# HMS-1655
# Installation Manual
# Version: 06.11.15


Triatek HMS-1655
Fume Hood Controller

## CONTROLLER SETTINGS

# HMS-1655 Fume Hood Controller Settings

**Fume Hood Name / Number** _____

**Unit Model Number and Serial Number (ESN)** _____

***This form should be completed during the initial configuration for each fume hood controller. See HMS-1655 Wiring and Installation Manual for details.***

**Sidewall Sensor Input**

- Normal Operating Face Velocity _____
- Sensor Linearization (enabled or disabled) _____
- Sensor Input Mode (normal or inverted) _____
- Sensor Input Range (zero-based or offset) _____
- Occupied Mode Setpoint _____
- Unoccupied Mode Setpoint _____
- Decommissioned Mode Setpoint _____
- Face Velocity Deadband _____

**Analog Output**

- Operating Mode (Direct or PID) _____
- Analog Output Range (zero-based or offset) _____
- Analog Output Upper Limit (0 – 100%) _____
- Analog Output Lower Limit (0 – 100%) _____
- Analog Output Input Channel (AI-1 thru AI-4, TI-1 or TI-2) _____
- Analog Output Action (Direct or Reverse) _____
- Analog Output Range (zero-based or offset) _____

**Sash Switch**

- Operating Mode (normally-open or normally-closed) _____
- Delay Setting (0 - 240 secs) _____

**Relay Output**

- Trigger Mode (Setpoints or Operating Mode) _____
- Input Channel (AI-1 thru AI-4, TI-1 or TI-2) _____
- Occupied Mode High Setpoint _____

## HMS-1655 Fume Hood Controller Settings

| | |
|---|---|
| Occupied Mode Low Setpoint | |
| Unoccupied Mode High Setpoint | |
| Unoccupied Mode Low Setpoint | |
| Relay Acting Mode (Direct or Reverse) | |
| Delay Setting (0 - 180 secs) | |

**PID Constants**

| | |
|---|---|
| Proportional Constant (0.5 – 100.0 %) | |
| Integral Constant (0.0 – 100.0 %) | |
| Derivative Constant (0.0 – 100.0 %) | |

**Alarm Limits**

| | |
|---|---|
| Occupied Mode High Alarm Setpoint | |
| Occupied Mode High Warning Setpoint | |
| Occupied Mode Low Warning Setpoint | |
| Occupied Mode Low Alarm Setpoint | |
| Unoccupied Mode High Alarm Setpoint | |
| Unoccupied Mode High Warning Setpoint | |
| Unoccupied Mode Low Warning Setpoint | |
| Unoccupied Mode Low Alarm Setpoint | |

**Audible Alert**

| | |
|---|---|
| Enabled Input Channels (AI-1 thru AI-4, TI-1, TI-2) | |
| Operating Mode (audible or silent) | |
| Delay Time Base (secs or mins) | |
| Delay Setting (0 – 60) | |
| Alarm Quiet Period Starting Hour (0 – 23) | |
| Alarm Quiet Period Ending Hour (0 – 23) | |

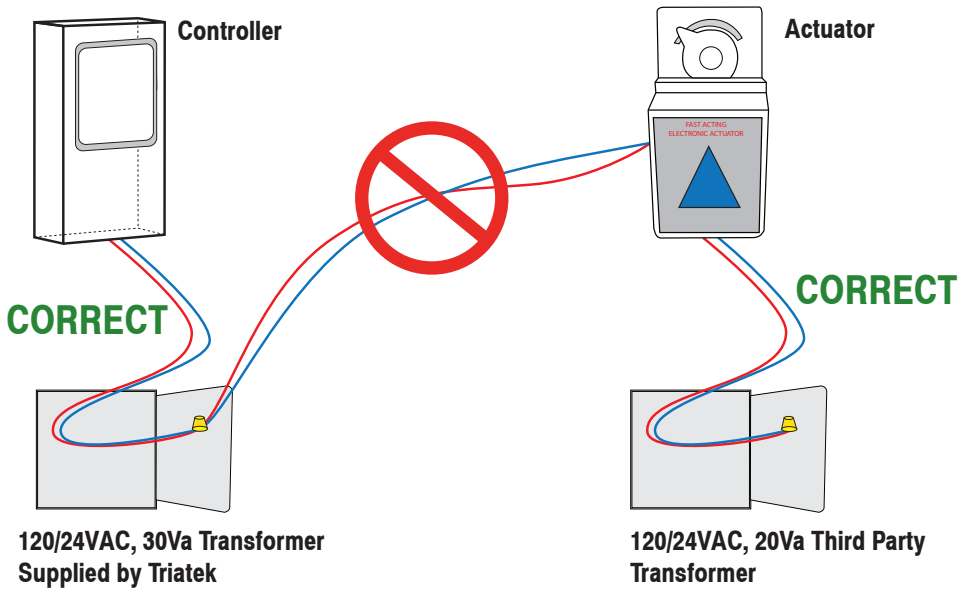
**Engineering Units**

| | |
|---|---|
| Feet per Minute or Meters per Second | |

# Warning

Failure to follow the wiring diagrams could result in damage to your equipment and could void your warranty. Wiring diagrams can also be found at www.triatek.com.

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 120/24V 30Va transformer is required for the controller and a separate 120/24V 20Va transformer is required for the actuator.



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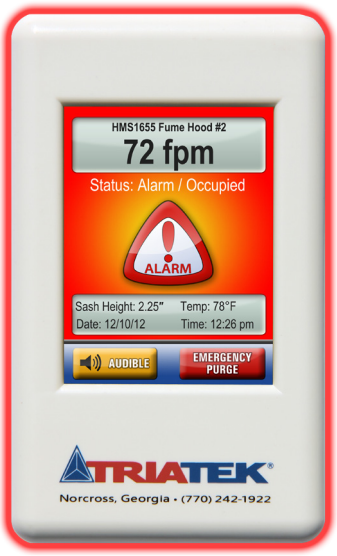



## Electrical

| | |
|---|---|
| 4 Analog Inputs | 4-20mAdc, 0-5Vdc or 0-10Vdc |
| 4 Analog Outputs | 4-20mAdc, 0-5Vdc or 0-10Vdc |
| 2 Thermistor Inputs | NTC Type 2 or 3, 10kΩ @ 25°C |
| 4 Digital Inputs | 0-5Vdc or 0-24Vdc, Active-High or Active Low |
| 4 Relay Outputs | 1A@24VDC |
| Control Signal Wire Size | 18 AWG minimum |
| Power Supply | Class 2, 24Vac ±10%, 30VA universal 120/240 to 24 Vac, 60/50 Hz, step-down isolation transformer provided |

## Communications

| | |
|---|---|
| BACnet® MS/TP network | Two-wire Twisted Pair, RS-485 signaling |
| Metasys® N2 network | Two-wire Twisted Pair, RS-485 signaling |
| Recommended Cable Type | Belden 1325A |

## Touchscreen User Interface

| | |
|---|---|
| LCD Size | 3.2" diagonal |
| LCD Type | Transmissive |
| Resolution | 240 x 320 portrait |
| Viewing Area | 50.60 mm x 66.80 mm |
| Color Depth | 18-bit or 262K colors |
| Backlight Color | White |
| Luminous Intensity | min 2500 cd/m2 |

## Specifications

### Mechanical

HMS-1655 Display Housing ..... 3”W x 5”H x .75”D
HMS-1655 Controller Housing ..... 4.1”W x 6”H x 1.85”D

### Environmental

Operating Temperature ..... 32° to 125° F Operating
Operating Humidity ..... 10% - 95% RH, Non-condensing

### HMS Air Flow Sensor

Type of Sensor ..... Thru-the-hood ultra sensitive
Face Velocity Accuracy ..... 0-200 FPM ± 2 FPM*
Dimensions ..... 2 5/32”H x 4 3/4”W x 3 5/16”D
*NIST Traceable / Individual certification available as option*
**@72°F ± 5°F*

### Venturi Valve (Order Separately)

Diameter..... 6”, 8”, 10”, 12”, 14” & 16”O.D.
CFM Range ..... 30-2400
Materials ..... Aluminum, Stainless Steel, Heresite Coating
Sound Insulation ..... Optional
Actuation ..... Electronic or Pneumatic

### Part Number Guide

HMS1655 - ☐ - ☐

**Sensor Type**
1 = single smart sidewall sensor
2 = dual smart sidewall sensor
A = single legacy sidewall sensor
B = dual legacy sidewall sensor

**Sash Sensor**
blank = sash sensor not included
S = sash position sensor included

*Accuracy is ± 5FPM when velocity drops below 60FPM or exceeds 140 FPM

# GENERAL

## Overview

The Triatek HMS-1655 Series Fume Hood Controller is an ultra-sensitive instrument used to monitor and/or control the fume hood face velocity in laboratories and clean rooms. This unit is a precision measuring system capable of measuring and displaying face velocities from zero to 200 ft/min (1.016 m/sec) with an accuracy of ±2 ft/min.

**Key features of the HMS-1655 include:**

- Three selectable control modes available: sidewall only, sash position only, sash with sidewall for closed-loop performance
- Comprehensive closed-loop sash control with sidewall velocity sensing
- Full-color touchscreen display with programmable display options and adjustable backlight
- Intuitive user interface simplifies setup and configuration of unit
- Display background changes color to indicate hood status at a glance
- Safety Halo™ provides full 180° status visibility from anywhere in laboratory space
- Audible and visual alarm annunciation
- Auxiliary universal analog inputs for use with optional sensors
- Four independent PID control loops for controlling damper actuators, speed drives, hot water valves, humidifiers, etc.
- Digital input used to monitor an optional fume hood sash switch, zone presence sensor or emergency override switch.
- Relay outputs used for transmitting alarm condition to remote location
- Dedicated thermistor inputs for temperature monitoring and/or control applications
- Multi-level password protection of touchscreen user interface
- Field Calibration of both sidewall velocity sensor and optional sash position sensor
- Multi-protocol native (BACnet®, Metasys® N2) for easy integration with any BMS
- Manual override of Analog and Relay outputs assist with Test & Balance procedures
- Comprehensive Real Time View diagnostics tool displays built into each unit
- Easy-to-install backplane/backplate assembly facilitates permanent termination of all wiring

The HMS-1655 enhances the popular HMS-1650 with enhanced graphics at the main display screen and the integration of the patent pending Saftey Halo™ status indicator. This simple yet elegant feature significantly enhances the alarm status indication of the HMS-1655 by providing full 180-degree visibility. Not only can you see the status while standing directly in front of the fume hood, you can now have full visibility from virtually anywhere in the laboratory. The HMS-1655's Safety Halo™ is shipped from the factory enabled at full brightness, but may be dimmed or even disabled completely from the Display Setup menus.

The HMS-1655 is equipped with a 3.2" diagonal **Full-color Touchscreen** display in portrait orientation (240 x 320). 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 popups to facilitate the ease-of-use of the HMS-1655.

The display implements bright graphical color changes to indicate the three different alarm status indication of the monitored fume hood. These graphical backgrounds indicate "Normal" when the face velocity is within defined limits, "Warning" when the face velocity is approaching an out-of-limits condition, and "Alarm" when the face velocity is outside the defined acceptable and safe limits. The face velocity ranges for these conditions are easily configured by the user for the specific installation when necessary, either directly from the touchscreen display or over the network from the BMS. The graphical background changes provide an overview of the monitored fume hood face velocity conditions at a glance.

**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 four user-definable ways: 1) on the display, 2) with an audible alarm, and 3) transmitted via contacts to a remote monitoring location and 4) over the BMS network. The alarm will automatically reset when the unit has sensed that the fume hood face velocity has returned to proper limits. The operator may easily mute the audible alarm by touching the OK button on the alarm notification message popup window of the touchscreen display.

