Flowsafe Stable Vortex II

Fume Hood

Installation Guide

LIT-12013642
July 2025

Introduction

Per UL61010A-1, Stable Vortex II™ Monitor must be installed to the following environmental conditions:

- Indoor use only
- Altitude maximum 6,500 feet (2000 meters)
- Maximum operating temperature of 40°F to 105°F (5°C to 40°C)
- Maximum Humidity of 80%
- Maximum voltage fluctuation of +/-10%
- Installation category II
- Pollution degree 2

Safety messages and general precautions

IMPORTANT: To reduce the risk of minor or moderate injury, read these instructions thoroughly and follow all cautions and notices included in all manuals that accompanied this product and any Fume Hood accessory units. For a list of additional safety measures, contact your laboratory health and safety officer.

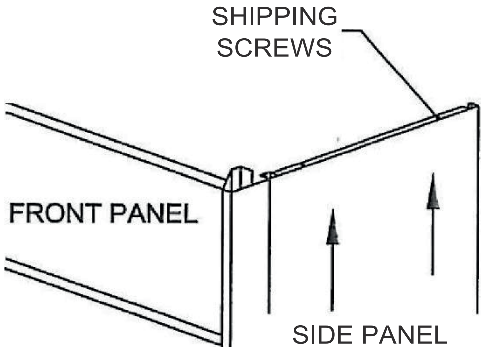
- This fume hood system should be used by personnel trained to work with this equipment.
- This hood is not designed for work with Perchloic Acid.
- Only specially designed laboratory fume hoods should be in use with nitric acid and radioactive work.
- The fume hood is not explosion proof and should not be used in an explosion proof room.
- Ensure you understand how the hood works, as well as your laboratory's action plan in event of a power failure or other emergency.
- Know the hazards of chemicals you are to work with; refer to the chemical's MSDS if unsure.
- Verify the hood exhaust is working and that the hood monitor device indicates a safe working condition (Green Light) before starting any work or operation within the fume hood.
- Make sure that the sash is open to the proper operating position, and stand behind the sash panel, reaching around the panel in slow, deliberate movements to conduct work.
- Never allow your head to enter the plane of the hood opening.
- Use appropriate eye protection and PPE for work to be performed.
- Do not attach anything to the back baffles, and ensure that nothing blocks the airflow through the baffles or through the baffle exhaust slots.
- Perform all work and keep all materials at least 6" away from the sash and opening.Elevate large objects at least 1" and equipment (e.g., a centrifuge) at least 2" off the base of the hood interior.
- Clean the hood interior regularly and check/inspect/maintain operation on a routine basis and recorded in a properly maintained log. (Note: OSHA recommends at least every three months and whenever a change to the operational characteristics of the ventilation devices is made).
- Promptly report any concerns. Remove the hood from service until corrected / repaired.
- When not working in the hood, close the sash. Never store chemicals inside the hood.
- Never permit the temperature of inside sash surface to reach or exceed 160°F, unless the sash material is designed to do so.
- Air Distribution Technologies, Inc shall not assume any liability for injuries or damage caused by not following steps outlined or described in this manual. Unauthorized modifications to Air Distribution Technologies, Inc products are prohibited for the following reasons:
  - May create hazards which could result in death, serious injury or equipment damage.
  - Will void product warranties.
  - May invalidate product regulatory certifications.
  - May violate OSHA standards.

Contents

Uncrating and installation

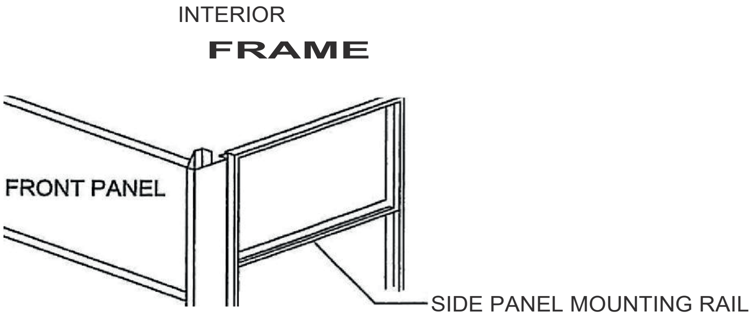
1. Remove plastic wrap.
2. Remove four screws (two each side) at top of hood side panel. Remove side panel by lifting up.

Figure 1: Interior frame



3. Remove four screws (two each side) at fame bottoms, detaching hood from skid.
4. Remove shipping screws from back of fluorescent light.
5. At rear of hood, grasp both cables and pull down to lift sash. do not lift sash without pulling cables.
6. Block sash in open position and remove sash weight from skid. Attach weight to cables using the screws provided.
7. Move sash up and down to be sure the sash is working freely.
8. Lift hood onto the countertop using an appropriate hood lifter or manpower. Do not lift hood by side panel mounting rails.
9. Connect ductwork, plumbing and electrical as required.
10. Replace side panels by positioning the panle slightly above its finished position and sliding it down to engage the side panel clips with the side panel mounting rails.

Figure 2: Interieor frame



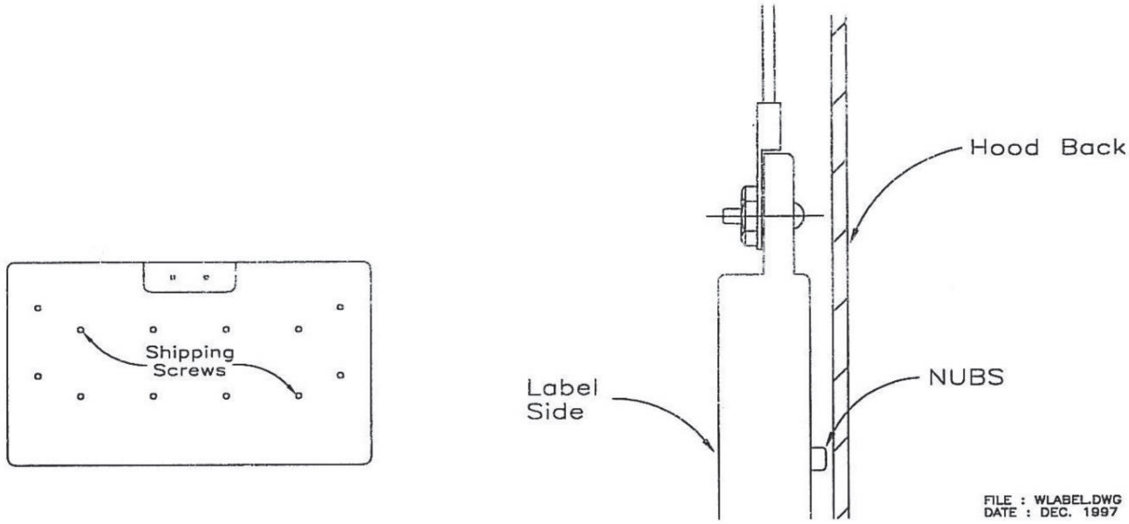
Label on weight

Instructions must be followed to ensure proper sash operation.

1. Remove all shipping screws.
2. Shake material inside weight to a level pisition. Weight must hang parallel to floor for correct operation.
3. Position weight with NUBS toward hood back and label side out.
4. Connect eyes as shown.

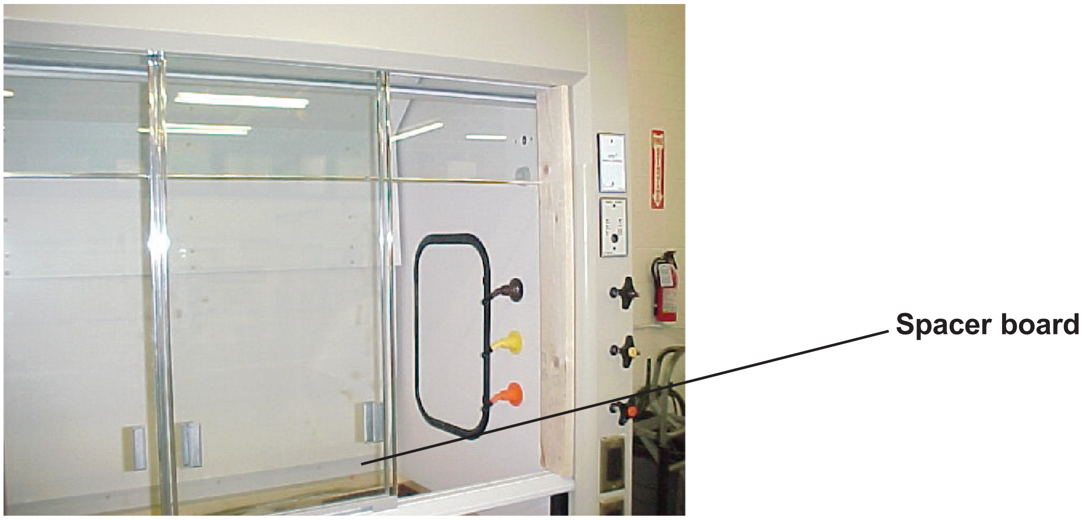
Note: Eye rotation is critical and must be installed as shown.

Figure 3: Label on weight



Sliding window replacement

Figure 4: Spacer board



Cut a 30 in. spacer board and place it between the sash pull and the bottom of the front panel as shown. Lift the sash to hold the board in place. You should have approximately 6 in. of space between the bottom of the sash pull and the lower airfoil.

This will prevent the sash from rising rapidly when you remove the sliding window.

Figure 5: Rear window

Figure 6: Front window

The sliding windows ride in two tracks, a front track and a rear track.

Remove the sliding window from the front track by lifting up and tilting the window inward while tipping the top of the window toward the front of the hood. Once the rollers are clear of the track, lower and remove the window. Replace the window in the reverse order.

Remove the sliding window from the rear track by lifting up and tilting the window outward while tipping the top of the window toward the back of the hood. Once the rollers are clear of the track, lower and remove the window.

Remove and replace only one window at a time.

Note: Practice the removal and installation of the windows using the old windows. Do not force, pry or twist the windows or they will break.

Removable fume hood face installation

1. Remove the exterior side panels of the hood.
2. Remove the lower airfoil
3. Unplug the actuator.
4. Disconnect the sensor hoses and unplug the probe from the sensor port.
5. Loosen the bolts holding the pulleys and cable keepers, on the rear half of the hood. Remove the sash cable from the pulley/keeper assembly and feed the front portion of the hood.
6. Remove remote control handles from service fixtures.
7. Remove four nuts and bolts, on each side, holding the front frame and back frame together.
8. Pull hood face forward to remove.

