

## Application 2302      Relative Humidity Control using Specific Humidity

Note: For the latest on Custom Solution Applications and Controllers, visit the [Custom Solutions website](#).

### Overview

In Application 2302, the controller modulates a humidity valve for humidification. In order for the application to work properly, the central air handling unit must provide pre-conditioned air to the terminal box. Refer to Figures 2302-1 and 2302-2.

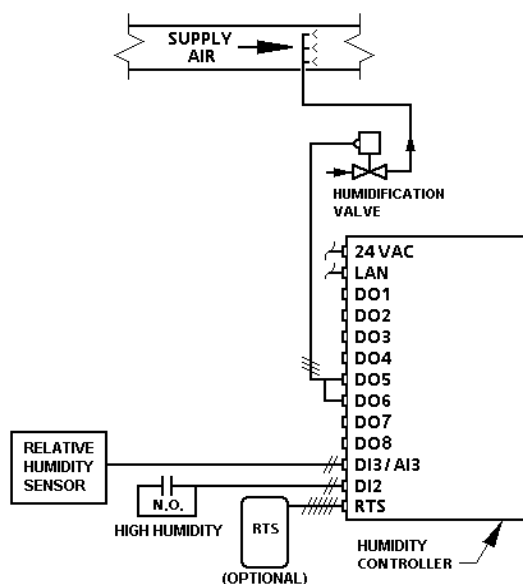


Figure 2302-1. Application 2302 Control Drawing.

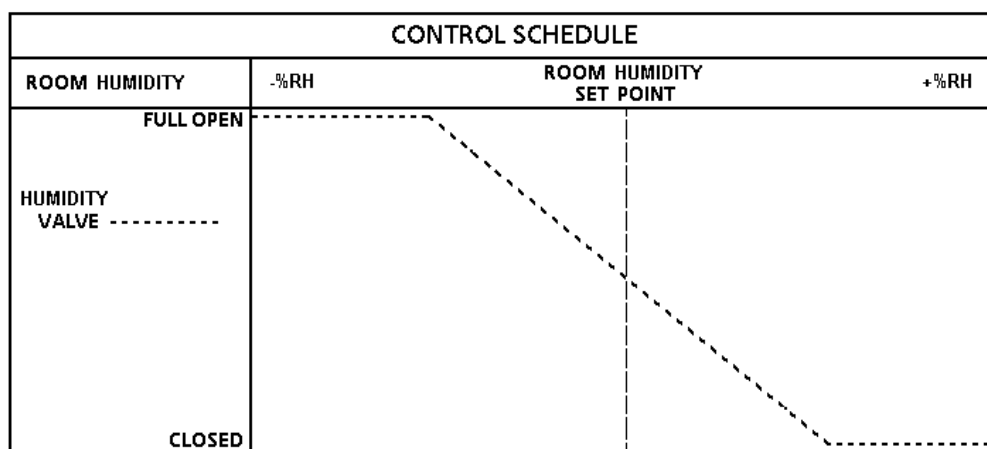


Figure 2302-2. Application 2302 Control Schedule.

*Hardware inputs***analog**

- humidity sensor (0-10v or 4-20mA)\*
- room temperature sensor (optional)

**digital**

- high humidity cut-off (optional)

*Hardware outputs***analog**

- none

**digital**

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

*Ordering notes*

Humidity Controller – Electronic Output  
Part Number 540-503

Custom Solution #207

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

Humidity Sensor  
Humidity Valve Actuator  
Terminal Equipment Controller room temperature sensor

*Point database*

Table 2302-1 presents the point database information for Application 2302. 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 2302, "Relative Humidity Control using Specific Humidity".

### Control loops

**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 (decreases), 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 rises, 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 as the temperature rises. The result is that relative humidity will stay closer to setpoint.

The specific humidity and the specific humidity setpoint are constantly recalculated using the relative humidity, relative humidity setpoint, and room temperature (if available) readings.

