SIEMENS

BACnet VAV with Reheat, Demand Control Ventilation (CO2), and optional Chilled Beam

Application Notes

Application 2558

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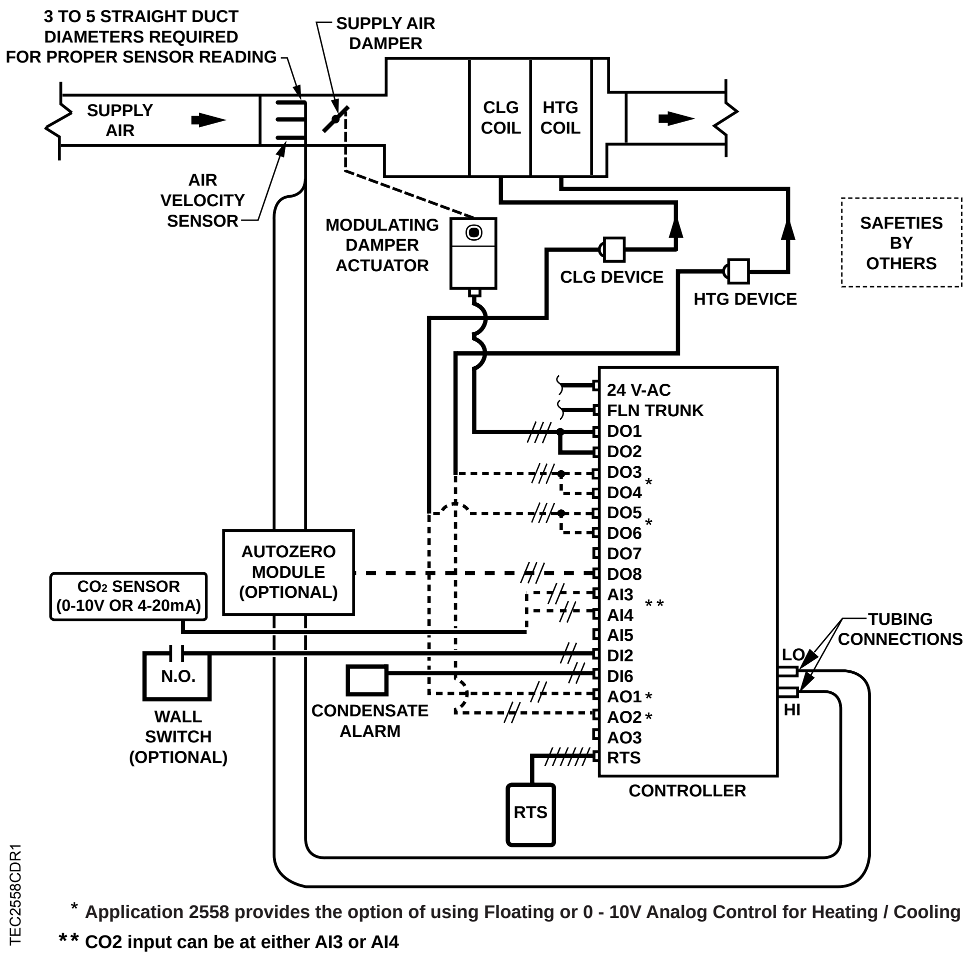
Overview

Application 2558 is a VAV controller used for temperature and ventilation control. This application is suitable for conventional VAV as well as chilled beam applications. In the cooling mode, the airflow and a chilled water valve can be modulated in series, in parallel or overlapped. If the VAV box airflow is to be modulated in heating mode, the airflow and the heating valve can be modulated in series, in parallel or overlapped. The heating coil and cooling coil valves can each be independently configured to be either floating control or analog control.

This application also includes a Demand Control Ventilation (DCV) sequence that monitors CO2 levels within the space. If additional ventilation is required based on CO2 levels, the temperature control flow setpoint is temporarily overridden to a value that ensures adequate ventilation. While in the ventilation mode, the temperature control is additionally maintained via the heating and cooling coils. (The heating and cooling valves can be configured for analog or floating control.)



* Application 2558 provides the option of using Floating or 0 - 10V Analog Control for Heating / Cooling

** CO2 input can be at either AI3 or AI4

Figure 1. Application 2558 Control Drawing.

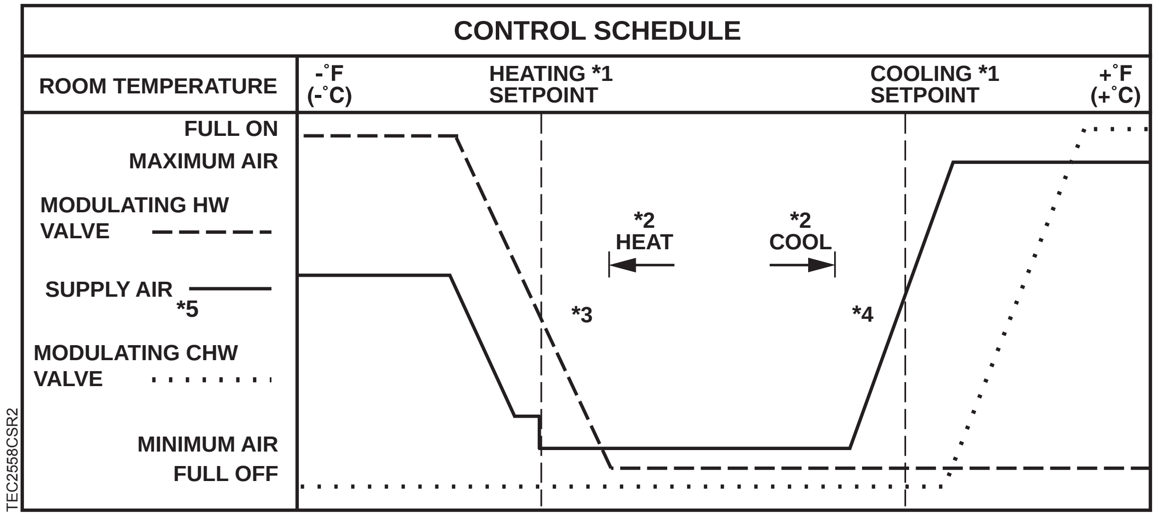


Figure 2. Application 2558 Control Drawing.

1 See *Sequence of operation, Control Temperature Setpoints*.

2 See *Sequence of operation, Heating/Cooling Switchover*.

3 The airflow for temperature control operates in parallel with the hot water valve (default). The airflow can operate sequenced, parallel or overlapping with the hot water valve. See *Sequencing Logic — Heating*.

4 The airflow for temperature control is shown sequenced with the chilled water valve (default). The airflow can operate sequenced, parallel or overlapping with the chilled water valve. See *Sequencing Logic — Cooling*.

5 The supply air as shown is for the temperature control. When the application is in the Demand Control Ventilation mode, the damper may modulate more open than is shown in the diagram. As the increased ventilation affects room temperature, the hot water and chilled water valves will adjust accordingly to maintain temperature setpoint.

BACnet

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

Table 1. Supported BIBBS.

