It is calculated as a percentage based on where the point AIR VOLUME (number 35) is between 0 CFM and CTL FLOW MAX. In the following text, this percentage will be referred to as % flow.

- If AIR VOLUME equals 0 CFM, then FLOW is 0% flow.
- If AIR VOLUME equals CTL FLOW MAX, then FLOW is 100% flow.

The low limit of FLOW STPT will be the percentage that corresponds to the volume given in CLG FLOW MIN. This percentage can be calculated as: (CTL FLOW MIN÷CTL FLOW MAX)×100% flow. The flow loop ensures that the supply air will not be less than CTL FLOW MIN.

For example:

If CTL FLOW MIN equals 250 CFM, and if CTL FLOW MAX equals 1000 CFM

then,

the low limit of FLOW STPT=(250 CFM÷1000 CFM)×100% flow
=0.25×100% flow
=25% flow

Since 25% of 1000 CFM equals 250 CFM, the minimum air flow out of the terminal box will be 250 CFM.

Humidity Loop – The humidity loop and its associated control algorithm maintain the relative humidity, ROOM RH (number 15), at its setpoint, ROOM RH STPT (number 16). The humidity loop itself controls the specific humidity using the points SPEC HUM (number 26) and SPH CTL SET (number 28) by modulating the humidity valve. The specific humidity setpoint is reset to control relative humidity.

Relative humidity is affected by both the quantity of moisture in the air (specific humidity) and the temperature of the air. When the room temperature changes (rises), the relative humidity changes too (falls), even though the amount of moisture in the air stays the same. This is because relative humidity is the percentage ratio between the amount of moisture is in the air and the amount of moisture the air can hold at a particular temperature. When the temperature rises, it is capable of holding more moisture, so the percentage ratio drops.

By controlling specific humidity, some of this interaction between temperature and relative humidity can be eliminated. When the temperature setpoint is raised, the specific humidity setpoint is automatically recalculated to a higher level. This new level corresponds to the amount of moisture necessary to keep the relative humidity at its setpoint when the temperature reaches its new setpoint. The result is that both the temperature and the specific humidity will rise at the same time, but the relative humidity will stay constant.

The specific humidity and the specific humidity setpoint are constantly recalculated using the relative humidity and temperature readings and the relative humidity and temperature setpoints.

Hot water reheat

CAUTION:

Do not set the point HTG FLOW MIN (number 33) to 0 CFM (0 LPS). A minimum air flow should be provided across the heating coils when the heating valve is open.

The heating loop modulates the heating valve in order to warm up the space as follows:

- When (HTG LOOPOUT−REHEAT START)÷(REHEAT END−REHEAT START)×100% varies from 0 to 100% open of the reheat output range, the point VLV1 COMD (number 52) varies from 0 to 100% open.

When the controller is in cooling mode, the heating valve is closed.

Sequencing logic (optional)

NOTE: The default setups for the points FLOW START (number 16) and FLOW END (number 17) are 0. This will provide minimum air flow during heating mode.

In heating mode, this application includes logic that allows the flow loop to operate either in sequence, parallel, or overlapping with the hot water valve. This algorithm is very similar to the spring range sequencing of valves and dampers. Portions of the output of the heating loop, point HTG LOOPOUT (number 80), will drive both the flow loop and the hot water valve from 0 to 100%. Refer to the following three examples. For simplicity, assume that in these examples the point HTG FLOW MIN (number 33) equals 0 CFM (when this is done, the point FLOW STPT (number 93) will equal 0 when HTG LOOPOUT equals 0). The ladder diagrams in Figure 2301-4 shows sequenced, parallel, and overlapping flow loop operations with electric reheat. The vertical bars show the output of heating loopout from 0 to 100%. The horizontal bars (reheat start, flow start, etc.) show the action that occurs when the loop output rises above the horizontal bar. The relative positions shown on the graphs are for illustration purposes only and may differ from the examples.