Notes:

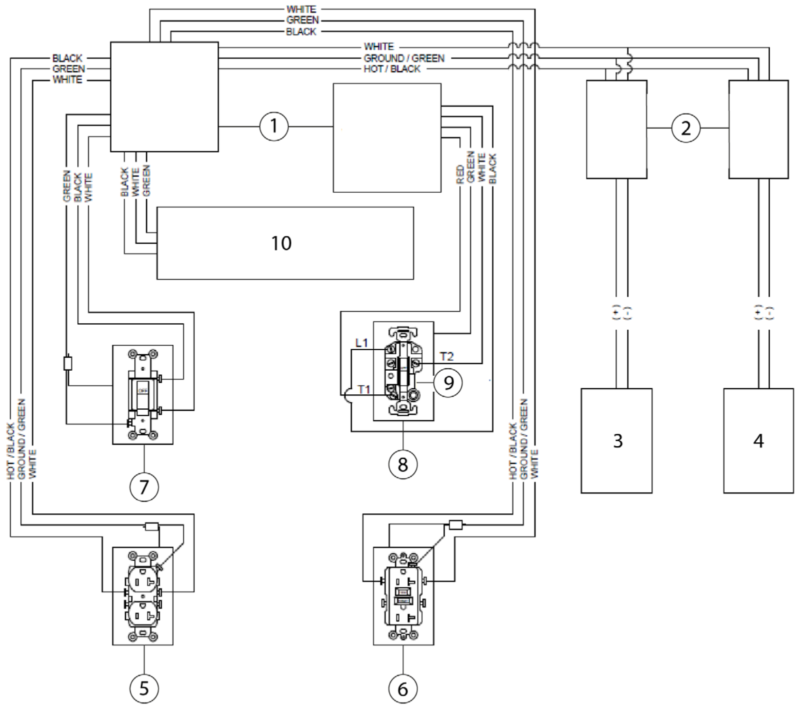
- The interior side panels will remain in one piece and will be deeper than 34 1/2 in. (35 3/8 in. on 39 1/4 in. deep hoods, and 41 3/8 in. on 45 in. deep hoods). However, there is no obstruction between the side panels, making it easy to angle it through a door opening.
- When front loaded valves are factory installed, the valve handle and nut that holds the fixture body to the post will have to be removed. When the front of the hood is removed, the valve will remain attached to the back portion of the hood. The valves will extend out past the side panels, but again with no other obstructions, the hood will be easy to angle throught a door opening.
- 8 in. hoods, 39 in. deep with a front bypass are taken apart as described above except that once the front of the hood is removed the glass bypass panels will also have to be removed.

Figure 7: Removable front

Figure 8: Removable front

IMPORTANT: The sash is intended to remain in place in the front portion of the hood. However, once the front is separated, the post and sash guide could spread apart allowing the sash to fall out. Use a strap or rope to prevent this.

Figure 9: Stable Vortex II Fume Hood wiring diagram



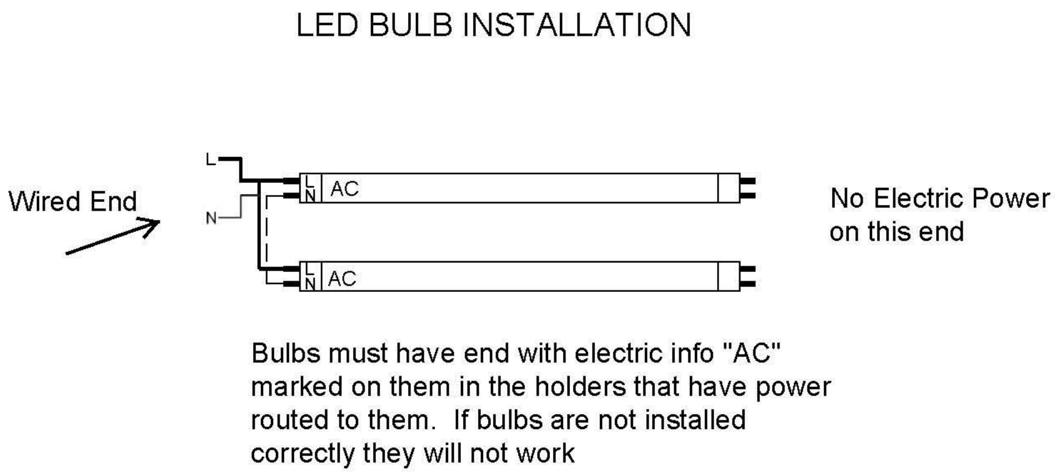
Callout	Description
1	Junction box
2	Stepdown isolation transformers
3	VMS-1655M Controller
4	Actuator
5	Duplex receptacle
6	GFCI receptacle
7	Light switch
8	Blower switch (optional)
9	Pilot light (optional)
10	LED light

- Wires are #12 THHN solid conductor, routed in 1/2 flexible metal conduit from outlets and switches to the junction box.
- A 6” pigtail of coiled wire is provided for the final hook up in the field by others.
- Duplex outlets = 125V; 20A; 60Hz; AC, NEMA 5-20R.
- GFCI receptacle = 125V; 20A; AC, TEMP RANGE -31F TO 158F; TRIP AT 5mA (+ or - 1mA), NEMA 5-20R.
- 208V receptacle = 208V; 20A; 60Hz; AC, NEMA 18-20R.
- 220V receptacle = 220V; 20A; 60Hz; AC, NEMA 6-20R.
- Light switch = 120/277V; 20A; 60Hz; AC
- Blower switch = Allen Bradley, Model Number X600-TQX216.
- Single pole = 1 PH 115/230V AC, 1 HP 277V AC, Type 1 general purpose enclosure with neon pilot light, requires a heater element (supplied by others, For more information, refer to the label on J-BOX cover).
- Light fixture = T-8 linear lamp, 4000K, 120V; 60 Hz; AC, 24" fixture 9W tubes, 48" fixture 18W tubes.

Recommended input connections:
Supply voltage should be 125V; 20A; 60Hz; AC. All electrical supply lines should be routed through an electrical panle with the appropriate rated circuit breaker. At no time should this product be hard wired to an existing electrical outlet or wired with a male plug end for a wall receptacle. Additionally, a disconnecting device should be located in close proximity of the equipment and within easy reach of the operator.
Recommended supply wire size:
Minimum = 12GA. copper wire, Maximum = VOLT 600V, 90 degree C dry THHN/THWN conductors.

LED bulb installation

Figure 10: LED bulb installation



Bulbs must have end with electric info "AC" marked on them in the holders that have power routed to them. If bulbs are not installed correctly they will not work.

Design chart

Table 1: Standard design based on 27.5 in. vertical sash height

Nominal hood width outside dimension (feet)	**4**	**5**	**6**	**8**
Exhaust outlet collar size round (inches)	8	10	10	Two 8 in. connections
Maximum vertical sash height (inches)	27.5	27.5	27.5	27.5
Vertical sash width (inches)	39	51	63	87
Vertical sash opening area (feet^2)	7.45	9.74	12.03	16.61
Net free area of work surface (feet^2)	8.38	11.02	13.67	22.55
Internal volume, 34 in. deep hood (feet^3)	27.44	36.11	44.78	62.11
Internal volume, 39 in. deep hood (feet^3)	32.72	43.05	53.39	74.05
Internal volume, 45 in. deep hood (feet^3)	N/A	N/A	N/A	88.39
Horizontal sash width (inches)	18.5	24.5	30.5	42.5
Horizontal sash opening (feet^2)	3.53	4.68	5.82	8.12
Calculated CFM, vertical sash opening	447	584	722	997
Static pressure loss (in. W.G.)	0.35	0.35	0.35	0.35
Face velocity, vertical sash (fpm)	60	60	60	60
Face velocity, horizontal sash (fpm)	50	51	50	50

Table 2: Modified design based on 18 in. vertical sash heights

Nominal hood width outside dimension (feet)	**4**	**5**	**6**	**Two 8 in. connections**
Exhaust outlet collar size round (inches)	8	10	10	Two 8 in. connections
Vertical sash width (inches)	38	50	62	86
Vertical sash opening area (feet^2)	4.8	6.3	7.8	10.8
Net free area of work surface (feet^2)	8.38	11.02	13.67	22.55
Internal volume, 34 in. deep hood (feet^3)	27.44	36.11	44.78	62.11
Internal volume, 39 in. deep hood (feet^3)	32.72	43.05	53.39	74.05
Internal volume, 45 in. deep hood (feet^3)	N/A	N/A	N/A	88.39
Vertical sash working height (with stop, inches)	18	18	18	18
Vertical sash open area with stop (feet^2)	4.75	6.25	7.75	10.75

Calculated cfm	285	375	465	645
Static pressure loss (in. W.G.)	0.35	0.35	0.35	0.35
Face velocity, vertical sash (fpm)	60	60	51	50

Notes:
- Excludes vented base cabinets, add 25 cfm per 2 in. vent.
- Does not include static pressure of constant volume control (CVC) Venturi Valve.
- Refer to ANSI/AIHA® Z9.5-2012 3.3.2 laboratory hood minimum flow rate to determine minimum fume hood air changes per hour (ACH) for your appliction, or your Chemical Hygiene Safety Officer.
- Vented base cabinets should be vented directly outside or vented to the ductwork.

Table 3: Internal volume and CFMs for the ACH required

Hood depth	48 in.	60 in.	72 in.	96 in.
34 in.	27.44 ft^3	36.11 ft^3	44.78 ft^3	62.11 ft^3
39 in.	32.72 ft^3	43.05 ft^3	53.39 ft^3	74.50 ft^3
45 in.	39.05 ft^3	51.39 ft^3	63.72 ft^3	88.39 ft^3

Table 4: cfm required for 150 ACH interior to hood

Hood depth	48 in.	60 in.	72 in.	96 in.
34 in.	69 cfm	90 cfm	112 cfm	155 cfm
39 in.	82 cfm	108 cfm	133 cfm	185 cfm
45 in.	N/A	N/A	N/A	N/A

Table 5: cfm required for 375 ACH interior to hood

Hood depth	48 in.	60 in.	72 in.	96 in.
34 in.	172 cfm	226 cfm	280 cfm	388 cfm
39 in.	205 cfm	269 cfm	334 cfm	463 cfm
45 in.	N/A	N/A	N/A	552 cfm

Calculations

Calculating Flowsfe Stable Vortex II Monitors for less than full vertical sash opening:

All Stable Vortex II monitors have two 4 1/2 in. utility posts (left and right posts). The active length (AL) opening can be calcualated by taking the monitor's overall length (DAL) in inches minus 9 in.

Example for a 5 ft (60 in.) DAL hood: 60 in. - 9 in. = 51 in. AL

Inspection

1. For safety considerations a schedule of inspection and documentation per CHP, ANSI Standards and ACGIH Handbook is required.
2. An inspection record should be maintained.
3. Inspection procedures should include the latest requirements in ANSI/NFPA 45 Code.
4. Inspection procedures should also consist of a physical examination of liner condition and cleanliness, baffle and sash operation and condition, counter balance cables, light operation and condition, and service fixture function.
5. Inspection results should be recorded and reported to the OSHA required Chemical Hygiene Safety Officer (CHO) for any required action.

Note: Special purpose fume hoods such as those used with radioactive materials, nitric acid or perchloric acid require additional inspection procedures to cover special equipment and requirements.

6. Fume hood alarms and baffle vortex controls, should be inspected and re-calibrated at least annually. Where extremely hazardous or corrosive conditions exist or when filters are present in the system, the inspection frequency should be increased appropriately. Velocity and pressure sensing detectors should be tested at signal transmission for alarms designed to activate signals at more than one location. They should be verified at each location during each inspection. Where double pulleys and bells are employed; the inspection frequency may be semi-annually.

Maintenance

1. Fume hood maintenance procedures consist primarily of clean up, adjustment and replacement of worn, damaged or non-functioning parts. Use good housekeeping in laboratory fume hoods at all times.
2. Periodically clean sash, exterior and interior surface, including fluorescent light panel. Replace fluorescent lamps periodically to maintain adequate illumination.
3. Clean-up should be accomplished by following CHP, under the supervision of CHO and should include removal of the baffle for clean-up of all interior surfaces.
4. Lubrication of sash guides, cables, pulley wheels, and other working parts is not required.
5. Replace broken, worn, or non-functioning parts as required.
6. Flush all spills immediately following CHP.