The HMS-1655 provides four **Universal Analog Outputs**, which may be configured for either current loop operation or for voltage operation. Each analog output may be configured for proportional operation to provide a linear signal to the BMS, or for PID (proportional-integral-derivative) control operation for closed-loop feedback control of damper actuators, variable frequency (speed) drives, hot water valves, humidifiers, or other analog-controlled devices. Each universal analog output may be field-configured for the required application using onboard configuration dipswitches on the controller module. Each analog output may also be temporarily overridden using the built-in diagnostic tools for troubleshooting during the installation and commissioning phase.

## Overview

For those applications requiring monitoring and/or control based on temperature variances, the HMS-1655 provide two dedicated **Thermistor Inputs** in addition to the four universal analog inputs. Therefore, a total of six analog inputs are available for control applications. The two thermistor inputs may be used with negative temperature coefficient (NTC) Type 2 or Type 3 sensors.

The HMS-1655 provides four **Relay Outputs**, which may be configured for either direct-acting or reverse-acting operation, and may have a programmable delay associated to meet the specific needs of the required application. A unique feature of the HMS-1655 is its ability to trigger a relay output for the purpose of activating an optional automatic sash closer device, thereby keeping an unattended fume hood with an open sash safe for occupants of the lab. Each relay output may also be temporarily overridden using the built-in diagnostic tools for troubleshooting during the installation and commissioning phase.

The HMS-1655 provides four **Digital Inputs** that may be used for monitoring sash switches, override switches, flow switches, occupancy sensors or other devices with binary outputs. The configuration and operation of each input may be configured by the user to define the effect of a change in its state. Each digital input may have a programmable delay duration associated with it. Each digital input may be configured for either normally-closed or normally-open operation, and may also be configured to be active-high or active-low triggered. The global configuration of the digital inputs is field selectable through the use of a configuration switch on the controller unit.

The HMS-1655 provides four **Relay Outputs** that may be used for remote alarm annunciation or pilot control functions. The operation of each output may be configured by the user to define the exact fume hood face velocity values above and below which the output will operate. Delay times before activation may be specified to minimize nuisance alarms. Each relay output may be configured for either direct action or reverse action. The configuration of each relay output is field selectable through the password-protected user menus.

The user may set up multiple multi-level **Passwords** to prevent unauthorized or casual access to the HMS-1655 configuration settings. Up to ten passwords of up to eight digits may be programmed, 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.
Fume hood operating mode selection of Occupied, Unoccupied, or Decommissioned may be protected using limited access passwords, thereby eliminating the need for keylock switches and keys. However, an **Optional Keylock Switch** may be used to further control access to change in operating modes.

The HMS-1655 provides native support for multiple networking protocols, including **BACnet® MS/TP** and **Metasys® N2 Open**. For applications requiring LonWorks networking capability, contact the factory about Triatek's HMS-1655L series. With multi-protocol native support, the HMS-1655 is able to communicate fume hood status information to the building automation system, regardless of which protocol is used. The configuration of the desired protocol is field selectable through the use of miniature dipswitches on the controller unit.

The HMS-1655 provides a unique set of built-in diagnostics tools that are extremely valuable for facilitating the troubleshooting process during the installation and commissioning phase. Included in these built-in diagnostics tools are **Manual Override** capabilities for both analog outputs and relay outputs, and a comprehensive **Real-Time View** capability that allows the real-time values and states of each analog and digital input and output to be displayed conveniently. This is an extremely useful tool that facilitates the verification and certification processes conducted by typical test and balance personnel during the commissioning of the system. There are also options for storing configuration settings and for restoring those settings, as well as performing a complete restoration of the factory default configuration settings.

The HMS-1655 incorporates an innovative **Backplane/Backplate** assembly which greatly facilitates the installation process and permits all wiring terminations to be permanent. The HMS-1655 serves as a direct drop-in functional replacement for all previous models of HMS-1600 series of BACnet/N2 fume hood controllers.

## MOUNTING/WIRING

### Installation

This section will illustrate a typical method of installing the HMS-1655 to a fume hood. Tools required include: drill, 3/8 drill bit, 1/8 drill bit, Phillips #2 screwdriver, standard medium blade screwdriver, silicone sealant. Also a suitable tool will be needed for cutting the opening shown on page 10.

1. Proper location of the sensor is very important for obtaining the best possible operation of the HMS-1655. The system uses through-the-wall sensing to measure the internal negative pressure of the fume hood to accurately determine the face velocity. The sensor must be located in a position that is least affected by turbulent air within the hood. See illustration on page 12. There are two types of fume hood arrangements which need to be considered: By-Pass and Non-By-Pass.

   - **Front-to-Back Position** – With either type of fume hood arrangement, the sensor is best located approximately 6 inches back from the vertical sash track.
   - **Vertical Position (By-Pass type)** – Locate the sensor vertically in the center of the region between the bottom of the sash in the fully open position and the bottom edge of the by-pass opening.
   - **Vertical Position (Non-By-Pass type)** – Locate the sensor vertically 6" above the bottom of the sash in the fully open position.

2. See page 14 for dimensions and suggested mounting arrangements of the Triatek flow sensor on the hood wall.**NOTE: Be certain that sensor reference port is in laboratory room air. If necessary to obtain this, use Triatek HMS-1600-PLATE mounted on exterior panel of the fume hood.**

3. Apply silicone sealant around the sensor immediately prior to mounting the assembly to its mounting surface. Be careful to avoid getting sealant in the sensor port.

4. See page 12 for mounting details for the HMS-1655 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 control unit, and provision must be made to route the cable without interference with the fume hood sash or sash cable. The control unit is typically secured in a convenient location on top of the fume hood. (See page 13)

5. At the HMS-1655 backplane, assuming the colors of the 3-conductor signal cable being red, black, and white, connect the leads to the terminals as follows:

   Red: SNS_PWR
   Black: AGND
   White: AI_1

   Modules with the 9-pin terminal block, connect the 3-conductor signal cable as follows:

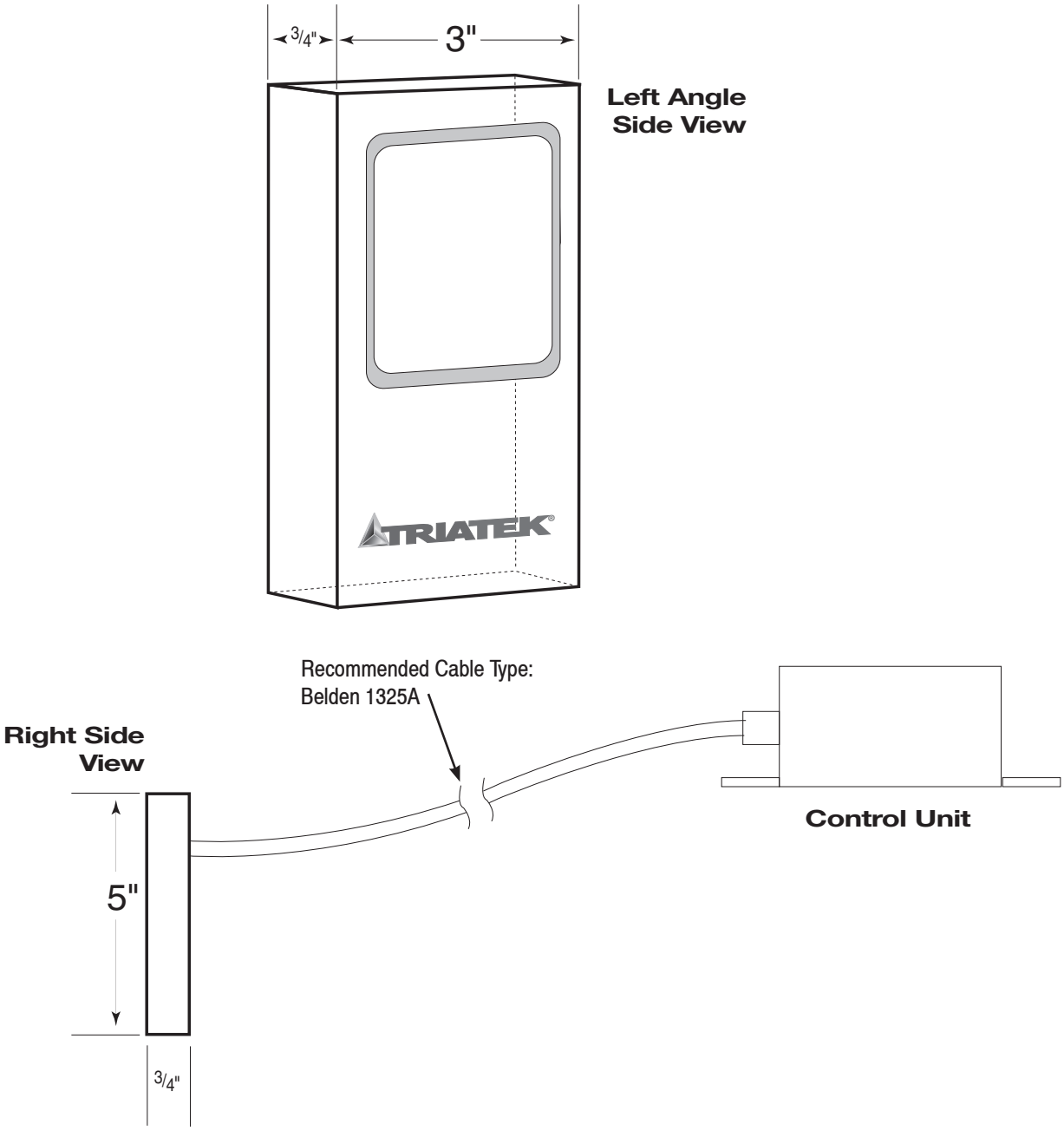
   Red: +Vin
   Black: GND
   White: $V_o$

6. Power supply connections - input voltage must be Class 2, 24 VAC or 24 VDC. A step-down isolation transformer is supplied with the HMS-1655. Triatek recommends that the HMS unit be powered using the supplied transformer, and that only one unit be powered with each transformer. Do not power any other device with the same transformer. See pages 24 and 25 for connection details.

7. All wiring should conform to the Local Regulations and the National Electrical Code. Take precautions to prevent routing the sidewall sensor wiring in the same conduit as line voltage or other conductors that supply highly inductive loads such as generators, motors, solenoids or contacts, etc. For all wiring connections, use 22 AWG or larger.