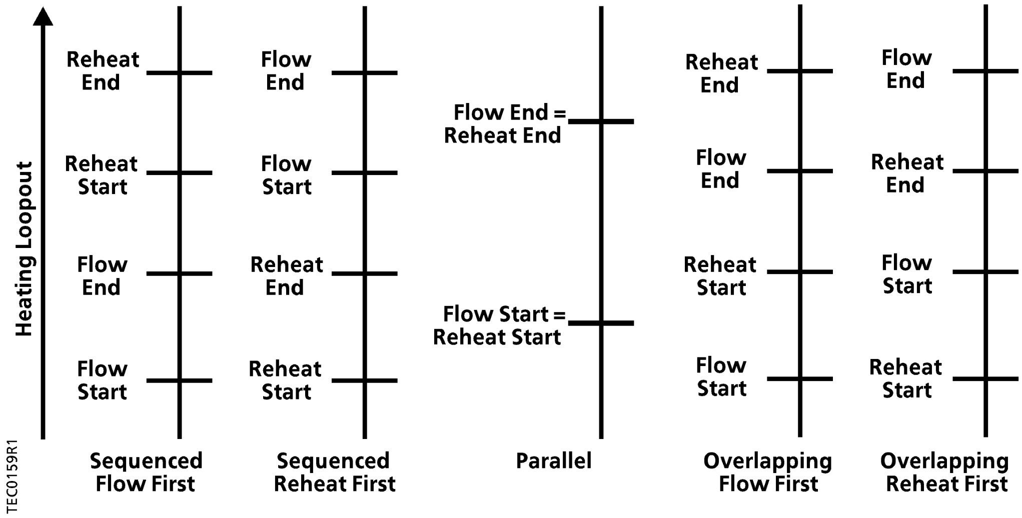


Figure 2301-4. Sequenced, Parallel, and Overlapping Flow Loop Operations with Hot Water Reheat.

Example 1: Assume that your system has a hot water valve that it is to operate in *sequence* with the flow loop. If,

- FLOW START (number 16) equals 0%
- FLOW END (number 17) equals 50%
- REHEAT START (number 22) equals 50%
- REHEAT END (number 23) equals 100%

then,

- when HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- when HTG LOOPOUT equals 25%, FLOW STPT will equal 50% flow.
- when HTG LOOPOUT is greater than or equal to 50%, FLOW STPT will equal 100% flow.
- when HTG LOOPOUT is less than or equal to 50%, VLV COMD will equal 0% open.
- when HTG LOOPOUT equals 75%, VLV COMD will equal 50% open.
- when HTG LOOPOUT equals 100%, VLV COMD will equal 100% open.

Example 2: Assume that your system has a hot water valve that is to operate in *parallel* with the flow loop. If,

- FLOW START (number 16) equals 0%
- FLOW END (number 17) equals 100%
- REHEAT START (number 22) equals 0%
- REHEAT END (number 23) equals 100%

then,

- when HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- when HTG LOOPOUT equals 50%, FLOW STPT will equal 50% flow.
- when HTG LOOPOUT equals 100%, FLOW STPT will equal 100% flow.
- when HTG LOOPOUT equals 0%, VLV COMD will equal 0% open.
- when HTG LOOPOUT equals 50%, VLV COMD will equal 50% open.
- when HTG LOOPOUT equals 100%, VLV COMD will equal 100% open.

Example 3: Assume that your system has a hot water valve that is to operate *overlapping* with the flow loop. If,

- FLOW START (number 16) equals 0%
- FLOW END (number 17) equals 75%
- REHEAT START (number 22) equals 25%
- REHEAT END (number 23) equals 100%

then,

- when HTG LOOPOUT equals 0%, FLOW STPT will equal 0% flow.
- when HTG LOOPOUT equals 37.5%, FLOW STPT will equal 50% flow.
- when HTG LOOPOUT is greater than or equal to 75%, FLOW STPT will equal 100% flow.
- when HTG LOOPOUT is less than or equal to 25%, VLV COMD will equal 0% open.
- when HTG LOOPOUT equals 62.5%, VLV COMD will equal 50% open.
- when HTG LOOPOUT equals 100%, VLV COMD will equal 100% open.