Note: Special parts, options, and accessories should be maintained as required.

General fume hood maintenance

- The practice of good hood housekeeping ensures the longevity and optimum return on your fume hood investment.
- The exterior of the fume hood should be periodically cleaned to avoid blemishes on the finish.
- The fume hood sash should be kept clean so that the operator's view of the interior of the fume hood is not compromised.
- The fume hood's interior liner and the work surface should be cleaned as required by owner's chemical safety plan (See ANSI/AIHA Z9.5 Standard).
- The sash guides, pulley wheels, and cables should be lubricated as needed. Cracked or broken sash panels should be replaced immediately.
- Any and all worn or broken components should be replaces as required.
- The VMS-1655M Fume Hood Monitor requires periodic maintenance to ensure its proper function.

Fume hood certification and testing

The Stable Vortex II Fume Hood has been tested per the ANSI/ASHRAE-1 IO 2016 Method of Testing Performance of Laboratory Fume Hoods. Air Distribution Technologies, Inc recommends that all fume hoods, as installed and as used, (See ANSI/ AIHI Z9.5 Standard), be tracer gas tested per the latest ANSI / ASHRAE 110 Standard.

All fume hoods air flows should be periodically (no less than annually) measured to ensure that the fume hood is exhausting the specified volume of air and that no escape of fumes or stalling of the air exists. This can be accomplished by measuring the face velocity of the fume hood using a thermal anemometer or exhaust airflow and testing the hood using theatrical smoke. The procedures for these tests are noted in the tracer gas ANSI / ASHRAE 110 Standard. Any change in the ventilation system warrants retesting all the fume hoods to determine the affect the change has had on each fume hood.

Troubleshooting

The Lack of sufficient and non-pulsating exhaust may adversely affect the performance of the Stable Vortex II Fume Hood:

- Following Federal/State OSHA regulations (see OSHA Fact Sheet) face velocity (FV) cannot be used as an indicator for worker protection handling hazardous chemicals but FV is still an important measurement to determine exhaust airflow, exhaust airflow instability (pulsating) and to evaluate cross draft interference. The minimum recommended FV is 50 fpm at any vertical sash opening to achieve containment of a Class "A " Hood per 1992ANSI/AIHA Z9.5 as installed (AI) rating. To calculate any vertical sash height, FV, exhaust flow and minimum exhaust airflow volume to meet Lower Explosive Limits (LEL) see "Cale. Vortex II FH's for less than full vertical sash opening". The exhaust fan must be of adequate size to handle the required exhaust volume of air. Note that the air flow chart specifies the static pressure losses for the fume hood only. The calculations for the fan size must include other factors in order to yield the correct fan size. These factors include, but are not limited to, the size and configuratin of the ductwork and the number of fume hoods on the same fan.

- Lack of Sufficient Supply Makeup Air - if the volume of air being supplied to the laboratory space is not sufficient to meet the Stable Vortex II Fume Hood's exhaust requirements and other devices, then the fume hood will not maintain containment. The total supply makeup air should be only 150 to 200 cfm (per entrance door) less than total lab room exhaust volume at all times.

- Flexible/spiral Ducts - The use of flexible ductwork to connect the fume hood to the ventilation system will adversely affect the fume hood's performance. Hard smooth ductwork should be used at all times to optimize the fume hood's performance.

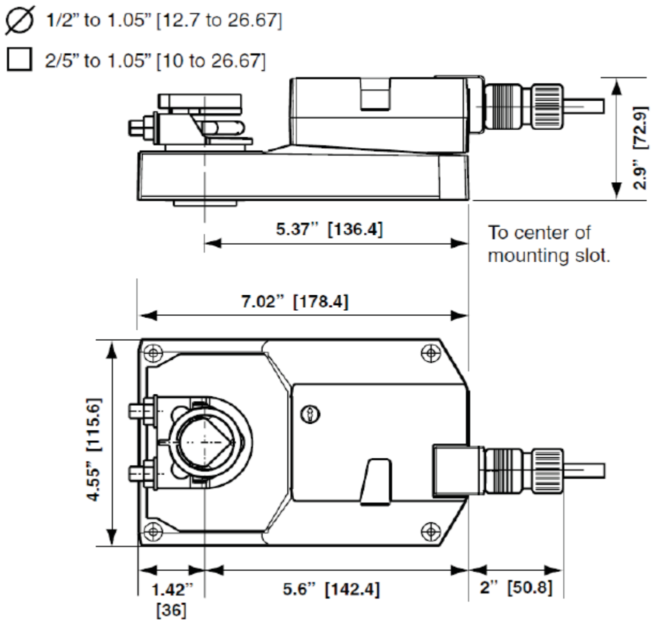
- Traffic in Front of the Fume Hood - When people walk slowly (300 fpm) in front of the hood, a vortex is formed behind the person, similar to the wake that forms on water behind a boat. These vortices cause turbulence at the face of the fume hood and may cause containment to break down especially when the vertical sash operation is used instead of horizontal sash operation. Excessive traffic should be avoided in the aisles adjacent to the fume hoods.

- Location of Supply Air Diffusers - Air supply diffusers that are located adjacent to the fume hood can cause cross draft disturbances in the airflow at the face of the hood, thereby adversely affecting containment especially when a vertical sash operating sash is used instead of the horizontal sash operation. Supply air diffusers should be located in such a way that they do not interfere with the airflow in front of the fume hood. Existing supply diffusers should be either relocated, replaced with another type that directs the air away from the fume hood or the supply air volumes should be rebalanced for the diffusers. ANSI Lab standards recommend that the cross drafts never exceeds 20% of the averaged measured FV.

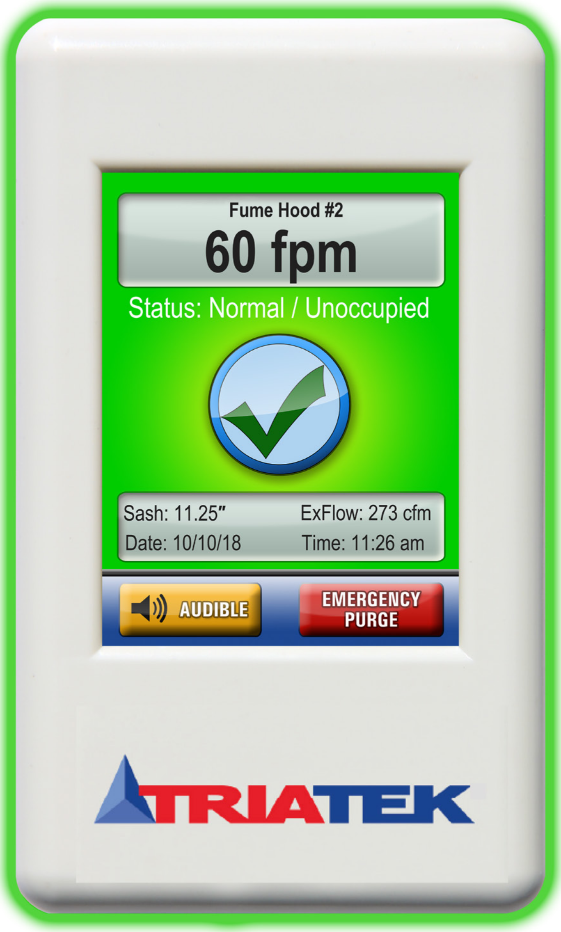
- Fume Hood Proximity to Doors and Windows - Fume hoods that are located next to windows and/or may lose containment efficiency due to the turbulent cross drafts caused by and closing of windows and doors. The opening and closing of doors causes energy waves of pressure that can adversely affect fume hood performance. In addition, the pressure changes in the laboratory space caused by the opening and closing of doors can also negatively affect the fume hood's performance especially when used with a vertical sash operation. Horizontal sash operation rejects these cross drafts and energy pressure disturbances better than vertical operating sashes. Horizontal sashes also provide Federal/State OSHA requirements for splash and explosion protection when used as a full body shield. Use horizontal sash operation for better worker overall protection.

- Face Velocity Fluctuation Readings- FV pulsating must not exceed ± 5 fpm. FV fluctuations are caused by exhaust duct static pressure fluctuations and/or cross drafts. The main causes creating exhaust static pressure fluctuations are dynamic losses due to errors in ductwork design, internal spring/cone isolating air flow control values and/or incorrect exhaust fan selection. To measure the effect of exhaust duct fluctuations requires monitoring the internal baffle slot velocity not the FV. At no time can the FV dip to 35 fpm. The only remedies are correcting the source of the static pressure fluctuations or process decoupling exhaust fluctuations through staged pressure drops.

Dynamic Vortex Actuator Specifications	Description
Power supply	24 VAC, 50/60 Hz
Power consumption	20 W max
Input	0-10 VDC floating ground
Motor	DC stepping accuracy Stall burnout protection Direct-acting Fail-safe Auto-stroking
Indication	0-10 position scale
Mounting	Direct
Ordering codes	DAM-VMS-B (New Stable Vortex II Fume Hoods) DAM-VMS-CNVSN (Stable Vortex Conversion Kits)



VMS-1655M Vortex Monitoring System overview



The VMS-1655M Vortex Monitor is used in the Flowsafe Stable Vortex II fume hood and Flowsafe Stable Vortex conversion kit to measure and control the vortex pressure and adjusts to maintain proper fume hood containment. The VMS-1655M adjusts for environmental and usage conditions such as sash movement, fume hood loading, room pressure fluctuations, and cross drafts with active vortex stabilization in real time. It's alarm function notifies the user if the fume hood performance is compromised. Some of the features and benefits include:

- Full-color touchscreen display with programmable display options and adjustable back-light
- 360° Safety Halo™
- Intuitive user interface that simplifies setup and configuration of unit
- Graphical hood status display
- Audible and visual alarms
- Multi-level password protection
- 1 analog input: 0 to 10 VDC
- 2 analog output: actuator control, exhaust air flow feedback
- BACnet MS/TP network comms
- Optional display mode to show real-time face velocity at main screen
- Real-time view feature facilitates diagnostics during setup and commissioning

The Air Distribution Technologies, Inc VMS-1655M Vortex Monitor is an ultra-sensitive fume hood controller used to monitor and modulate the bi-stable vortex within the FlowSafe Stable Vortex II monitor and the FlowSafe Stable Vortex Conversion Kit.

The VMS-1655M is equipped with a 3.2” diagonal full-color touchscreen and displays in portrait orientation (240 pixels by 320 pixels). The password-protected menu tree is very intuitive and simplifies the setup and configuration of the unit. The menus incorporate touch-based interfaces such as sliders, radio buttons, and dialog popup windows.

The display implements bright background color changes along with the Safety Halo with 360° edge lighting to indicate the three different hood statuses. These background colors indicate “Normal” when the face velocity at the sash opening is within defined limits,“Warning” when it is nearing an out-of-limits condition, and “Alarm” when the face velocity is outside defined acceptable limits. The face velocity ranges for these conditions are easily set by the user for the specific installation when necessary. The Safety Halo color changes provide an at-a-glance view of the fume hood face velocity conditions from anywhere in the lab.

Alarm conditions may be defined by the user, in terms of desired face velocity settings for the fume hood being monitored. When an alarm condition occurs, it may be annunciated in three user-definable ways: 1) on the display, 2) the Safety Halo, and 3) with an audible alarm. The alarm will automatically reset when the unit has sensed that the fume hood face velocity has returned to proper limits. The user may easily mute the audible alarm by touching the Alarm Audible button at the bottom of the touchscreen display.