Product	Supported BIBBs	BIBB Name
BTEC	DS-RP-B	Data Sharing-ReadProperty-B
	DS-RPM-B	Data Sharing-ReadPropertyMultiple-B
	DS-WP-B	Data Sharing-WriteProperty-B
	DM-DDB-B	Device Management-Dynamic Device Binding-B
	DM-DOB-B	Device Management-Dynamic Object Binding-B
	DM-DDC-B	Device Management-Device Communication Control-B

Hardware Inputs

Analog

- Air velocity sensor
- Two 0-10V/4-20 mA switch selectable inputs (AI3/AI4). Either is configurable for use with a CO2 sensor for ventilation control. If one input is assigned as a CO2 input, there other input is spare. If neither is assigned as a CO2 input both are spare.
- Room temperature sensor
- Room temperature set point dial (optional)
- Auxiliary temperature sensor (10K Ohm thermistor) (optional)

Digital

- Condensate alarm (DI6) dry contact
- Wall switch (optional) / night mode override (optional)

Hardware Outputs

If AOs are used for modulating valves, the associated DOs are spare but cannot be used for motor control of an actuator. If DOs are used for floating control, the associated AOs are spare.

For example, Motor 2 (DO3 and DO4) can be used for floating control of a Heating Valve actuator, and AOV 1 can be used for modulating control of a Cooling Valve. In this case, while DO5 and DO6, and AOV 2 are all spare (DOs are only usable individually).

Analog

- AOV1 - analog cooling. (Spare if DO5,DO6 used for floating control of CHW valve)
- AOV2 - analog heating. (Spare if DO3,DO4 used for floating control of HW valve)
- AOV3 - spare

Digital

- DO1, DO2 damper actuator
- D03, DO4 HW valve (spare if AO2 used for HW valve)
- DO5, DO6 CHW valve (Spare if AO1 used for CHW valve)
- DO7 spare
- DO8 autozero (optional)

Ordering Notes

Part Number 550-494A

Sequence of Operation

The following paragraphs present the sequence of operation for BACnet VAV with Reheat, Demand Control Ventilation (CO2), and optional Chilled Beam.

Control Temperature Setpoints

The application has a number of different room temperature setpoints (DAY HTG STPT, NGT CLG STPT, RM STPT DIAL, etc.). The application actually controls to CTL STPT, which will get set to different values depending on different circumstances. The next several sections will explain this further.

CTL STPT is Overridden - When CTL STPT is overridden, CTL STPT will equal its overridden value and the application will have no effect on the value of CTL STPT. Also when CTL STPT is overridden, CTL STPT will always have a status of Normal, even if the Status of RM STPT DIAL is Failed.

Night Mode – In night mode, CTL STPT holds the value of NGT CLG STPT (Point 08) or NGT HTG STPT (Point 09). This is true whether or not a setpoint dial is being used. Also during night mode, CTL STPT will always have a status of Normal, even if the status of RM STPT DIAL is Failed.

Day Mode (setpoint dial not used) – In the day mode when a setpoint dial is not being used, then CTL STPT holds the value of DAY CLG STPT (Point 06) or DAY HTG STPT (Point 07). Also, CTL STPT will always have a Status of Normal, even if the Status of RM STPT DIAL is Failed.

Room Temperature Setpoint Dial

A setpoint dial is being used when STPT DIAL (Point 14) is YES. When a setpoint dial is present, it is only used when both of the following two conditions hold:

- the controller is in Day mode.
- CTL STPT is not overridden.

If these two conditions are both true, then:

When RM STPT DIAL has a status of Normal, CTL STPT will have a status of Normal. The current value of RM STPT DIAL will be used to determine the value of CTL STPT.

When RM STPT DIAL has a status of Failed and RM STPT DIAL is overridden, CTL STPT will have a status of Normal. The current (overridden) value of RM STPT DIAL will be used to determine the value of CTL STPT.

When RM STPT DIAL has a status of Failed and RM STPT DIAL is not overridden, CTL STPT will have a status of Failed. The last known good value of RM STPT DIAL will be used to determine the value of CTL STPT.

When a setpoint dial is being used, the actual value of CTL STPT will depend on whether or not a there is a deadband being used. The following two sections will explain this further. In both of these sections, the following assumptions are made:

- A setpoint dial is being used.
- The controller is in Day mode.
- CTL STPT is not overridden.

Setpoint dial used with a deadband configured to zero

When DAY HTG STPT equals DAY CLG STPT, a setpoint deadband is not present. (A space where the deadband is not used may be more comfortable than a space where the deadband is being used, but may use more energy.) If a setpoint deadband is zero, then:

1. CTL STPT will equal RM STPT MAX (Point 12) if RM STPT DIAL > RM STPT MAX.
2. CTL STPT will equal RM STPT MIN (Point 11) if RM STPT DIAL < RM STPT MIN.
3. Otherwise, CTL STPT will equal RM STPT DIAL.

Setpoint dial used with a deadband configured

When DAY HTG STPT does not equal DAY CLG STPT, a setpoint deadband (or zero energy band) is being used. (A space where the deadband is used can be more energy efficient than a space where the deadband is not being used.) As described below, the setpoint(s) for heating/cooling will be 1/2 of the deadband above or below the setpoint dial value.

If a setpoint deadband is being used, then:

When HEAT.COOL (Point 5) equals HEAT.

1. If RM STPT DIAL > than RM STPT MAX, then:
   a. If [RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT MAX – 0.5 * (DAY CLG STPT – DAY HTG STPT).
2. If RM STPT DIAL < than RM STPT MIN, then:
   a. If [RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT MIN – 0.5 * (DAY CLG STPT – DAY HTG STPT).
3. If RM STPT MAX > RM STPT DIAL > RM STPT MIN, then:

   a. If [RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT DIAL – 0.5 * (DAY CLG STPT – DAY HTG STPT).

When HEAT.COOL (Point 5) equals COOL.

1. If RM STPT DIAL > than RM STPT MAX, then:
   a. If [RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT MAX + 0.5 * (DAY CLG STPT – DAY HTG STPT).
2. If RM STPT DIAL < than RM STPT MIN, then:
   a. If [RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT MIN + 0.5 * (DAY CLG STPT – DAY HTG STPT).
3. If RM STPT MAX > RM STPT DIAL > RM STPT MIN, then:
   a. If [RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT)].> RM STPT MAX, then CTL STPT will equal RM STPT MAX.
   b. If [RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT)] < RM STPT MIN, then CTL STPT will equal RM STPT MIN.
   c. Otherwise, CTL STPT will equal RM STPT DIAL + 0.5 * (DAY CLG STPT – DAY HTG STPT).

Room Temperature, Room Temperature Offset and CTL TEMP

ROOM TEMP is the temperature that is being sensed by the room temperature sensor (the RTS).

Room Temperature Offset, TEMP OFFSET (Point 66), is a user-adjustable offset that will compensate for deviations between the value of ROOM TEMP (Point 4) and the actual room temperature.

CTL TEMP is the room temperature that is used for control purposes. In other words, what the application is trying to do is to maintain CTL TEMP at CTL STPT.

When CTL TEMP is not overridden, CTL TEMP and ROOM TEMP are related by the following equation:

CTL TEMP (Point 78) = ROOM TMP (Point 4) + TEMP OFFSET (Point 66).

If CTL TEMP is not overridden, then:

If ROOM TEMP has a status of Normal, then CTL TEMP will also have a status of Normal. The current value of ROOM TEMP will be used to determine the value of CTL TEMP.