Another option that the sequencing logic provides is to have the flow loop provide an air flow equal to HTG FLOW MIN throughout the heating mode with all of the temperature control being done by the hot water valve. The air flow minimum will be maintained by setting the FLOW START and FLOW END to 0% which will cause FLOW STPT to hold the value corresponding to minimum flow throughout the entire heating mode, regardless of the value of HTG LOOPOUT. Example 4 clarifies this:

Example 4: Assume that your system has a hot water valve that provides the temperature control in the heating mode, while the flow loop provides for the minimum air requirements. Assume,

- HTG FLOW MIN equals 170 CFM
- HTG FLOW MAX equals 1000 CFM

If,

- FLOW START (number 16) equals 0%

- FLOW END (number 17) equals 0%
- REHEAT START (number 22) equals 0%
- REHEAT END (number 23) equals 100%

then,

- when HTG LOOPOUT equals 0%, FLOW STPT will equal (170 CFM–1000 CFM)×100% flow=17% flow. This will cause the flow loop to maintain an air flow of 170 CFM out of the terminal box.
- when HTG LOOPOUT equals 50%, FLOW STPT will equal 17% flow.
- when HTG LOOPOUT equals 100%, FLOW STPT will equal 17% flow.
- when HTG LOOPOUT equals 0%, VLV COMD will equal 0% open.
- when HTG LOOPOUT equals 50%, VLV COMD will equal 50% open.
- when HTG LOOPOUT equals 100%, VLV COMD will equal 100% open.

Calibration

Air Velocity Transducer – Calibration of the controller's internal air velocity transducers is periodically required to maintain accurate air velocity readings. The point CAL SETUP (number 95) is set with the desired calibration option during controller startup. Depending upon the value of CAL SETUP, calibration may be set to take place automatically or manually. If the status of the point CAL AIR (number 94) is YES, then calibration is in progress.

- The damper is commanded closed to get a zero air flow reading during calibration.

Hot Water and Humidity Valves – Calibration of the valves is done by commanding the valves to closed whenever an air velocity transducer calibration is initiated

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

Temperature and Humidity Interaction Protection

Under most conditions the interaction between temperature and relative humidity is prevented because specific humidity is used as the loop input instead of relative humidity (refer to *Control loops*). Occasionally, additional protections are needed to prevent potentially hazardous conditions.

In some circumstances, the temperature loop is held constant while the humidity loop operates. In other circumstances, the humidity loop is held constant while the temperature loop operates. This protection only takes place when allowing both loops to operate simultaneously may lead to dangerously high or low relative humidity levels.

The temperature loop is held still under the following conditions:

1. Both temperature and humidity are low, and both temperature and humidity setpoints are raised, or the temperature setpoint is raised while the relative humidity is more than RH LIMIT (number 83) below its setpoint.

   If both loops are allowed to operate, the temperature loop may move faster than the humidity loop, which would cause the relative humidity to dip to unacceptably low levels.

2. Both temperature and humidity are high, and both temperature and humidity setpoints are lowered, or the temperature setpoint is lowered while the relative humidity is more than RH LIMIT above its setpoint.

   If both loops are allowed to operate, the temperature loop may move faster than the humidity loop, which would cause the relative humidity to rise to unacceptably high levels.

The humidity loop is held constant under the following conditions (these are more rare):

1. Temperature is low and humidity is high, both temperature and humidity setpoints are raised, and the relative humidity setpoint, although it has been raised, is still far below the relative humidity.

   It is possible that the specific humidity needs to increase to meet the new setpoint requirements, although the relative humidity needs to decrease. The humidity loop is held constant until the relative humidity is within RH LIMIT of the relaive humidity setpoint to prevent the relative humidity from going even higher. This condition might occur in the winter on a night-to-day changeover.

2. Temperature is high and humidity is low, both temperature and humidity setpoints are lowered, and the relative humidity setpoint, although it has been lowered, is still far above the relative humidity.

   It is possible that the specific humidity needs to decrease to meet the new setpoint requirements, although the relative humidity needs to increase. The humidity loop is held constant until either the temperature reaches its setpoint, or the relative humidity is within RH LIMIT of the relative humidity setpoint to prevent the relative humidity from dropping any further.

Fail-safe operation

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

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

If the point WALL SWITCH (number 18) is set to NO, then if DI 2 is closed the humidity valve will be closed and the humidity loop suspended to prevent wind-up. DI 2 is used to indicate a high duct humidity or a low duct flow.

If the point AIR VOLUME (number 35) falls below the value held in LOW FLOW (number 30), the humidity valve will be closed to prevent condensation in the duct. The air volume must then rise above the value held in CTL FLOW MIN (number 76) for the humidity control to be re-enabled.

Application notes

1. If the temperature swings in the room are excessive, or if there is trouble in maintaining the set point, then either the cooling loop, the heating loop or both need to be tuned. If the point FLOW (number 75) is oscillating while the point FLOW STPT (number 93) is constant, then the flow loop requires tuning. Refer to *APOGEE Automation Maintenance and Troubleshooting Manual* on InfoLink for more information.

