FVC2600

SASH SENSING VAV FUME HOOD SYSTEM

MODEL 2600: Variable volume control based on sash position utilizes microprocessor based electronics and linear air control valve to monitor and control fume hood face velocity.

- **Measures and maintains fume hood exhaust volume**
- **Ensures operator safety**
- **Conserves energy**
- **Improves fume hood performance**
- **User selectable control features**
- **Communicates with Building Automation System**

General Description

The Model **FVC2600** provides variable volume control based on sash position. Tek-Air's **VorTek Airflow Traverse Probes** provide volumetric measurement to provide airflow control.

The basic system consists of the sash position sensors and transmitter, controller, **VorTek** duct airflow sensor, display unit, electronic to pneumatic converter, and **PRD** exhaust air control valve (see figure 1). The controller is typically wall-mounted above the fume hood. Sash position sensor strips are mounted inside the hood in close proximity to the sash. A factory-assembled **PRD** airflow control valve with **Vortek** probe, mounted in the duct, provides airflow control by measuring and modulating the volume of air being exhausted. A hand-held configuration tool is used to configure the controller operation.

True Distributed Control

The key word in industrial control is "distributed". The **FVC2600** is a fully distributed microprocessor-based controller operating independently of other airflow and temperature controls in the lab. Each system is dedicated to the control of a single hood, providing control distribution for maximum operator safety.

Speed

While containment of gases in the fume hood is the chief goal of any fume hood control system, Tek-Air recognizes the need for fast, accurate response to changes in sash position and duct static pressure. The **FVC2600** scans all inputs, performs control equations, and updates all output signals 5 times per second to eliminate control lag. Controller response to movement of the sash is virtually instantaneous. In one second from when the sash comes to rest, the airflow is modulated to within 90% of required airflow for the new sash position. In 3 seconds the airflow is stabilized within +/- 5% of the target airflow. In that 3 second period the **FVC2600** controller updates the valve position more than 10 times. This speed of response has been proven to be much faster than that required to maintain containment on a well-performing fume hood.

Application

Operators and planners associated with laboratory facilities must focus on two concerns unique to that environment: fume hood operator safety and the high energy cost associated with discharging large volumes of exhaust air from fume hoods. Tek-Air Systems addresses these concerns with the **FVC2600**, representing the latest in fume hood control technology.

The **FVC2600** is a high performance controller capable of instant response to changes in sash opening and air handling systems. The **FVC2600** is a true "closed loop" control system, utilizing actual fume hood exhaust airflow measurement with reset based on sash position measurement to provide speed and accuracy, which are key to ensuring worker safety and energy savings.

Safety

The **FVC2600** provides both audible and visual alarms. Because tests have shown that toxic fumes can only be contained when hood control response is immediate, the **FVC2600** has been designed to re-establish face velocity to OSHA limits within one to three seconds.

Energy Conservation

As the **FVC2600** resets air volume in response to sash position changes, energy conservation is maximized by sash closure. Because the **FVC2600** is capable of communicating digitally with central building monitoring systems, users who leave their sashes open can be identified. Further energy savings are possible with a nighttime face velocity setback feature using a communications link or by adding a simple dry contact into the controller digital input.

Tek-Air Systems, Inc.
41 Eagle Road • Danbury, CT 06810 • (203) 791-1400 • FAX: (203) 798-6534 • SALES FAX: (203) 730-9564 • www.tek-air.com

Fume Hood Controller FVC2600

Principle of Operation

The **FVC2600** consists of the following basic elements: (see Fig. 1)

1. Sash position sensors and transmitter
2. Fume hood display
3. Controller
4. Electronic to pneumatic converter or actuator
5. Exhaust air control valve with VorTek airflow probes
6. Configuration tool (not shown)

In simple terms, the **VorTek** airflow sensor in the fume hood exhaust duct measures and reports the airflow volume to the **FVC2600** controller. The volume setpoint is set for both "occupied" and "unoccupied" status via a hand-held configuration tool. The appropriate setpoint is then selected, via a digital input, by the Building Automation System, a time clock lock or other switching system. The controller then modulates the exhaust valve, via the Electronic-to-Pneumatic Converter to maintain the proper airflow rate.