### Calibration

**Humidity Valve** – Calibration of the valve is done by commanding the valve to closed. This occurs according to the setup of the point CAL SETUP (number 95).

### Fail-safe operation

If the room temperature sensor fails, then the controller holds the last known temperature value. In this application, the room temperature is not controlled.

If DI2 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.

### Application notes

1. The Humidity Controller – Electronic Output, as shipped from the factory, keeps all associated equipment OFF. Refer to *Start-up* document for this application for information on how to release the controller and its equipment to application control.
2. Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database. The combination of DO 3 and DO 4 or DO 5 and DO 6 may be used as auxiliary motors. If using these pairs of spare DOs to control motors, you

must unbundle the points MTR1 COMD (number 48) and MTR2 COMD (number 52) and set the point MTR SETUP (number 58) as described in *Start-up* document for this application.

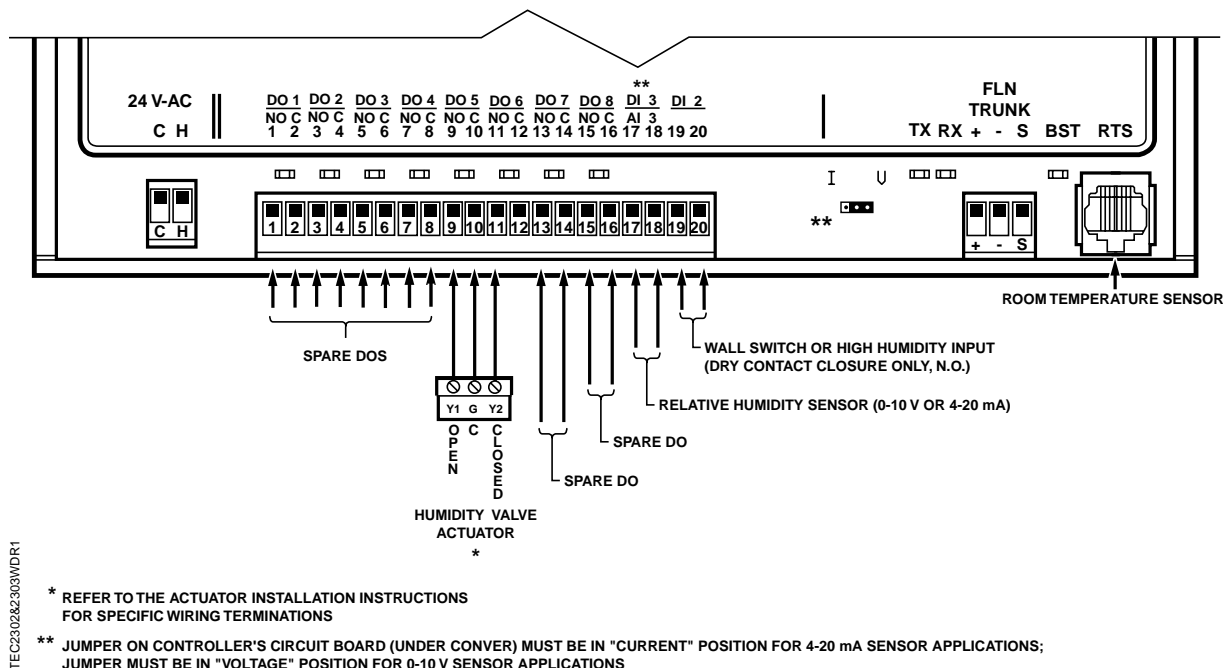
### Wiring diagram

The point wiring for Application 2302 is shown in Figure 2302-3.



