SIEMENS

BACnet Programmable Fume Hood Controller

Vertical Sash Configuration with Damper or Venturi Valve Application 6741 and Application 6742

Application Note

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Overview

Application 6741 and Application 6742 are designed for use with a wide range of fume hood sash configurations connected to a manifold fume hood exhaust system. The sash configurations include:

- Bench style fume hoods – single vertical sash
- Dual Bench style fume hoods – side-by-side single vertical sash
- Floor Mounted style fume hoods – two vertical sashes, one on top of the other

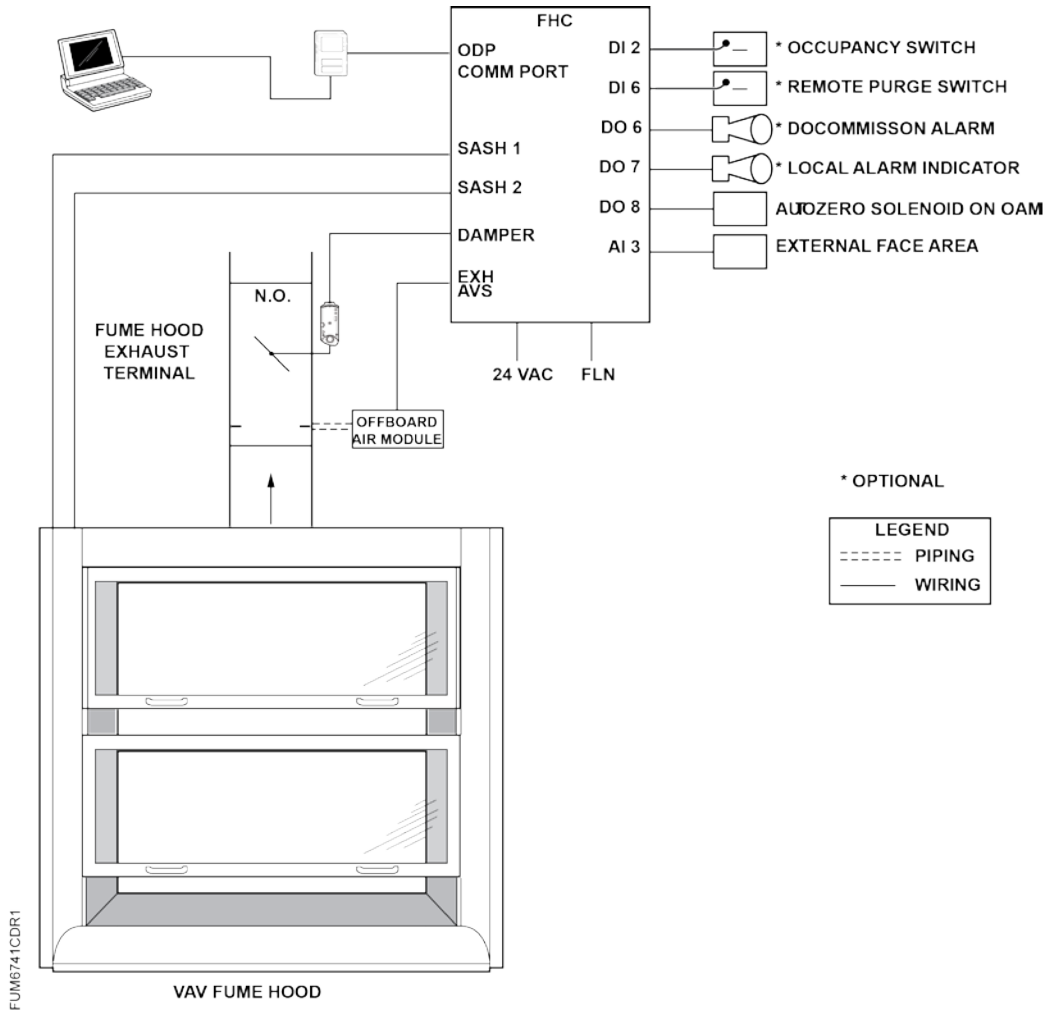
⚠ WARNING

The application cannot detect a broken wire to the analog input for the second sash.

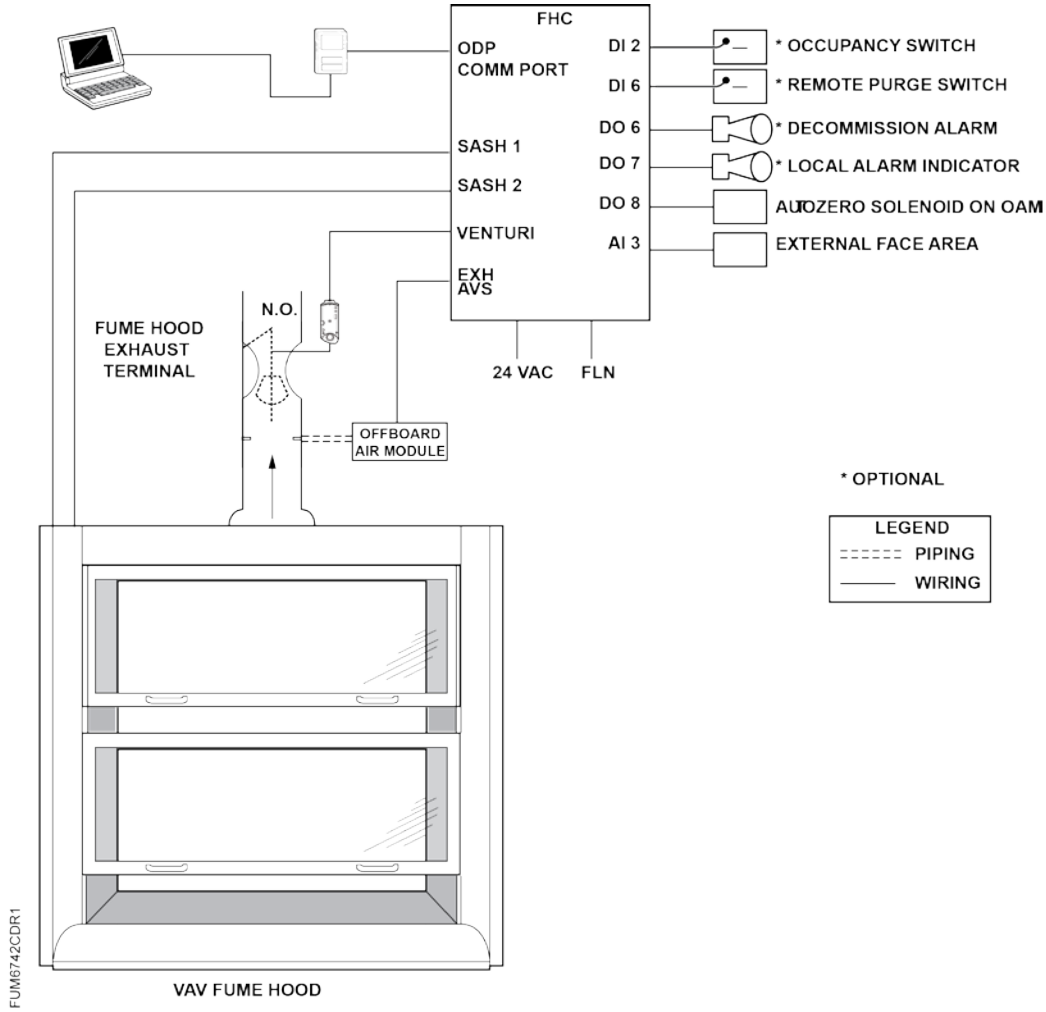
An external sash aggregating device should be used to calculate the face area for all fume hoods with more than one sash.

This application uses sash position sensors and three face velocity setpoints to limit the air entering the hood, each fume hood has an individual exhaust damper or valve connected to a central fan and allows face velocity setpoint changes at the ODP.

An Autozero module automatically calibrates the flow input to the FHC. The application incorporates special functionality that changes AO2 (hard-wired to room controller) to a value that more closely matches the exact measured airflow rather than the setpoint. This application also modulates the normally open exhaust damper/air valve based on inputs from the vertical sash sensor(s), external face area input, an exhaust airflow sensor and the controller setpoints.



Application 6741 Control Drawing.



Application 6742 Control Drawing.

BACnet

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

Product	Supported BIBBs	BIBB Name
BTEC/PTEC	DS-RP-B B	Data Sharing-Read Property-B
	DS-RPM-B	Data Sharing-Read Property Multiple-B
	DS-WP-B	Data Sharing-Write Property-B
	DM-DDB-B	Device Management-Dynamic Device Binding-B
	DM-DOB-B	Device Management-Dynamic Object Binding-B
	DM-DCC-B	Device Management-Device Communication Control-B
	DM-RD-B	Device Management-Reinitialize Device-B
	DM-BR-B	Device Management-Backup and Restore-B
	DM-OCD-B	Device Management-Object Creation and Deletion-B
	CPT	Confirmed Private Transfer (Auto Discovery)
	UPT	Unconfirmed Private Transfer

Auto Discovery

Auto Discovery allows you to automatically discover and identify PTEC/ATEC controllers on the BACnet MS/TP Network. There are two basic configurations:

- Devices not configured with an address. (Devices are discovered by their unique serial number.)
- Devices configured with an address and available for modification.

