

Fume Hood Controller Variable Air Volume (VAV)



Figure 1. Fume Hood Controller (SMT board), Enclosure and Operator Display Panel

The Fume Hood Controller is an integral part of the APOGEE®™ Automation System. The controller is a proven, patented stand-alone Direct Digital Control (DDC) system for Variable Air Volume (VAV) control of laboratory fume hoods. The controller maintains constant face velocity as the fume hood sash is raised and lowered. An Operator Display Panel provides the fume hood user with the face velocity readout, operating status of the hood, alarm horn, and an emergency purge function. The Fume Hood Controller operates independently and extends the benefits of DDC to an entire facility's HVAC equipment.

Features

Controller

- Constant face velocity fume hood operation.
- Maintains programmed minimum exhaust flow.
- Fully integrates with the APOGEE Automation System controllers and software.
- True exhaust flow measurement used to position the flow control device.
- Modular components, easy to install and service.
- Program and calibration parameters are user defined or modified via the Laptop Terminal.

- PID closed loop control for all control devices.
- Electrically Erasable Programmable Read Only Memory (EEPROM) memory for setpoint and control parameters—no battery needed.
- Supports multiple hood and sash configurations.
- Supports damper, VFD and Venturi Air Valve airflow control devices.
- Surface Mount Technology for low electrical noise.

Operator Display Panel

- Continuous display of hood operating parameters using a large alpha-numeric display,
- Colored hood status lights for normal (green), marginal (yellow), and alarm (red) conditions,
- Purge push-button for activation of emergency operation mode,
- Alarm horn for high and low face velocity and emergency purge indication
- Easy to install and connect to the controller via a single cable and telephone type connectors.

Applications

Operating independently, or integrated with the APOGEE Automation System, the Fume Hood Controller may be configured for the following types of laboratory fume hood applications:

- Single/Multi-Vertical Sash, Horizontal Sash and Combination Sash Bench top and Distillation type Fume Hoods.
- Vertical and Horizontal Sash Walk-in Hoods,
- Damper or Venturi Air Valve control for manifold exhaust systems or VFD for single hood fans.
- Electronic or pneumatic damper actuators.

Description

The VAV Fume Hood Controller consists of the following components, which are required for each fume hood:

- Fume Hood Controller
- Operator Display Panel and Cable
- Sash Sensor Kits (Vertical/Horizontal)
- Airflow Measurement and Control Options

For Pneumatic Damper applications you will need the Pneumatic Fume Hood Exhaust Terminal, which includes:

- #3 Pneumatic Actuator
- LAB AO-P Module.
- Velocity Pressure Transmitter
- Orifice Plate Airflow Sensor
- Single Blade Damper

For Electronic Actuation applications you will need the Electronic Fume Hood Exhaust Terminal which includes:

- Lab Electronic Damper Actuator Assembly
- Velocity Pressure Transmitter
- Orifice Plate Airflow Sensor
- Single Blade Damper or Venturi Air Valve Controller

The Fume Hood Controller consists of a control circuit board and metal enclosure. The enclosure may be mounted directly on the exterior of the fume hood or remotely on the laboratory wall or ceiling. The controller circuit board is snap mounted inside the enclosure and provides all wiring terminations for input and output points, 24 Vac power, FLN trunk, and the Operator Display Panel. A spare digital input and output are provided for user applications such as auxiliary sensors and alarms.

The control algorithms are pre-programmed. The Fume Hood Controller is ready to begin operation after selecting the proper application number defining the network address, and appropriate setpoint and control parameters using the laptop terminal. User definable parameters include:

- Face Velocity Setpoint
- Alarm and Warning Limits
- Minimum Exhaust Flow
- Maximum Exhaust Flow
- Hood Sash Dimensions
- Control PID Gains
- Display Resolution
- Alarm Delay
- Emergency Setpoint

- Sash Open Area "Alert" for both Attended and Unattended conditions

The controller uses the measured sash position and the exhaust airflow to calculate the fume hood face velocity using the equation:

$$\text{Face Velocity} = \frac{\text{Exhaust CFM}}{\text{Hood Open Area}^*}$$

*Includes the sash opening, air foil and bypass area

The face velocity is compared to the face velocity setpoint to calculate the required exhaust flow. The controller modulates the damper using a floating output to maintain the required exhaust airflow. VFD and Venturi Air Valve applications include use of calibration table and an analog output to take advantage of the special flow control characteristics of these devices. The fume hood controller performs this control algorithm up to 10 times per second to ensure maximum speed of response to changes in hood sash upsets. Concurrently, the controller continually monitors and updates all fume hood points including:

- Face Velocity
- High/Low Alarms
- Exhaust Airflow
- Sash Position

Controller Specifications

Power Requirements	
Operating Range	18-30 Vac, 50/60 Hz
Power Consumption	4.0 VA (nominal) @ 24 Vac plus actuator loads
Inputs	
Analog	1 Velocity Pressure Sensor (4-20 mA) 1 Spare (0-10 Vdc)
Digital	5 Sash position sensors 1 dry contact
Outputs	
Analog (0-10 Vdc)	1 Exhaust Airflow Signal 1 Modulating for use with Venturi or VFD, or Spare
Digital (24 Vac optically isolated solid state switches @ 0.5A)	1 Damper Actuator (2 DOs) 1 Spare
Package	
Dimensions	6.5" H x 10.5" W x 3.0" D (165 mm x 267 mm x 67 mm)
Weight	Approx. 3 lb. (1.35 kg)
Environmental	
Storage Temperature	-40°F to 167°F (-40°F to 75°C)
Operating Temperature	32°F to 122°F (0°C to 50°C)
Operating Humidity	20% to 80% RH non-condensing

Agency Listings	UL 916, PAZX & CSA Certified FCC, Class B, Subpart J CE, C-tick	
Communications		
Local Area Network (FLN trunk)	RS-485	4800 baud
Portable Operator's Terminal	RS-232	1200 baud
Control Performance		
Speed of Response	<1 second to flow change	
Airflow Measurement		
Range		
Accuracy*	0 – 2.5" wc ±3.0%	

*Accuracy is shown in percent of Actual Airflow and includes differential pressure transmitter accuracy.

Operator Display Panel

The Fume Hood Controller Operator Display Panel (ODP) includes a custom designed package for visual and audible indication of fume hood operating conditions and push-buttons for emergency mode operation, alarm silence and user defined auxiliary functions. The panel is mounted on the fume hood in an easy to access location and will fit over an unused hood electrical box or over pre-drilled holes. RJ-11 type connectors provide termination to the Fume Hood Controller and for the Portable Operator's Terminal. One Operator Display Panel is supported per Fume Hood Controller.

The Operator Display Panel supports the following functions:

- Digital display of face velocity in FPM (MPS),
- Green, yellow and red status lights,
- Emergency purge push button,
- Alarm horn with silence push button, and
- Two auxiliary push buttons.

The face velocity display also indicates high and low alarm conditions, emergency purge activation, and diagnostic failure mode conditions when the controller is in the minimum flow mode. Face velocity FPM (MPS) display may be blanked as an option for applications where the user does not desire the face velocity reading.

Operator Display Panel Specifications

Face Velocity Display Range	0 fpm to 255 fpm (0.0 MPS to 1.3 MPS)
Display Resolution	1 fpm adjustable up to 255 fpm
Push-Buttons Switch inputs	1 Emergency Purge 1 Horn Silence 2 Momentary Auxiliary
Alarm Horn	85 dB @ 4" (10 cm)
Dimensions	5.5" H x 3.125" W x 1.5" D (140 mm x 80 mm x 39 mm)
Weight	8 oz. (0.2 kg)

Fume Hood Controller Communication

Compatible with the Modular Building Controller (MBC), Mechanical Equipment Controller (MEC) and FLN Controller, up to 32 Fume Hood Controllers can be connected to each one of a field panel's three FLN Trunks, for a total of 96 per field panel.

Operators can communicate with the Fume Hood Controller from any field panel on the system network. The APOGEE Automation System network does not require additional hardware to connect controllers. When Fume Hood Controllers are networked to an MBC, MEC or FLN Controller, all the APOGEE Automation System features available can utilize the Fume Hood Controller.

Portable Operator's Terminal

The laptop computer serving as the Portable Operator's Terminal can communicate with the Fume Hood Controller. The terminal connects to the controller via a plug-in jack on the ODP. The terminal can be used to remotely adjust setpoints, to troubleshoot and start up the system. The terminal uses full English language prompting for all functions, eliminating the need to remember coded commands.

Ordering Information

Description	Part Number	
Fume Hood Controller – Universal Configuration, Different Horizontal Sash Widths	546-00705	(Board Only)
• Application 941 for use with Damper	546-00705E	(With enclosure)
• Application 942 for use with Venturi Air Valve or VFD		
4:8 Sash Sensor MUX Board	537-460	
Operator Display Panel (consisting of two parts)		
Operator Display Panel, Panel	537-720A	
Operator Display Panel, Mounting Kit	537-720B	
Operator Display Cable 15'	537-772	
Operator Display Cable 25'	537-773	
Operator Display Cable 50'	537-774	
GNP Fast Acting Lab Electronic Actuator	GNP191.1P	
Lab Pneumatic Actuator	546-00020	
Lab AO-P Module (for pneumatic actuation)	546-00090	
UNITRAK™ Sash Sensor Technical Specification Sheet	149-269P25	
Venturi Air Valve Technical Specification Sheet	149-425P25	
Laboratory Exhaust Terminal Technical Specification Sheet	149-320P25	

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