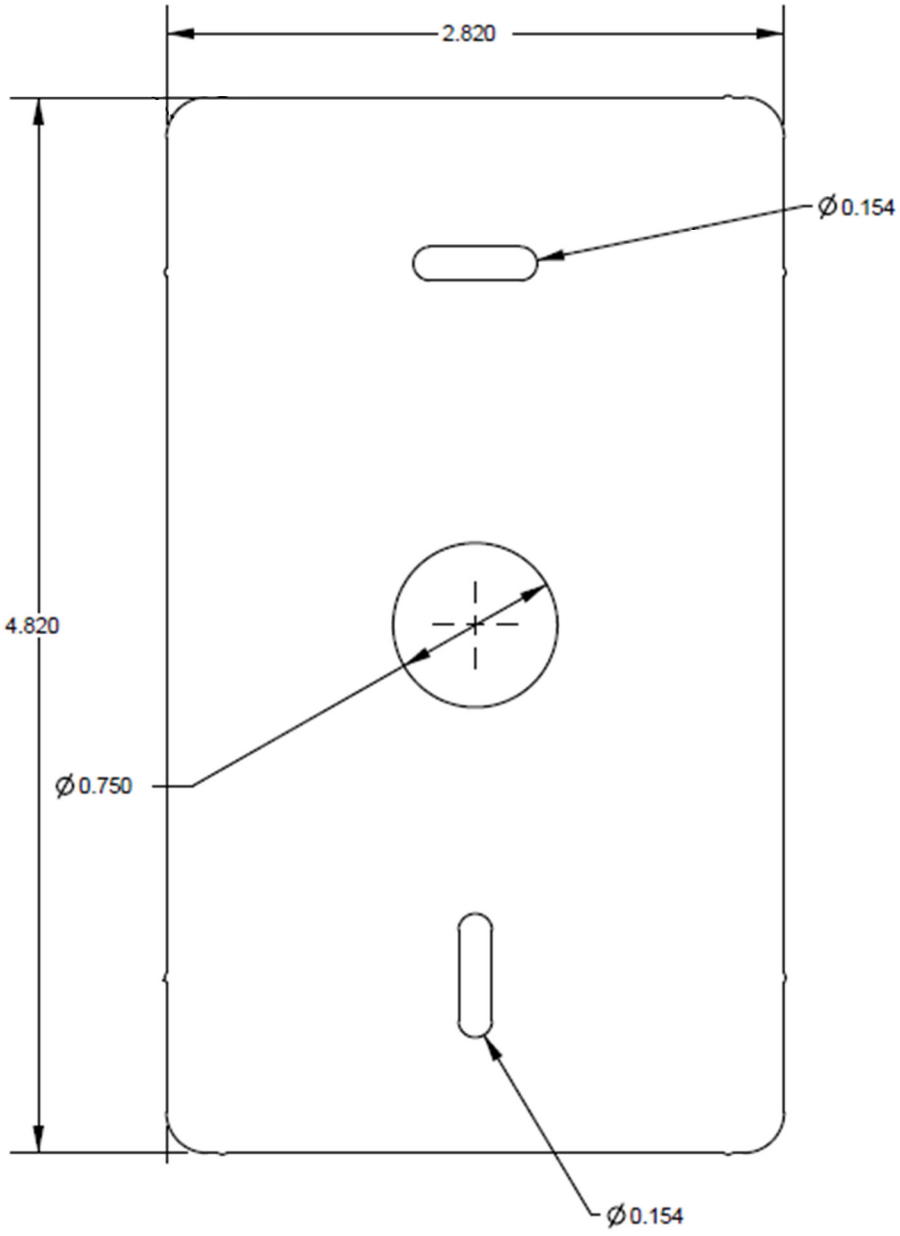
8. After the installation is complete, apply power to the unit, open the sash to a normal operating position and observe the flow reading on the touchscreen display. If necessary, proceed to the Programming Section beginning on page 27.

## HMS Case Dimensions



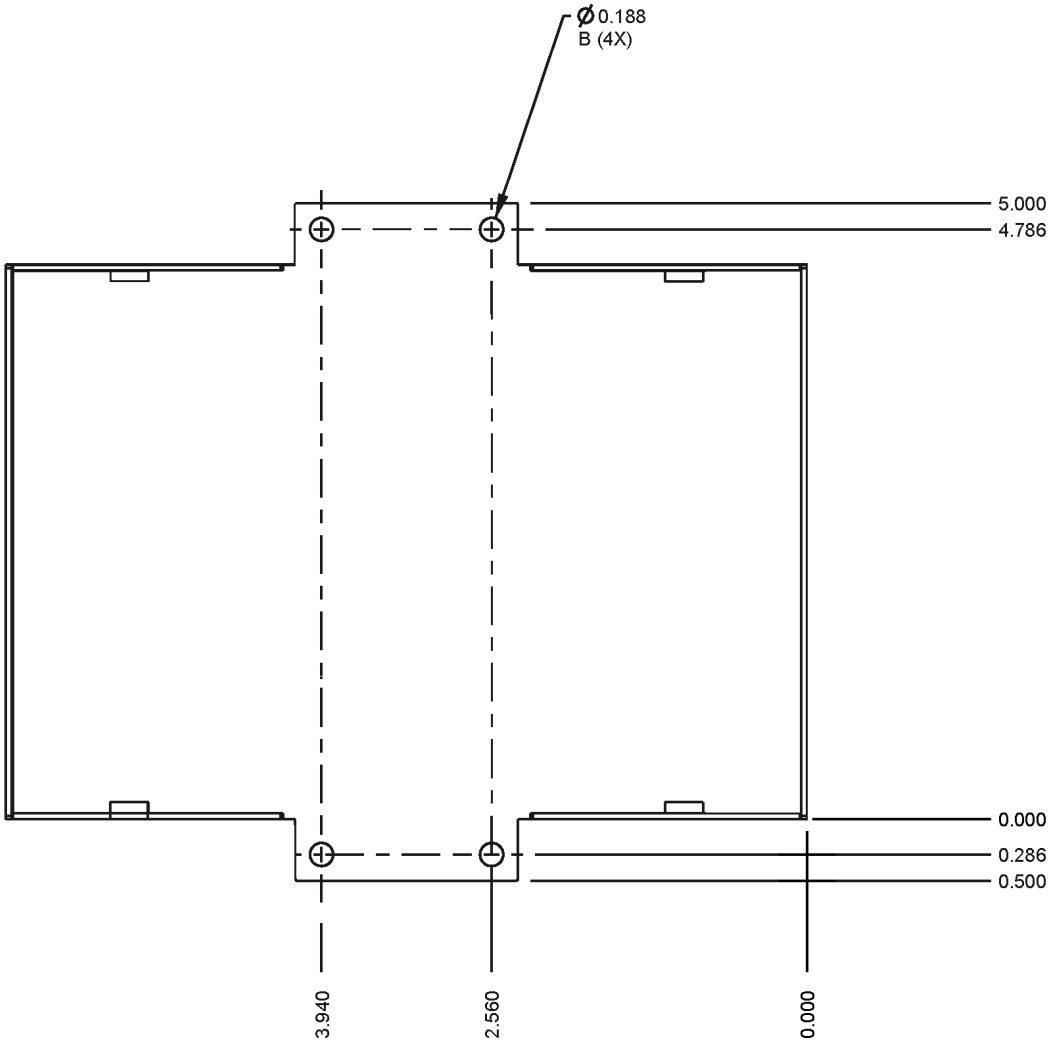
## MOUNTING/WIRING

### Display Mounting Hole Pattern



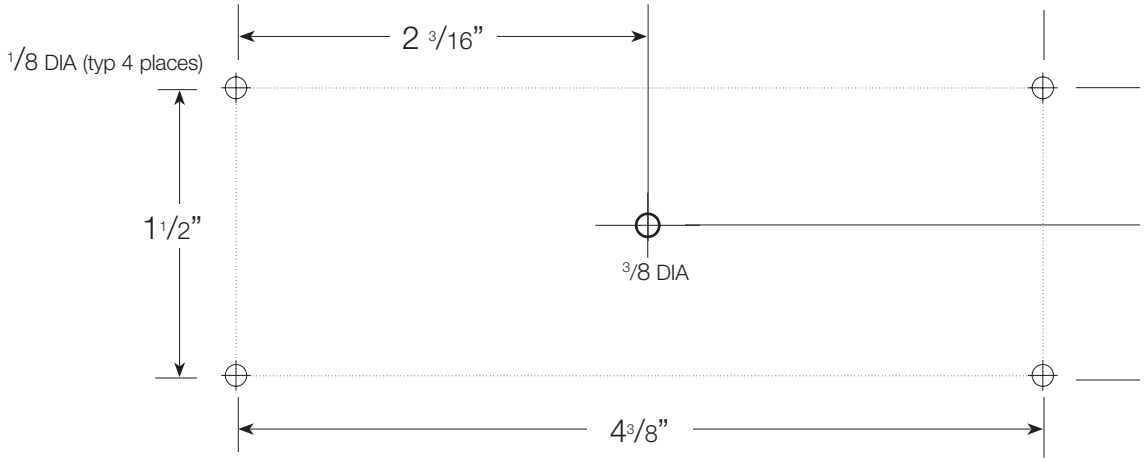

The HMS-1655 display backplate may be mounted directly to a standard single-gang wall box using the two slots along the centerline. Use the backplate as a template to mark the mounting holes and the cable access hole at the center of the backplate.