To understand the **FVC2600**, one must look in greater detail to each of the elements of the system.

The Sash Position Sensors (see figure 1)

Variable Volume Control Based on Sash Position
For safety reasons, many facilities require sash position monitoring and alarm capabilities. Because of its high speed-of-response, sash sensing provides safety protection for laboratory fume hood operators by minimizing both overshoot and undershoot of the exhaust air control valve.

Tek-Air's sash sensing system consists of the **SPT2600 Transmitter**, and both vertical and horizontal sash position sensors, as required for each fume hood type.

Vertical sensing is accomplished by a potentiometer with spring return that is rotated by a connecting cable attached to the sash, counterweight, or sash cable. The assembly can typically be mounted on top of the hood, outside the airstream, where it is not visible and is out of reach. The sash transmitter can accept up tp six vertical sash sensors.

Horizontal sensing utilizes the "absolute position" sensing method. Each sash pane is equipped with a small magnet. A sensing strip is mounted to the sash frame and consists of a series of magnetically sensitive relays at one inch increments along the width of the strip. Each relay reports a position along the width of the sash. Where a sash magnet comes in proximity to the strip, the relay closest to the magnet is actuated, sending a binary position signal to a dedicated microprocessor serving the sensing strip. Using the location and width of each sash, the processor does the math to determine the open area of the horizontal sash panes. Each **SPT2600 Transmitter** receives signals from one horizontal sash sensing strip that is the full width of the hood opening, up to a 16' width. The strip can sense the position of any number of horizontal sashes. If sashes are not all equal in size on a given hood, consult factory for configuration of sensors. The transmitter outputs a 4-20 mA signal to the **FVC2600** controller to indicate sash position. The controller immediately modulates the air valve control signal to adjust the airflow volume to the appropriate value. It can also be configured to generate an alarm if the sash is left open past a pre-set limit for a pre-determined time period.

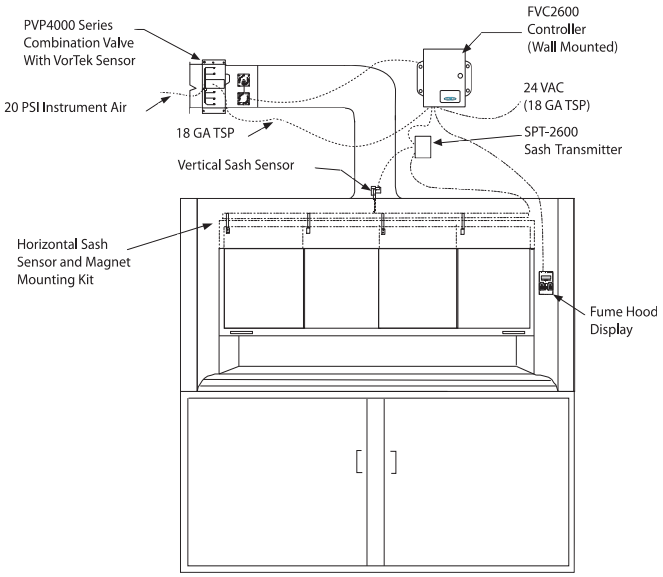


Figure 1 - Typical installation of FVC2600 with sash position sensing airflow control

The Fume Hood Display (see figures 1 & 2)

The **FVC2600** display is normally mounted on the left or right front panel of the fume hood where it can best aid the operator in the safe operation of the hood. The display mounts on a standard 2" x 4" switch box installed behind the front panel.

Simple Operation
The display window and associated audio and visual alarm indicators instantly advise the operator when the face velocity is not within the desired high or low setpoints. LEDs and simple push button controls are easy to read and simple to operate.

Normal conditions are indicated by an illuminated green LED and a 'norm' (normal) message displayed in the LCD window. Short periods of low face velocity, usually induced by moving the hood sash quickly, will cause the alarm indicator to blink and the digital display to show 'ALrt' (alert). If the alarm delay time is exceeded, the audible alarm will sound, the alarm LED will light, and 'Hi' or 'Lo' will be shown on the digital display, depending upon the alarm condition.