If ROOM TEMP has a status of Failed and ROOM TEMP is overridden, then CTL TEMP will have a status of Normal. The current value of ROOM TEMP will be used to determine the value of CTL TEMP.

If ROOM TEMP has a status of Failed and ROOM TEMP is not overridden, then CTL TEMP will have a status of Failed. The last known good value of ROOM TEMP will be used to determine the value of CTL TEMP.

If CTL TEMP is overridden then:

1. CTL TEMP equals its overridden value and the points, ROOM TEMP and TEMP OFFSET, have no effect on the value of CTL TEMP.

2. The status of CTL TEMP will always equal Normal, even if ROOM TEMP is Failed.

Day and Night Modes

The day/night status of the space is determined by the status of DAY.NGT (Point 29). The control of this point differs depending on whether the controller is monitoring the status of a wall switch or connected to a field panel.

When a wall switch is physically connected to the termination strip on the controller at DI 2, and WALL SWITCH (Point 18) = YES, the controller monitors the status of DI 2. When DI 2 (Point 24) is ON (the switch is closed), DAY.NGT will be set to DAY indicating that the controller is in day mode. When DI 2 is OFF (the switch is open), DAY.NGT will be set to NIGHT indicating that the controller is in night mode.

When WALL SWITCH = NO, the controller does not respond to the status of the wall switch, even if one is connected to it. In this case, the controller is operating stand-alone, it stays in day mode all the time. If the controller is operating with centralized control, connected to a field panel, the field panel can send an operator or PPCL command to override the status of DAY.NGT. See *Powers Process Control Language (PPCL) User's Manual (125-1896)* and *Field Panel User's Manual (125-3000)* for more information.

Night Mode Override Switch

If an override switch is present on the room temperature sensor and a value (in hours) other than zero has been entered into OVRD TIME (Point 20), pressing the override switch will reset the controller to day mode for the time period set in OVRD TIME. The status of NGT OVRD (Point 21) changes to DAY. After the override time elapses, the controller returns to night mode and NGT OVRD changes back to NIGHT.

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

Heating/Cooling Switchover

This section describes how the heating/cooling switchover feature works when both heating and cooling are enabled (HC.ENDIS (Point 91) = 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) < SWITCH LIMIT (Point 85).
- CTL TEMP (Point 78) > CTL STPT (Point 92) by at least the value set in SWITCH DBAND (Point 90).
- CTL TEMP > the appropriate cooling setpoint minus 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) < SWITCH LIMIT.
- CTL TEMP < CTL STPT by at least the value set SWITCH DBAND.
- CTL TEMP < the appropriate heating setpoint plus SWITCH DBAND.

Application 2558 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.

Cooling only - set HC.ENDIS = 2.

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 HEAT.COOL (Point 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 (see *Sequencing Logic — Heating).* If the flow loop is used in heating mode just to meet minimum air requirements, the heating/cooling switchover mechanism operates as described in this section to control HEAT.COOL (see Example 4 in *Sequencing Logic*).

Control Loops

Application 2558 is controlled by four Proportional, Integral, and Derivative (PID) control loops; two temperature loops, a flow loop, and a CO2 (ventilation) loop.

Temperature Loop — Each loop uses CTL STPT (Point 92) and CTL TEMP (Point 78) to modulate the value of its respective loopout point, CLG LOOPOUT (Point 79) or HTG LOOPOUT (Point 80).

The cooling loop is active whenever HEAT.COOL (Point 5) = COOL. The heating loop is active whenever HEAT.COOL = HEAT.

Loops contain advanced PID algorithms that limit motor movement when the temperature is close to setpoint.

Flow Loop – Maintains minimum airflow and maximum airflow through CTL FLOW MIN (Point 76) and CTL FLOW MAX (Point 77).

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

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

In Application 2558, you can set CLG FLOW MIN equal to, but not greater than, CLG FLOW MAX, and set HTG FLOW MIN equal to, but not greater than, HTG FLOW MAX. If the minimum and maximum values are set equal, the flow loop becomes a constant volume loop and loses its ability to control temperature.

The flow loop maintains FLOW STPT by modulating the supply air damper, DMPR COMD (Point 48). The flow loop maintains the airflow between CTL FLOW MIN and CTL FLOW MAX.

FLOW (Point 75) is the input value for the flow loop. It is calculated as a percentage based on where AIR VOLUME (Point 35) is between 0 cfm and CTL FLOW MAX. This percentage is referred to as % flow.

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

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

(CTL FLOW MIN / CTL FLOW MAX) × 100% flow .

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

Example

If CTL FLOW MIN = 250 cfm, and CTL FLOW MAX = 1000 cfm,
the low limit of FLOW STPT = (250 cfm / 1000 cfm) × 100% flow
= 0.25 × 100% flow
= 25% flow.

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

CO2 (Ventilation) Loop

When the application is in the Ventilation mode (FLO CTL MODE = VENT), the damper is controlled by the larger demand of either the ventilation or temperature loop. The damper is typically modulated to assure adequate ventilation.

- CO2DIFF STPT (Point 88) is the desired CO2 concentration differential between ROOM CO2 (Point 3) and OUTDOOR CO2 (Point 50).
- CO2DIFF (Point 74) is the measured CO2 concentration differential between the room and outdoors.

The CO2 loop brings the measured CO2 differential to the desired CO2 differential by adjusting the damper position. When the damper is being modulated during ventilation mode, temperature control is maintained by modulating the chilled water and hot water valves.

Modulating Heat

CAUTION:

As a safety feature, application 2558 includes MODHTG FLOW (Point 120) to ensure that adequate airflow is present before an electric heating element is energized. Since application 2558 will typically not have electric heat, the default for MODHTG FLOW is 0, no safety. If the application does use electric heat, MODHTG FLOW **must** be configured to an appropriate value to ensure adequate airflow is present before an electric heating element is energized. Setting MODHTG FLOW to 20 will ensure airflow is at least 20% of max heating flow before H VLV COMD will turn on.

In Application 2558, the value of MTR SETUP (Point 58) determines the *type*, not the number, of output control signals generated by the application. The output signals for H VLV COMD and C VLV COMD can be floating or 0 to 10V analog. Use the additive values in Table 2, along with the output signal logic in Table 3, to arrive at the MTR SETUP value needed for your job.

The MTR SETUP values in Table 2 are **additive**. For example, if you needed Motor 1 (DOs 1 and 2) enabled, Motor 2 (DOs 3 and 4) enabled, and Motor 3 (DOs 5 and 6) disabled, you would set MTR SETUP equal to 5. This is because the Motor 1 (for the damper) enable value is 1, the Motor 2 enable value is 4, and the Motor 3 disable value is 0. 1 + 4 + 0 = 5. In this case, you would have a floating signal for heating (DOs 3 and 4), and a 0 to 10V analog signal for cooling (AOV1). See Table 3.

Table 2. Motor Enable/Reverse Values for MTR SETUP (Point 58).

	MTR SETUP (Point 58) Value[a]		
	Disabled	**Enabled**	**Enabled and reversed**
Motor 1	0	1	3
Motor 2	0	4	12
Motor 3	0	16	48

[a] The values in this table are additive and must be added per the requirements of the job.