3. The VAV and Humidity Controller – Electronic Output, as shipped from the factory, keeps all associated equipment OFF. Refer to the *Start-up* document for this application for information on how to release the controller and its equipment to application control.

4. 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 using a pair of spare DOs to control a motor, you must unbundle the corresponding motor command point.

Wiring diagrams The point wiring for Application 2301 is shown in Figure 2301-5.

CAUTION:
The Controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. For higher VA requirements, 110 or 220 Vac requirements, or DC power requirements, use an interposing 220V relay module.

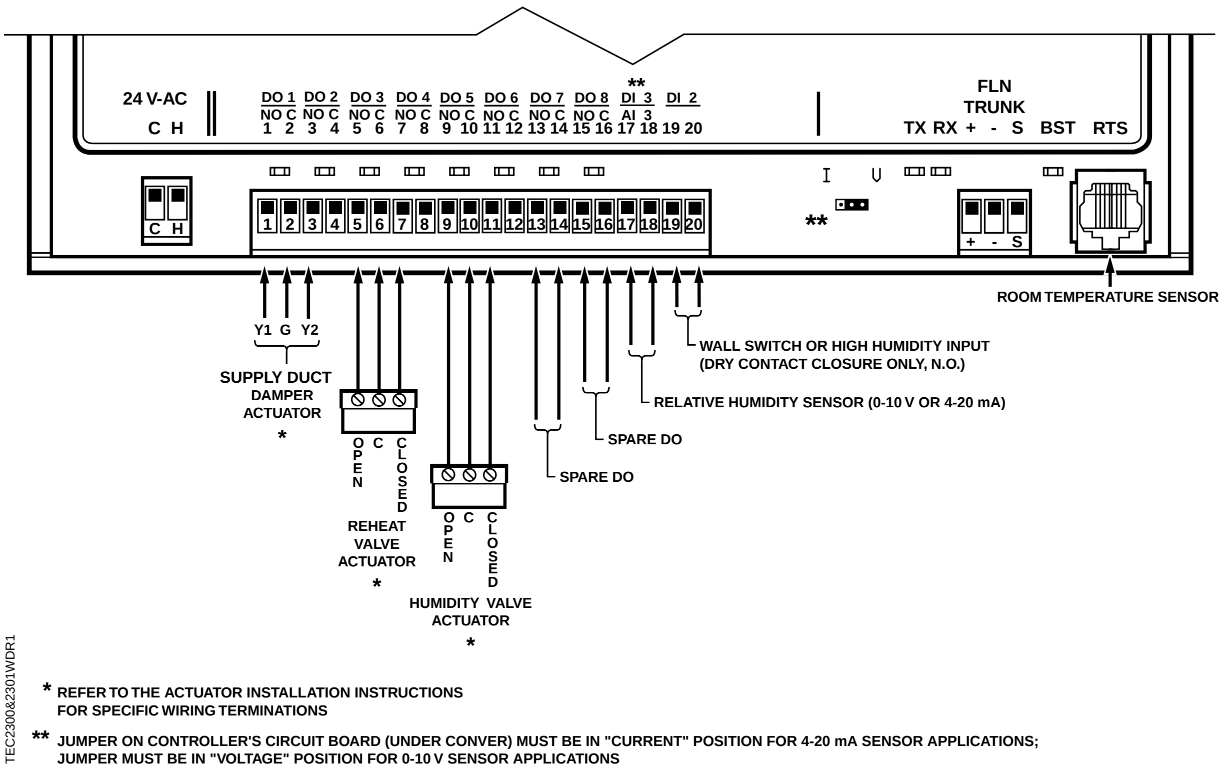


Figure 2301-5. Application 2301 Wiring Diagram.

CAUTION:

IMPORTANT! If a 4-20mA sensor is used at AI 3, special wiring precautions must be followed. See Figure 2301-6.