The VMS-1655M provides an optional analog Input that may be used for monitoring the exhaust flow of the fume hood using a third party flow pressure sensor with a 0-10VDC output.

Multi-level passwords may be configured to prevent the unauthorized or casual access to the VMS-1655M configuration settings. Up to ten passwords of up to eight digits may be stored, with each having one of four associated access levels. Administrators and facility management personnel may have unrestricted access, while general staff may be assigned restricted access passwords which limit the functionality of the user menus.

The VMS-1655M includes its own power supply, which should be connected to the system as shown on page 6. The standard power supply includes a universal 120/240VAC-to-24VAC isolation transformer enclosed within a 4x4 electrical box with a 1A slow blow fuse.

This power supply also provides power to the vortex sensor module which monitors the effective vortex in the fume hood. A 10-foot length of 4-conductor cable is supplied with the VMS-1655M to interface the vortex sensor to the touchscreen display.

The VMS-1655M includes a vortex sensor for measuring the vortex of the monitored fume hood. This sensor must be installed at the top of the monitored fume hood. Tools required for the installation include: drill, ¾” drill bit, 3/8” drill bit, ¼” drill bit, 1/8” drill bit, #2 Phillips screwdriver, standard medium blade screwdriver, and silicone sealant.

An interface cable is included and pre-wired to the sensor module that connects it to the touchscreen display module.

IMPORTANT: Failure to follow the wiring diagrams could result in damage to your equipment and could void your warranty. Under no circumstances should a single transformer be split between actuator and controller. Doing so will damage the actuator, the transformer, the controller or all units. A single 120/24 V 30 VA transformer is required for the controller and a separate 120/24 V20 VA transformer is required for the actuator.

IMPORTANT: This equipment contains electrostatic sensitive components. To prevent possible damage, take action to prevent electrostatic discharge when handling or servicing this equipment.

VMS-1655M Vortex Monitor

Fume Hood Name / Number ______________________________

Unit Model Number and Serial Number (ESN) ______________________________

Analog Output ______________________________

Dead Band Percentage ______________________________

Alarm Limits

Occupied Mode High Alarm Setpoint ______________________________

Occupied Mode High Warning Setpoint ______________________________

Occupied Mode Low Warning Setpoint ______________________________

Occupied Mode Low Alarm Setpoint ______________________________

Audible Alert

Operating Mode (audible or silent) ______________________________

Delay Time Base (secs or mins) ______________________________

Delay Setting (0 - 60) ______________________________

NOTICE

Risk of Property Damage

Do not use a single transformer to power both the actuator and the controller. Use a 24 VAC 30 VA Class 2, Limited Energy, or LPS for the controller, and a separate 24 VAC 20 VA Class 2, Limited Energy, or LPS for the actuator. Failure to follow the wiring diagrams may result in damage to the actuator, the transformer, the controller, or all devices and could void your warranty.

Note: The Actuator is sold separately.

AVIS

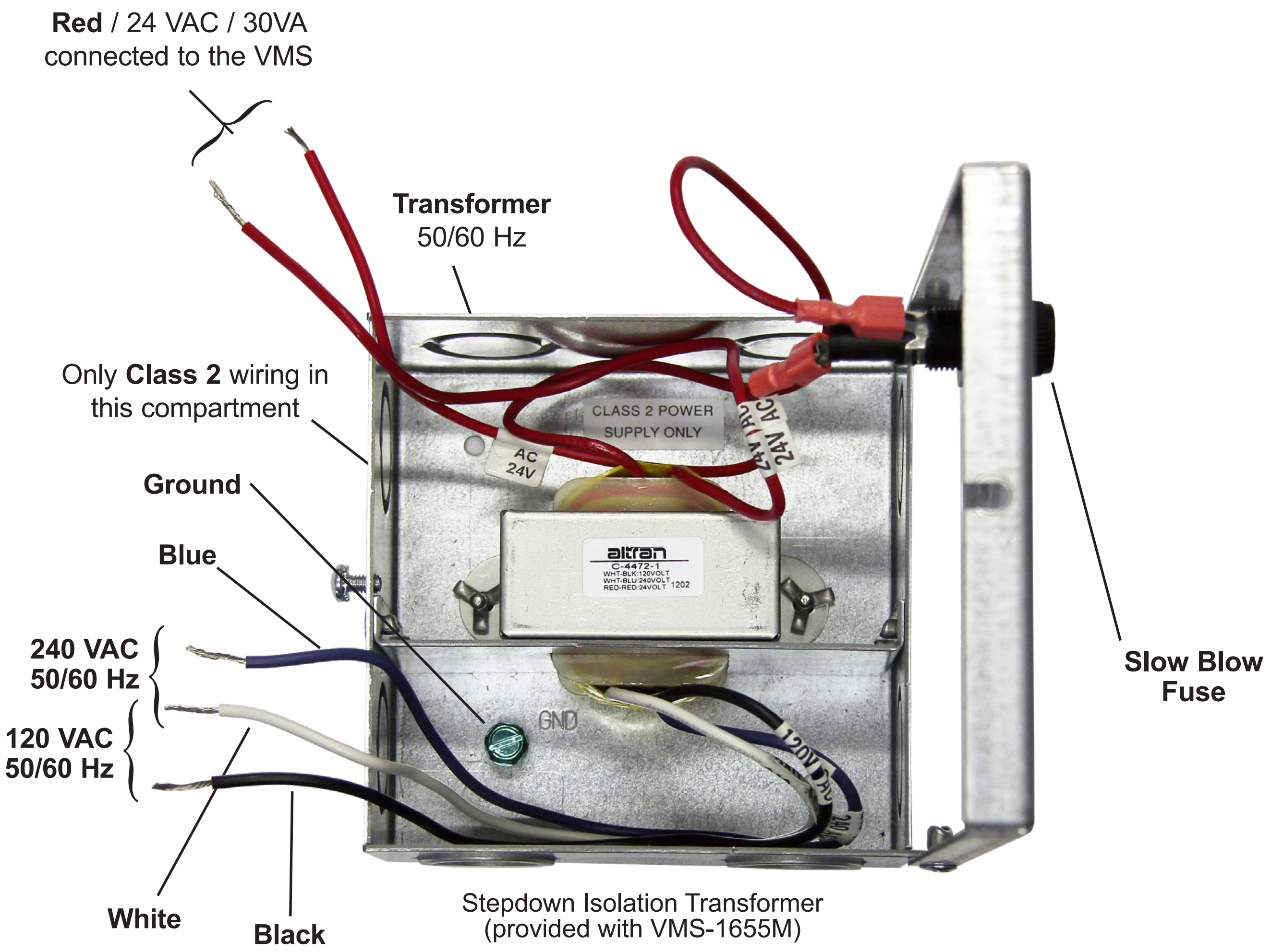
Risque de dommage à la propriété

N’utilisez pas un seul transformateur pour alimenter à la fois l’actionneur et le régulateur. Utilisez un transformateur de classe 2 à 24 V CA 30 VA, à limitation d’alimentation ou LPS pour le régulateur et un transformateur de classe 2 à 24 V CA 20 VA à limitation d’alimentation ou LPS séparé pour l’actionneur. Ne pas respecter les schémas de câblage peut causer des dommages à l’actionneur, le transformateur, le régulateur ou tous les appareils et peut annuler votre garantie.

Remarque : L’actionneur est vendu séparément.

Isolated power supply

Figure 11: Stepdown isolation transformer (provided with VMS-1655M)



Note: This product should be installed with the manufacturer provided isolated power supply and connected to an electrical circuit protected by a minimum 20A circuit breaker, This circuit breaker should be mounted in an approved electrical enclosure located separately, but in close proximity to this product.

Installation

The VMS-1655M incorporates two analog output signals, one is a 0-10VDC actuator control output for controlling the Flow Safe Vortex II baffles and the other is a 4-20mA output for monitoring hood exhaust air flow remotely. These factory- calibrated analog signals are available at the vortex sensor connector. The VMS-1655M is also capable of being directly monitored by the BMS over the BACnet MS/TP RS485 port(CN7) located at back of the VMS-1655M touchscreen display. See page 17 for BACnet object list.

Note: While the VMS-1655M model is calibrated and programmed at the factory with default settings for typical fume hood applications, a final calibration of face velocity is required following installation.

Installation

Proper location of the vortex sensor is crucial for obtaining the best possible operation of the VMS-1655M. The system measures the internal negative pressure of the fume hood to accurately determine the vortex requirements at the sash opening. The sensor must be located in a position that is least affected by turbulent air within the fume hood. See the illustration on page 9.

See pages 9 and 10 for dimensions and suggested mounting arrangements of the flow sensor on the fume hood.

Note: Be certain that sensor reference port is in laboratory room air. If necessary to obtain this, use the louvered mounted on exterior panel of the fume hood.

See page 11 for mounting details for the VMS-1655M touchscreen display unit. The preferred location is eye-level, usually on one of the side bezel panels. Please note that the display unit is cable connected to the vortex sensor module, and provisions must be made to route the cable without interference with the fume hood sash or sash cable.

Note: Remove red cap from sensor after installation.

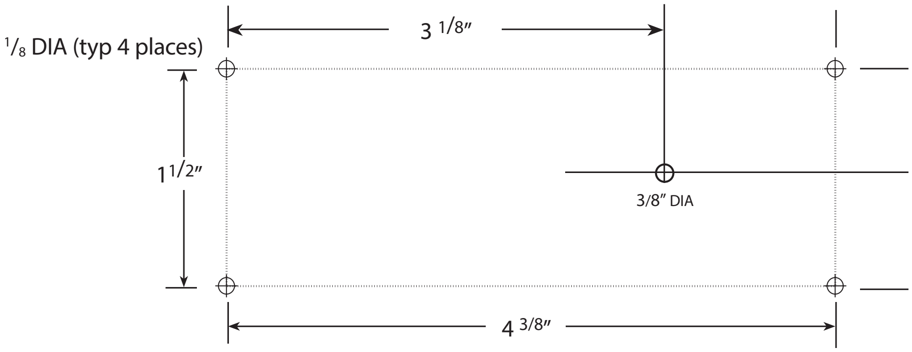
To monitor the VMS-1655M over a BACnet MS/TP BMS network, connect the VMS-1655M touchscreen display to the BMS via the CN7 terminal block located on back of display board. Make sure to observe proper polarity of RS485 connection.

Connect the interface cable between the vortex sensor and the touchscreen display before applying power to the system.

Note: In a Retrofit project, use the VMS-Retro-Kit to cover the holes left after the removal of old FlowSafe controls.

Mounting/wiring

Figure 12: Vortex sensor mounting location



Vortex sensor placement

New Stable Vortex II Fume Hoods come with the VMS-1655M pre-installed at the factory. If you are installing the VMS-1655M on a Conversion Kit, install the sensor and its reference plate as show below.