Auto Addressing

Auto Addressing allows you to automatically assign device addresses to a PTEC/ATEC controller on the BACnet MS/TP Network. If a controller is not configured with a MAC address, you have the option to auto-address or manually address the controller. During this time the baud rate is automatically detected by the controller.

Controller(s) must be connected on the BACnet/IP network in order for automatic addressing to occur.

Hardware Inputs

Analog

- Air velocity sensor(s) – (2nd sensor available for field use)
- *(Optional)* Differential pressure transmitter/Linear Flow input (Vortex Shedder)
- *(Optional)* External face area
- Vertical sash sensor(s)

Digital

- Operator Display Panel (ODP)
- ATTN.UNATTN (through DI 2)
- OCC.UNOCC (through DI 2)
- *(Optional)* OCC Face Velocity Setpoint (through ODP)
- Remote Emergency Purge (through DI 6)

Hardware Outputs

Analog

- Operator Display Panel (ODP)
- AO2 (flow signal, 1 to 10 Vdc)
- AO3 Analog Actuation

Digital

- Autozero Solenoid in Offboard Air Module (DO8)
- *(Optional)* Alarm (DO 7)
- *(Optional)* OFF Mode (DO 6)
- Exhaust damper (DO 1 and DO 2, Floating Control Actuation)
- Sash Alert

Ordering Notes

570-00701	BACnet FHC-OAVS VAV Fume Hood Controller, Fast-acting Actuation for Damper or Venturi Air Valve with Vertical Sash Configurations – Application 6741 and 6742 Requires Offboard Air Module – order and ship separately
550-819B	Offboard Air Module (OAM) – order and ship separately
575-820A	Operator Display Panel
AQM2200	Power Module
546-04000	Fume Hood Sash String Pot 50"
546-04001	Fume Hood Sash String Pot 80"

Sequence of Operation

The following paragraphs present the sequence of operation for Fume Hood Controller Application 6741 and Application 6742: Vertical Sash Configuration Fume Hood with Damper or Venturi Air Valve.

Average Face Velocity Control

In face velocity mode, the Fume Hood Controller maintains the average face velocity at the face velocity setpoint, FVEL STPT. This is accomplished as follows:

The controller uses the following points to calculate the open area of the Fume Hood:

VERT WIDTH1	VSASH HGHT1
TRACK HEIGHT	VERT WIDTH2
VSASH HGHT2	BYPASS HGHT
BYPASS OPEN	FACE AREA
VERT SASH1	VERT SASH2
FAIL AREA	EXTERNAL A
FIXED AREA	

The calculated face area is then stored in FACE AREA.

EXTERNAL FACE AREA – The controller allows an external face area to be included in the final FACE AREA calculation. Optionally, EXTERNAL A is inputted from AI3 and is scaled using MAX EXT AREA and MIN EXTVOLTS.

EXH STPT – The controller calculates the exhaust airflow volume setpoint, EXH STPT, that is required to reach the face velocity setpoint, FVEL STPT, by using the following equation:

EXH STPT = FACE AREA × FVEL STPT

Using a Proportional, Integral, and Derivative (PID) control algorithm, the controller modulates the exhaust flow control device to adjust the actual exhaust flow so that FVEL STPT is reached.

FVEL STPT – The controller uses the following points to determine the face velocity setpoint: OCC DELAY, OCC.UNOCC, OCC FV STPT, and UNOCC FV STPT. OCC.UNOCC is controlled by the DI. When it is in OCC mode, the face velocity is controlled to OCC FV STPT; when it is in UNOCC mode, the face velocity is controlled to UNOCC FV SET. When changing from OCC to UNOCC mode, the controller must wait for the time specified in OCC DELAY to elapse before the face velocity is set to UNOCC FV STPT.

ODP Face Velocity Setpoint Control – Additional face velocity setpoints can be assigned to the lower middle buttons on the ODP.

If Table Access points OCC LOW FV and OCC HIGH FV equal 100 (default), no control is assigned to the ODP buttons.

The left button will lower the face velocity setpoint from high to medium or medium to low. The right button will raise the face velocity setpoint from low to medium or medium to high. The new face velocity will display for 2 seconds.

If the face velocity setpoint is overridden by the system or the controller is in Emergency/General Failure this function does not work. The controller will remember the current occupied face velocity setpoint even after changing from unoccupied back to occupied.

Air Velocity Sensing

Primary sensing of the exhaust airflow is through the OAVS. Optionally, AI3 may be used to input a Differential pressure transmitter or a Linear Flow input signal. Using AI3 for this purpose will prevent you from using the external face area functionality.

AVS Calibration

When using an OAVS sensor the following applies.

Calibration of the air velocity transducer(s) is periodically required to maintain accurate air velocity readings. Depending on the value of CAL SETUP, calibration takes place either at fixed time intervals or whenever the application goes into unoccupied mode. When calibration is in progress, CAL AIR equals YES. After calibration, CAL AIR returns to NO.

The application uses Autozero Modules connected to AUTOZERO DO8. This means that the exhaust flow control device does not close during calibration of the transducers.

NOTE:
The FHC does not monitor Fume Hood flow changes for 3 seconds during AVS calibration.

AO2 Flow Signal

An analog signal of the exhaust flow is available at AO2 of the controller board and is displayed at EXH SIG AO2. To get an output from EXH SIG AO2, you must command AO2 RANGE to the maximum expected flow for the fume hood. Then AO2 is scaled such that 1 Vdc is equal to 0 cfm, and 10 Vdc is equal to AO2 RANGE. If the output drops below 1 Vdc, this indicates a GENERAL FAILURE or loss of power.

EXH SIG AO2 = (EXH VOL/AO2 RANGE x 9 volts) + 1 volt

AO2 V MIN allows the minimum AO2 output voltage to be modified.

NOTE:
If the AO2 V MIN is set to 0, failure detection is lost.

The value of AO2 is determined by the following conditions:

<table>
<tr><th>Operating Condition</th><th>AO2 FLOW SIG Value</th></tr>
<tr><td>Normal/warning condition inside the range of AO2 DEADBAND</td><td>EXH STPT</td></tr>
<tr><td>Normal/warning condition outside the range of AO2 DEADBAND</td><td rowspan="2">EXH VOL</td></tr>
<tr><td>Alarm and emergency condition</td></tr>
</table>

AO2 DEADBAND defaults to 5.2%. If EXH STPT is 1000 cfm, AO2 FLOW SIG = EXH STPT if the actual flow is between 948 and 1052 cfm (these values are approximate and will vary based on duct area). If the actual flow is outside these values AO2 FLOW SIG = EXH VOL.

For stable pressure reading, lower the AO2 DEADBAND. For unstable pressure readings, raise the AO2 DEADBAND until the output signal stabilizes.

AO2 DEADBAND can be set from 0 to 102% in 0.4 % increments. 0% will give the actual flow all the time. This signal may be too unstable to give a stable output and will cause short-term room instability during fume hood sash movements. 5.2% removes most of the signal bounce, maintains tighter control of actual flow changes and maintains room stability during fume hood sash movements. A 10% deadband is equal to a ± 5% of the flow. Any value over 100% will turn the feature off and revert to standard control.

ODP Face Velocity

FACE VEL = EXH VOL / FACE AREA

The average value of AVE FACE VEL is displayed at the ODP. The following two points help stabilize the displayed face velocity:

- DISPLAY WT assigns a weighted calculated value to the face velocity. If DISPLAY WT is set to 100%, the value of face velocity displayed at the ODP is the same as the value displayed at FACE VEL and may fluctuate rapidly. When DISPLAY WT is set to a value less than 100%, the displayed value updates less frequently.

NOTE:
If you set DISPLAY WT to zero, the ODP “freezes” at the last read value. Resetting DISPLAY WT to a value other than zero allows the Operator Display Panel to update the displayed value.

- DISPLAY RES is the COV limit for exhaust volume readings.

NOTE:
If you set DISPLAY RES to zero, the ODP continuously displays the value of FVEL STPT. Resetting DISPLAY RES to a value other than zero displays the face velocity incrementally. The factory default is 5, fpm values displayed will be in increments of 5 (for example, 80, 85, 90, 95, 100, etc.). If the actual filtered fpm is 84, 85 will be displayed.

These two points affect the ODP display only; they do not affect the values in the controller or values sent to the network.

Control Loop - Damper Application

The PID loop controls the damper based on the values of EXH VOL and EXH STPT. The loop output, DMPR CMD, controls EXTN DO1 and RETC DO2 through a time modulation scheme. The DMPR CMD ranges of -100 to 100%.

- -100% is the maximum extend which closes the damper at full speed.
- 0% holds the damper at its current position.
- 100% is the maximum retract which opens the damper at full speed.

For example, if you command the point to -50, the damper will still close the drive but not as quickly as if it were commanded to -100.

The controller sends a separate signal to each of the two inputs that reside on the damper actuator. For values of 100% to 0%, the controller sends a decreasing percentage of the full signal length to the retract input. For values of 0% to -100%, the controller sends an increasing percentage of the full signal to the extend input.

Venturi Application

Venturi Operational Modes

Mode 1 – Operates with both a PID loop and a Venturi table.

This mode provides the best control and is the most commonly used mode for these applications. In this mode, the embedded Venturi table statements work together with a PID feedback loop to operate the Venturi air valve so that the measured air velocity is maintained at setpoint. The following sections describe this mode.

Mode 2 - Operates with a PID loop, but no Venturi table.

In this mode, the controller operates with PID control based on a flow sensor input, but the Venturi table is not used. See the *PID Only Mode* section for specific information on this mode.