## Controller Mounting Hole Pattern

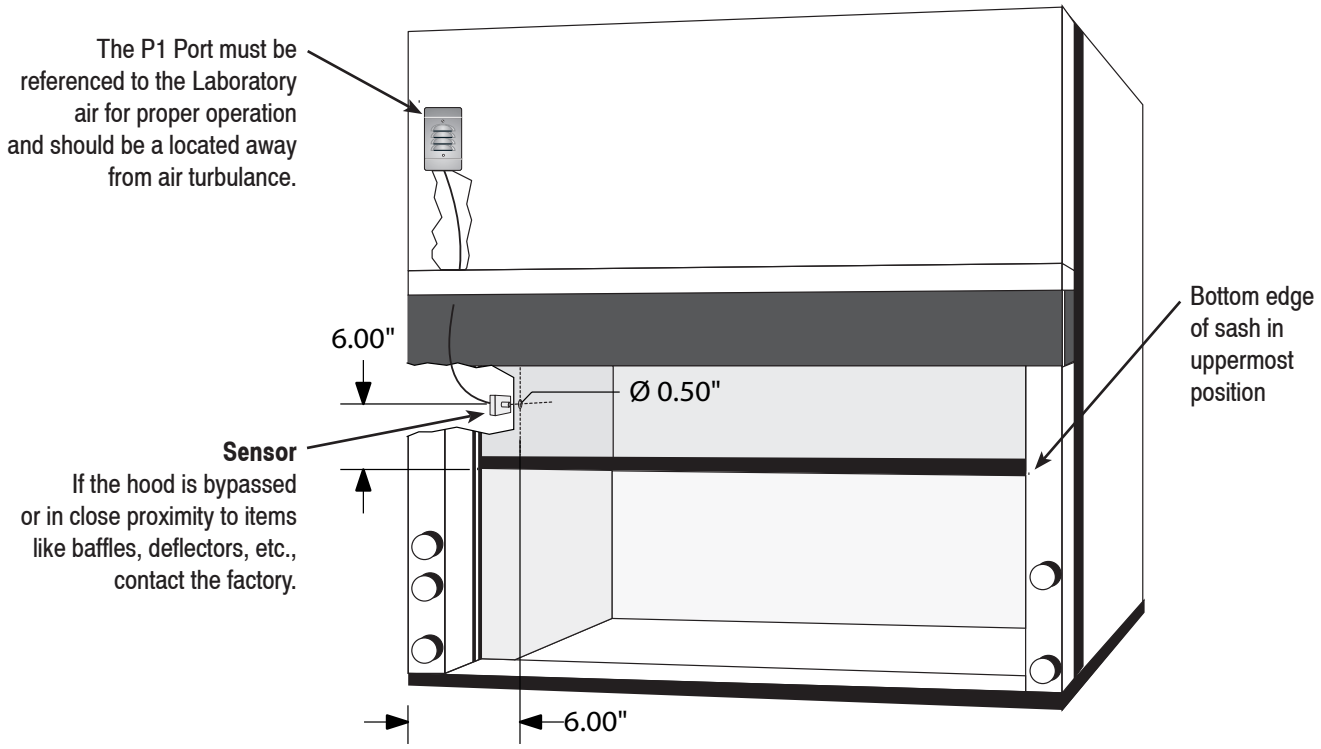


## MOUNTING/WIRING

### Sensor Mounting Hole Pattern




### *Sensor Placement - Non By-Pass Type*



## Standard Sidewall Sensor (9-pin)

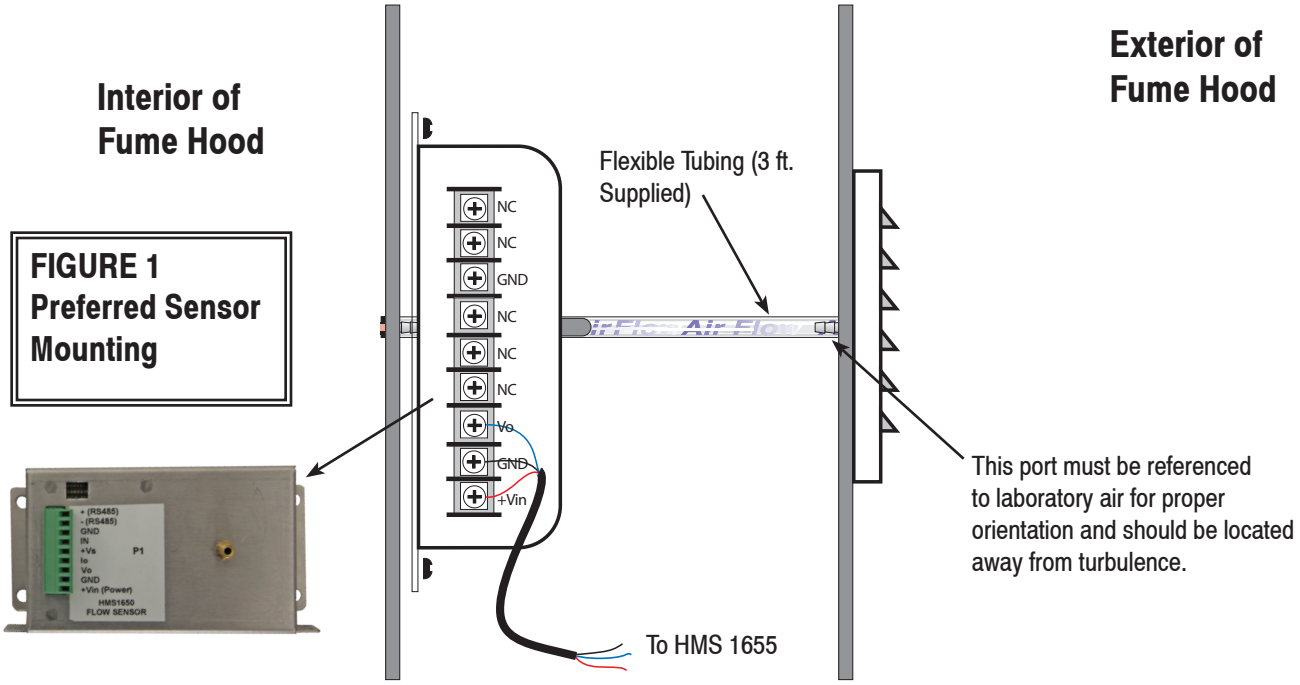



**FIGURE 1**
**Preferred Sensor Mounting**

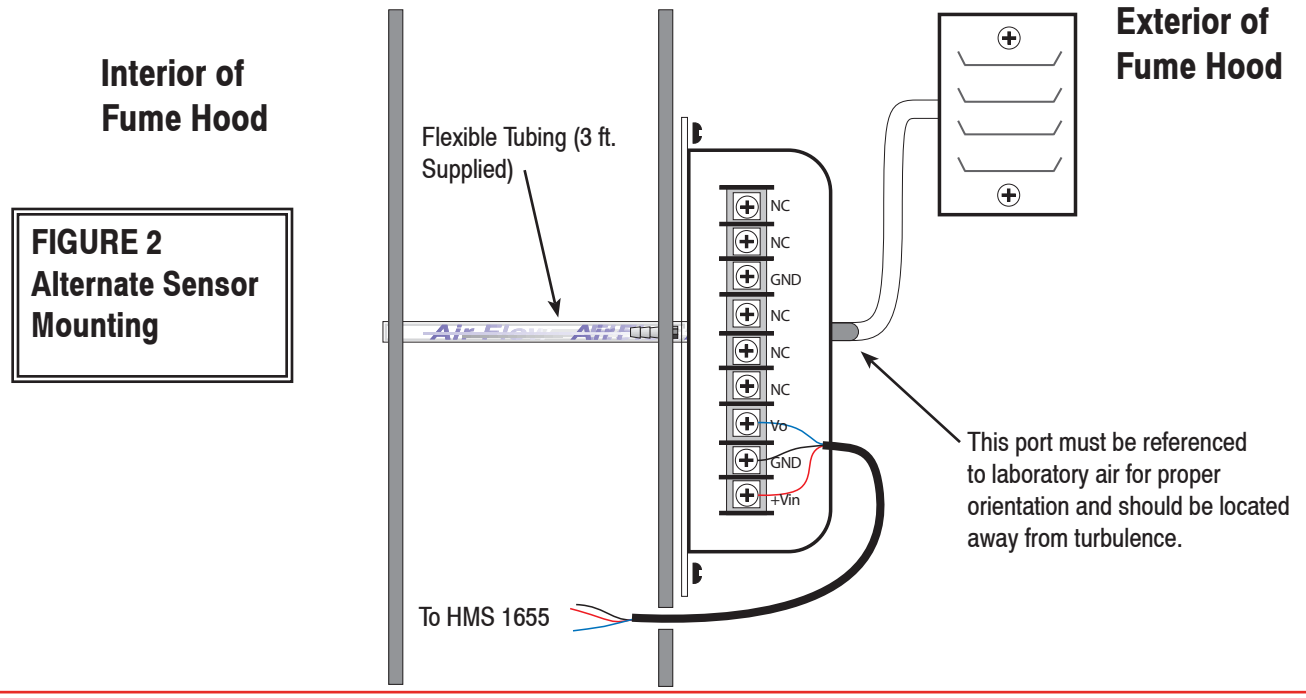



**FIGURE 2**
**Alternate Sensor Mounting**

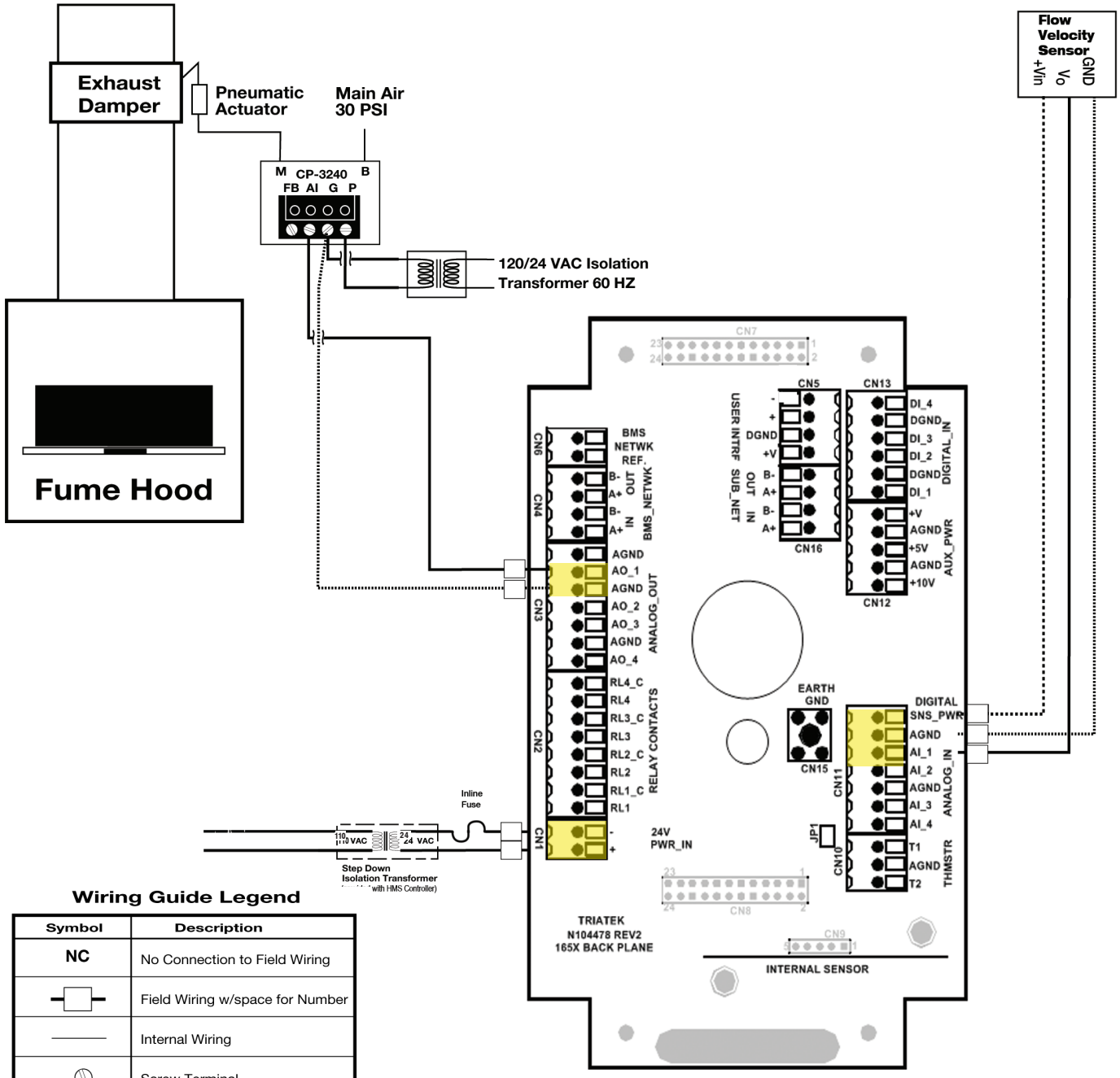
## MOUNTING/WIRING

### Notes

## Notes

## MOUNTING/WIRING

### Analog Output to Pneumatic Actuator

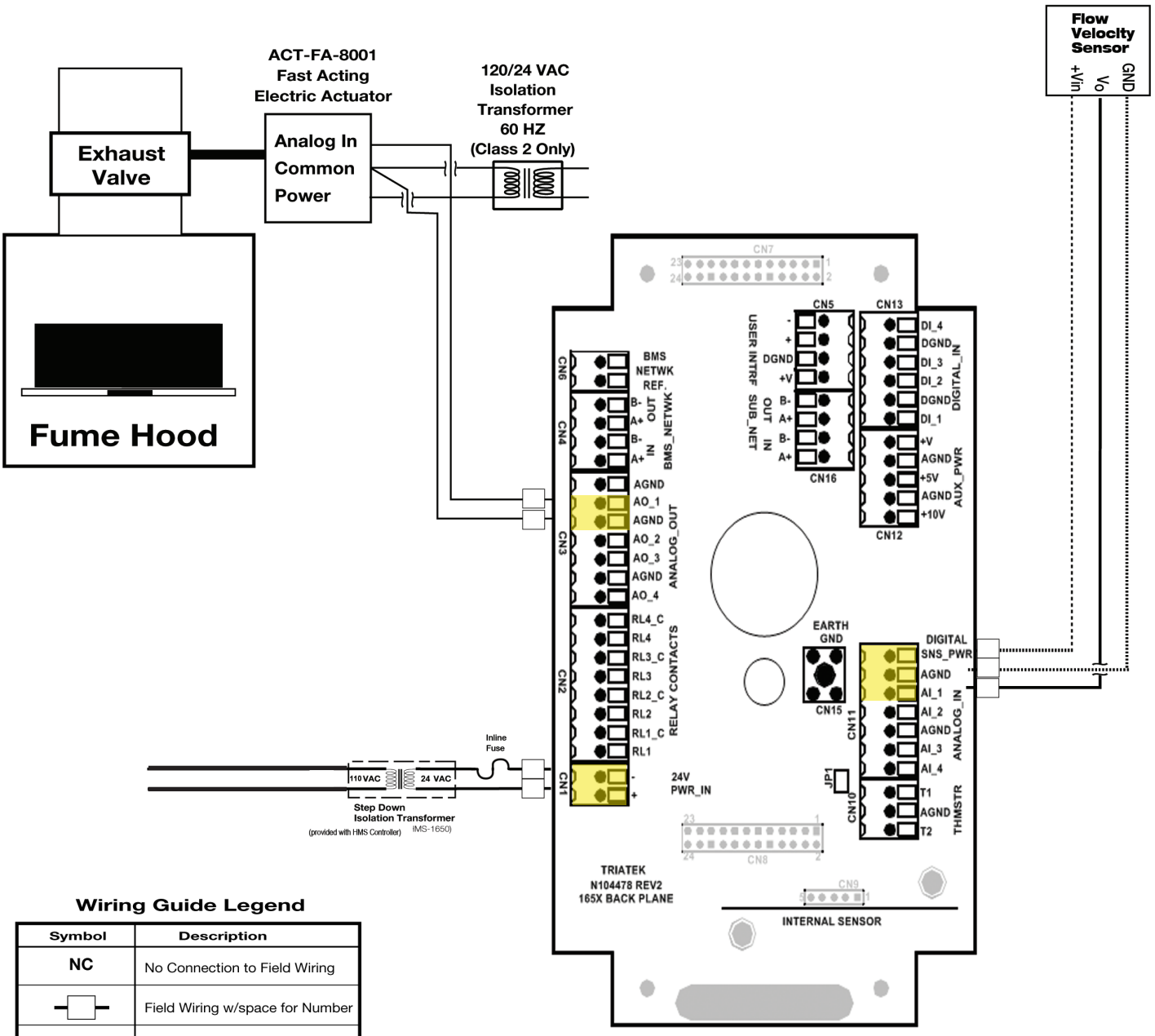



**Wiring Guide Legend**

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S1 - 1 = OFF, S1 - 5 = OFF (AI - 1 set as 0-5V Input) |