Figure 13: Vortex sensor location

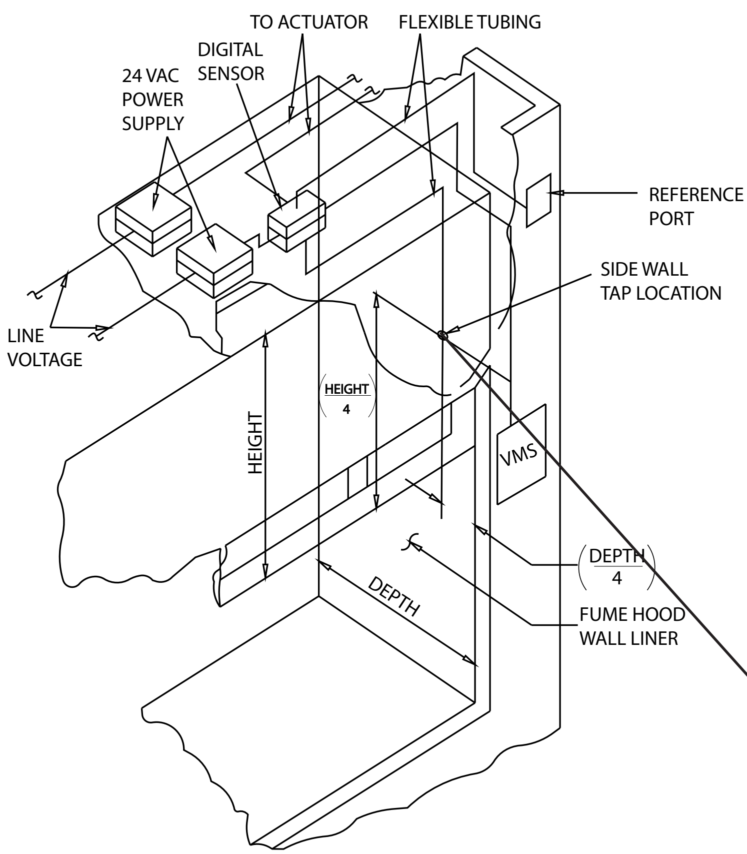


Figure 14: Vortex sensor location

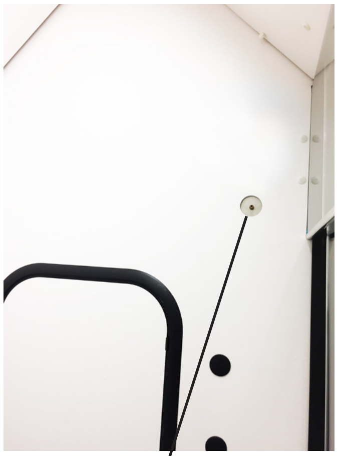
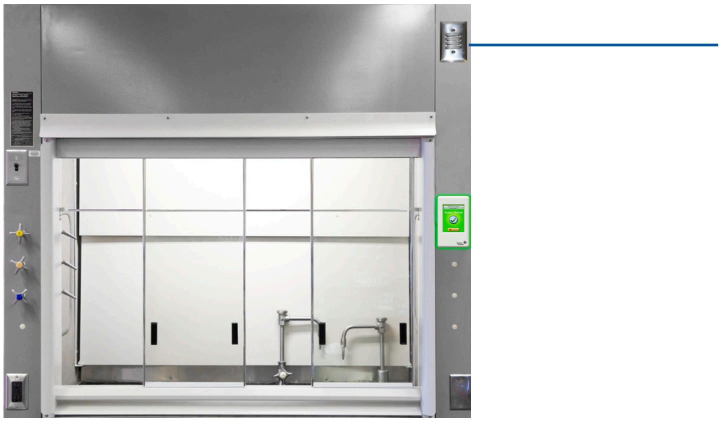


Figure 15: Sensor

Note: Height equals maximum sash opening measured from hood ceiling surface. Depth equals measurement from sash window to rear baffle

Install the sensor in the hood's sidewall as shown in Figure 3.

Figure 16: Hood location



Mount the vortex sensor reference plate on the hood away from where it might encounter airflow turbulence. Connect the supplied tubing to the sensor's reference port and then to the barbed fitting on the sensor reference plate.

Vortex sensor mounting location

Figure 17: Preferred vortex sensor mounting

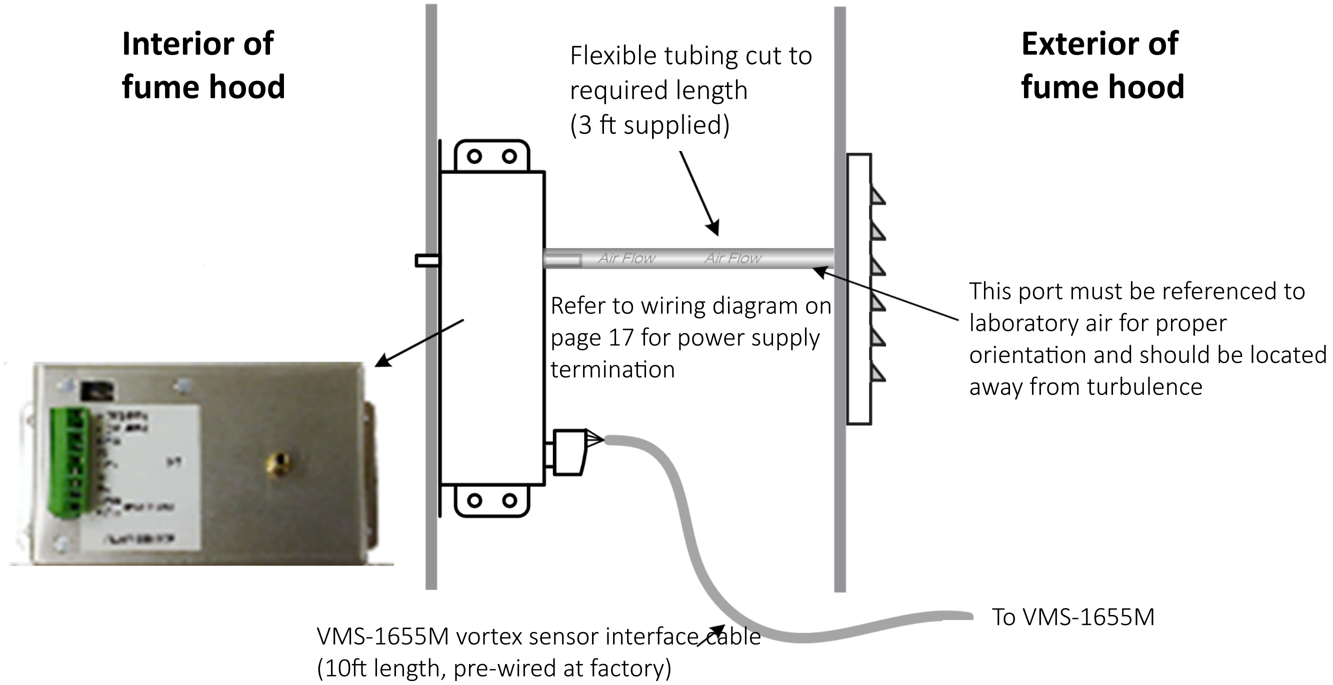
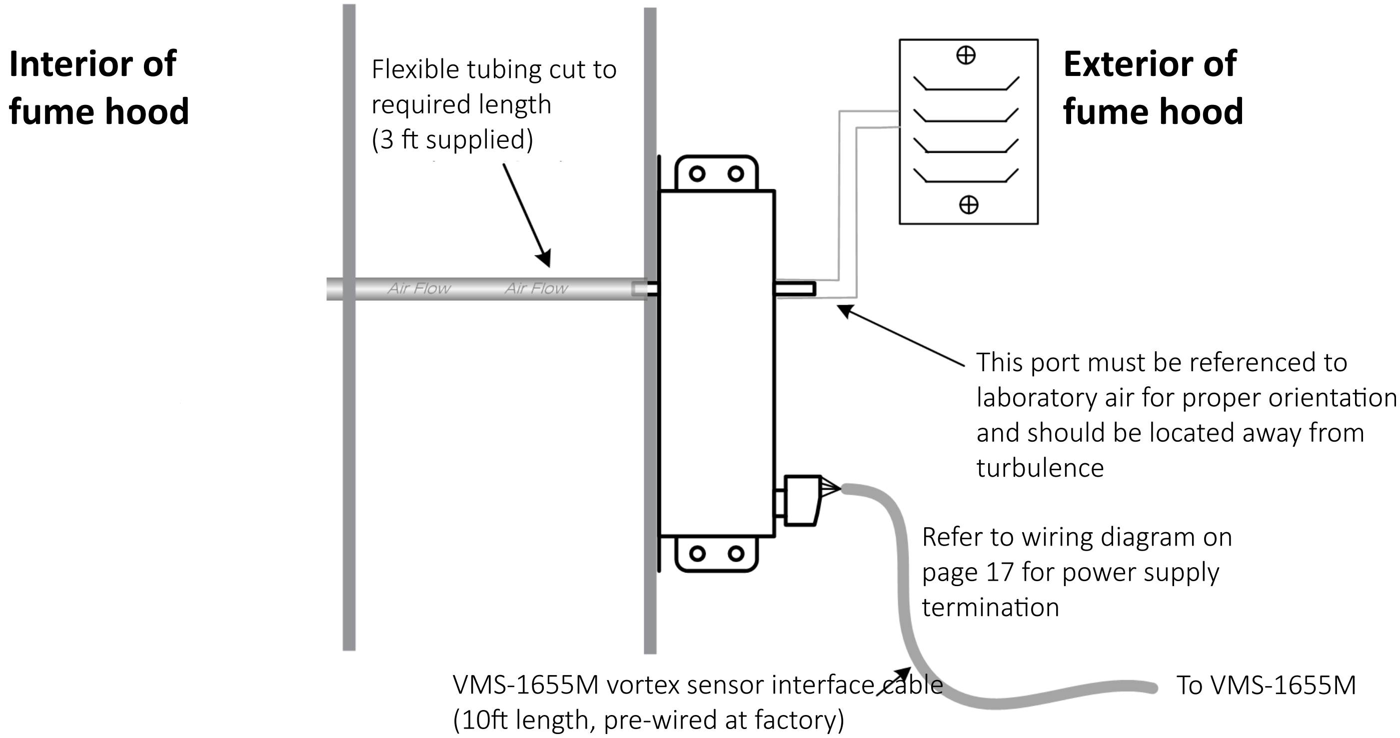
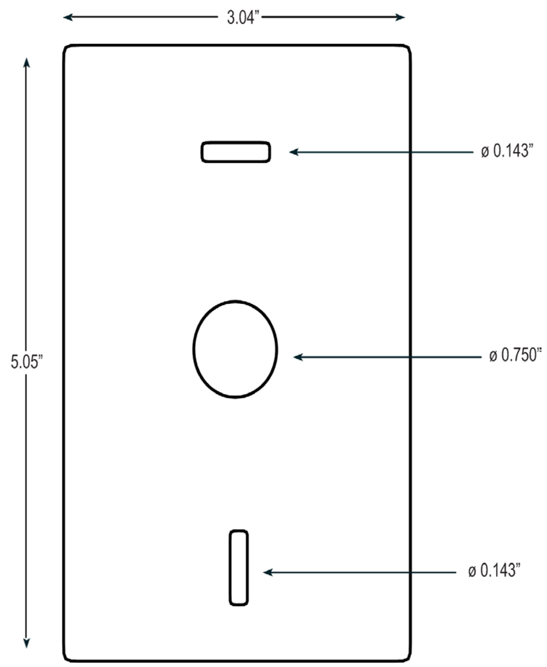


Figure 18: Alternative vortex sensor mounting



Mounting the display

Figure 19: Display mounting hole pattern



The VMS-1655M backplate may be mounted directly to a standard single-gang wall box using the two slots along the centerline. Use the backplate as a template to mark the mounting holes and the cable access hole at the center of the backplate.