Mode 3 - Operates with Venturi table, but no PID loop

In this mode, the controller operates open loop (without a flow sensor). There is no PID control. Positioning of the actuator is based solely on a Venturi table consisting of command voltages and their resultant corresponding airflows. See the *Open Loop Operation (Mode 3)* section for specific information on configuring the application for open loop control.

Venturi Air Valve Calibration (Mode 1, 3)

Calibration of the Venturi Air Valve(s) must be performed at least once during start-up to determine the relationship between airflow and the voltage curve of the actuator.

Prerequisites for calibrating Venturi Air Valves:

- Fully operational exhaust airflow systems.
- Exhaust Air Velocity Sensor is calibrated and working normally (EXH VOL cannot be Failed).

If operating without an Air Velocity Sensor, see the *Open Loop (Mode 3)* section.

The exhaust Venturi Air Valve is calibrated by setting CAL EXH VLV to YES. Calibration proceeds automatically and takes about 3 minutes, after which CAL EXH VLV returns to NO. If calibration is successful, EXH VLV STAT is set to CAL OK. A failed calibration requires checking the equipment for possible causes—loose or kinked flow sensor tubes, improper actuator or valve operation, etc.—followed by recalibration.

NOTE:
The factory default value of EXH VLV STAT is NOTCAL. The value of EXH VLV STAT is set whenever a calibration or table transfer is performed as the last step of the calibration/table transfer. EXH VLV STAT is never used for active control decisions.

When calibration is complete, the EEPROM automatically stores a table statement of voltages (no loss of values upon power failure) that will be output to the AO point, EXH SIG AO2, to drive the actuator.

Table values are the result of the application's analysis of the voltages that drove the actuator during calibration and the resulting airflow values in cfm. To hedge against airflow accuracy slippage, the air velocity feedback loop is used along with the table statement to maintain correct airflow out of the Venturi.

Table Access Feature (Mode 1, 3)

In Application 6742, an embedded table statement and a feedback loop work together to operate the exhaust Venturi Air Valve.

The table contains 16 pairs of "active" voltage/flow values, and 16 pairs of "inactive" voltage/flow values.

The active values are used to operate the Venturi Air Valve at desired airflows. For example, when the controller is given a flow setpoint value of 500 cfm, it goes to the active portion of the table statement and looks up what the voltage output to the actuator should be in order to achieve 500 cfm. The inactive values are used to edit the active values as explained later in this section.

Table *Venturi Table Statement Example* shows an example of active values in a Venturi table statement after the Venturi Air Valves have been calibrated (note reverse acting exhaust voltage). Table statement values will vary per system.

Venturi Table Statement Example (active values).	
Exhaust Venturi Air Valve	
cfm	volts
0 [a)]	10 [a)]
180	5.48
216	5.08
244	4.68
340	3.88
368	3.48
452	2.98
476	2.73
504	2.48
572	1.98
604	1.73
618	1.48
712	0.98
760	0.73
800	0.48
904	0

a) These voltage/flow values constitute the “low flow” element (or “point”) for the Exhaust Venturi Air Valves. They are shown here with factory default values. They are not altered during calibration—they must be set manually. However, they only need to be set if the Venturi Air Valve is going go be operating at low flow settings of less than 350 fpm. Otherwise, they can be left at default and ignored.

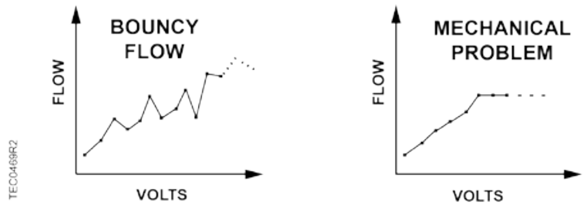
NOTE:
The first pair (or "point") of flow/voltage values in the table statement is the low flow point. It is provided for low flow situations where airflow through the Venturi Air Valve must be controlled at velocities less than 350 fpm. Otherwise, this point can be left at factory default of 0 cfm and 0V (10V if exhaust) and ignored, as is the case in the example table statement in Table *Venturi Table Statement Example*. See the Table *Venturi Air Valve Table Statement* for how to manually set this point.

If there is a low flow cfm value, it is taken from either the room schedule or the Venturi Air Valve housing. Cubic feet per minute (cfm) flows in this range (where velocity equals less than 350 fpm) and related voltages must be determined and/or confirmed with help from a balancer. See Table *Venturi Airflow @ 350 fpm* for cfm flows equal to 350 fpm. The following equation associates airflow to air velocity:
Airflow (cfm) = Velocity (fpm) × Duct Area (sq ft) × Flow Coefficient.

Venturi Airflow @ 350 fpm.	
Valve Size in Inches	**cfm**
5	48
6	69
8	122
10	191
12	275
Dual 10	380
Dual 12	550
Triple 12	825

During calibration, 15 voltage/flow values are automatically generated (the first pair of voltage/flow values—the low flow point—is not generated; it must be set manually). The Venturi Valve actuator is then fed the voltages and the application reads the resulting airflows. At the end of calibration, the airflow readings are analyzed and the calibration is either given a CAL OK or a NOT CAL (EXH VLV STAT). To obtain a CAL OK, at least 5 of the airflow readings must increment correctly (the points in the table increase as the voltage increases). For example, if one point on the voltage/flow curve shows 5V and 500 cfm and the next point shows 6V and 450 cfm, the second point (6V, 450 cfm) would fail. But 6V at 550 cfm would pass. (This example assumes the actuator is direct acting, where more volts equal more flow. Exhaust devices are usually reverse acting and have an inverse voltage/flow relationship.) Too many failed airflow points along the voltage/flow curve will result in a NOT CAL status for the calibration.

This application has a table statement edit feature that allows you to view and edit the voltage/flow values in the table. This is useful for fine tuning the air valve to meet precise room flow setpoints and for diagnosing/editing problematic voltage/flow curves (see Table *Venturi Air Valve Table Statement*).



Problematic Venturi Air Valve Voltage/Flow Curves.

NOTE:
Bouncy flow means that airflow through the air valve's flow orifice is too turbulent to be read consistently.

Venturi Table Evaluation and Editing (Mode 1, 3)

A Venturi Air Valve table statement consists of two sets of voltage/flow values—one set is active and the other inactive. When you run the calibration, the first thing that happens is that the inactive table values are filled in with new values generated by the calibration. Then the application checks these new values to make sure they are good. If they pass (that is, if enough increment correctly), these new values become the active values, and the old active values become inactive. However, if the new values don't pass, then the old active values remain active.

Running a successful calibration sequence is one way of changing or updating the active values. You can also edit the table manually. Normally this is not necessary, but if you are having flow control problems you may need to edit the table.

In order to manually edit the table statement, you must first know which points in the active table need adjusting. This is done by setting V TABLE PT to the appropriate active point values found in Table *Venturi Air Valve Table Statement* in order to gather and view the active voltage/flow curve for the Venturi Air Valve and its actuator. By gathering and analyzing the active voltage/flow values (for example, you can plot them on a graph as in Figure *Problematic Venturi Air Valve Voltage/Flow Curves*), you can decide which one(s) need adjusting. The flow curve should be smooth and incremental.

You can change the active values using the following steps:

1. Set V TABLE PT to a "swap" value that tells the application to exchange active table values with inactive table values (see Table *Venturi Air Valve Table Statement* for swap value).

   ⇨ This step is necessary because the application does not allow active values to be manually overridden.

NOTE:
An exception to this rule is the first element in the active portion of the table—the low flow point—can be edited directly. Table *Venturi Air Valve Table Statement* explains this in more detail.

2. Edit the inactive table values.
   - ⇨ Since you have just switched the active and inactive portions of the table in Step 1, the inactive values are now identical to what the active values were moments ago. You can now edit these new inactive values by using V TABLE PT to reference them in TABLE FLOW and TABLE VOLTS. Table *Venturi Air Valve Table Statement* explains this in more detail.
3. Set V TABLE PT once again to the swap value. This places the newly edited inactive values back into the active portion of the table statement (again, the active and inactive portions of the table are simply swapped). However, before the swap is finalized, the application analyzes your proposed values using the same logic as in a regular calibration sequence.

NOTES:
1. If **FLOW COEF** is 0, the table edit feature uses a flow coefficient of 1.
2. If **DUCT AREA** is 0, the table edit feature uses a duct area of 1 square foot.

- ⇨ If your proposed values are good, then the swap is made and the edited values are accepted into the active portion of the table. EXH VLV STAT is set to CAL OK for exhaust calibration and control of the Venturi Air Valve resumes.
- ⇨ However, if either point is set to NOTCAL, you must gather and view the voltage/flow values to see where the problem lies.

The following table lists all values for V TABLE PT and describes their use.