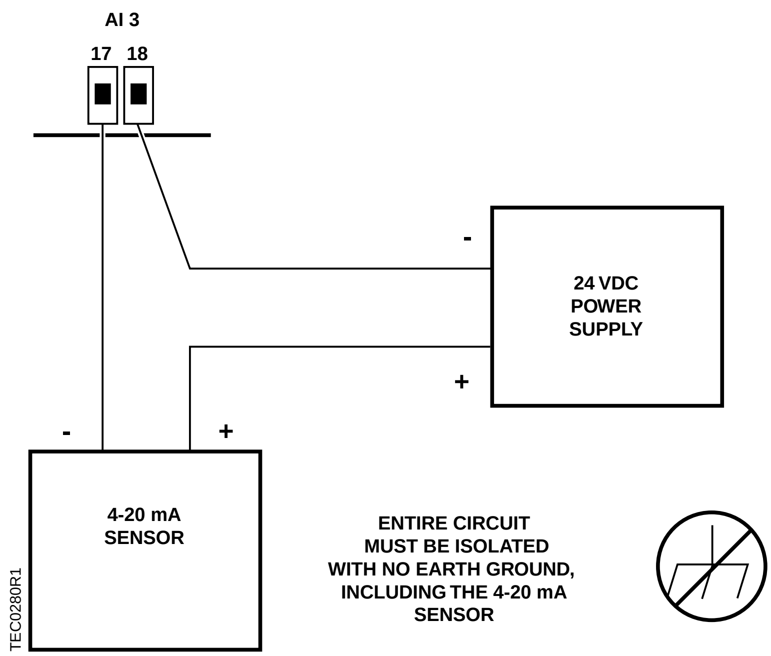


Figure 2301-6. Special Wiring Requirements if 4-20mA sensor used at AI 3.

CAUTION:

You can NOT use the same transformer to power the TEC and the 4-20 mA sensor(s). A **SEPARATE** power supply is required for the 4-20 mA sensor(s).

Table 2301-1. Point Database for Application 2301.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
01	CTLR ADDRESS	99.000	--	1.000	0.000	--	--
02	APPLICATION	2091	--	1.000	0.000	--	--
{03}	ROOM RH STPT	50.0	PCT	0.400	0.000	--	--
{04}	ROOM TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{05}	HEAT.COOL	COOL	--	--	--	HEAT	COOL
06	DAY CLG STPT	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
07	DAY HTG STPT	70.000 (21.209)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
08	NGT CLG STPT	82.000 (27.929)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
09	NGT HTG STPT	65.000 (18.409)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
11	RM STPT MIN	55.000 (12.809)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
12	RM STPT MAX	90.000 (32.409)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{13}	RM STPT DIAL	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
14	STPT DIAL	NO	--	--	--	YES	NO
{15}	ROOM RH	29.2	PCT	0.400	0.000	--	--
16	FLOW START	0.0	PCT	0.400	0.000	--	--
17	FLOW END	0.0	PCT	0.400	0.000	--	--
18	WALL SWITCH	NO	--	--	--	YES	NO
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
20	OVRD TIME	0.000	HRS	1.000	0.000	--	--
{21}	NGT OVRD	NIGHT	--	--	--	NIGHT	DAY
22	REHEAT START	0.000	PCT	0.400	0.000	--	--
23	REHEAT END	100.0	PCT	0.400	0.000	--	--
{24}	DI 2	OFF	--	--	--	ON	OFF
{25}	DI 3	OFF	--	--	--	ON	OFF
{26}	SPEC HUM	0.0	--	0.1	0.000	--	--
{27}	SPEC HUM SET	50.0	--	0.1	0.000	--	--
{28}	SPH CTL SET	50.0	--	0.1	0.000	--	--
{29}	DAY.NGT	DAY	--	--	--	NIGHT	DAY
30	LOW FLOW	220 (103.8180)	CFM (LPS)	4.000 (1.888)	0.000	--	--
31	CLG FLOW MIN	220.000 (103.818)	CFM (LPS)	4.000 (1.888)	0.000	--	--

NOTES:
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.