## Analog Output to Electric Actuator



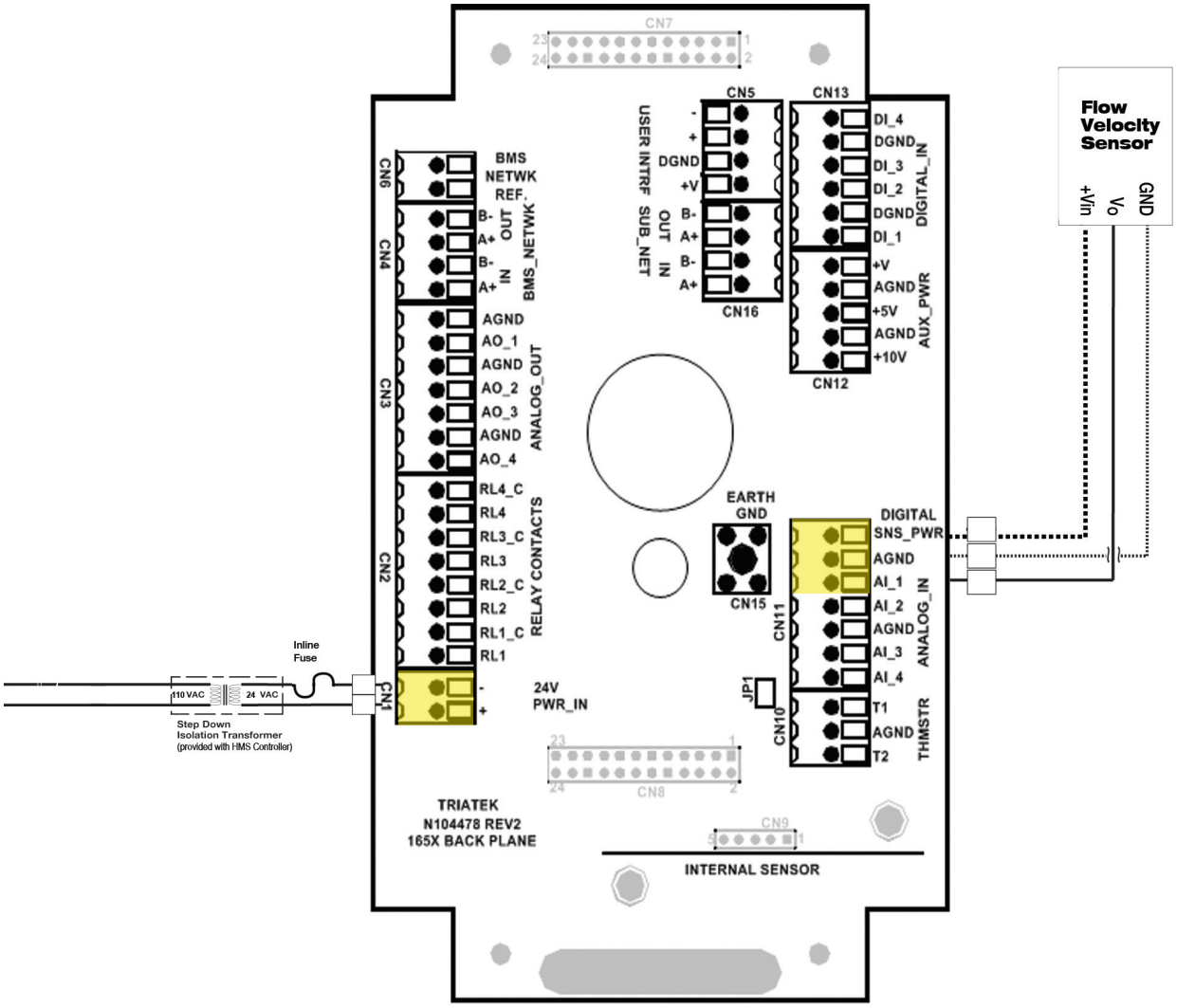

### Wiring Guide Legend

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S1 - 1 = OFF, S1 - 5 = OFF (AI - 1 set as 0-5V Input) |

## MOUNTING/WIRING

### Analog Input Single Flow Sensor

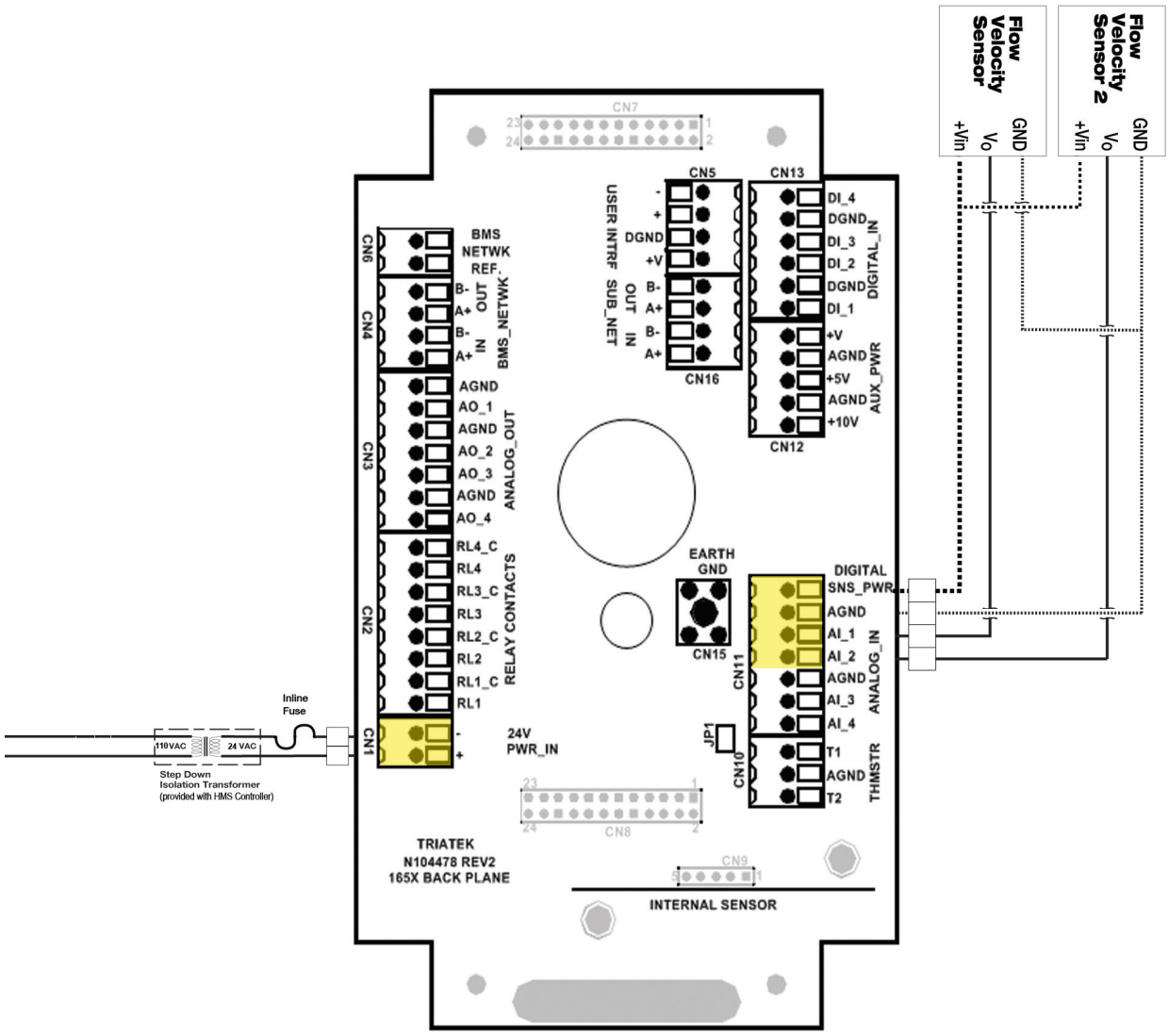



**Wiring Guide Legend**

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S1 - 1 = OFF, S1 - 5 = OFF (AI - 1 set as 0-5V Input) |

## Analog Input Dual Flow Sensors



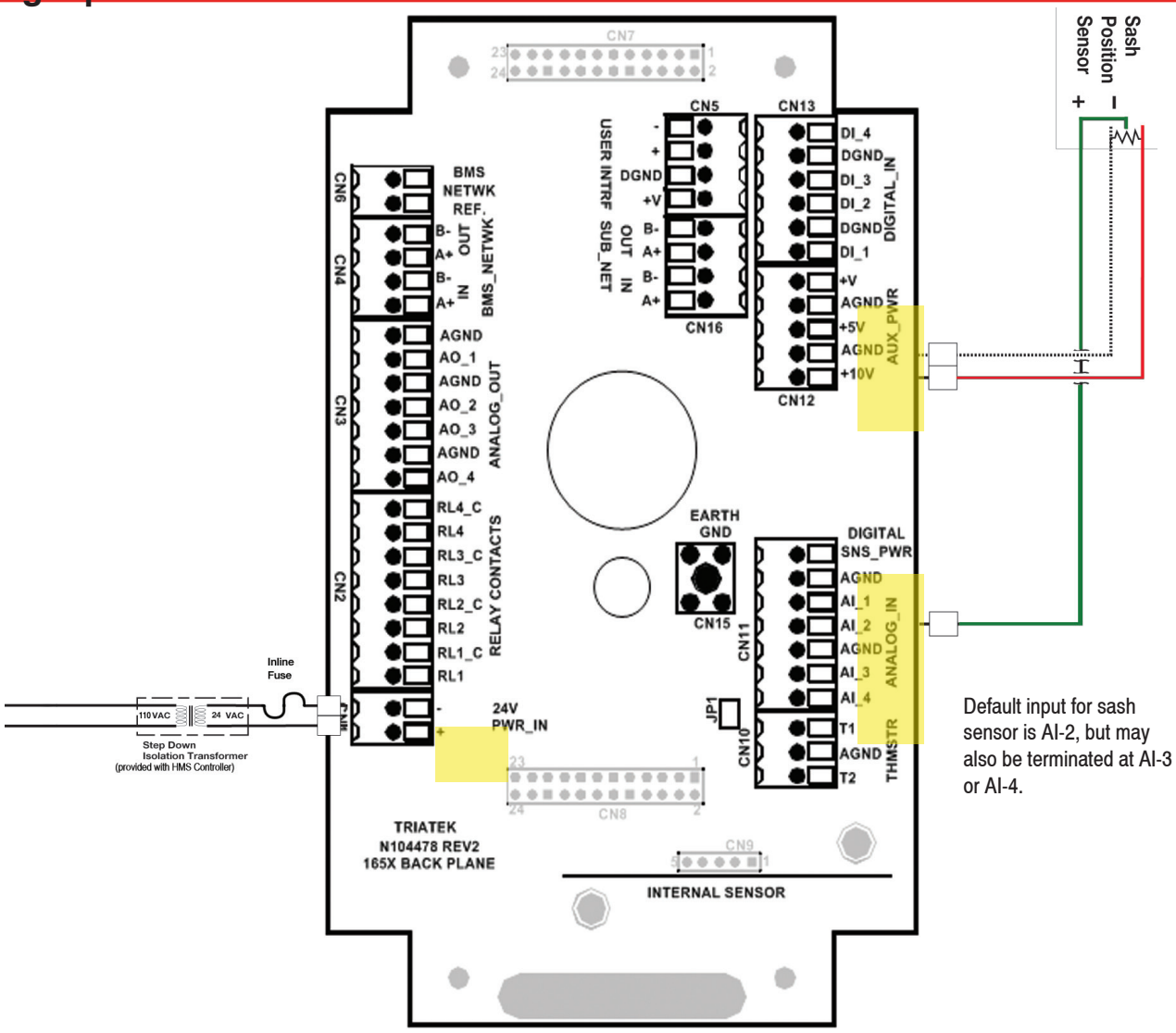

### Wiring Guide Legend

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S1 - 1 = OFF, S1 - 5 = OFF (AI - 1 set as 0 - 5V Input) |
| S1 - 2 = OFF, S1 - 6 = OFF (AI - 2 set as 0 - 5V Input) |