Venturi Air Valve Table Statement		
	V TABLE PT	**Description**
	0	Default value for **V TABLE PT**. When **V TABLE PT** equals 0, changes to **TABLE FLOW** or **TABLE VOLTS** are ignored. Setting **V TABLE PT** to 0 cancels an edit session.
Active	31	Setting **V TABLE PT** to 31 takes the flow (cfm) and voltage values from the first element of the active supply table and displays them in **TABLE FLOW** and **TABLE VOLTS** where they can be edited. (This is the only active supply element (or "point") that can be directly edited.) Flow and voltage values are not allowed to exceed those in active supply point 32. To operate in the range below minimum readable flow (less than 350 fpm), a low flow value in cfm from either the room schedule or the supply Venturi Air Valve housing is entered into **TABLE FLOW**, with the correct corresponding actuator voltage determined/confirmed by the balancer and entered into **TABLE VOLTS**. **NOTE:** This point is only necessary for supply Venturi Air Valve operation in the range below minimum readable flow (below 350 fpm). Otherwise it can be ignored. This low flow point must be entered only after other non-zero points exist in the table as a result of manual edits, or as the result of a prior Venturi auto calibration sequence.
Active	32 - 46	This portion of the table (32 through 46) can be viewed but not edited directly. When a point is selected (that is, when **V TABLE PT** is set to a value 2 through 16), the corresponding flow and voltage values are displayed in TABLE FLOW and **TABLE VOLTS**. Setting **V TABLE PT** to 32 will result in the smallest readable flow and associated voltage for the supply Venturi Air Valve to be displayed in **TABLE FLOW** and **TABLE VOLTS**; setting V TABLE PT to 46 will result in the maximum flow and associated voltage for the supply Venturi Air Valve to be displayed in TABLE **FLOW** and **TABLE VOLTS**. The in between values (33 through 45) are for the range of flow between min and max. **NOTE:** The table swap will fail if valid flow and voltage values are not entered in Point 46. Table entries marked as failed display FAIL for both flow and voltage.
Inactive	91 – 106	This portion of the table can be viewed and edited. By entering a point (any value 91 through 106) **into V TABLE PT**, the corresponding cfm and voltage values display in **TABLE FLOW** and **TABLE VOLTS** where they can be edited.
Swap	121	Setting **V TABLE PT** to 121 instructs the controller to evaluate the values in the inactive portion of the table using standard calibration pass/fail logic. If they pass, they are exchanged with those in the active portion of the table.

NOTE:
The calibration table initially contains all zeros by default, that is, it contains no calibration information. When the application detects all zeros, the application operates, but runs with only PID control. If PID only control is satisfactory for a given job, there is no need to populate the table. If necessary, a populated table can later be edited back to all zeroes to force PID only control.

PID Only (Mode 2)

NOTE:
The default P gain value is intended for PID operation in conjunction with the Venturi table. The P gain and Venturi table work together to provide an appropriate response to setpoint changes. When operating without the Venturi table in PID Only mode, the application is slower to respond. Therefore, you should adjust the P gain as needed when operating in PID Only mode to ensure acceptable performance.

The Venturi calibration table initially contains all zeros by default, that is, it contains no calibration information. When the application detects a zero flow for the sixteenth entry (the table entry with the highest flow), the application does operate, but runs with only PID control. If PID Only mode control is satisfactory for a given job; there is no need to populate the Venturi tables.

Open Loop (Mode 3)

This application can operate in open loop mode. In open loop control, there is no airflow sensor to provide an actual airflow measurement. Instead, operation is based completely on the values in the Venturi table. For example, if the actuator's setpoint is 600 cfm, the application will use the Venturi table to derive the voltage setting that generates a flow of 600 cfm and then set the actuator to that voltage to generate the desired flow. Assuming the table has accurate entries, the flow (if it were to be measured) would be at setpoint.

Internally within the application, with open loop control, the flow is always assumed to be at setpoint As a result there is virtually no difference between flow tracking and setpoint tracking when the actuator being tracked is operating open loop.

Set OPEN LOOP to YES to indicate that the actuator is to operate open loop. This will suppress the AVS failure indication that otherwise would occur when no airflow sensor is connected.

When operating open loop, there is no flow sensor for use in the calibration sequence. Instead, the Venturi table values are directly input by the user. If the Venturi Valve has end points for calibration such as 1200 cfm at end voltage, and an implied lower range of 0 cfm at its other end of the voltage range, you should enter this information into Point 16, as shown in Example 1 and 2 below.

Point	Flow	Volt
1	0	10.0
2	0	10.0
15	0	10.0
16	1200	0.0

Example 1 - Table with CFM End Limits

It may not be necessary to enter 10.0 values since 10.0 values are initially in the table by default when reverse acting is selected.

If specific information about the voltage at low flow is known, that would be entered into point 1 which is reserved for information about low flow. See Example 2.

Point	Flow	Volt
1	300	7.0
2	0	10.0
3	0	10.0
15	0	10.0
16	1200	0.0

Example 2 - Table with Voltage End Limits and Low Flow Value

You can also manually populate the table with additional values as shown in Example 3 below. In this case, the table becomes indistinguishable from a table generated via the calibration process.

Point	Flow	Volt
1	300	10
2	340	7.0
3	390	5.8
4	521	4.9
5	531	4.1
6	598	3.8
7	691	3.5
8	798	3.2
9	1200	3.0
10	0	0
16	0	0

Example 3 - Multi-point Table

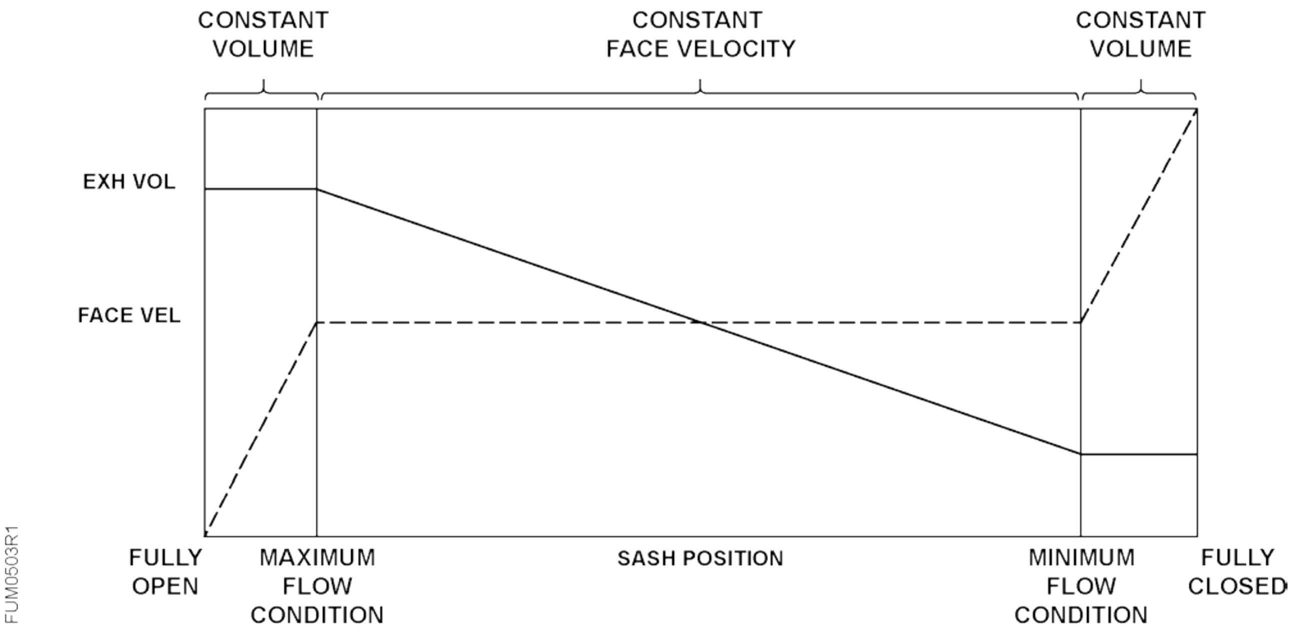
NOTE:
Since **PID Only Mode** uses PID without a Venturi table and **Open Loop Mode** uses Venturi table without PID, these two modes cannot be used at the same time.

Minimum Exhaust Mode

If, as the open sash area is decreased, the calculated exhaust airflow setpoint, EXH STPT, falls below the minimum exhaust airflow specified in EXH MIN, then EXH STPT is set equal to EXH MIN. Under this minimum flow condition the ODP displays the closed status instead of the average face velocity.

The Fume Hood Controller maintains a constant face velocity until the minimum flow condition occurs. At that point the controller controls to a constant exhaust volume, EXH MIN.

In the minimum flow mode, the face velocity rises above the desired setpoint as the open sash area decreases toward the fully closed position. This is not considered an alarm condition; no face velocity alarms will occur and flow alarms are still active.



Exhaust Control Schedule.

Maximum Exhaust Mode

If, as the open sash area is increased, the calculated exhaust airflow setpoint, EXH STPT rises above the maximum airflow specified in EXH MAX, then EXH STPT is set equal to EXH MAX. Under this maximum flow condition, the ODP displays the average face velocity that will drop as the open sash area is further increased.

The Fume Hood Controller maintains a constant face velocity until the maximum flow condition occurs. At that point the controller controls to a constant exhaust volume, EXH MAX.

In the maximum flow mode, the face velocity drops below the desired setpoint as the open sash area increases toward the fully open position. This may cause an alarm to occur.