Applying power

Following the proper installation of the VMS-1655M, apply power to the unit and confirm that you hear a brief chirp at the touchscreen display. There will be a six second power up delay during which the Safety Halo will cycle through the following colors: red, green, blue, yellow, magenta, cyan, and white.

After this power up delay, the unit will display a brief five second animation of the action icons, followed by the VMS-1655M splash screen. The splash screen displays the model number, electronic serial numbers, firmware version numbers, and current network address. The splash screen remains displayed for about 15 seconds, and then proceeds to the main display screen. The information displayed on the splash screen during the power up sequence may also be re-displayed using the About This VMS option on the diagnostics menu.

Main display screen

All VMS-1655M units are shipped from the factory in the decommissioned operating mode, which is represented by a blue graphical screen with a disabled status icon at the center of the screen as shown in the figure above. The information that is displayed on the main screen includes the following from top to bottom:

- Current operating mode and status
- Status icon centrally located

Located at the bottom of the display is an audible toggle button.

While in decommissioned operating mode, the screen background is blue. However, while in occupied mode, the screen background represents the current alarm status of the unit. A green background with a check mark at the center indicates that the current face velocity is within allowable limits of the desired setpoint. A yellow background with an exclamation point at the center indicates that the current face velocity has drifted outside the allowable limits of the desired setpoint and is in the caution range. A red background with an exclamation point at the center indicates that the current face velocity has reached a critical unsafe condition, as it is beyond the safe operating range. An alarm buzzer will sound at this screen as well providing an audible alert of the unsafe conditions.

Configuring vortex monitor

The initial setup of the VMS-1655M Vortex Monitor involves the following simple steps:

- Calibrate vortex sensor
- Configure face velocity alarm setpoints

Calibrating vortex sensor

The standard VMS-1655M comes pre-configured and pre-calibrated with a vortex sensor that gets installed in the sidewall of the fume hood being monitored.

To begin calibrating the vortex sensor following installation, enter the Main Setup Menu by touching the touchscreen display anywhere other than one of the hotspot locations. Refer to page 13 for hot spots features. From the Main Setup Menu, select Unit Setup >> Hood Setup >> Field Calibration. At this initial field calibration screen, the vortex sensor should be capped to prevent air flow.

Confirm that the sensor pressure reading is at 0.00 pascals, tap the Next button to proceed to the next field calibration screen. With the sash positioned at a height of 18 inches, measure the face velocity in 3 locations across the sash opening with a calibrated air flow measuring instrument. Enter the average of the three velocity readings by using the slider on the field calibration screen.

Tap the OK button to complete the field calibration procedure of the fume hood vortex sensor.

Configuring face velocity alarm setpoints

The VMS-1655M features a comprehensive alarm facility that includes both audible and visual capabilities. To configure the alarm setpoints for the face velocity, enter the Main Setup Menu by touching the touchscreen display anywhere other than one of the hotspot locations. From the Main Setup Menu, select System Setup >>Alarm Limits. Enter the High Alarm, High Warning, Low Warning , and Low Alarm setpoints using the popup numeric keypad on the touchscreen display. The default settings for the occupied mode face velocity alarm setpoints are 150 fpm, 130 fpm, 90 fpm, and 75 fpm.

Changing fume hood operating mode

The VMS-1655M vortex monitor can be set for occupied, and decommissioned modes of operation. To change the mode of operation, selectUnit Setup >>Hood Setup >> Operating Mode and the user is prompted to select one of two modes.

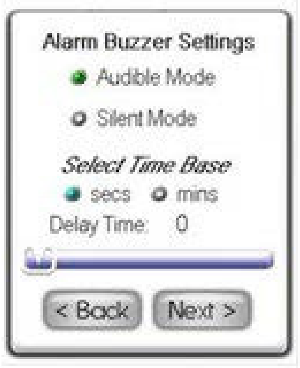
Setting a deadband

The VMS-1655M vortex monitor has a deadband feature to help keep the actuator control signal constant until the sensed velocity has gone above or below the deadband limit. To set the deadband, select Unit Setup >>Hood Setup >>Set Deadband and enter the deadband value as a percentage using the numeric keypad. Click Finish to save setting.

Figure 20: Operating mode election pop up screen

To quickly change the operating mode from the main display without entering the user menus, the Hood Status hotspot may be used to invoke the Operating Mode selection pop up. See Figure 7 above.

Figure 21: Alarm buzzer may be set for audible



The alarm buzzer may be selected for one of two modes of operation: Audible or Silent Mode. If audible mode is selected, a delay may be specified in seconds or minutes.

If Silent Mode is selected, then the alarm buzzer will not sound whenever the unit encounters an alarm condition. The alarm buzzer will reset to audible mode when alarm condition has cleared

The VMS-1655M can be monitored over a BMS network using the BACnet MS/TP protocol available at CN7 terminal on the VMS-1655M- User Interface display. Refer to page 17 and 18 for CN7 location.

The VMS-1655M also provides an analog output signal that linearly represents the exhaust air flow when a flow pressure sensor is connected to the analog input at the VMS-1655M vortex sensor. This output may be connected to an available analog input on a third party controller, thereby allowing the hood exhaust air flow to be monitored from the BMS front- end.

Changing network settings

Changing network settings on the VMS-1655M is simple and can be accessed by selecting Unit Setup >> Network Setup. The Network Setup menu will present the user with the available options.
All VMS-1655M units have a BACnet MS/TP protocol and therefore the Network Setup menu options pertain to this protocol. From this menu, the user can select a different baud rate or change the network address of the unit.

Adding password security

The VMS-1655M menu system can be protected by adding up to ten multi-level passwords to the system. A password entry may be created by selecting System Setup >> Passwords Setup >> Add Password and the user is prompted to enter a minimum of four and up to eight digits. Once a password has been specified, the user is prompted to specify one of four access levels: Unrestricted, Standard, Basic, and Restricted. All password entries are saved to non-volatile memory. In the event that a password has been forgotten, there is a factory-default password that will provide unrestricted access to the user menu system. Please consult with the factory for more information regarding this password. The first user password is automatically saved as unrestricted.

Changing display settings

The Safety Halo feature significantly enhances the status visibility of individual units, and allows an unsafe fume hood to be immediately recognized from anywhere in the laboratory space. The display settings of this feature may be configured using the Safety Halo option on the Display Setup menu. This option may be disabled if not required by the installation, which simply turns off the Safety Halo status indicator. If enabled, the brightness may be adjusted from full intensity down to barely visible in daylight conditions.
The VMS-1655M supports an optional Face Velocity display mode that displays the real-time face velocity on the main screen. You can access this optional display mode through the Display Modes option on the Display Setup menu. You can switch the the display mode between the default status only mode and the optional face velocity mode at any time. The display mode is preserved through a power cycle of the system. The brightness of the VMS-1655M main display screen may also be adjusted using the Set Brightness option on the Display Setup menu. All brightness settings are stored to non-volatile memory and remain in effect through a power cycle.

Built-in diagnostics

The VMS-1655M incorporates several useful diagnostic tools to diagnose and troubleshoot the system during the installation and commissioning phase. The Override PID Out option allows the analog output to be overridden. The analog output may be locked at the overridden percentage while test and balance makes adjustments to exhaust damper. While in the overridden state, the analog output is “disconnected” from its control loop, if enabled. Cancelling the override effectively resumes the normal control loop operation, again if enabled.
A unique feature of the VMS-1655M is the Real-Time View option, which allows the user to see in real-time the actual face velocity, actuator deadband, actuator position and exhaust air flow.

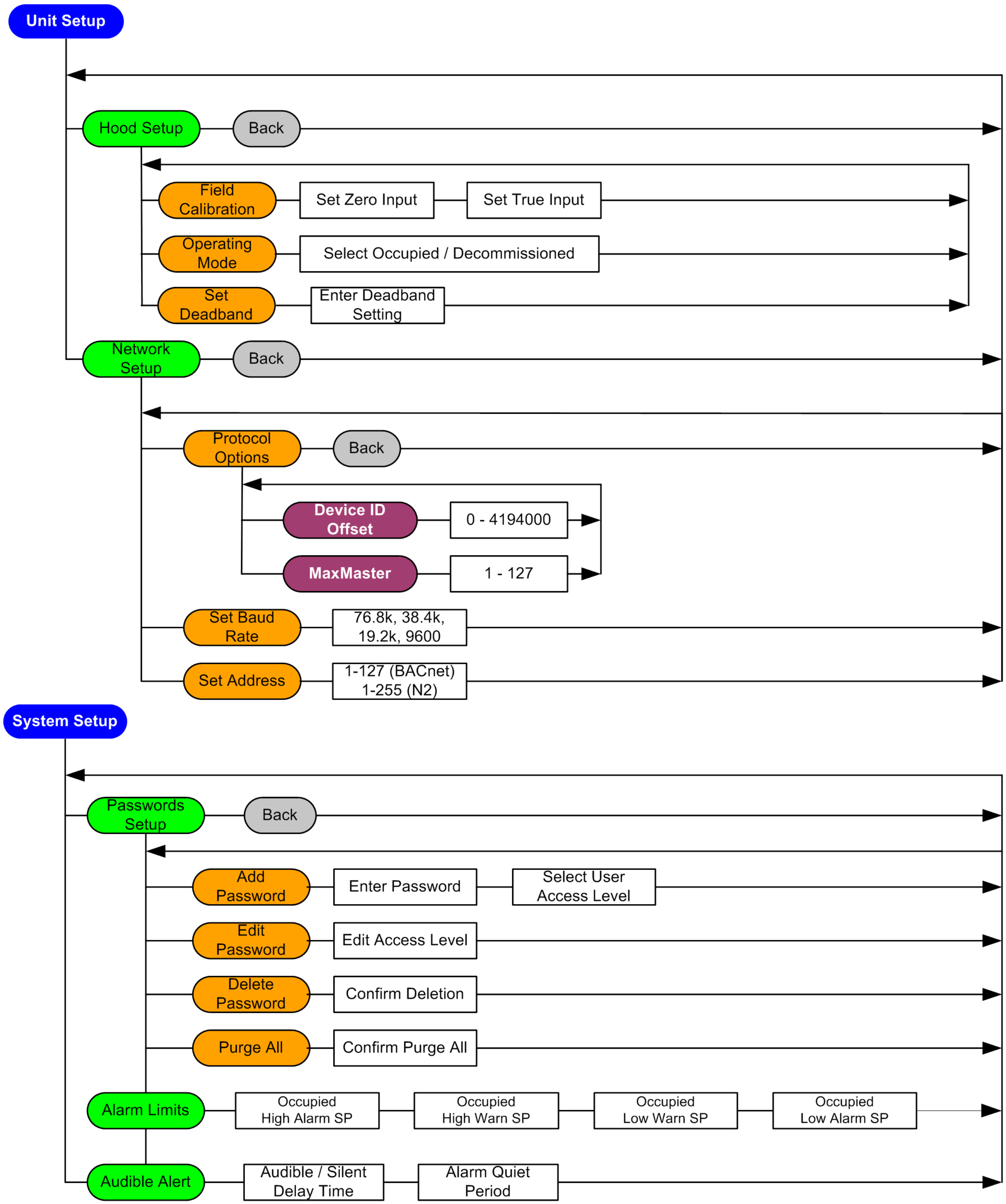
Cleaning the display

- Use a dry or lightly dampened cloth with a mild cleaner or ethanol. Be sure the cloth is only lightly dampened, not wet.
- Never apply cleaner directly to touch panel surface. If cleaner is spilled onto touch panel, soak it up immediately.
- Cleaner must be neither acid nor alkali (neutral pH).
- Never use acidic or alkaline cleaners, or organic chemicals such as: paint thinner, acetone, tolulene, xylene, propyl or isopropyl alcohol, or kerosene.