## MOUNTING/WIRING

### Analog Input Sash Position Sensor



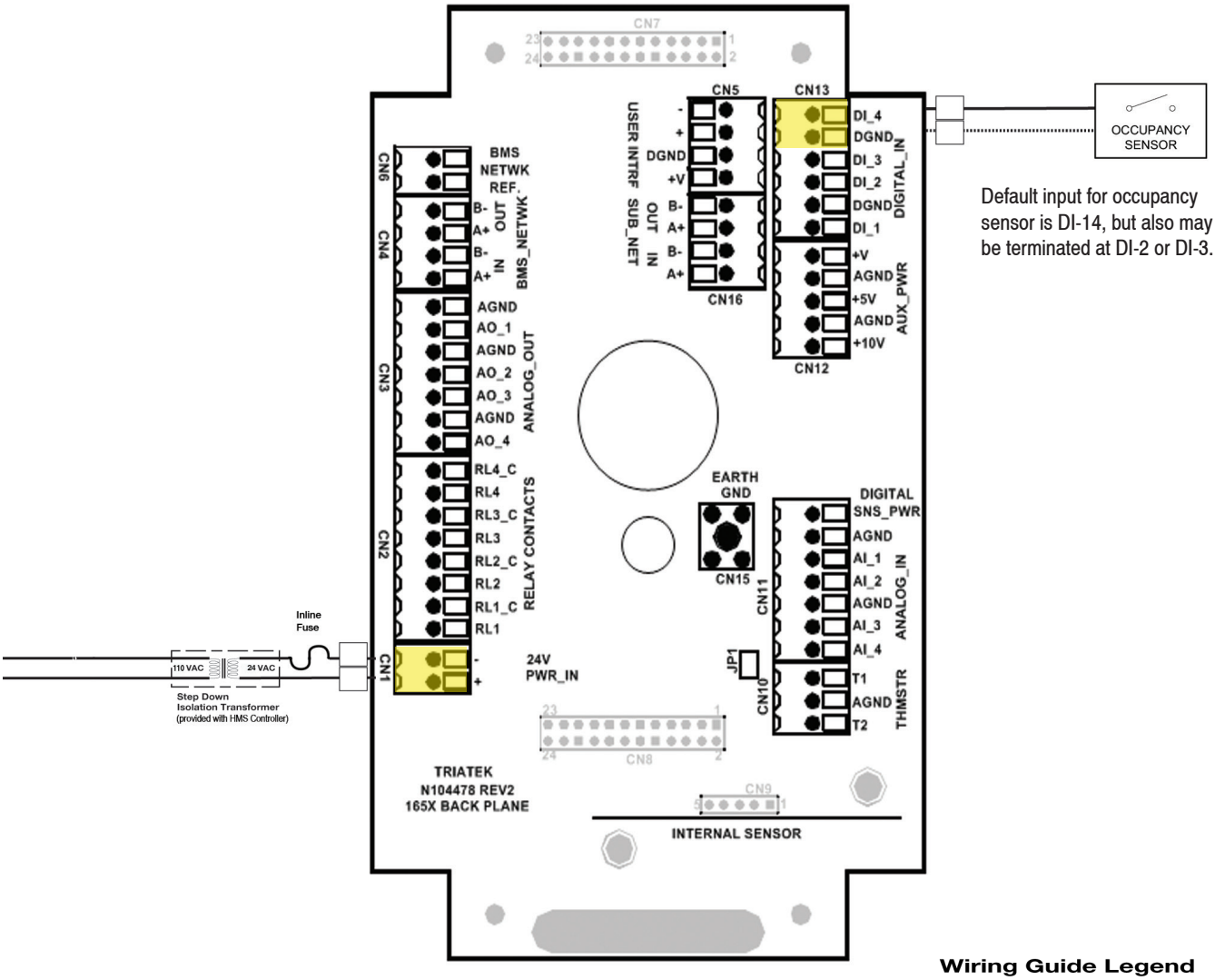

Default input for sash sensor is AI-2, but may also be terminated at AI-3 or AI-4.

**Wiring Guide Legend**

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S1 - 2 = OFF, S1 - 6 = ON (AI - 3 set as 0-10V Input) |

## Digital Input Occupancy Sensor




Default input for occupancy sensor is DI-14, but also may be terminated at DI-2 or DI-3.

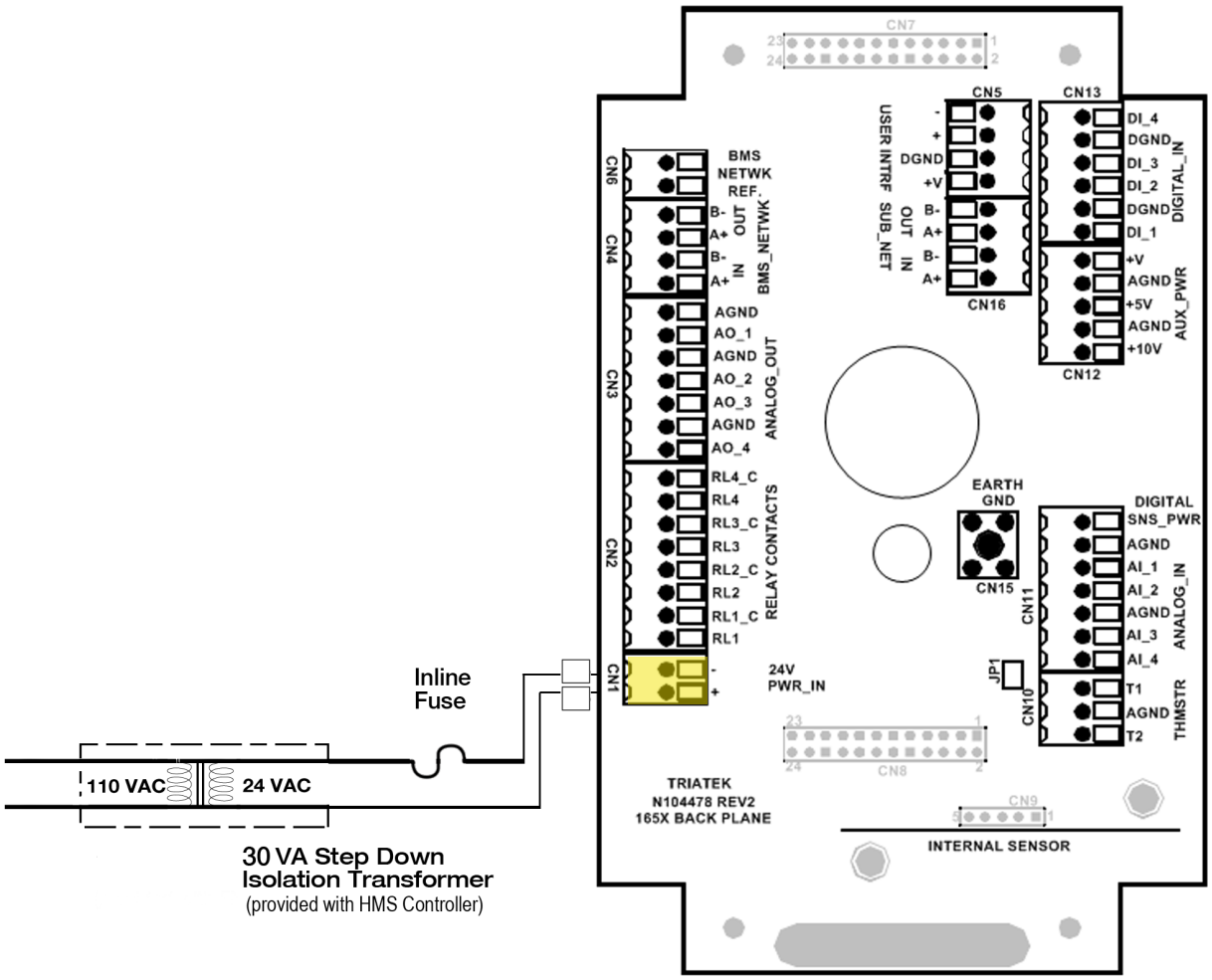
### Wiring Guide Legend

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Slideswitch Settings |
|---|
| S5 = Left (Active - Low Digital Input) |