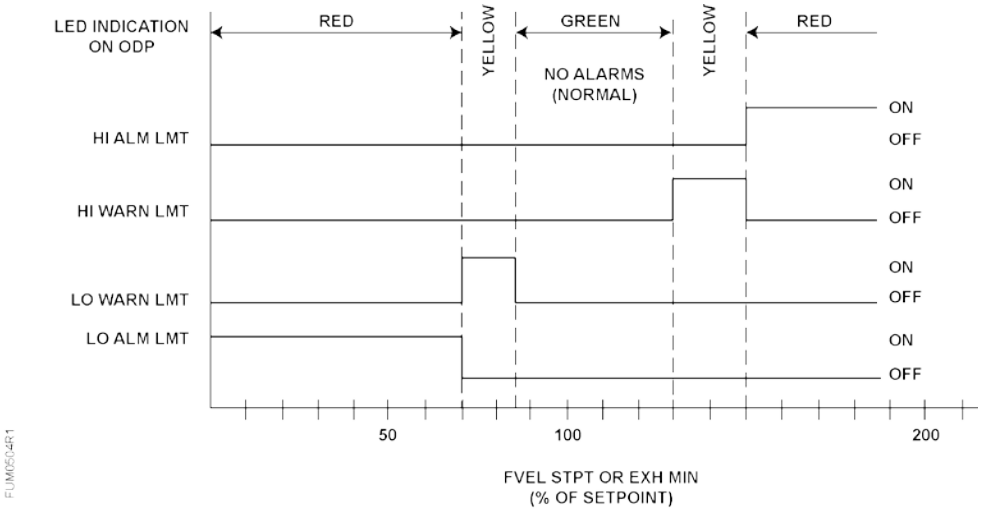
Warning Limits

The Fume Hood Controller contains high and low flow warning limits, HI WARN LMT and LOW WARN LMT, respectively.

The warning limits are defined as a percentage of the controller setpoint; therefore, the warning limits apply to EXH STPT during normal control.

For either of the warnings to become active, the warning condition must be maintained for the time specified in ALARM TIME.

When the actual flow is greater than HI WARN LMT or less than LOW WARN LMT for a time greater than ALARM TIME, the yellow LED illuminates and HIGH WARN or LOW WARN turns ON.



Warning and Alarm Schedule.

Alarm Limits

The Fume Hood Controller contains high and low flow alarm limits, HI ALM LMT and LOW ALM LMT, respectively.

The alarm limits are defined as a percentage of the controller setpoint; therefore, the alarm limits apply to EXH STPT during normal control.

For either of the alarms to become active, the alarm condition must be maintained for the time specified in ALARM TIME.

When the actual flow is greater than HI ALM LMT or less than LOW ALM LMT for a time greater than ALARM TIME, the red LED illuminates, HIGH ALM or LOW ALM turns ON, the audible alarm on the Operator Display Panel sounds, “High Alarm” or “Low Alarm” is displayed. See Figure *Warning and Alarm Schedule*.

Alarm Output

The digital output DO7 can be used for local indication of an alarm condition. The output will be turned ON if EMER ALM, GEN FAILURE, LOW ALM, or HI ALM are ON and the output will be OFF when they are all OFF.

Horn Disable

When the alarm silence button is pressed, ALM AKNLG turns ON, the audible alarm turns OFF, and the red LED stays ON. The alarm descriptor remains until the flow returns to the normal range and ALM AKNLG turns OFF. Alarm limits always override any current warning limits.

Sash Area Alarms

NOTE:
Sash alarms are set to be OFF by default and are not required on most jobs. Enabling sash alarms requires training for the operators.

Sash area alarms alert you when the sash area is above set limits. There are limits for both attended and unattended modes of operation. The controller uses the following points to perform this function:

DI2, ATTN.UNATTN, SASH TONE, UN ALRT AREA, AT ALRT AREA, OPEN TIME, and SASH OP ALRT. ATTN.UNATTN is controlled by DI2, and when the DI is opened the controller changes to ATTN mode.

When the DI is shorted, the controller changes to UNATTN mode.

- **ATTN MODE** – When in ATTN mode and the FACE AREA is larger than AT ALRT AREA, the SASH OP ALRT point is turned on and the ODP horn beeps six times every minute until the sash area is lowered below the AT ALRT AREA limit. The horn beeping feature may be removed in ATTN mode by turning off the SASH TONE point. When the FACE AREA is less than the AT ALRT AREA, the SASH OP ALRT turns off and the ODP horn no longer beeps.

  By pressing the horn silence button, you may stop the beeping for the time shown in OPEN TIME.

- **UNATTN MODE** – When in UNATTN mode and the FACE AREA is larger than UN ALRT AREA, the SASH OP ALRT point is turned on and the ODP horn beeps six times every minute until the sash area is lowered below the UN ALRT AREA limit. When the FACE AREA is less than the UN ALRT AREA, the SASH OP ALRT turns off and the ODP horn no longer beeps.

Table Access Feature

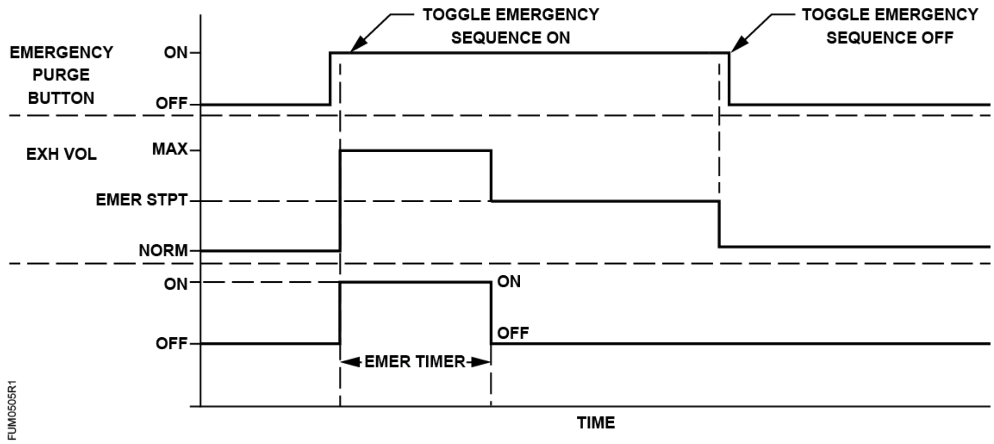
The table access feature allows the controller to store values that are set once and left alone, used infrequently or not accessed by the network.

These values are accessed using V TABLE PT. It will access the points TABLE FLOW and TABLE VOLTS. For more information see the *Start-up Procedures for Application 6741 and Application 6742*.

Emergency Mode

The emergency mode operation overrides any other control mode in the Fume Hood Controller. When the Emergency Purge button on the ODP is pressed, the following sequence of events occurs.

1. EMER ALM turns ON at BACnet priority level 1, the horn sounds, and the red LED on the ODP illuminates. The ODP displays “EMERGENCY” mode and indicates to close the hood.
2. The Fume Hood Controller commands the damper/Venturi valve to fully open for the time (in seconds) specified in EMER TIMER.
3. After EMER TIMER has timed out, the Fume Hood Controller controls the flow at the flow setpoint, EXH STPT, multiplied by the emergency set point percentage, EMER STPT.
4. When the Emergency Purge button is pressed a second time, the Fume Hood Controller returns to normal operation for the current conditions.



Emergency Purge Schedule.

NOTE:
Norm = Normal operation in which control is at the EXH STPT.
EMER STPT = EXH STPT increased by the value (%) of EMER STPT.
MAX = Maximum flow, where the damper is controlled to fully opened.

Start-up/Decommission Mode

The Fume Hood Controller contains different modes controlled by STARTUP MODE (default is 3). These modes of operation allow the controller to be started up without the sound of nuisance alarms at the hood. These modes are useful at different stages of construction and after decommissioning.

The FHC also contains decommission modes and allow some or all of the functionality of the controller to be turned off.

The modes are described as an enumerated point:

STARTUP MODE	Mode	Description
0	Normal	The controller is fully functional.
1	Decommission	The controller is fully functional, except the flow setpoint is set to 0, alarming is limited and the ODP displays “Out of service” and “OFF”. If the sash is opened, control is returned and you are notified that the hood is “Out of service”.
2	Non-functional Decommission, closed	The controller is fully functional, except the flow setpoint is set to 0, alarming is limited and the ODP displays “Out of service” and “OFF”. If the sash is opened, nothing changes.
3 (default)	Non-functional Startup	The controller is fully functional, except alarming does not work and the ODP displays “Controller – Startup” and “OFF”.

To enter modes 1 and 2, the fume hood sashes must be in the closed position, and FACE AREA must be smaller than UN ALRT AREA.

The digital output DO6 can be used for local indication that the sash was opened after the hood entered Out of Service mode. The output will remain ON until STARTUP MODE is changed.

Fail Mode

If the Fume Hood Controller or one of its accessories fails, then a failure mode sequence is initiated.

Fume Hood Controller – If the Fume Hood Controller power fails, the exhaust damper goes to the fully opened position. Since there is no power to the controller, no LEDs or displays are available on the ODP. If the power fails to both the exhaust fan and the controller, there is no indication except for the absence of the noise that the air makes during normal operation.

Sash Sensor – If the sash sensor fails, then GEN FAILURE turns ON, and the Fume Hood Controller maintains flow through the fume hood at an exhaust setpoint calculated using the value in FAIL AREA and making FACE AREA equal to FAIL AREA. The ODP displays FFF and GENERAL FAILURE.

Operator Display Panel – If the ODP fails, then the Fume Hood Controller continues to control the flow. However, displays and audible alarms are not available.

OAVS Sensor – If the OAVS sensor fails or is disconnected, then GEN FAILURE turns ON, AO2 goes to zero Vdc, and the Fume Hood Controller controls the exhaust damper to the condition described in AVS FAILMODE. This will be either fully open or holding the current position. The ODP displays the failure.