Table 3. MTR SETUP Values and Corresponding Output Signals in Application 2558.

MTR SETUP (Point 58)[a,b]	H VLV COMD (Point 52)	C VLV COMD (Point 53)
Motors 1 and 2 Enabled, Motor 3 Disabled (MTR SETUP = 5)	Motor 2 (DO 3 and DO 4)	AOV1
Motor 1 Enabled, Motor 2 Disabled, Motor 3 Enabled (MTR SETUP = 17)	AOV2	Motor 3 (DO 5 and DO 6)
Motors 1, 2, and 3 Enabled (MTR SETUP = 21)	Motor 2 (DO 3 and DO 4)	Motor 3 (DO 5 and DO 6)
Motor 1 Enabled, Motors 2 and 3 Disabled (MTR SETUP = 1)	AOV2	AOV1

[a] Motor 1 is reserved for the damper and is assumed always to be enabled.

[b] The MTR SETUP values given in this table assume none of the actuators are reverse acting. If any actuators must be reverse acting, use the additive values in Table 2 to arrive at the correct value for MTR SETUP.

If Motor 2 (DOs 3 and 4) is being used for floating point control of a valve for heating, then AOV2 (Point 38) is spare. In this case, although AOV2 is spare, AOV2 OPEN (Point 114) and AOV2 CLOSE (Point 115) are not usable, because H VLV COMD (Point 52) is being sent to Motor 2. Likewise, if Motor 3 is being used for Floating Control of cooling, AOV1 (Point 60) would be spare but AOV1 OPEN (Point 112) and AOV1 CLOSE (Point 113) would not be usable.

If AOs are used for modulating heating/cooling devices, the associated DOs are spare but unavailable for motor control.

Sequencing Logic — Heating

H FLOW START (Point 16) and H FLOW END (Point 17) are defaulted to 0 and 100 respectively. This will provide airflow during heating mode from HTG FLOW MIN (Point 33) to HTG FLOW MAX (Point 34).

In heating mode, this application includes logic that allows the flow loop to operate in sequence, parallel, or overlapping with the modulating heating device. Portions of the output of the heating loop, HTG LOOPOUT (Point 80), will drive both the flow loop and the modulating heating device from 0 to 100%. See the four examples that follow in this section.

The ladder diagrams in Figure 3 show sequenced, parallel, and overlapping flow loop operations with modulating heating device. 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.

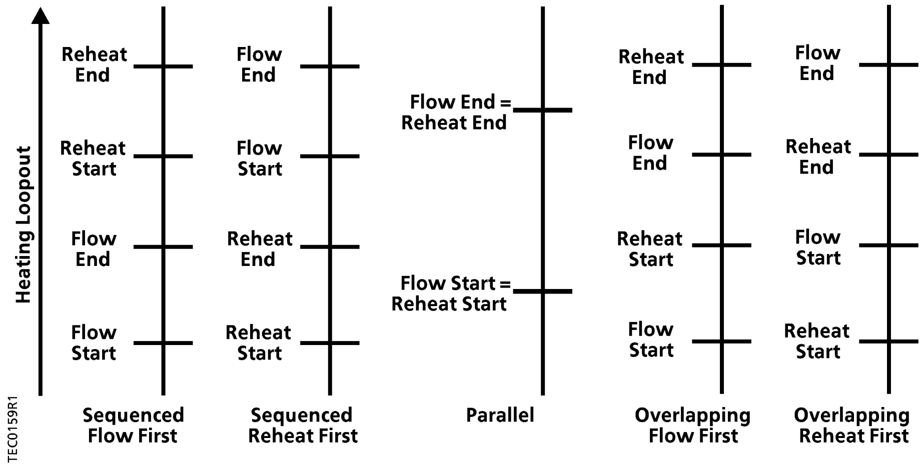


Figure 3. Sequenced, Parallel, and Overlapping Flow Loop Operations with Modulating Heating.

For simplicity, assume that in these examples:

- HTG FLOW MIN (Point 33) = 0 cfm.

Example 1

Assume that your system has a modulating heating device that is to operate *in sequence* (after) the flow loop. If:

- H FLOW START (Point 16) = 0%
- H FLOW END (Point 17) = 50%
- REHEAT START (Point 22) = 50%
- REHEAT END (Point 23) = 100%

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 25%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT ≥ 50%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT ≤ 50%, H VLV COMD will equal 0% open.
- When HTG LOOPOUT = 75%, H VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, H VLV COMD will equal 100% open.

If the heating device is to operate first, reverse the sequences for H FLOW START / END and REHEAT START / END.

Example 2

Assume that your system has a modulating heating device that is to operate in *parallel* with the flow loop (default). If:

- H FLOW START (Point 16) = 0%
- H FLOW END (Point 17) = 100%
- REHEAT START (Point 22) = 0%
- REHEAT END (Point 23) = 100%

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 50%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT = 100%, FLOW STPT will equal 100% flow.
- When HTG LOOPOUT = 0%, H VLV COMD will equal 0% open.
- When HTG LOOPOUT = 50%, H VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, H VLV COMD will equal 100% open.

Example 3

Assume that your system has a modulating heating device that is to operate *overlapping* with the flow loop (with Flow occurring first). If:

- H FLOW START (Point 16) = 0%
- H FLOW END (Point 17) = 75%
- REHEAT START (Point 22) = 25%
- REHEAT END (Point 23) = 100%

then,

- When HTG LOOPOUT = 0%, FLOW STPT will equal 0% flow.
- When HTG LOOPOUT = 37.5%, FLOW STPT will equal 50% flow.
- When HTG LOOPOUT ≥ 75%, FLOW STPT will equal 100% flow.

- When HTG LOOPOUT ≤ 25%, H VLV COMD will equal 0% open.
- When HTG LOOPOUT = 62.5%, H VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, H VLV COMD will equal 100% open.

Another option that the sequencing logic provides is to have the flow loop provide an airflow equal to HTG FLOW MIN throughout the heating mode with all of the temperature control being done by the modulating heating device(s). The airflow minimum will be maintained by setting the FLOW START and FLOW END to a value of 0%, resulting in the corresponding 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 modulating heating device that provides the temperature control in the heating mode, while the flow loop provides for the minimum air requirements. Assume:

- HTG FLOW MIN = 170 cfm
- HTG FLOW MAX = 1000 cfm

If:

- H FLOW START (Point 16) = 0%
- H FLOW END (Point 17) = 0%
- REHEAT START (Point 22) = 0%
- REHEAT END (Point 23) = 100%

then,

- When HTG LOOPOUT = 0%,
  FLOW STPT will equal (170 cfm / 1000 cfm) × 100% flow = 17% flow. This will cause the flow loop to maintain airflow of 170 cfm out of the terminal box.
- When HTG LOOPOUT = 50%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT = 100%, FLOW STPT will equal 17% flow.
- When HTG LOOPOUT = 0%, H VLV COMD will equal 0% open.
- When HTG LOOPOUT = 50%, H VLV COMD will equal 50% open.
- When HTG LOOPOUT = 100%, H VLV COMD will equal 100% open.

Sequencing Logic — Cooling

Cooling sequencing operates similar to the Sequencing Logic in Example 4 of *Sequencing Logic — Heating* by using the configuration parameters C FLOW START, C FLOW END, CHW START (chilled water start), and CHW END (chilled water end). The second stage of cooling can be delayed by setting CLG STG DLY to the number of delay seconds.