## MOUNTING/WIRING

### Power




**Wiring Guide Legend**

| Symbol | Description |
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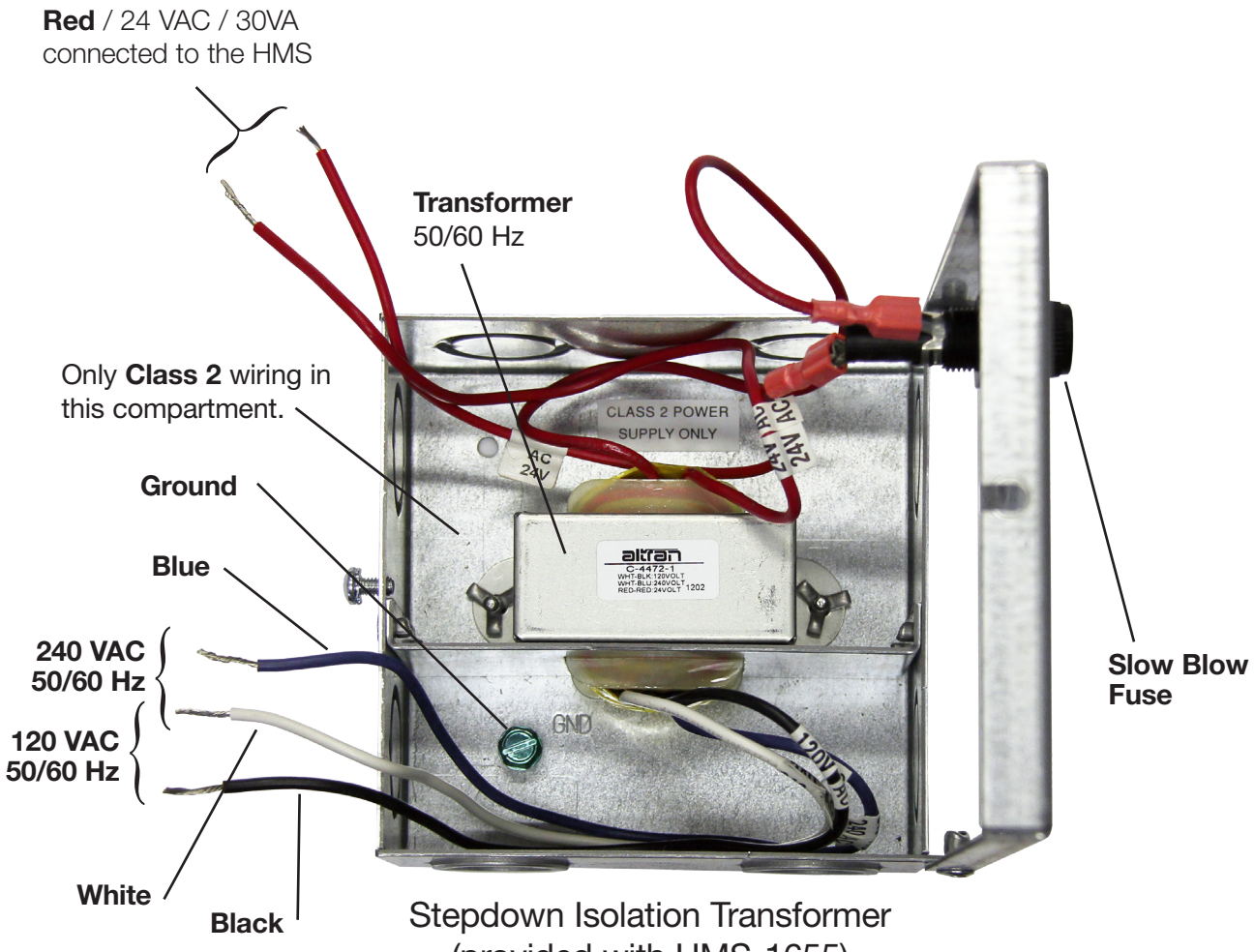
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

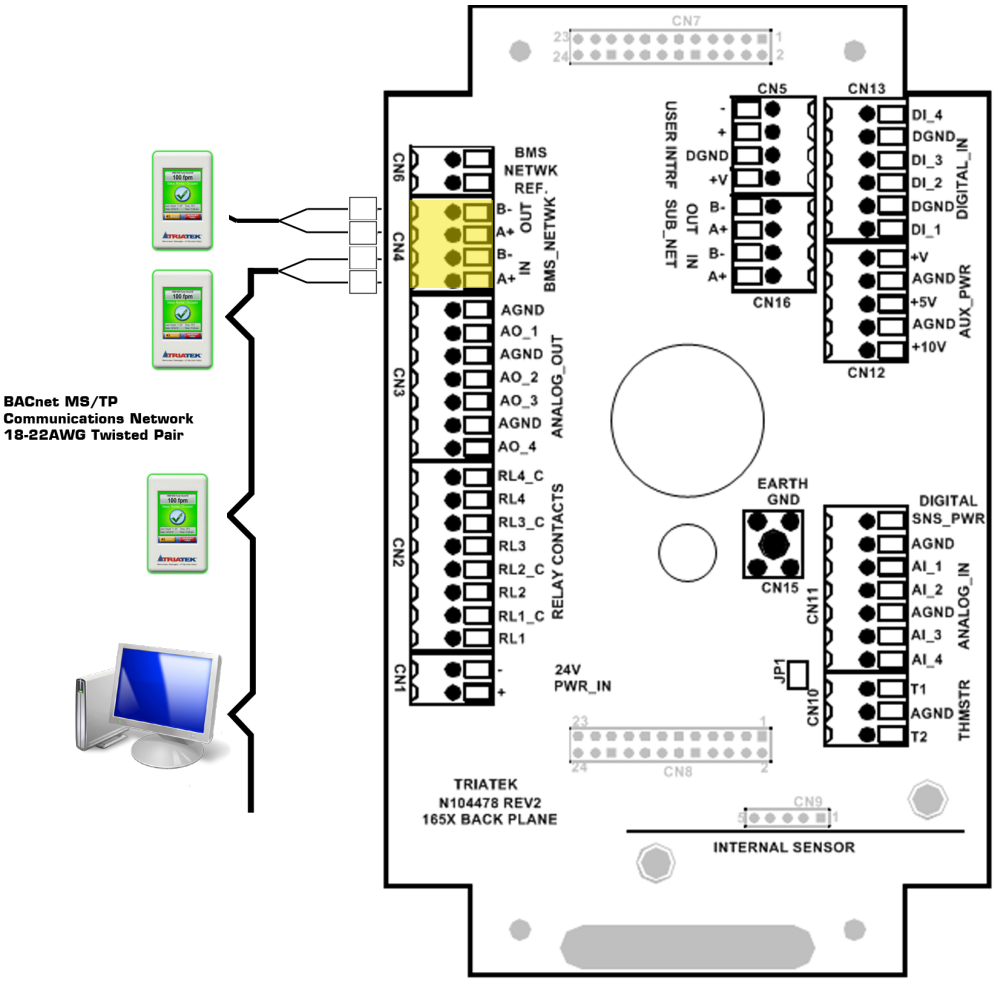
## Isolated Power Supply




Stepdown Isolation Transformer
(provided with HMS-1655)

*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.

## BACnet MS/TP Wiring



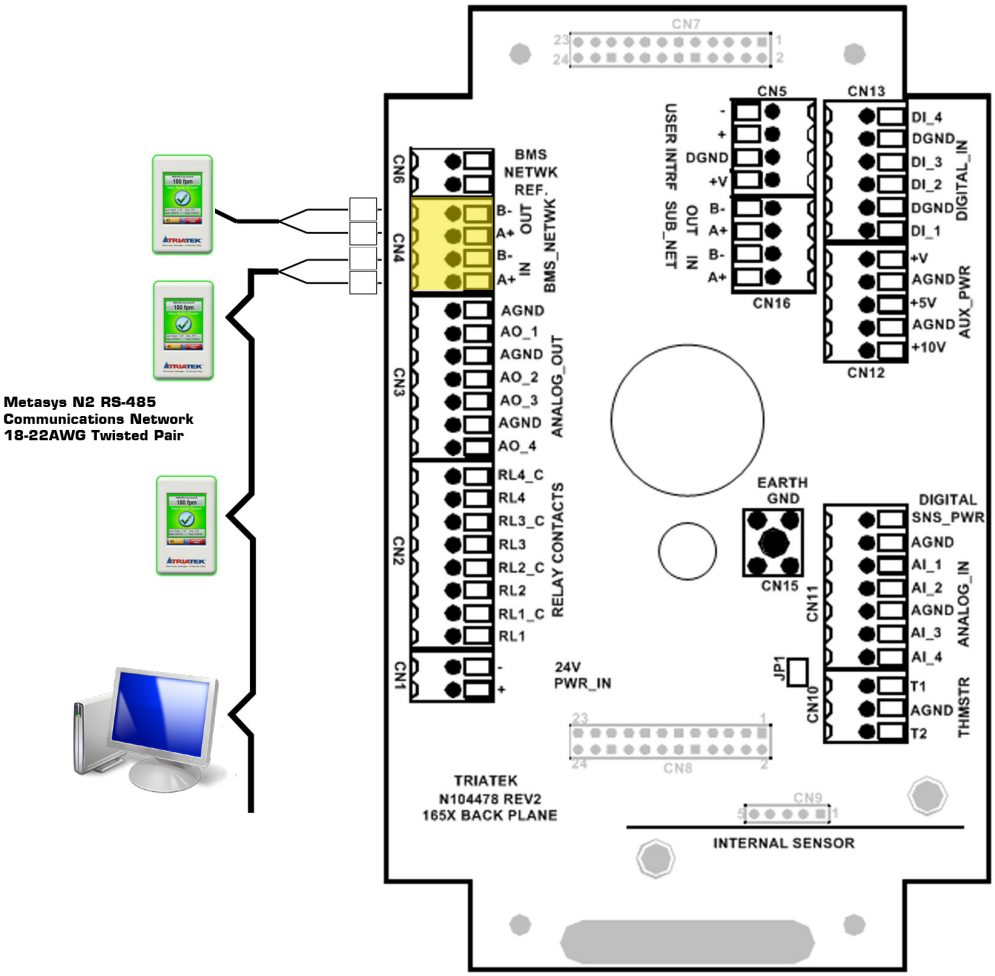

### Wiring Guide Legend

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

NOTE: For optimum network communications, the reference signal (REF) must be connected to the "NETWK REF" terminals at the backplane.

| Controller Configuration Dipswitch Settings |
|---|
| S3 - 7 = ON, S3 - 8 = ON (BACnet MS/TP protocol selected) |

## Metasys N2 Open Wiring




NOTE: For optimum network communications, the reference signal (REF) must be connected to the "NETWK REF" terminals at the backplane.

### Wiring Guide Legend

| Symbol | Description |
|---|---|
| NC | No Connection to Field Wiring |
| | Field Wiring w/space for Number |
| | Internal Wiring |
| | Screw Terminal |
| | Air Flow To and From Unit Between Room and Corridor |

| Controller Configuration Dipswitch Settings |
|---|
| S3 - 7 = ON, S3 - 8 = OFF (Metasys N2 Open protocol selected) |

# HMS-1655 BASIC PROGRAMMING

**Introduction**
Following the proper installation of the HMS-1655, apply power to the unit and confirm that you hear a brief chirp at the touchscreen display, which indicates that the display module is communicating with the controller module. There will be a 6-second pwoer 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 5-second animation of the action icons, followed by the HMS-1655 splash screen. This splash screen displays the model number, electronic serial numbers, firmware version numbers, protocol selection, and current network address. The splash screen remains displayed for about 15 seconds, and then proceeds to the main face velocity screen.

NOTE: The information displayed on the splash screen during the power up sequence may also be redisplayed using the **About This HMS** option on the Diagnostics menu.


*Each HMS-1655 comes pre-configured in Decommissioned Mode.*

**Main Display Screen**
All HMS-1655 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:

- Fume hood name in the upper window (up to 24 characters)
- Current face velocity (default units: ft/min)
- Current operating mode and status
- Intuitive status icon centrally located
- Current sash height in the lower window (default units: inches)
- Current exhaust airflow in the lower window (default units: cfm)
- Current time and date in the lower window

Located just below the lower window with the time and date display are the audible toggle button and the emergency purge button, if it has been enabled. The emergency purge button may be used to instantaneously force the exhaust damper to the maximum open position in the event of a chemical spill or other unsafe condition at the fume hood work space.

While in Decommissioned operating mode, the graphical background is blue in color. However, while in either *Occupied* or *Unoccupied* mode, the graphical background intuitively represents the current alarm status of the unit. A green graphical background with a checkmark at the center indicates that the current face velocity is within allowable limits of the desired setpoint. A yellow graphical 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 graphical 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.

The HMS-1655 incorporates a full-color touchscreen and includes an extensive easy-to-use menu system that allows the user to quickly setup the fume hood controller for immediate use. Also integrated into the HMS-1655 display are several hotspots that provide quick access to various settings. Refer to page 36 for details on using these hotspots as display settings shortcuts. Touching the screen anywhere other than one of the reserved hotspots invokes the menu system, unless one or more security passwords have been entered.

**Configuring Fume Hood Monitor**
The initial setup of the HMS-1655 Fume Hood Controller involves the following simple steps:

- Configure analog output
- Calibrate face velocity sensor
- Configure face velocity setpoints

- Configure sash position sensor input
- Calibrate sash position sensor
- Configure sash alarm heights
- Configure face velocity alarm setpoints

**Calibrating Face Velocity Sensor**

The standard HMS-1655 comes pre-configured and pre-calibrated with a face velocity sensor that gets installed in the sidewall of the fume hood being monitored. If the application requires sash position control only, then proceed to the next section to configure the sash position sensor settings.