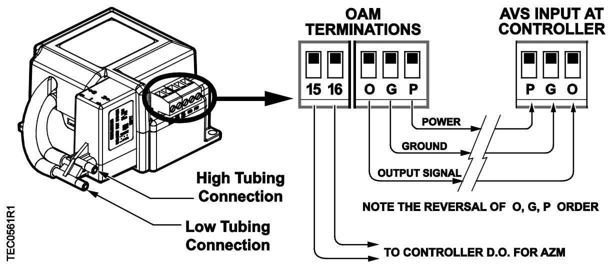
(Optional) Differential Pressure Transmitter – If A I3 is used and the differential pressure transmitter fails by losing the 4 to 20 mA signal, then GEN FAILURE turns ON, AO2 goes to 0 Vdc, and the Fume Hood Controller controls the exhaust damper to the condition described in AVS FAILMODE. This will be either fully open or holding the current position. The ODP displays the failure.

Electronic Actuator – If the actuator fails and flow control is lost, the ODP displays alarms indicating unsafe operating conditions.

Upon loss of power the actuator will fail based on the related DIP switch settings.

Face Velocity – If the Face Velocity falls out of the safe range of operation, the LOW ALM or HIGH ALM turns ON and alarms are displayed on the ODP indicating unsafe operating conditions.

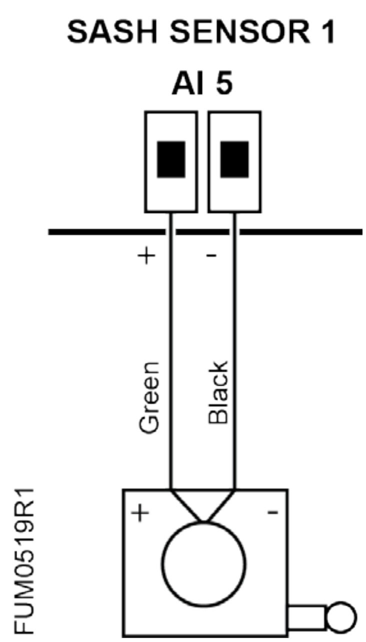
Wiring Diagrams



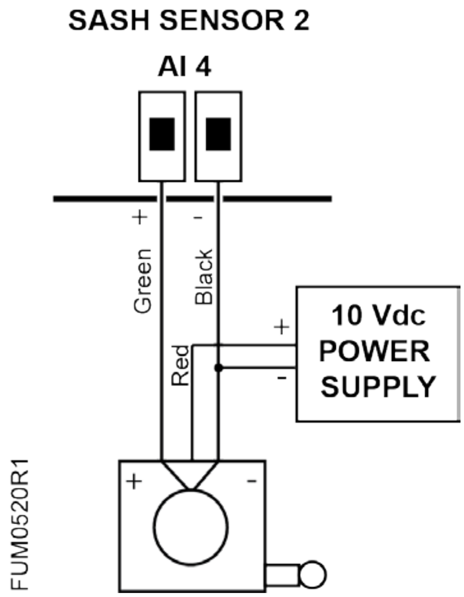
Offboard Air Module Wiring.

	⚠ CAUTION
	The FHC-OAVS has two terminal blocks with terminations numbered identically (terminations 1 through 16). DO NOT mix these up with each other. If the FHC-OAVS is not connected as shown, it is not resistant to electrical surges. It is also susceptible to interference from other equipment.

	⚠ CAUTION
	A separate power supply is required if a 4-20 mA sensor is used. Failure to follow wiring precautions will result in equipment damage.



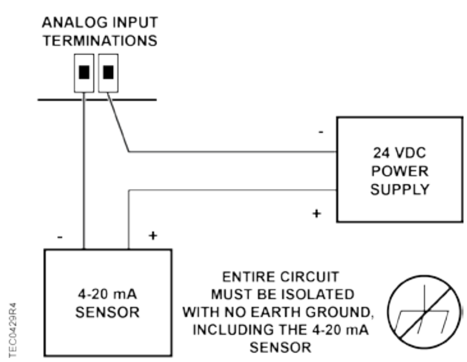
Wiring for AI5: Sash Sensor 1.



Wiring for AI4: Sash Sensor 2.

	WARNING
	The application cannot detect a broken wire to the analog input for the second sash. An external sash aggregating device should be used to calculate the face area for all fume hoods with more than one sash.

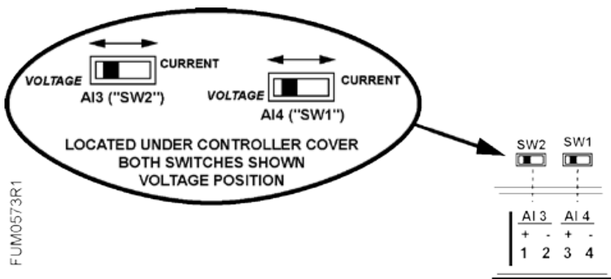
	WARNING
	Must use external 10 Vdc power supply. Do not power AI from an onboard AO that is forced to 10 volts.



Wiring for AI with a 4 to 20 mA Sensor.

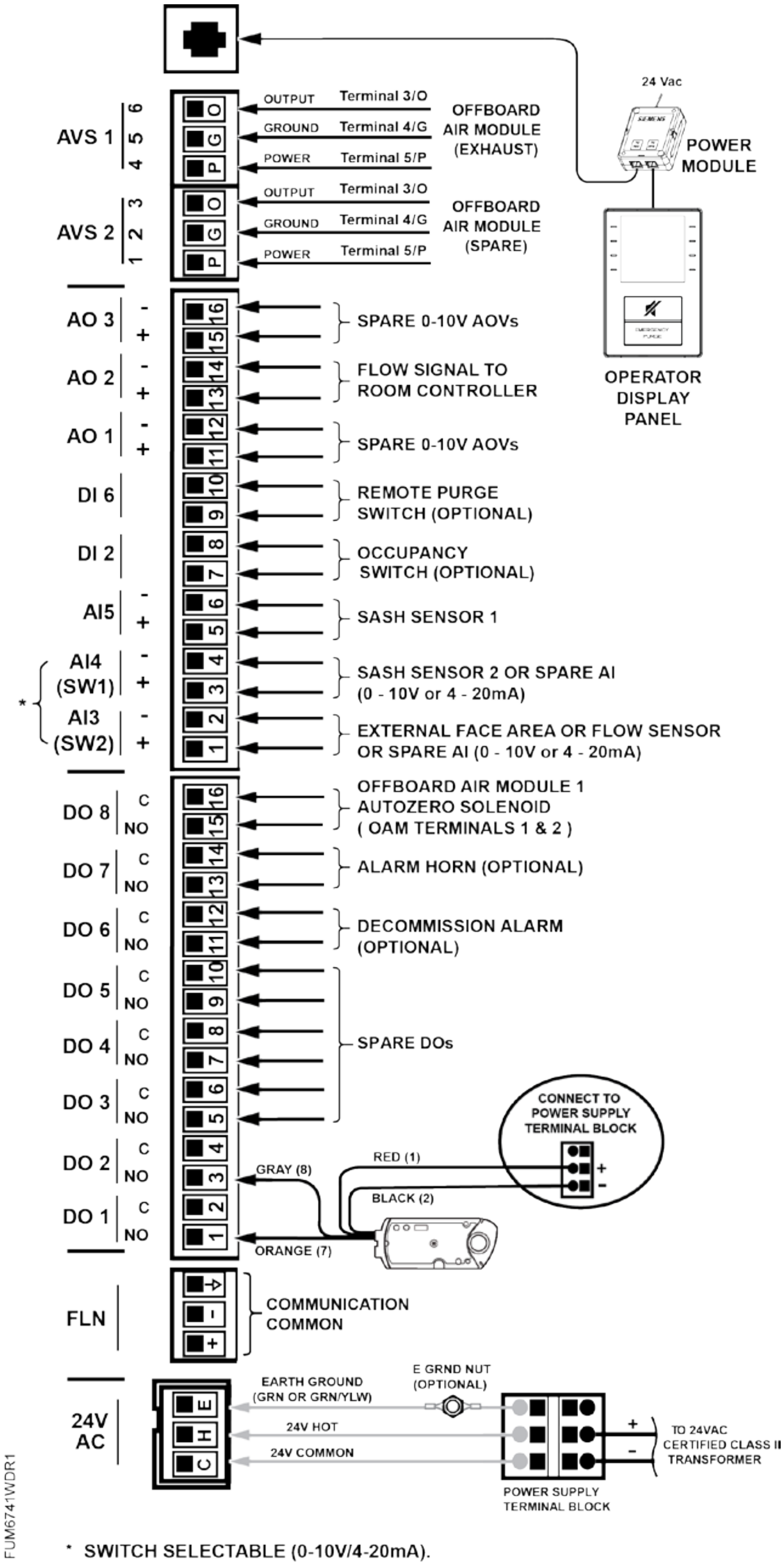
	⚠ CAUTION
	Each 4-20 mA sensor requires a SEPARATE dedicated power limited 24 Vdc power supply. DO NOT use the same transformer to power both the sensor and the controller.

NOTE:
If the voltage/current switch is set to current and a 4 to 20 mA sensor is connected to an AI, then special wiring requirements must be followed.