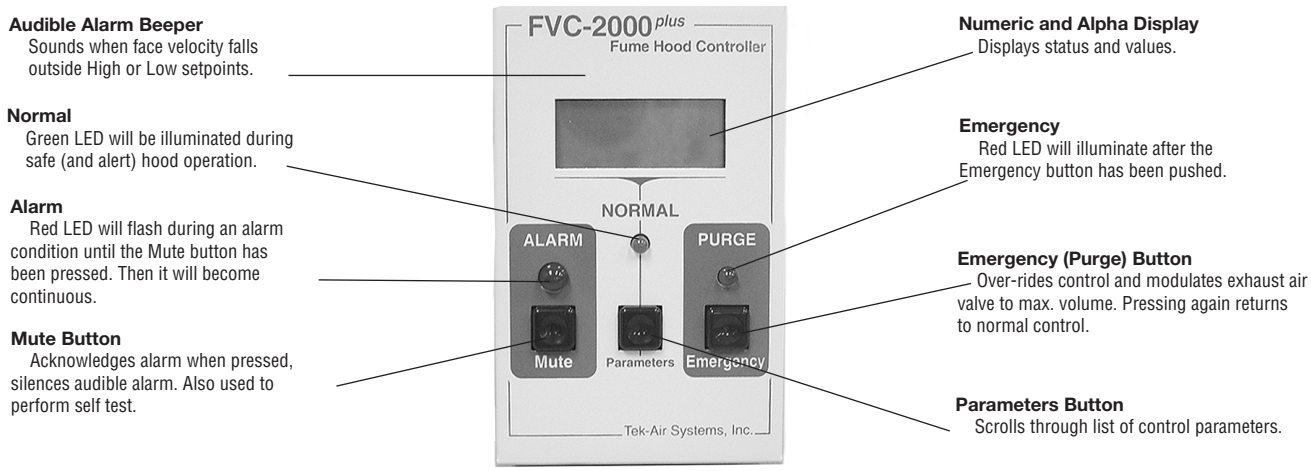
The display window also indicates the face velocity in feet per minute (FPM). Setpoints for control, low alarms, and high alarms can also be selected for display using the 'Parameter' scroll button. All readings and settings are available for operator review via the display and keypads.

Because accidents can occur within the hood, an emergency override button is provided on the display face. When pressed, automatic control of face velocity is suspended and the exhaust air valve is opened to provide for maximum exhaust volume, purging the hood.

Tek-Air Systems, Inc.
41 Eagle Road • Danbury, CT 06810 • (203) 791-1400 • FAX: (203) 798-6534 • SALES FAX: (203) 730-9564 • www.tek-air.com

Fume Hood Controller FVC2600

Figure 2 - Fume Hood Display Face



The Controller (see figures 1, 3, & 4)

Inputs

Using industry-standard modular plugs and cable, the **FVC2600** has a sash sensor input that allows interfacing with a variety of sensors designed for fume hood control. A direct input for the **VorTek Airflow Probes** enables the controller to measure and display exhaust volumes. Modular connection points are also provided for the configuration tool and the fume hood display.

Outputs

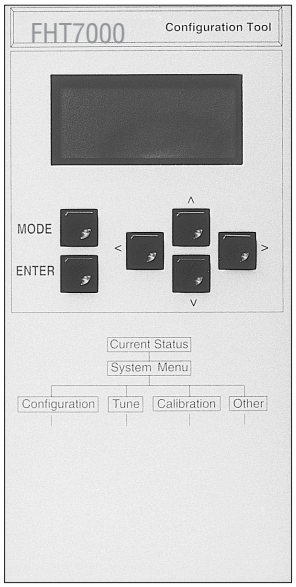
The **FVC2600** utilizes an industry standard 4-20 milliamp analog output signal for modulating the final control device. It is compatible with most variable frequency drives, electronic to pneumatic converters, and electronic actuators. The controller uses a relay dry contact for alarm output. Both visual and audible alarms are activated when the actual face velocity is not within the desired high and low setpoints.

The VorTek Airflow Probe (see figures 1 & 5)

A key feature that sets the **FVC2600 Fume Hood Control System** is active airflow control with direct fume hood exhaust duct airflow measurement. The device used for airflow measurement is the **VorTek Airflow Probe**, which senses air velocity in the duct using vortex shedding technology. The **VorTek** probe has a long history of successful use throughout the world, in critical airflow control applications and in airstreams that are corrosive and carry particulate matter. Such demanding applications do not adversely effect the performance of the **VorTek** probes.