If CHW START > C FLOW END, the chilled water valve will not begin to open until **both** of the following are true:

- CLG LOOPOUT > CHW START, for a time longer than CLG STG DLY seconds.
- FLOW is at max cooling (FLOW (Point 75) > 90%), **or** the damper is fully open (DMPR POS > 99%), **or** DMPR COMD status is OVERRIDE, for a time longer than CLG STG DLY seconds.

If C FLOW START > CHW END, flow will not begin modulating until **both** of the following are true:

- CLG LOOPOUT > C FLOW START, for a time longer than CLG STG DLY seconds.
- C VLV POS > 95%, **or** COND ALARM is ALARM, **or** C VLV COMD status is OVERRIDE, for a time longer than CLG STG DLY seconds.

Ventilation Control

This application includes DCV (Demand Control Ventilation). For DCV to be available, CO2 CONFIG (Point 57) must equal 1, 3, or 4.

- CO2 CONFIG = 0. Demand Control Ventilation feature is disabled.
- CO2 CONFIG = 1. ROOM C02 concentration level is reported to the controller via the field panel and PPCL.
- CO2 CONFIG = 2. Not used (reverts to 0).
- CO2 CONFIG = 3. ROOM CO2 sensor input is wired to AI3.
- CO2 CONFIG = 4. ROOM CO2 sensor input is wired to AI4.

With a known ventilation rate and number of occupants, a predictable steady state concentration of CO2 can be maintained. DCV uses this principle to modulate ventilation to acceptable levels based on CO2 concentrations within the space. Rather than having a minimum ventilation based on full occupancy of a space such as 15 or 20 CFM per person, DCV allows ventilation airflow to be modulated below what otherwise would be the full occupancy ventilation minimum, provided that CO2 concentration (in ppm) indicates adequate ventilation.

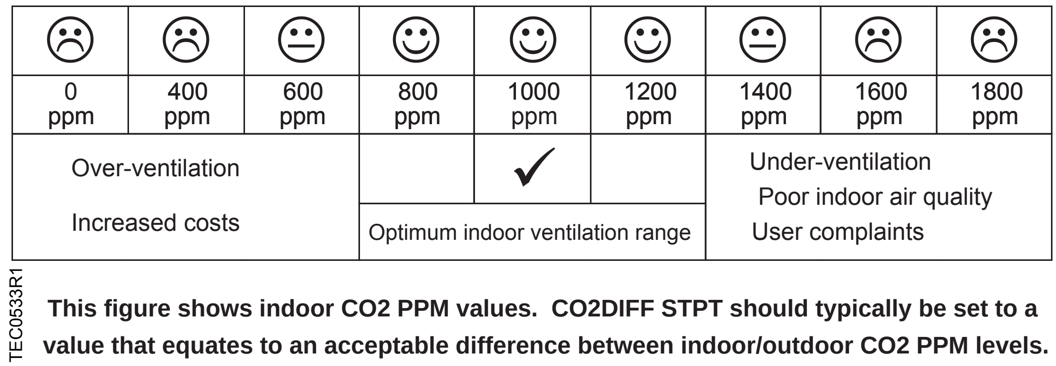


Figure 4. Demand-based Ventilation with CO2/VOC Sensors.

If ventilation levels are acceptable, the application operates as outlined in the previous sections of this document. However, if the difference between indoor and outdoor CO2 concentration levels rises above a configurable threshold, the damper control is switched from temperature control to ventilation control. The point FLO CTL MODE designates whether the application is in the normal temperature control mode (FLO CTL MODE = TEMP) or in the ventilation mode (FLO CTL MODE = VENT). The ventilation mode is entered whenever CO2DIFF (the difference between ROOM CO2 and OUTDOOR CO2) is greater than CO2DIFF HLIM.

Once the threshold is reached, an algorithm is invoked (CO2 PID) which increases the airflow to bring in more fresh air to control the CO2 concentration to the target CO2 difference value set in CO2DIFF STPT.

While in the ventilation mode, the heating and cooling PIDs are still active and temperature will be maintained by the heating and cooling coils. If the heating or cooling demand is such that the damper should open more than required for ventilation, damper control will revert to temperature control. The damper will switch back and forth between ventilation and temperature control modes as needed until the ventilation mode is eventually exited. This will happen as occupants leave the room causing the CO2 level to naturally drop. When the level drops below a configurable threshold (such as 400 ppm above outside air) for a configurable time delay, the ventilation mode is exited. The threshold for exiting the ventilation mode is set via CO2DIFF LLIM and the time delay is set via CO2 RST DLY.

DCV Modes

Demand Control Ventilation can operate in two basics modes: threshold monitoring and PID control (proportional control only).

DCV Mode 1 – Threshold Monitoring

This is the factory default. In this mode, when the CO2 measurement for the indoor air becomes greater than the CO2 measurement for the outdoor air by a configurable amount, the damper will move to the ventilation max (VNT FLOW MAX) until differential CO2 level drops below a 2nd lower configurable limit. When differential CO2 level has been at or below the lower limit for a specified number of minutes, the application returns to normal temperature control. If the CO2 differential rises again, the process repeats. With factory default settings, as the differential between indoor and outdoor CO2 concentrations rises above 500 ppm, the damper will open to the ventilation maximum until the CO2 differential level drops below 400 ppm for 10 minutes. To operate in this mode, the CO2 PID gain (CO2 P GAIN) should be set equal to or greater than 1 and the CO2DIFF STPT should be at least 100 ppm below CO2DIFF LLIM.

DCV Mode 2 – with PID Loop Proportional Control only
In this mode the user adjusts CO2 P GAIN and CO2DIFF STPT to establish a desired CO2 steady state level. For example, CO2DIFF STPT could be set to 250 and the gain set to .33. With these settings, a CO2 steady state level would establish itself somewhere between an indoor/outdoor differential of 250 and 550 ppm. In this example, the upper limit CO2DIFF HLIM should be set to slightly above 550 ppm to avoid alarms when the controller is controlling near the upper limit of its PID range.

The use of I gain (CO2 I GAIN) is not recommended in this application.

The following table shows the relationship between gain and proportional band. Due to the tendency of CO2 levels to drift, the lowest gain possible is recommended when using proportional control.

Table 4. Proportional P Gain Values.

CO2 P GAIN	Proportional Band
1	Control range will be from setpoint to 100 ppm above setpoint
.33	Control range will be from setpoint to 300 ppm above setpoint
.2	Control range will be from setpoint to 500 ppm above setpoint

DCV Used/Not Used

DCV Not Used — Setting CO2 CONFIG (Point 57) to zero disables the Demand Control Ventilation feature. If CO2 CONFIG = 0, set CLG FLOW MIN and HTG FLOW MIN to values that will assure adequate ventilation based on full occupant capacity and the square footage of the space. Consult ASHRAE or other appropriate guidelines.

DCV Used — When DCV is enabled (CO2 CONFIG = 1, 3, or 4), set CLG FLOW MIN and HTG FLOW MIN to values that assure adequate ventilation for the building component. This is typically about 30% of a ventilation flow rate based on full occupancy. If 400 cfm was min flow based on occupancy, 120 cfm (30% of 400) might be used for the CLG FLOW MIN and HTG FLOW MIN values. The number of occupants will be inferred by measuring the level of CO2. As occupancy goes from no occupancy to full occupancy the ventilation can ramp from 120 to 400 cfm.