**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 2302-3. Application 2302 Wiring Diagram.**



**CAUTION:**

**IMPORTANT!** If a 4-20mA sensor is used at AI 3, special wiring precautions must be followed. See Figure 2302-4.

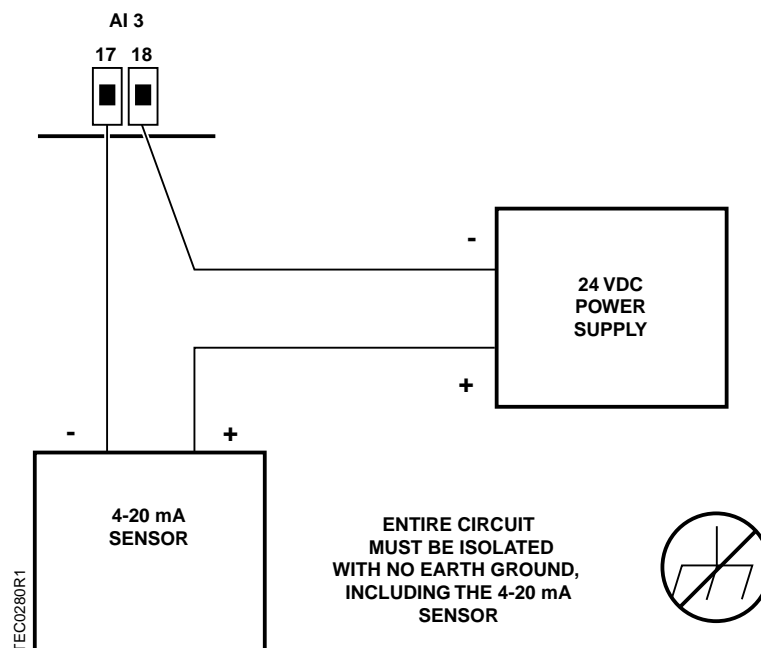


Figure 2302-4. Special Wiring Requirements if 4-20mA sensor used at AI 3.



**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 2302-1. Point Database for Application 2302.

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	2092	--	1.000	0.000	--	--
{04}	ROOM TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
{15}	ROOM RH	29.2	PCT	0.400	0.000	--	--
{16}	ROOM RH STPT	50.0	PCT	0.400	0.000	--	--
17	RH LIMIT	2.000	PCT	0.400	0.000	--	--
{19}	DI OVRD SW	OFF	--	--	--	ON	OFF
{24}	DI 2	OFF	--	--	--	ON	OFF
{25}	DI 3	OFF	--	--	--	ON	OFF
{26}	SPEC HUM	0.0	--	0.100	0.000	--	--
{27}	SPEC HUM STPT	0.0	--	0.100	0.000	--	--
{28}	SPH CTL SET	50.0	--	0.100	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	0.0	PCT	0.400	0.000	--	--
{38}	HMD VLV POS	0.0	PCT	0.400	0.000	--	--
39	MTR3 TIMING	90.000	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}	MTR1 COMD	0.000	PCT	0.400	0.000	--	--
{49}	MTR1 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}	MTR2 COMD	0.000	PCT	0.400	0.000	--	--
{53}	MTR2 POS	0.000	PCT	0.400	0.000	--	--
54	AI3 VOLT.CUR	CURRENT	--	--	--	VOLT	CURRENT
55	MTR2 TIMING	90.000	SEC	1.000	0.000	--	--
56	DPR1 ROT ANG	90.000	--	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.

**Table 2302-1. Point Database for Application 2302.**

Point Number	Descriptor	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
57	DPR2 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	--	--
74	SPH P GAIN	5.000 (9.000)	--	0.250 (0.450)	0.000	--	--
75	SPH I GAIN	0.005 (0.009)	--	0.001 (0.0018)	0.000	--	--
76	SPH D GAIN	0.000	--	2.000 (3.600)	0.000	--	--
77	SPH BIAS	0.000	PCT	0.400	0.000	--	--
{78}	CTL TEMP	74.000 (23.449)	DEG F (DEG C)	0.250 (0.140)	48.000 (8.889)	--	--
87	CAL MODULE	NO	--	--	--	YES	NO
{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	--	--	--	--	--	--

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