The **VorTek** airflow measuring system consists of multi-sensor probes which are inserted in the ductwork between the fume hood and the air valve. **VorTek** sensing provides pulse type electronic out[ut signals which have a frequency that is directly proportional and linear to the airflow velocity. These digital pulses from each sensor are totalized in the **FVC2600** controller, The controller is designed with an input for the **VorTek** probe that provides direct digital handling of the signals, eliminating the need for analog-to digital conversion. By providing true velocity averaging, exhaust volume is accurately measured and the value can be viewed using the configuration tool or the FVC display. Exhaust volume control is maintained by actively measuring the volume and controlling the air valve to insure that the desired airflow volume, based on sash position, is provided.

FHT7000 Configuration Tool



Research facility managers have individual preferences regarding fume hood control features. For this reason, the **FHT7000** is designed to be user configurable. The user is able to modify the control mode, turn alarms off or on, adjust alarm setpoints, airflow and face velocity setpoints, and calibrate airflow and face velocity, to meet the ever changing needs of facility and staff. A password function is provided to protect against unauthorized tampering with the controller.

The **FHT7000 Configuration Tool** is a hand held device used to configure the operation of the fume hood controller. The tool is menu driven, and incorporates a 4-line, 16-character per line, LCD window. The user can easily connect the tool to the fume hood display or directly to the controller. By removing the display face panel. The user can access the clearly marked modular receptacle on the circuit board. On ARCnet equipped units, a receptacle is provided on the bottom exterior of the display enclosure.

Tek-Air Systems, Inc.
41 Eagle Road • Danbury, CT 06810 • (203) 791-1400 • FAX: (203) 798-6534 • SALES FAX: (203) 730-9564 • www.tek-air.com

Fume Hood Controller FVC2600

Setpoint and Configuration Adjustments Available:

Password	Exhaust Volume Calibration
Hi Face Velocity Setpoint, Alarm	Sash Type
Lo Face Velocity Setpoint, Alarm	Vert. Sash Dimension, Width
LoLo Face Velocity Setpoint	Vert. Sash Dimension, Height
Maximum Valve Opening	Horiz. Sash Dimension, Width
Minimum Valve Closure	Horiz. Sash Dimension, Height
Alarm Mute Control	Set Vert. Sash Open
Alarm Latching Configuration	Set Vert. Sash Closed
Remote Reset Selection	Set Horiz. Sash Open
Remote Emergency Selection	Set Horiz. Sash Closed
Minimum Exhaust CFM	Sash Output, Realtime
Maximum Exhaust CFM	Face Velocity Calibration

Communications

Dedicated Fume Hood Network

Each **FVC2600** controller is provided with a serial communications interface. This interface provides the ability to network up to 243 controllers to a central location. Information is available on the performance of each controller throughout the network.

For a comprehensive list of control parameters that are available for the transfer to the Building Management System via communications, refer to the **FVC2600 Installation and Operation Manual**. Face velocity, airflow and alarm status parameters are "write" variables. Setpoints for alarms, airflow, and face velocity are "read/write". This capability also allows for remote setpoint reset from the BMS.

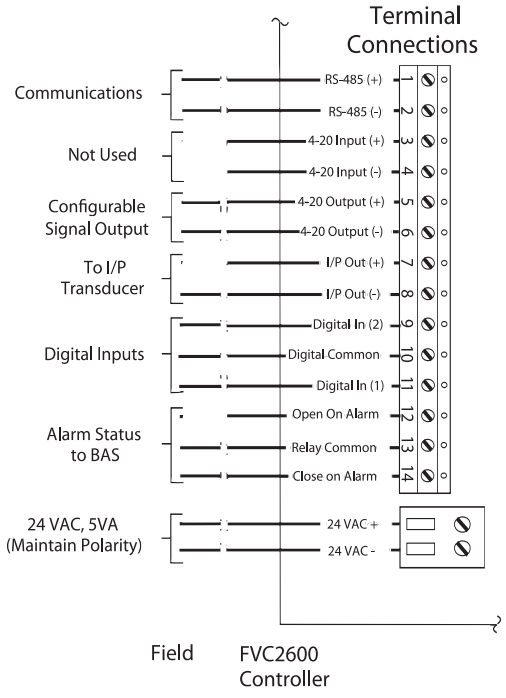


Figure 3 - Controller Connection Diagram

Specifications FVC2600

Power..... 24 VAC +/- 10%, 10 VA max.