Figure 22: Hot-Spot features of VMS-1655M touchscreen display

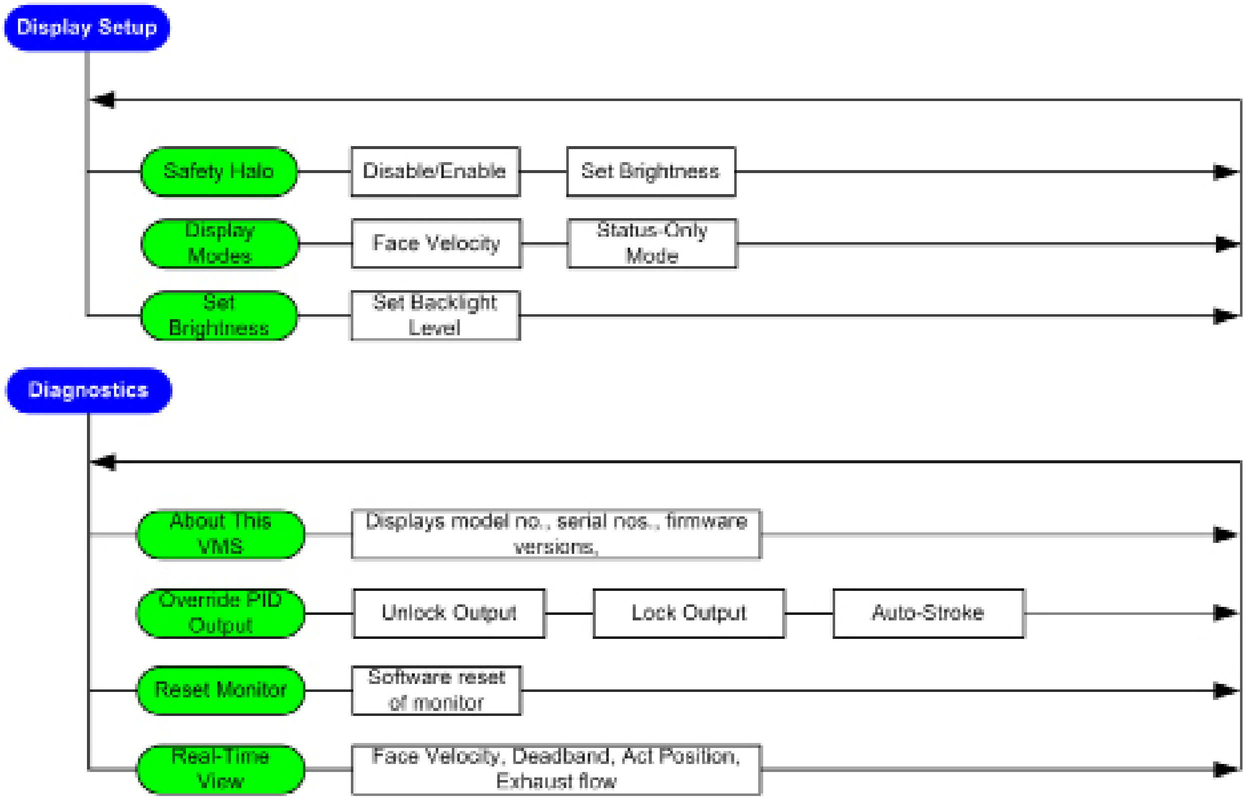
Setup menu tree

Figure 23: Unit and system setup



Display setup

Figure 24: Display setup



Module settings

Configuring display module settings

Options Dipswitch (S1) - internal use only		
1. Graphics Chip Mode Selection	OFF = Programming Mode	ON = Run Mode
2. Touchscreen Calibration Mode	OFF = Force calibration	ON = Auto calibration
3. Reserved		
4. Reserved		

Options Dipswitch (S2) — mode configuration 1		
1. Product Type	OFF = VMS-1655M	ON = Invalid
2. Reserved		
3. Mode Select	OFF = Invalid	ON = VMS-1655M
4. Operational Mode	OFF = Demo Mode	ON = Run Mode

Push button Switch (SW1):	Reset Button	
Push button Switch (SW2):	Reserved	

BACnet objects

The following table itemizes the list of points available for integration in a building management system (BMS). This table contains the objects for open BACnet integration.

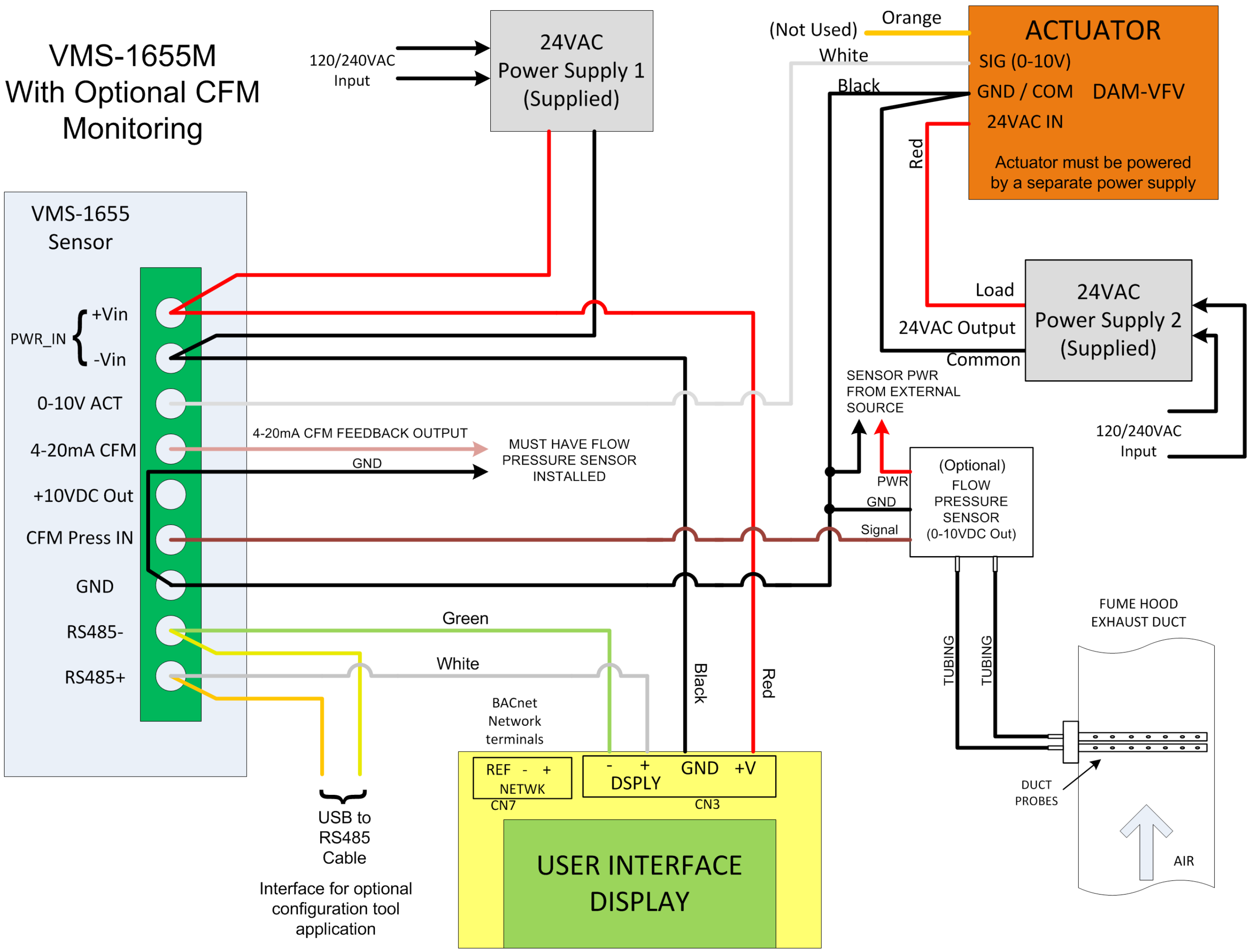
Object instance	Functional description	Read or Write
	Analog Inputs	
AI - 1	Analog Input 1 (Fume Hood Face Velocity)	Read-Only
AI - 2	Analog Input 2 (Exhaust Air Flow)	Read-Only
	Analog Outputs	
AO - 1	Analog Outputs (Actuator Position %)	Read-Only

Object instance	Functional description	Read or Write
	Analog Inputs	
AV - 1	Face Velocity Low Alarm Setpoint	Read/Write
AV - 2	Face Velocity Low Warning Setpoint	Read/Write
AV - 3	Face Velocity High Warning Setpoint	Read/Write
AV - 4	Face Velocity High Alarm Setpoint	Read/Write
AV - 5	Face Velocity Deadband percentage	Read/Write
	Multistate objects	
MSO - 1	Operating Mode: 1 = occupied, 2 unoccupied*, 3 = decom	Read/Write
MSO - 2	Alarm Status: 1 = normal, 2 = warning, 3 = alarm	Read-Only

* Can only be set if enabled at VMS-1655M User Interface

Wiring

Figure 25: VMS-1655M wiring



Technical specifications

Electrical	**Face velocity range**	0 fpm - 600 fpm. Use the Configuration Tool to adjust the maximum face velocity
	Accuracy of measurement	± 2 fpm, Accuracy is ± 5 fpm when velocity drops below 60 fpm or exceeds 140 fpm.
	2 analog outputs	0 VDC - 10 VDC, 4 mA - 20 mA
	1 analog inputs	0 VDC - 10 VDC
	Power supply	Class 2, 24 VAC ± 10%, 30 VA universal 120/240 VAC - 24 VAC, 60/50 Hz, step-down isolation transformer provided
	Recommended cable type	Belden 1325A
Communications	**BACnet MS/TP network**	Two-wire twisted pair, RS-485 signaling
	Recommended cable type	Belden 3107A
Touch screen user interface	**LCD size**	3.2 in. diagonal
	LCD type	Transmissive
	Resolution	240 pixels x 320 pixels portrait
	Viewing area	50.6 mm x 66.8 mm
	Color depth	18-bit or 262K colors
	Back light color	White
	Luminous intensity	Min 2500 cd/m2
Mechanical	**VMS-1655M surface-mount enclosure (height x width x depth)**	5 in. x 3 in. x 1.13 in.
	External vortex sensor housing (height x width x depth)	4 in. x 2.5 in. x 2 in.
	Stainless steel cover plate for flow tube (height x width x depth)	4.5 in. x 2.7 in. x 0.2 in.
	VMS-1655M with flow tube cover plate	Approx. 3.5 lb
	VMS-1655M with vortex sensor	Approx. 4.0 lb
	Flow tube cover plate mounting	Flush
Environmental	**Operating temperature**	32°F to 125°F
	Operating humidity	10% - 95%

1. NIST Traceable/Individual certification available as an option.
2. Accuracy is ±5 FPM when velocity drops below 60 FPM or exceeds 140 FPM.

The performance specifications are nominal and conform to acceptable industry standard. For application at conditions beyond these specifications, consult the local Air Distribution Technologies, Inc office. Air Distribution Technologies, Inc shall not be liable for damages resulting from misapplication or misuse of its products.