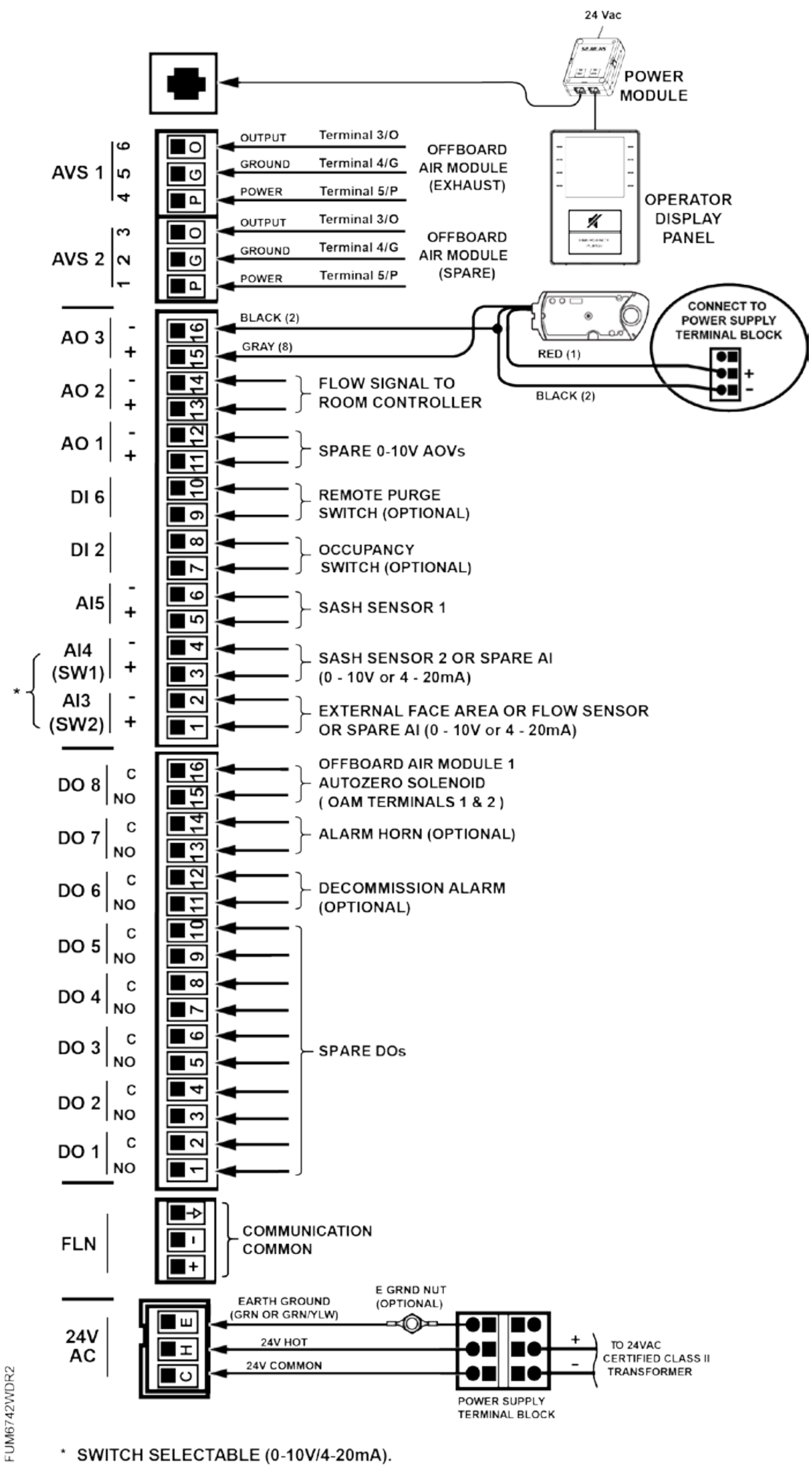
NOTE:
The controller's DOs control 24 Vac loads only. The maximum rating is 12 VA for each DO. An external interposing relay is required for any of the following:

- VA requirements higher than the maximum
- 110 or 220 Vac requirements
- DC power requirements
- Separate transformers used to power the load
(for example, part number 540-147, Terminal Equipment Controller Relay Module)



* SWITCH SELECTABLE (0-10V/4-20mA).

Application 6741 Wiring Diagram.



Application 6742 Wiring Diagram.

Point Database Application 6741

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	--	0-255	--	--
AO	2	APPLICATION	6700	--	0-32767	--	--
AO	{04}	FACE VEL	0 (0.0)	FPM (MPS)	0-4095	--	--
BO	{05}	LOW ALM	OFF	--	Binary	ON	OFF
BO	{06}	HIGH ALM	OFF	--	Binary	ON	OFF
BO	{07}	EMER ALM	OFF	--	Binary	ON	OFF
BO	{08}	GEN FAILURE	OFF	--	Binary	ON	OFF
AO	10	HI ALM LMT	150	PCT	0-255	--	--
AO	11	HI WARN LMT	135	PCT	0-255	--	--
AO	12	LOW WARN LMT	85	PCT	0-255	--	--
AO	13	LOW ALM LMT	70	PCT	0-255	--	--
AO	14	EMER TIMER	300	SEC	0-1023	--	--
AO	15	EMER STPT	150	PCT	0-255	--	--
BO	{16}	LOW WARN	OFF	--	Binary	ON	OFF
BO	{17}	HIGH WARN	OFF	--	Binary	ON	OFF
AO	18	ALARM TIME	5	SEC	0-1023	--	--
BO	{19}	ALM AKNLG	OFF	--	Binary	ON	OFF
BO	{20}	OCC.UNOCC	OCC	--	Binary	UNOCC	OCC
AO	{21}	STARTUP MODE	3	--	0-255	--	--
BO	{22}	LEFT SWITCH	OFF	--	Binary	ON	OFF
BO	{23}	RIGHT SWITCH	OFF	--	Binary	ON	OFF
BO	{24}	ATTN.UNATTN	ATTN	--	Binary	UNATTN	ATTN
AO	25	AT ALRT AREA	49.9999970198 (4.64515183)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	26	UN ALRT AREA	4.999999702 (0.46451518)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	27	OPEN TIME	300	SEC	0-1023	--	--
BO	28	SASH TONE	OFF	--	Binary	ON	OFF
BO	{30}	SASH OP ALRT	OFF	--	Binary	ON	OFF
AI	{31}	EXH VOL	0 (0.0)	CFM (LPS)	0-32764	--	--
AO	32	FLOW COEF	0.73	--	0-2.55	--	--
AO	33	DUCT AREA	0.55 (0.051106)	SQ. FT (SQ M)	0-6.375	--	--

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	34	TRANS RANGE	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
AO	35	LINEAR FL RG	0 (0.0)	CFM (LPS)	0-32764	--	--
AI	{36}	AVS2 PRESS	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
BI	{37}	DI 2	OFF	--	Binary	ON	OFF
BI	{38}	DI 6	OFF	--	Binary	ON	OFF
AO	{39}	AO 1	0	VOLTS	0-10.23	--	--
AO	{40}	AO 3	0	VOLTS	0-10.23	--	--
BO	{41}	EXTN DO1	HOLD	--	Binary	EXTN	HOLD
BO	{42}	RETC DO2	RETC	--	Binary	HOLD	RETC
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}	DECOM DO6	OFF	--	Binary	ON	OFF
BO	{47}	ALARM DO7	OFF	--	Binary	ON	OFF
BO	{48}	AUTOZERO DO8	OFF	--	Binary	ON	OFF
AI	{49}	AI 3	0	VOLTS	0-10.23	--	--
AI	{50}	AI 4	0	VOLTS	0-32.767	--	--
AI	{51}	AI 5	0	KOHM	0-327.67	--	--
AO	{52}	VERT SASH1	0.0 (0.0)	INCHES (CM)	0-16383.5	--	--
AO	{53}	VERT SASH2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	{54}	FACE AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	{55}	CAL SASH POS	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
BO	{56}	CAL SASH LOC	MIN	--	Binary	MAX	MIN
AO	{57}	CAL SASH NUM	0	--	0-255	--	--
AO	{58}	DMPR CMD	-100	PCT	-100-155	--	--
BO	59	INVERT DO2	YES	--	Binary	YES	NO
BO	60	AVS FAILMODE	OPEN	--	Binary	OPEN	HOLD
AO	61	EXH P GAIN	0.04	--	0-4.095	--	--
AO	62	EXH I GAIN	0	--	0-4.095	--	--
AO	63	EXH D GAIN	0	--	0-4.095	--	--
AO	64	FIXED AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	65	VERT WIDTH1	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	66	VERT WIDTH2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	67	VSASH HGHT1	0.0 (0.0)	INCHES (CM)	0-255.5	--	--