Always refer to the appropriate industry standards and design guides for selecting minimum ventilation levels. ASHRAE guidelines base ventilation needs on a building component and an occupant component.

Ventilation Alarm

CO2 ALARM will be set to ALARM if the CO2 concentration differential between ROOM CO2 and OUTDOOR CO2 is greater than CO2DIFF HLIM for more than CO2 ALM DLY minutes.

Condensate Control and Alarming

Application 2558, when used with chilled beams, provides condensation protection by shutting the cooling valve for either of the following two conditions:

- If dew point calculations in the field panel determine that the chilled water valve should be closed, the field panel should command CHW DISABLE to YES. The application will set C VLV COMD to 0 when CHW DISABLE = YES.
- If the condensation alarm (COND ALARM) = ALARM, C VLV COMD will be set to 0. COND ALARM will be ALARM depending on the status of DI 6 and the type of condensate sensor as configured in point DI6 TYPE. See the following table.

If DI6 TYPE =	and DI6 status =	then COND ALARM will be
NOPEN	OFF	NORMAL
	ON	ALARM
NCLOSE	OFF	ALARM
	ON	NORMAL

To prevent possible false alarms due to noisy or transient inputs, the application includes a time delay provision. The abnormal condition must persist for the number of seconds in COND ALM DLY before the alarm activates and the valve closes. For an immediate response to the condensate sensor, set COND ALM DLY to 1.

COND ALM DLY = 0 is a special case which is used to disable DI6 as a condensate sensor input. When COND ALM DLY = 0, DI6 becomes spare and does not affect the cooling valve, and COND ALARM will always stay normal. Regardless of the value of COND ALM DLY, a field panel command setting CHW DISABLE to YES will always immediately shut the chilled water valve.

Calibration

Air Velocity Sensor – Calibration of the controller’s internal air velocity sensor (AVS) is periodically required to maintain accurate air velocity readings. CAL SETUP (Point 95) is set with the desired calibration option during controller startup. Depending on the value of CAL SETUP, calibration may be set to take place automatically or manually. If CAL AIR (Point 94) = YES, calibration is in progress.

If an Autozero module is not used, the damper is commanded closed to get a zero airflow reading during calibration.

If an Autozero module is used, the damper remains frozen in place while the air velocity sensor is calibrating.

Modulating Heating and Cooling Valves – Calibration of a modulating heating valve(s) is done by commanding the valve(s) to closed.

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

Damper Status Operation

Under normal operation DMPR STATUS (Point 84) reads “CAL.” However, if using an Autozero Module, it is possible after a period of operation for the calculated damper position, DMPR POS (Point 49), to differ from the actual (physical) damper position.

If this occurs, the controller will automatically compensate for any difference by setting DMPR STATUS to “RECAL” which readjusts the value of DMPR POS. DMPR STATUS will be set to “RECAL” if all of the following conditions are true:

- DMPR POS = 100%
  air velocity > 200 FPM
  FLOW (Point 75) < FLOW STPT (Point 93)

OR

- DMPR POS = 0%
  air velocity > 200 FPM
  FLOW > FLOW STPT

It is important to realize that while the Damper Status firmware module runs, DMPR POS (Point 49) will change in value but FLOW (Point 75) might not.

Since air velocity is not in the application database, you cannot view it directly. However, air velocity is related to AIR VOLUME (Point 35) by the following equation.

air velocity = AIR VOLUME (Point 35) / DUCT AREA (Point 97)

To change the value of DMPR STATUS from “RECAL” back to “CAL”, set DMPR STATUS to CAL, and then release it. (A status of RECAL will not prevent the recalibration sequence from running if it needs to.)

The Autozero Module is enabled when it is wired to DO 8 and CAL MODULE (Point 87) is set to YES.

Fail-safe Operation

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

Refer to the *Control Temperature Setpoints* section of this document for information on what happens if the room temperature setpoint dial fails.

Refer to the *Room Temperature, Room Temperature Offset and CTL TEMP* section of this document for information on what happens if the room temperature sensor fails.

Application Notes

1. If temperature swings in the room are excessive or there is trouble maintaining the setpoint, the cooling loop needs to be tuned. If FLOW (Point 75) is oscillating while FLOW STPT (Point 93) is constant, the flow loop requires tuning. See *iKnow Troubleshooting Tool* for more information.

2. The controller as shipped from the factory keeps all associated equipment OFF. See the *Start-up Procedures* for information on how to release the controller and its equipment to application control.

3. Spare DOs can be used as auxiliary points that are controlled by the field panel after being defined in the field panel's database.

4. AOV1 and AOV2 are not restricted to controlling valves; they can control SCRs if desired. In order to do this, the SCR must have its own controller that will modulate the SCR based on the value of a 0 to 10 V input. In this case, the TEC can control the SCR by connecting either AOV1 or AOV2 on the TEC to the 0 to 10 V input on the SCR.

Wiring Diagram

The point wiring for Application 2558 is shown in the wiring diagram.

CAUTION:

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

• VA requirements higher than the maximum

• 110 or 220 Vac requirements

• DC power requirements

• Separate transformers used to power the load.