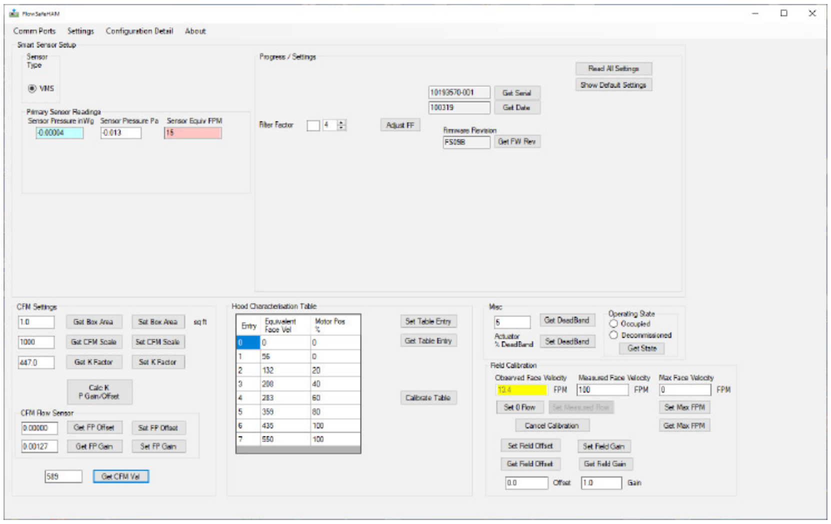
VMS Configuration

To install the VMS configuration tool, complete the following steps:
1. Open the Tool folder.
2. Double-click the **setup.exe** file.

To calibrate with the tool, complete the following steps:

1. Remove the display from the panel.
2. Disconnect the 4-pin plug with power and coms from the display.
3. A factory-installed USB-to-RS485 cable is included with the VMS-1655M unit to facilitate use of the VMS configuration tool.
4. Use the PC based tool to calibrate the sidewall sensor.
   This calibrates the sensor to read Face Velocity that matches your reference meter.
5. Use the PC based tool and the sash to characterize the mapping table.
   This sets the high and low limits for the Sash to Actuator position.
6. **Optional:** If hood cfm information is required, a velocity sensor and flow probe need to be installed.
   Use the tool to calibrate the velocity sensor and flow probe to provide the correct cfm information.
   On completion, re-connect the display and re-mount the display.

Figure 26: FlowSafeHAM homescreen



To use the VMS configuration tool to calibrate the actuator performance, complete the following steps:

1. Remove the RS485 connection to the Display module. The display continually communicates to the sensor and disrupts the PC communications.
2. A factory-installed USB-to-RS485 cable has been included with your VMS-1655M unit. Insert the USB connector of this cable into an available USB port on your PC.
   Note: For initial installations, wait for the USB driver to install before proceeding with using the VMS configuration tool.
3. In the PC Control Panel program, select **Device Manager**.
4. From the **Comms Port** window, from the **Sensor Port** list, select the COMXX that matches the COM number on your PC.

Ensure the VMS sensor is turned on. The USB plug flashes red for the request and green as a response from the sensor. Some of the pressure and face velocity fields populate. The GET buttons request and present the associated information. **Get Serial, Ger Date** and **Get FW Rev** return preset information about the sensor unit. The Sensor is in an operating and calibrated condition from the factory settings, but you can field calibrate various aspects.

As the airflow in the fume hood is turbulent, the pressure readings used to compute face velocity can also be noisy. The pressure readings can be dampened with a Filter Factor parameter. The greater the number is, the damping effect on the face velocity reading is larger, and also the response with changes in the face velocity is slower. The starting value is typically between 4-6.

You can calibrate the measured Face Velocity to conform with the specifics of the local Fume Hood.
The sensor uses a two point calibration. To achieve the first point, zero or offset calibration, you must cap the sensor to remove any air pressure from the hood on it.

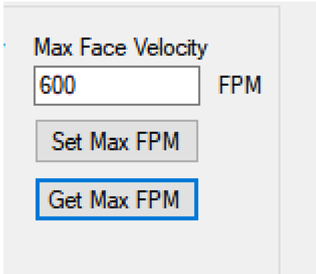
To achieve the first point, zero or offset calibration, complete the following steps:

1. Cap the 1/4 in the nipple that is exposed inside the hood with the Red sensor cap.
2. In the **VMS configuration tool**, in the **Field Calibration** section, ensure the value in the **Observed Face Velocity** field is stable.
3. Click **Set 0 Flow**.
4. Remove the cap from the sensor, adjust the hood sash so that the face velocity is at a typical operating value or higher than 60fpm and ensure the value in the **Observed Face Velocity** field is stable.
5. Use an external velocity measuring instrument, for example Shortridge or Alnor, to measure the velocity at the face.
6. Enter the measured face velocity in the **Measured Face Velocity** field and click **Set Measured Flow**.
   The Offset and Gain fields now update and the data is sent to the sensor. The sensor is now calibrated to local conditions.
7. **Optional:** At any point, if you need to abort the procedure, click **Cancel Calibration**.

Face velocity

Face velocity varies as the sash moves up and down, and the exhaust is at a constant volume.
When the sash reaches the closing position, the face velocity is very high. Use the **Max Face Velocity** setting to limit the internally used limit and face velocity on display. Click the **Get Max FPM** to obtain the current setting.To alter the current setting, enter a new value in the text field and click **Set Max FPM**.

Figure 27: Max Face Velocity



To prevent the Baffle Actuator from continually adjusting with fluctuating face velocities, it is possible to set a deadband on the motor operation. The deadband is expressed as a percentage of motor movement. As a value of 5 indicates that the motor only moves if it's positional requirement changes more than +- 5% from the current position. You can view or set this value with the **Get Deadband** and **Set Deadband** fields.

The Flow Safe fume hood uses a Vortex technology to maintain fume hood safety. A baffle at the rear of the fume hood manipulates the vortex. The face velocity derives a characterization table that determines the position of the baffle.

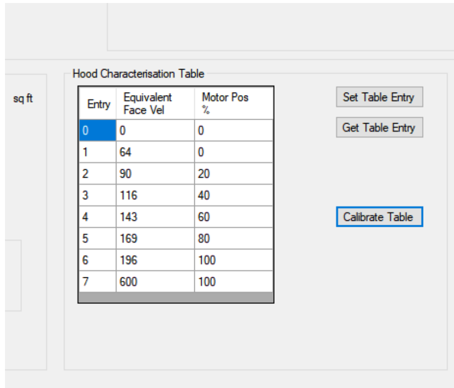
Calibrating characterization table

As each fume hood is different, and the cfm settings are different, the characterization table may need calibration in the field with its respective hood. To calibrate the characterization table, complete the following steps:

1. In the FlowSafeHAM window, in the **Hood Characterisation Table** section, click **Calibrate Table**.
2. In the **Calibrate Table** window, move the sash to the lowest operating height or lowest expected point of use.
   At this position, the face velocity will be the highest. Ensure the the face velocity is stable.
4. In the **High Face Velocity** field, enter the face velocity the tool reports or click **Get High Face Velocity**.
5. Move the sash to the highest operating height or highest expected point of use.
   At this position the face velocity will be the lowest. Ensure the the face velocity is stable.
6. In the **Low Face Velocity** field, enter the face velocity the tool reports or click **Get Low Face Velocity**.
7. Click **Update Calibration**.

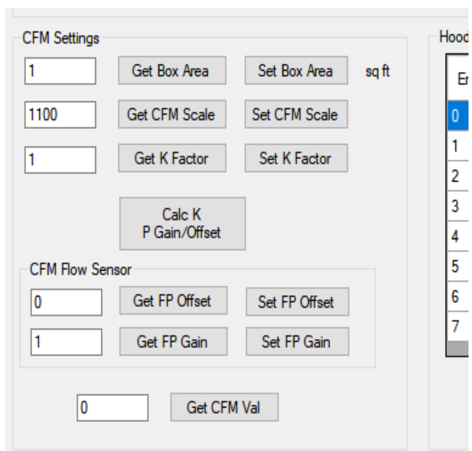
The Tool computes a new characterization table with the values you configure above and sends it to the controller.
The Calibrate Table Dialog turns grey.
Note: Ensure you set the max face velocity as this is also used to generate a table.

Figure 28: Hood Characterisation Table



The controller has the ability to accept a 0 -10V (0 – 5V, 4 – 20mA) input signal from a pressure or flow sensor that is attached to a flow probe in the duct work. This signal can compute a cfm value that, with scaling, can be output on the 4- 20mA output signal. Information and tools for setting this up are available in the **CFM Settings** tab.

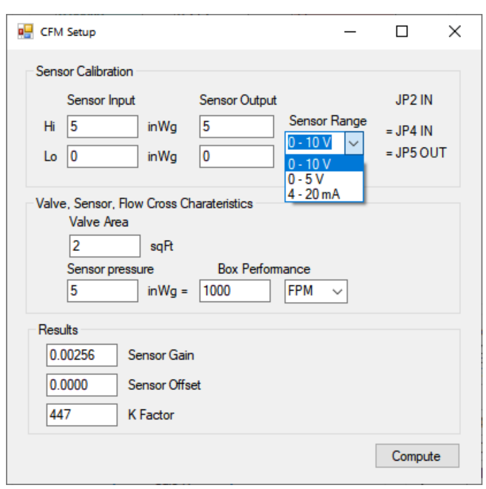
Figure 29: CFM Settings



To calculate and generate the cfm and cfm 4-20mA, the Tool uses the following parameters:

- Pressure Reading: The pressure sensor calibration (gain and offset),
- K factor
- Duct area
- Scaling factor for cfm to 4-20mA conversion

Figure 30: Sensor Calibration



To set to the calibration factors, gain and offset for converting the sensor voltage to pressure, complete the following steps:

1. In the **CFM Settings** window, click the **Calc K P Gain/Offset** button and a calculator window opens.
2. In the CFM Setup window, in the **Sensor Calibration** section, enter the features of the sensor that are in use.
3. From **Sensor Range** list, select the sensor range or signal type.
   Note: Ensure that JP2, JP4 and JP5 links are configured as per the information on the dialog.
4. Enter the sensor's output for a specific duct velocity or cfm.
5. In the **Valve. Sensor. Flow Cross Characteristics** section, in the **Valve Area** field, enter the valve area in sq ft.
6. From the Box Performance list, select **FPM** (velocity) or **CFM** (flow) as the interpretation of the sensor signal.
7. Click **Compute**. The Sensor Gain and Offset and K factor compute. These values transfer to the appropriate fields in the main **Tool** display. The values you update highlight in Yellow, as they do not pass to the controller yet.
8. If the values are valid, click **Set K Factor**, **Set FP Offset** and **Set FP Gain** to update the VMS with the settings.
9. **Optional:** Click **Get CFM Val** to view the current CFM value.

Note: To allow for various cfm ranges to 4 – 20mA output signal, it is necessary to enter a CFM Scale factor. This value represents what cfm the 20mA signal output represents. For example, if you enter a scale factor of 1000, when the cfm is 0, the output is 4mA, when the cfm is 1000 cfm or above, the output is 20mA, and subsequently when the cfm is 500cfm the output is 12mA. In the CFM Setting window, in the CFM Scale field, enter the scaling factor and click **Set CFM Scale** to communicate it to the VMS.

North American Emissions Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case users will be required to correct the interference at their own expense.

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la Classe (A) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.