Table 2301-1. Point Database for Application 2301.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
32	CLG FLOW MAX	2200.000 (1038.180)	CFM (LPS)	4.000 (1.888)	0.000	--	--
33	HTG FLOW MIN	220.000 (103.818)	CFM (LPS)	4.000 (1.888)	0.000	--	--
34	HTG FLOW MAX	2200.000 (1038.180)	CFM (LPS)	4.000 (1.888)	0.000	--	--
{35}	AIR VOLUME	0.000	CFM (LPS)	4.000 (1.888)	0.000	--	--
36	FLOW COEFF	1.000	--	0.010	0.000	--	--
{37}	HMD VLV CMD	0.000	PCT	0.400	0.000	--	--
{38}	HMD VLV POS	0.000	PCT	0.400	0.000	--	--
39	MTR3 TIMING	130.000	SEC	1.000	0.000	--	--
{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}	DO 5	OFF	--	--	--	ON	OFF
{46}	DO 6	OFF	--	--	--	ON	OFF
{47}	DO 7	OFF	--	--	--	ON	OFF
{48}	DMPR COMD	0.000	PCT	0.400	0.000	--	--
{49}	DMPR POS	0.000	PCT	0.400	0.000	--	--
{50}	DO 8	OFF	--	--	--	ON	OFF
51	MTR1 TIMING	95.000	SEC	1.000	0.000	--	--
{52}	VLV1 COMD	0.000	PCT	0.400	0.000	--	--
{53}	VLV1 POS	0.000	PCT	0.400	0.000	--	--
54	AI3 VOLT,CUR	VOLT	--	--	--	CURENT	VOLT
55	MTR2 TIMING	130.000	SEC	1.000	0.000	--	--
56	DMPR ROT ANG	90.000	--	1.000	0.000	--	--
58	MTR SETUP	0.000	--	1.000	0.000	--	--
59	DO DIR. REV	0.000	--	1.000	0.000	--	--
63	CLG P GAIN	20.000 (36.000)	--	0.250 (0.450)	0.000	--	--
64	CLG I GAIN	0.010 (0.018)	--	0.001 (0.0018)	0.000	--	--
65	CLG D GAIN	0.000	--	2.000 (3.600)	0.000	--	--
66	CLG BIAS	0.000	PCT	0.400	0.000	--	--

NOTES:

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.

Table 2301-1. Point Database for Application 2301.

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
67	HTG P GAIN	10.000 (18.000)	--	0.250 (0.450)	0.000	--	--
68	HTG I GAIN	0.010 (0.018)	--	0.001 (0.0018)	0.000	--	--
69	HTG D GAIN	0.000	--	2.000 (3.600)	0.000	--	--
70	HTG BIAS	0.000	PCT	0.400	0.000	--	--
71	FLOW P GAIN	0.250	--	0.050	0.000	--	--
72	FLOW I GAIN	0.020	--	0.001	0.000	--	--
73	FLOW D GAIN	0.000	--	2.000	0.000	--	--
74	FLOW BIAS	50.000	PCT	0.400	0.000	--	--
{75}	FLOW	0.000	PCT	0.250	0.000	--	--
{76}	CTL FLOW MIN	220.000 (103.818)	CFM (LPS)	4.000 (1.888)	0.000	--	--
{77}	CTL FLOW MAX	2200.000 (1038.180)	CFM (LPS)	4.000 (1.888)	0.000	--	--
{78}	CTL TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{79}	CLG LOOPOUT	0.000	PCT	0.400	0.000	--	--
{80}	HTG LOOPOUT	0.000	PCT	0.400	0.000	--	--
{83}	RH LIMIT	2.000	PCT	0.400	0.000	--	--
85	SWITCH LIMIT	5.200	PCT	0.400	0.000	--	--
86	SWITCH TIME	10.000	MIN	1.000	0.000	--	--
87	SPH P GAIN	5.000 (9.000)	--	0.250 (0.450)	0.000	--	--
88	SPH I GAIN	0.005 (0.009)	--	0.001 (0.0018)	0.000	--	--
89	SPH D GAIN	0.000	--	2.000 (3.600)	0.000	--	--
90	SWITCH DBAND	1.000 (0.560)	DEG F (DEG C)	0.250 (0.140)	0.000	--	--
91	SPH BIAS	0.000	PCT	0.400	0.000	--	--
{92}	CTL STPT	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{93}	FLOW STPT	0.000	PCT	0.250	0.000	--	--
{94}	CAL AIR	NO	--	--	--	YES	NO
95	CAL SETUP	4.000	--	1.000	0.000	--	--
96	CAL TIMER	12.000	HRS	1.000	0.000	--	--
97	DUCT AREA	1.000 (0.093)	SQ. FT (SQ M)	0.025 (0.002)	0.000	--	--
98	LOOP TIME	5.000	SEC	1.000	0.000	--	--
{99}	ERROR STATUS	0.000	--	1.000	0.000	--	--

NOTES:

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.