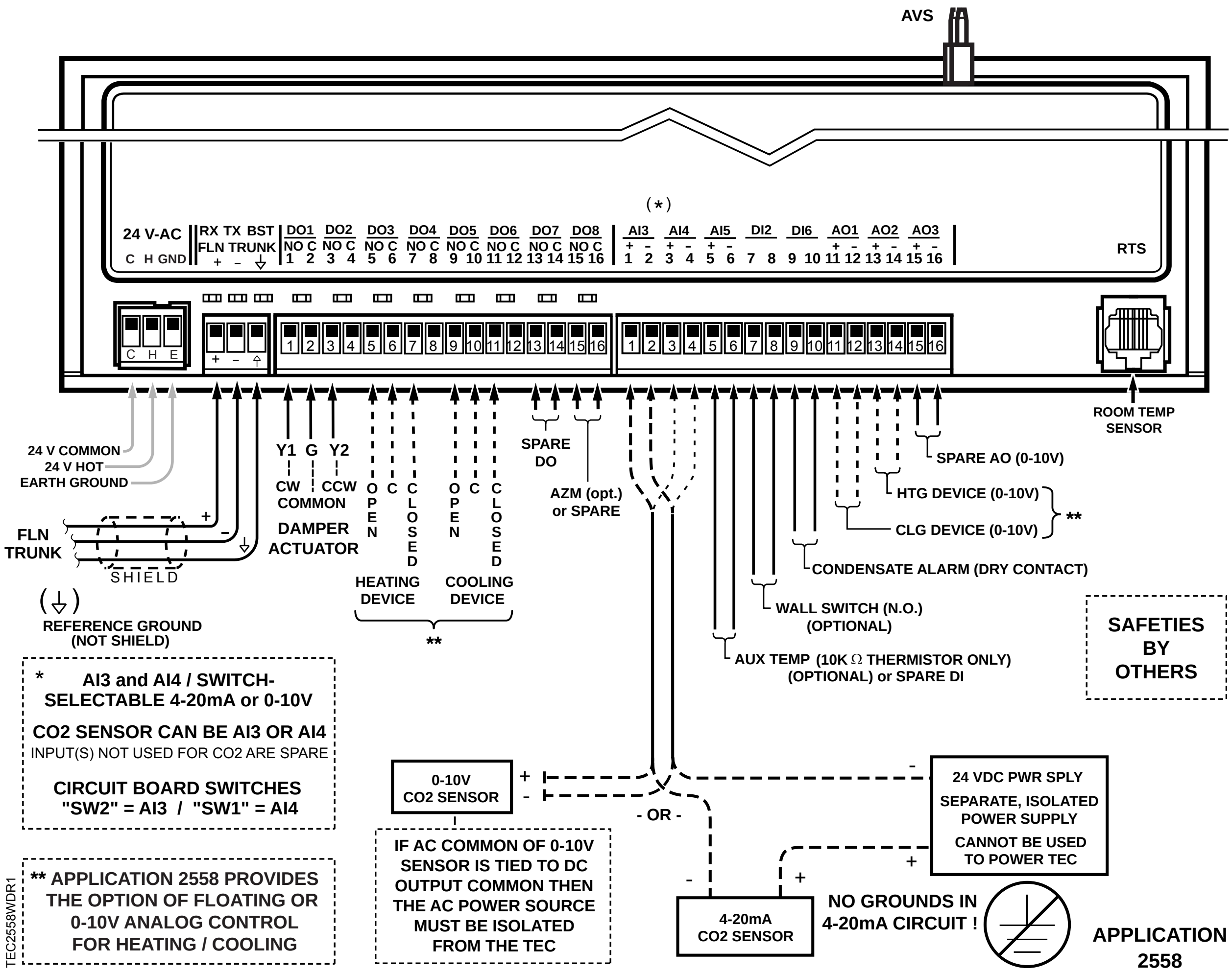


Figure 5. Application 2558.

Point Database

Table 5. Application 2558 Point Database.

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units) [c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-254	–	–
AO	2	APPLICATION	2592	–	2558, 2592	–	–
AI	{03}	ROOM CO2	450	PPM	0-8191	–	–
AI	{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
BO	{05}	HEAT.COOL	COOL	–	Binary	HEAT	COOL
AO	6	DAY CLG STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AO	7	DAY HTG STPT	70.0 (21.20888)	DEG F (DEG C)	48-111.75	–	–
AO	8	NGT CLG STPT	82.0 (27.92888)	DEG F (DEG C)	48-111.75	–	–
AO	9	NGT HTG STPT	65.0 (18.40888)	DEG F (DEG C)	48-111.75	–	–
AO	10	CO2 SCALE	2000	PPM	0-8191	–	–
AO	11	RM STPT MIN	55.0 (12.80888)	DEG F (DEG C)	48-111.75	–	–
AO	12	RM STPT MAX	90.0 (32.40888)	DEG F (DEG C)	48-111.75	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
BO	14	STPT DIAL	NO	–	Binary	YES	NO
AI	{15}	AI 3	0	PCT	0-102	–	–
AO	16	H FLOW START	0	PCT	0-102	–	–
AO	17	H FLOW END	100	PCT	0-102	–	–
BO	18	WALL SWITCH	NO	–	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	–	Binary	ON	OFF
AO	20	OVRD TIME	0	HRS	0-255	–	–
BO	{21}	NGT OVRD	NIGHT	–	Binary	NIGHT	DAY
AO	22	REHEAT START	0	PCT	0-102	–	–
AO	23	REHEAT END	100	PCT	0-102	–	–
BI	{24}	DI 2	OFF	–	Binary	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	ON	OFF
BI	{26}	DI 4	OFF	–	Binary	ON	OFF
BI	{27}	DI 5	OFF	–	Binary	ON	OFF

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Table 5. Application 2558 Point Database. *(continued)*

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units) [c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
BI	{28}	DI 6	OFF	–	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	NIGHT	DAY
BO	{30}	FLO CTL MODE	TEMP	–	Binary	VENT	TEMP
AO	31	CLG FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	–	–
AO	32	CLG FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	–	–
AO	33	HTG FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	–	–
AO	34	HTG FLOW MAX	220 (103.818)	CFM (LPS)	0-131068	–	–
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	–	–
AO	36	FLOW COEFF	1	–	0-2.55	–	–
BO	{37}	CHW DISABLE	NO	–	Binary	YES	NO
AO	{38}	AOV2	0	VOLTS	0-10.23	–	–
AO	{39}	C VLV POS	0	PCT	0-102	–	–
AO	{40}	H VLV POS	0	PCT	0-102	–	–
BO	{41}	DO 1	OFF	–	Binary	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	ON	OFF
BO	{46}	DO 6	OFF	–	Binary	ON	OFF
AI	{47}	AI 4	0	PCT	0-102	–	–
AO	{48}	DMPR COMD	0	PCT	0-102	–	–
AO	{49}	DMPR POS	0	PCT	0-102	–	–
AO	{50}	OUTDOOR CO2	450	PPM	0-8191	–	–
AO	51	DMPR TIMING	95	SEC	0-511	–	–
AO	{52}	H VLV COMD	0	PCT	0-102	–	–
AO	{53}	C VLV COMD	0	PCT	0-102	–	–
AO	{54}	AOV3	0	VOLTS	0-10.23	–	–
AO	55	CO2 RST DLY	10	MIN	0-255	–	–
AI	{56}	AIR VOL STPT	0 (0.0)	CFM (LPS)	0-131068	–	–

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Table 5. Application 2558 Point Database. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units) [c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
AO	57	CO2 CONFIG	0	–	0-255	–	–
AO	58	MTR SETUP	0	–	0-255	–	–
AO	59	DO DIR.REV	0	–	0-255	–	–
AO	{60}	AOV1	0	VOLTS	0-10.23	–	–
AO	61	CO2DIFF LLIM	400	PPM	0-8191	–	–
AO	62	CO2DIFF HLIM	500	PPM	0-8191	–	–
AO	63	CLG P GAIN	20.0 (36.0)	–	0-63.75	–	–
AO	64	CLG I GAIN	0.01 (0.018)	–	0-1.023	–	–
BO	{65}	CO2 ALARM	NORMAL	–	Binary	ALARM	NORMAL
AO	66	TEMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-63.75	–	–
AO	67	HTG P GAIN	10.0 (18.0)	–	0-63.75	–	–
AO	68	HTG I GAIN	0.01 (0.018)	–	0-1.023	–	–
BO	{69}	COND ALARM	NORMAL	–	Binary	ALARM	NORMAL
AO	70	COND ALM DLY	60	SEC	0-32767	–	–
AO	71	VNT FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	–	–
AO	72	FLOW I GAIN	0.01	–	0-1.023	–	–
AO	73	CO2 P GAIN	1.00	–	0-20.47	–	–
AI	{74}	CO2DIFF	0	PPM	-16383	–	–
AO	{75}	FLOW	0	PCT	0-1023.75	–	–
AO	{76}	CTL FLOW MIN	220 (103.818)	CFM (LPS)	0-131068	–	–
AO	{77}	CTL FLOW MAX	2200 (1038.18)	CFM (LPS)	0-131068	–	–
AO	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AO	{79}	CLG LOOPOUT	0	PCT	0-102	–	–
AO	{80}	HTG LOOPOUT	0	PCT	0-102	–	–
BO	{81}	DO 7	OFF	–	Binary	ON	OFF
AI	{82}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	–	–
AO	83	CLG STG DLY	60	SEC	0-32767	–	–
BO	{84}	DMPR STATUS	CAL	–	Binary	RECAL	CAL
AO	85	SWITCH LIMIT	5.2	PCT	0-102	–	–