Display
- LCD..... 4 1/2 Digit
- Dimensions..... 5 in. x 3.125 in. x 1.5 in.
- Keypads..... Mute, Parameters
  Emergency (purge)

LED Indicators
- Normal..... Green
- Alarm..... Red
- Emergency (purge)..... Red

Face Velocity
- Range..... 0 to 1000 fpm
- Resolution..... 5 fpm
- Accuracy..... +/- 5 fpm @ 100 fpm
- Low Alarm Setting..... 0 to 500 fpm
- High Alarm Setting..... 100 to 1000 cfm
- Alarm Delay..... Adjustable, 5 to 30 seconds

Airflow Volume
- Range..... 0 to 5000 cfm
- Resolution.....1 cfm
- Accuracy..... +/- 1.5% Rate +/- 0.5% FS

NOTE: Valve size will ultimately determine minimum fpm measurable.

Outputs
- Control..... 4-20 mA, 500 ohms max.
- Signal..... 4-20 mA, 500 ohms max.
  (options: Face Velocity, Volume)
- Alarm..... SPDT Relay, 0.5 amps max.

Communications..... RS-485, 2-wire
Tek-Air Open Protocol; JCI Metasys N2 @ 9600 bps
*ARCnet Protocol @ 625 kilobits/sec.

* NOTE: Due to high speed, network requires low cap 12.5pF, 24 AWG shield type CMP (UL) 75C equal to Windy City #042002.

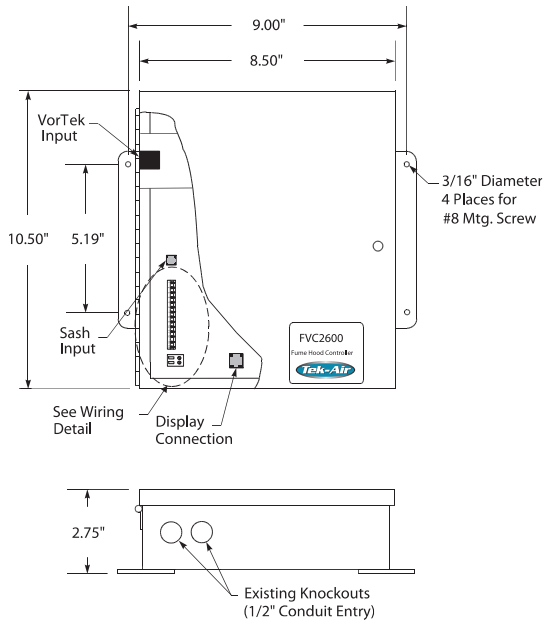


Figure 4 - Controller Mounting Detail

Tek-Air Systems, Inc.
41 Eagle Road • Danbury, CT 06810 • (203) 791-1400 • FAX: (203) 798-6534 • SALES FAX: (203) 730-9564 • www.tek-air.com

Fume Hood Controller FVC2600

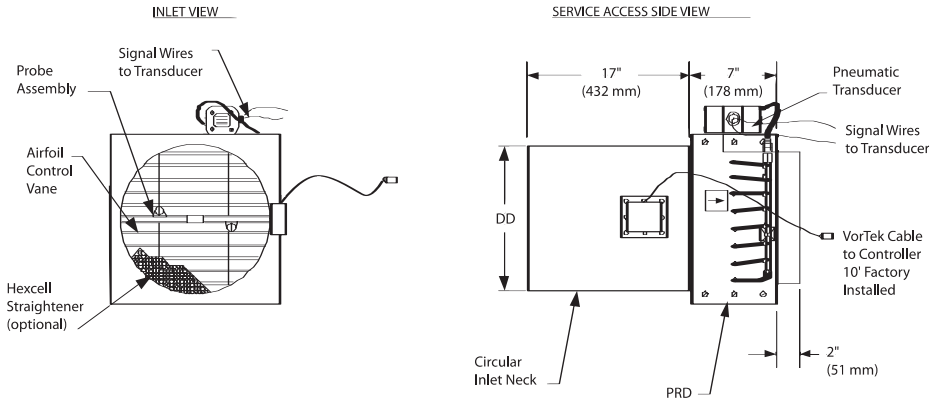


Figure 5 - PVP4000 PRD with Circular Inlet and Outlet, and VorTek VT4000 Sensor

FVC2600 Model Code

T - FVC26 [ ] [ ] – [ ] [ ]