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	68	VSASH HGHT2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	69	TRACK HEIGHT	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	70	BYPASS HGHT	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	{71}	BYPASS OPEN	100	PCT	0-255	--	--
AO	72	FAIL AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	{73}	EXTERNAL A	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	74	MAX EXT AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	75	MIN EXTVOLTS	1	VOLTS	0-2.55	--	--
AO	{80}	EXH MAX	3500 (1651.65)	CFM (LPS)	0-16380	--	--
AO	{81}	EXH MIN	192 (90.6048)	CFM (LPS)	0-16380	--	--
AO	{82}	EXH STPT	0 (0.0)	CFM (LPS)	0-16380	--	--
AO	{83}	FVEL STPT	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	84	OCC FV STPT	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	85	UNOC FV STPT	90 (0.4572)	FPM (MPS)	0-4095	--	--
AO	86	OCC LOW FV	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	87	OCC HIGH FV	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	88	OCC DELAY	30	SEC	0-1023	--	--
AO	{89}	EXH SIG AO2	0	VOLTS	0-10.23	--	--
AO	90	AO2 RANGE	0 (0.0)	CFM (LPS)	0-16380	--	--
AO	91	AO2 DEADBAND	5.2	PCT	0-102	--	--
AO	92	AO2 V MIN	1	VOLTS	0-10.23	--	--
BO	{94}	CAL AIR	NO	--	Binary	YES	NO
AO	95	CAL SETUP	4	--	0-255	--	--
AO	96	CAL TIMER	12	HRS	0-255	--	--
AI	{97}	AVS1 PRESS	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
AO	98	LOOP TIME	0.1	SEC	0-25.5	--	--
AO	{99}	ERROR STATUS	0	--	0-255	--	--
AO	106	DISPLAY WT	100	PCT	0-102	--	--
AO	107	DISPLAY RES	5 (0.0254)	FPM (MPS)	0-4095	--	--
BO	108	BLANK DSPLY	OFF	--	Binary	ON	OFF
BO	109	LAMP TEST	OFF	--	Binary	ON	OFF
BO	110	ENG UNITS	ENG	--	Binary	SI	ENG
AO	121	HI LIMIT	1	--	0-2.55	--	--

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	122	LO LIMIT	1	--	0-2.55	--	--
BO	123	EMER DI6	OFF	--	Binary	ON	OFF
AO	{126}	AVE FACE VEL	0 (0.0)	FPM (MPS)	0-4095	--	--
BO	{127}	PPCL STATE	EMPTY	--	Binary	LOADED	EMPTY

a) Points not listed are not used in this application.

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.

Point Database Application 6742

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	1	CTLR ADDRESS	99	--	0-255	--	--
AO	2	APPLICATION	6700	--	0-32767	--	--
AO	{04}	FACE VEL	0 (0.0)	FPM (MPS)	0-4095	--	--
BO	{05}	LOW ALM	OFF	--	Binary	ON	OFF
BO	{06}	HIGH ALM	OFF	--	Binary	ON	OFF
BO	{07}	EMER ALM	OFF	--	Binary	ON	OFF
BO	{08}	GEN FAILURE	OFF	--	Binary	ON	OFF
AO	10	HI ALM LMT	150	PCT	0-255	--	--
AO	11	HI WARN LMT	135	PCT	0-255	--	--
AO	12	LOW WARN LMT	85	PCT	0-255	--	--
AO	13	LOW ALM LMT	70	PCT	0-255	--	--
AO	14	EMER TIMER	300	SEC	0-1023	--	--
AO	15	EMER STPT	150	PCT	0-255	--	--
BO	{16}	LOW WARN	OFF	--	Binary	ON	OFF
BO	{17}	HIGH WARN	OFF	--	Binary	ON	OFF
AO	18	ALARM TIME	5	SEC	0-1023	--	--
BO	{19}	ALM AKNLG	OFF	--	Binary	ON	OFF
BO	{20}	OCC.UNOCC	OCC	--	Binary	UNOCC	OCC
AO	{21}	STARTUP MODE	3	--	0-255	--	--
BO	{22}	LEFT SWITCH	OFF	--	Binary	ON	OFF
BO	{23}	RIGHT SWITCH	OFF	--	Binary	ON	OFF
BO	{24}	ATTN.UNATTN	ATTN	--	Binary	UNATTN	ATTN
AO	25	AT ALRT AREA	49.9999970198 (4.64515183)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	26	UN ALRT AREA	4.999999702 (0.46451518)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	27	OPEN TIME	300	SEC	0-1023	--	--
BO	28	SASH TONE	OFF	--	Binary	ON	OFF
BO	{30}	SASH OP ALRT	OFF	--	Binary	ON	OFF
AI	{31}	EXH VOL	0 (0.0)	CFM (LPS)	0-32764	--	--
AO	32	FLOW COEF	0.73	--	0-2.55	--	--
AO	33	DUCT AREA	0.55 (0.051106)	SQ. FT (SQ M)	0-6.375	--	--

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	34	TRANS RANGE	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
AO	35	LINEAR FL RG	0 (0.0)	CFM (LPS)	0-32764	--	--
AI	{36}	AVS2 PRESS	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
BI	{37}	DI 2	OFF	--	Binary	ON	OFF
BI	{38}	DI 6	OFF	--	Binary	ON	OFF
AO	{39}	AO 1	0	VOLTS	0-10.23	--	--
AO	{40}	EXH AO3	0	VOLTS	0-10.23	--	--
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}	DECOM DO6	OFF	--	Binary	ON	OFF
BO	{47}	ALARM DO7	OFF	--	Binary	ON	OFF
BO	{48}	AUTOZERO DO8	OFF	--	Binary	ON	OFF
AI	{49}	AI 3	0	VOLTS	0-10.23	--	--
AI	{50}	AI 4	0	VOLTS	0-32.767	--	--
AI	{51}	AI 5	0	KOHM	0-327.67	--	--
AO	{52}	VERT SASH1	0.0 (0.0)	INCHES (CM)	0-16383.5	--	--
AO	{53}	VERT SASH2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	{54}	FACE AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	{55}	CAL SASH POS	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
BO	{56}	CAL SASH LOC	MIN	--	Binary	MAX	MIN
AO	{57}	CAL SASH NUM	0	--	0-255	--	--
AO	{58}	DMPR CMD	-100	PCT	-100-155	--	--
BO	60	AVS FAILMODE	OPEN	--	Binary	OPEN	HOLD
AO	61	EXH P GAIN	0.04	--	0-4.095	--	--
AO	62	EXH I GAIN	0	--	0-4.095	--	--
AO	63	EXH D GAIN	0	--	0-4.095	--	--
AO	64	FIXED AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	65	VERT WIDTH1	0.0 (0.0)	INCHES	0-255.5	--	--

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
				(CM)			
AO	66	VERT WIDTH2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	67	VSASH HGHT1	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	68	VSASH HGHT2	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	69	TRACK HEIGHT	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	70	BYPASS HGHT	0.0 (0.0)	INCHES (CM)	0-255.5	--	--
AO	{71}	BYPASS OPEN	100	PCT	0-255	--	--
AO	72	FAIL AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	{73}	EXTERNAL A	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	74	MAX EXT AREA	0.0 (0.0)	SQ. FT (SQ M)	0-113.774298274	--	--
AO	75	MIN EXTVOLTS	1	VOLTS	0-2.55	--	--
BO	{78}	CAL EXH VLV	NO	--	Binary	YES	NO
BO	79	EXH VLV STAT	NOTCAL	--	Binary	NOTCAL	CAL OK
AO	{80}	EXH MAX	3500 (1651.65)	CFM (LPS)	0-16380	--	--
AO	{81}	EXH MIN	192 (90.6048)	CFM (LPS)	0-16380	--	--
AO	{82}	EXH STPT	0 (0.0)	CFM (LPS)	0-16380	--	--
AO	{83}	FVEL STPT	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	84	OCC FV STPT	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	85	UNOC FV STPT	90 (0.4572)	FPM (MPS)	0-4095	--	--
AO	86	OCC LOW FV	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	87	OCC HIGH FV	100 (0.508)	FPM (MPS)	0-4095	--	--
AO	88	OCC DELAY	30	SEC	0-1023	--	--
AO	{89}	EXH SIG AO2	0	VOLTS	0-10.23	--	--
AO	90	AO2 RANGE	0 (0.0)	CFM (LPS)	0-16380	--	--
AO	91	AO2 DEADBAND	5.2	PCT	0-102	--	--
AO	92	AO2 V MIN	1	VOLTS	0-10.23	--	--
BO	{94}	CAL AIR	NO	--	Binary	YES	NO

Object Type	Object Instance (Point Number) a) b)	Object Name (Descriptor)	Factory Default (SI Units) c)	Eng Units (SI Units) c)	Range	Active Text	Inactive Text
AO	95	CAL SETUP	4	--	0-255	--	--
AO	96	CAL TIMER	12	HRS	0-255	--	--
AI	{97}	AVS1 PRESS	0.0 (0.0)	IN H2O (K PA)	0-3.2767	--	--
AO	98	LOOP TIME	0.1	SEC	0-25.5	--	--
AO	{99}	ERROR STATUS	0	--	0-255	--	--
AO	106	DISPLAY WT	100	PCT	0-102	--	--
AO	107	DISPLAY RES	5 (0.0254)	FPM (MPS)	0-4095	--	--
BO	108	BLANK DSPLY	OFF	--	Binary	ON	OFF
BO	109	LAMP TEST	OFF	--	Binary	ON	OFF
BO	110	ENG UNITS	ENG	--	Binary	SI	ENG
AO	{118}	TABLE VOLTS	0	VOLTS	0-10.23	--	--
AO	{119}	TABLE FLOW	0 (0.0)	CFM (LPS)	0-32764	--	--
AO	{120}	V TABLE PT	0	--	0-255	--	--
AO	121	HI LIMIT	1	--	0-2.55	--	--
AO	122	LO LIMIT	1	--	0-2.55	--	--
BO	123	EMER DI6	OFF	--	Binary	ON	OFF
BO	124	OPEN LOOP	NO	--	Binary	YES	NO
AO	{126}	AVE FACE VEL	0 (0.0)	FPM (MPS)	0-4095	--	--
BO	{127}	PPCL STATE	EMPTY	--	Binary	LOADED	EMPTY

a) Points not listed are not used in this application.

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.

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