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Table 5. Application 2558 Point Database. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units) [c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
AO	86	SWITCH TIME	10	MIN	0-255	–	–
BO	87	CAL MODULE	NO	–	Binary	YES	NO
AO	88	CO2DIFF STPT	100	PPM	0-8191	–	–
BO	{89}	DO 8	OFF	–	Binary	ON	OFF
AO	90	SWITCH DBAND	1.0 (0.56)	DEG F (DEG C)	0-63.75	–	–
AO	91	HC.ENDIS	3	–	1-256	–	–
AO	{92}	CTL STPT	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AO	{93}	FLOW STPT	0	PCT	0-255.75	–	–
BO	{94}	CAL AIR	NO	–	Binary	YES	NO
AO	95	CAL SETUP	4	–	0-255	–	–
AO	96	CAL TIMER	12	HRS	0-255	–	–
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	–	–
AO	98	LOOP TIME	5	SEC	0-255	–	–
AO	{99}	ERROR STATUS	0	–	0-255	–	–
AO	102	H VLV TIMING	130	SEC	0-511	–	–
AO	103	C VLV TIMING	130	SEC	0-511	–	–
AO	104	CHW START	50	PCT	0-102	–	–
AO	105	CHW END	100	PCT	0-102	–	–
AO	106	C FLOW START	0	PCT	0-102	–	–
AO	107	C FLOW END	40	PCT	0-102	–	–
AO	108	CLG D GAIN	0 (0.0)	–	0-510	–	–
AO	109	CO2 D GAIN	0	–	0-2046	–	–
AO	110	DMPR ROT ANG	90	–	0-255	–	–
AI	{111}	CO2 LOOPOUT	0	PCT	0-102	–	–
AO	112	AOV1 OPEN	10	VOLTS	0-10.23	–	–
AO	113	AOV1 CLOSE	0	VOLTS	0-10.23	–	–
AO	114	AOV2 OPEN	0	VOLTS	0-10.23	–	–
AO	115	AOV2 CLOSE	10	VOLTS	0-10.23	–	–
AO	116	CO2 ALM DLY	10	MIN	0-255	–	–

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Table 5. Application 2558 Point Database. ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units) [c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
BO	117	DI6 TYPE	NOPEN	–	Binary	NCLOSE	NOPEN
AO	118	HTG D GAIN	0 (0.0)	–	0-510	–	–
AO	119	CO2 I GAIN	0	–	0-1.023	–	–
AO	120	MODHTG FLOW	20	PCT	0-1023.75	–	–

[a] Object Types: Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).
[b] Point numbers that appear in brackets { } may be unbundled at the field panel.
[c] A single value in a column means that the value is the same in English units and in SI units.

Table 6. Slave Mode (2592).

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units)[c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	–	0-254	–	–
AO	2	APPLICATION	2592	–	2558, 2592	–	–
AI	{04}	ROOM TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AI	{13}	RM STPT DIAL	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
AI	{15}	AI 3	0	PCT	0-102	–	–
BO	18	WALL SWITCH	NO	–	Binary	YES	NO
BI	{19}	DI OVRD SW	OFF	–	Binary	ON	OFF
BI	{24}	DI 2	OFF	–	Binary	ON	OFF
BI	{25}	DI 3	OFF	–	Binary	ON	OFF
BI	{26}	DI 4	OFF	–	Binary	ON	OFF
BI	{27}	DI 5	OFF	–	Binary	ON	OFF
BI	{28}	DI 6	OFF	–	Binary	ON	OFF
BO	{29}	DAY.NGT	DAY	–	Binary	NIGHT	DAY
AI	{35}	AIR VOLUME	0 (0.0)	CFM (LPS)	0-131068	–	–
AO	36	FLOW COEFF	1	–	0-2.55	–	–
AO	{38}	AOV2	0	VOLTS	0-10.23	–	–
AO	{39}	MTR3 POS	0	PCT	0-102	–	–
AO	{40}	MTR2 POS	0	PCT	0-102	–	–
BO	{41}	DO 1	OFF	–	Binary	ON	OFF
BO	{42}	DO 2	OFF	–	Binary	ON	OFF
BO	{43}	DO 3	OFF	–	Binary	ON	OFF
BO	{44}	DO 4	OFF	–	Binary	ON	OFF
BO	{45}	DO 5	OFF	–	Binary	ON	OFF
BO	{46}	DO 6	OFF	–	Binary	ON	OFF
AI	{47}	AI 4	0	PCT	0-102	–	–
AO	{48}	MTR1 COMD	0	PCT	0-102	–	–
AO	{49}	MTR1 POS	0	PCT	0-102	–	–

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Table 6. Slave Mode (2592). ***(continued)***

Object Type[a]	Object Instance (Point Number)[b]	Object Name (Descriptor)	Factory Default (SI Units)[c]	Engr Units (SI Units)	Range	Active Text	Inactive Text
AO	51	MTR1 TIMING	95	SEC	0-511	–	–
AO	{52}	MTR2 COMD	0	PCT	0-102	–	–
AO	{53}	MTR3 COMD	0	PCT	0-102	–	–
AO	{54}	AOV3	0	VOLTS	0-10.23	–	–
AO	58	MTR SETUP	0	–	0-255	–	–
AO	59	DO DIR.REV	0	–	0-255	–	–
AO	{60}	AOV1	0	VOLTS	0-10.23	–	–
AO	66	TEMP OFFSET	0.0 (0.0)	DEG F (DEG C)	-63.75	–	–
AO	{78}	CTL TEMP	74.0 (23.44888)	DEG F (DEG C)	48-111.75	–	–
BO	{81}	DO 7	OFF	–	Binary	ON	OFF
AI	{82}	AUX TEMP AI5	74.0 (23.495556)	DEG F (DEG C)	37.5-165	–	–
BO	87	CAL MODULE	NO	–	Binary	YES	NO
BO	{89}	DO 8	OFF	–	Binary	ON	OFF
BO	{94}	CAL AIR	NO	–	Binary	YES	NO
AO	95	CAL SETUP	4	–	0-255	–	–
AO	96	CAL TIMER	12	HRS	0-255	–	–
AO	97	DUCT AREA	1.0 (0.09292)	SQ. FT (SQ M)	0-6.375	–	–
AO	{99}	ERROR STATUS	0	–	0-255	–	–
AO	102	MTR2 TIMING	130	SEC	0-511	–	–
AO	103	MTR3 TIMING	130	SEC	0-511	–	–
AO	110	MTR1 ROT ANG	90	–	0-255	–	–

[a] Object Types: Analog Input (AI), Analog Output (AO), Binary Input (BI) and Binary Output (BO).
[b] Point numbers that appear in brackets { } may be unbundled at the field panel.
[c] A single value in a column means that the value is the same in English units and in SI units.