Communications
- 1 - ARCnet (SmartLab)
- 2 - Open / N2

Vertical Sash Configuration
- 0 - No Vertical Sash
- 1 - 1 Vertical Sash
- 2 - 2 Vertical Sashes
- 3 - 3 Vertical Sashes
- 4 - 4 Vertical Sashes
- 5 - 5 Vertical Sashes
- 6 - 6 Vertical Sashes

Length of Horizontal Sensor Strip
- 00 - No Horizontal Sensor Strip
- 25 - 25 inches
- 33 - 33 inches
- 41 - 41 inches
- 49 - 49 inches
- 57 - 57 inches
- 65 - 65 inches
- 73 - 73 inches
- 81 - 81 inches
- 89 - 89 inches

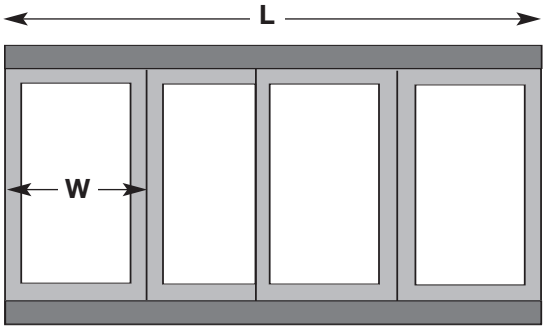
The **FVC2600** provides VAV control based on sash position and airflow exhaust volume measurement. The basic system consists of a controller, display, and sash position sensors. A **VorTek VT4000** airflow probe is also required and must be ordered separately. For fume hoods containing horizontal sash panels, magnets and mounting brackets are also required and must be ordered separately. You will need to provide the hood manufacturer, model #, quantity of panels and sash tracks to determine the magnet mounting requirements.

For combination type fume hoods, consult your local Tek-Air Regional Director before placing your order. Because combination type fume hood sashes are highly customized based on the end user specifications, it may be necessary to coordinate the mounting with the fume hood manufacturer.

To determine the length of the horizontal sash sensor strip required for your application, perform the following calculation and round UP to the closest size listed.

Length of Horizontal Strip = L - W + 2
L = Length of Horizontal Sash Opening in Inches
W = Width of On Panel in Inches

Example: L = 48 inches and W = 12.5 inches
Length of Strip Required = 48 - 12.5 + 2 = 37.5
Select 41 in Horizontal Sensor Strip



Tek-Air Systems Horizontal Sash Sensor

NOTE: The **FVC2600** Model Code includes "Standard" sash configurations only. Any non-standard configurations shall be handled as special orders. The descriptions below define what Tek-Air considers "Standard" sash configurations.

Standard Vertical Type Fume Hood Sash Configuration - For multiple vertical sashes, all sashes are assumed to be side-by-side and each sash is assumed to have the same dimensions. Maximum travel of sash from 100% open to 0% open is < 40".

Standard Horizontal Type Fume Hood Sash Configuration - Horizontal sash panels are assumed to have the same dimensions and there is a minimum of two moving panels.

Standard Combination Type Fume Hood Sash Configuration - The fume hood must contain only one vertical sash with horizontal panels contained within that vertical sash. Each horizontal panel is assumed to be the same dimension.

NOTE: Consult your local Tek-Air representative for further information.
(for your local representative listing please visit our web site at www.tek-air.com)
All specifications are subject to change without notice.

Tek-Air Systems, Inc.
41 Eagle Road • Danbury, CT 06810 • (203) 791-1400 • FAX: (203) 798-6534 • SALES FAX: (203) 730-9564 • www.tek-air.com