To begin calibrating the face velocity sensor following installation, enter the *Main Setup Menu* by touching the touchscreen display anywhere other than one of the hot-spot locations. From the *Main Setup Menu*, select *Unit Setup* --> *Hood Setup* --> *Field Calibration*. At the initial field calibration screen, the analog output is overridden to close off the exhaust damper and the sidewall velocity sensor should be capped to prevent air flow.

Once the face velocity reading stabilizes, click the *Next* button to proceed to the next field calibration screen where the overriden analog output should be repositioned to achieve approximately 100 ft/min at the sash opening with the sash positioned at a height of 18 inches. An air flow measuring instrument should be used to confirm that the face velocity is approximately 100 ft/min. Move the analog output slider to increase or decrease the effective face velocity at the sash opening, and then click the *Next* button to proceed to the next field calibration screen. Using the air flow measuring instrument, take three measurements across the 18-inch sash opening and enter the average using the slider on the field calibration screen. Click the *Next* button to complete the field calibration procedure of the fume hood face velocity sensor. Proceed with the next section to configure the sash position sensor (if applicable).

**Configuring Sash Position Sensor**

For those applications requiring sash position control of an exhaust damper actuator by the HMS-1655, the sash position sensor (POS-100) must be configured and calibrated accordingly. If this application requires monitoring only and does not include controlling the exhaust valve of the fume hood, then proceed to *Selecting Sash Control Mode Section* below.

To begin configuring the sash position sensor input, enter the *Main Setup Menu* by touching the touchscreen display anywhere other than one of the hot-spot locations. From the *Main Setup Menu*, select *System Setup* --> *Analog Inputs* and select the analog input to which the sash position sensor is physically connected (default is AI-3). At the *Select Input Type* screen for the selected input, click on *Sash Position* and then click the *Next* button to proceed. At the *Analog* Input x *Settings* popup screen, select the desired engineering units (default is inches) and the range (default is 0-5V,0-10V,0-20mA), and click the *Finish* button to save the settings to non-volatile memory.

To confirm that the analog input has been configured properly, use the *Real-Time View* option on the *Diagnostics* menu to monitor the selected analog input. Moving the sash from fully closed to fully open should result in a change for the selected analog input on the *Analog Inputs Real-Time View* screen.

**Calibrating Sash Position Sensor**

To begin calibrating the sash position sensor, enter the *Main Setup Menu* by touching the touchscreen display anywhere other than one of the hot-spot locations. From the *Main Setup Menu*, select *Unit Setup* --> *Sash Setup* --> *Field Calibration*. At the initial field calibration screen, the sash should be moved to the fully closed position. Move the slider to represent the actual sash height in the fully closed position (default is zero), and click the *Next* button to proceed to the next field calibration screen. Move the sash to the fully open position, measure the actual height of the sash opening, and enter the measured value using the slider. Click the *Next* button to complete the field calibration of the sash position sensor. Proceed with the next section to configure the sash settings, including the sash opening height and width.

**Configuring Sash Settings**

The HMS-1655 monitors sash height for alarming purposes, if this unit has been equipped with a sash position sensor (POS-100). The Sash High Alarm Height specifies the height at which the HMS-1655 will sound an audible alarm if the sash is left at or above this position for an extended period of time, specified as the Sash High Alarm Delay setting. The Sash Low Mute Height specifies the height below which the HMS-1655 will mute the audible alarm if it has been activated due to high face velocity conditions.

To begin configuring these sash settings, enter the Main Setup Menu by touching the touch screen display anywhere other than one of the

# HMS-1655 BASIC PROGRAMMING

hot-spot locations. From the Main Setup Menu, select Unit Setup --> Sash Setup --> Sash Settings. Enter the Sash High Alarm Height, Sash High Alarm Delay, Sash Low Mute Height, and Sash Opening Width using the popup numeric keypad on the touch screen display. The sash heights and width should be entered in inches, while the sash high delay should be entered in seconds. Proceed with the next section to configure the face velocity alarm setpoints of the HMS-1655.

**Selecting Sash Control Mode**

The HMS-1655 provides support for five different combinations of sash and sidewall monitoring and control. When using the sash position sensor for controlling the fume hood exhaust valve, it may be used in conjunction with or without the sidewall sensor. For sash-only control mode, the exhaust valve is positioned strictly based on the real-time height of the sash. The face velocity reading is calculated based on the area of the sash opening and the real-time exhaust air flow. This requires the use of Triatek's Universal Valve Module (UVM1000) to provide the real-time air flow of the exhaust duct. To configure the HMS-1655 for sash-only control mode, select Sash Position on the Sash Control Mode popup configuration screen, and click the Next button. Follow the instructions on the next four screens to calibrate the sash position sensor for sash control operation.

For those applications that do not include a sash position sensor, the sidewall sensor is used to directly measure the face velocity at the sash opening for both monitoring and control. To configure the HMS-1655 for sidewall sensor-only control mode, select Sidewall Sensor on the Sash Control Mode popup configuration screen, and click the OK button.

To achieve the benefits of speed-of-response and closed-loop feedback, the combination of sidewall and sash position sensing is recommended. The configure the HMS -1655 for this closed-loop control mode, select Sidewall & Sash on the Sash Control Mode popup configuration screen, and click the Next button. Follow the instructions on the next four screens to calibrate the sash position sensor for sash control operation.

**Calibrating the Sash Control Feature**

The HMS-1655 features a comprehensive closed-loop control scheme using both sash control and sidewall sensing. The sash control is activated automatically anytime the sash moves, and immediately positions the exhaust damper at the position calibrated to provide the required face velocity at the sash opening. This provides an immediate response to the moving sash to adjust the exhaust damper accordingly. Once the sash stops moving, the PID control loop resumes using the sidewall sensor to fine tune the face velocity to meet the target setpoint.

Selecting the *Sash Control* option on the Sash Setup menu invokes the sash width configuration screen, where the width of the sash opening may be specified in inches. This width is used in conjunction with the height of the sash opening to calculate the effective flow in cfm.

After entering the sash width, click the *Next* button to advance to the first calibration screen where the sash should be moved to the closed position. Wait for the face velocity to stabilize near the current setpoint, and then click the *Next* button to advance to the next calibration screen. Move the sash to the quarter open position, wait for the face velocity to resume the target setpoint, and then click the *Next* button to advance to the next calibration screen. Move the sash to the half open position, wait for the face velocity to resume the target setpoint, and then click the *Next* button to advance to the next calibration screen. Move the sash to the three-quarter open position, wait for the face velocity to resume the target setpoint, and then click the *Next* button to advance to the next calibration screen. Move the sash to the full open position, wait for the face velocity to resume the target setpoint, and then click the *Next* button to invoke the calibration results screen.

**Configuring Face Velocity Setpoints**

To begin configuring the face velocity setpoints following the field calibration procedure, select *Edit Setpoints* from the *Hood Setup* menu. Enter the desired setpoint for the current operating mode using the popup numeric keypad. To configure setpoints for the other two operating modes, use the *Operating Mode* option on the *Hood Setup* menu to switch modes and enter the setpoints as described above. Once setpoints have been entered for all three operating modes, proceed with the next section to configure the sash position sensor (POS-100) if included with this unit. If a sash position sensor was not included with this unit, proceed to the section describing the procedure for setting the face velocity alarm setpoints below.

**Configuring Face Velocity Alarm Setpoints**

The HMS-1655 features a comprehensive alarm facility that includes both audible and visual capabilities. To begin configuring the alarm setpoints for the face velocity, enter the *Main Setup Menu* by touching the touchscreen display anywhere other than one of the

hot-spot locations. From the *Main Setup Menu*, select *Unit Setup* --> *Controller Setup* --> *Next* --> *Alarm Limits*. Enter the *High Alarm*, *High Warning*, *Low Warning*, and *Low Alarm* setpoints for the current operating mode (*Occupied* or *Unoccupied*) using the popup numeric keypad on the touchscreen display. Alarm setpoints are unavailable for *Decommissioned* mode. The default settings for the face velocity alarm setpoints are 150 fpm, 130 fpm, 90 fpm, and 75 fpm.

**Changing Fume Hood Operating Mode**

The HMS-1655 fume hood controller can be set for *Occupied*, *Unoccupied*, and *Decommissioned* modes of operation. To change the mode of operation, select *Unit Setup* --> *Hood Setup* --> *Operating Mode* and the user is prompted to select one of three modes. Changing the mode of operation automatically selects the pre-programmed setpoints and alarm limits associated with each mode. 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 popup. Also, if the fume hood controller is in *Decommissioned mode*, the *Occupied* button at the bottom of the main display may be used to directly switch to the *Occupied* operating mode.

**Configuring Analog Output for Exhaust Damper Control**

For those applications requiring control of an exhaust damper actuator by the HMS-1655, the analog output must be configured accordingly. If this application requires monitoring only and does not include controlling the exhaust damper of the fume hood, then proceed to the next section to calibrate the fume hood face velocity sensor.

To begin configuring the analog output for controlling the exhaust damper actuator, enter the *Main Setup Menu* by touching the touchscreen display anywhere other than one of the hot-spot locations. From the *Main Setup Menu*, select *Unit Setup* --> *Controller Setup* --> *Analog Output* and the user is prompted to select an operating mode (direct control or PID control) and an operating range. Most applications will take advantage of the PID (proportional-integral-derivative) control mode, where the control output can be customized by varying the control loop constants. The operating range can either include an offset from zero or not, independent of whether the analog output is configured for current or voltage mode.

Once the operating mode and range are selected, the user is prompted to specify the upper and lower limits of the analog output as percentages. Most applications will use the default settings of zero and 100 percent. But for those applications where the top or bottom limits need to be tweaked, these settings may be adjusted accordingly to further limit the range of the actual analog output signal. Finally, the user is prompted to specify the analog input channel to be used for this analog output. The default channel is AI-1, which is the sidewall-mounted velocity sensor input. The analog output can be configured for either direct-acting or reverse-acting mode.

Each of the three operating modes (*Occupied*, *Unoccupied*, *Decommissioned*) has a unique setpoint. This allows the target setpoint to automatically update based on the selected operating mode. For controlling Triatek's fast-acting actuators, the HMS-1655 comes pre-configured from the factory with the correct settings for proper PID loop control of the exhaust damper. To confirm that the analog output is properly configured for the specific installation at hand, use the *Overrides* option on the *Diagnostics* menu to manually override analog output 1 which is controlling the exhaust damper actuator. Moving the slider from zero to 100 percent should cause the damper to move from closed to full open, or vice versa, depending upon the acting mode of the actuator.

**Changing Network Settings**

Changing network settings on the FMS-1650 is extremely simple and can be accessed by selecting *Unit Setup* --> *Network Setup*. Depending upon the protocol selected, the *Network Setup* menu will present the user with the available options. All HMS-1655 demo units have a default protocol selection of BACnet, 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 HMS-1655 menu system can be protected by adding up to ten (10) multi-level passwords to the system. A password entry may be created by selecting *System Setup* --> *Next* --> *Passwords Setup* --> *Add Password* and the user is prompted to enter a minimum of four (4) and up to eight (8) 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 "back door" password that will provide unrestricted access to the user menu system. Please consult with the factory for more information regarding this password.

# HMS-1655 BASIC PROGRAMMING

**Changing Display Settings**

The patent pending Safety Halo™ feature is exclusive to the 1655 series of controllers from Triatek, and significantly enhances the visibility of the status of individual units, and allows an unsafe fume hood to be immediately recognized from anywhere in the laboratory space. The display settings of this enhanced 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. For convenience, the Safety Halo™ status indicator incorporates a *Nightly Auto-Dim* feature which allows the brightness of the status indicator to automatically reduce in intensity at a designated hour every day, and then resume normal brightness at another designated hour. The brightness of the HMS-1655 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.

The main display screen of the HMS-1655 may be customized very easily using options on the *Display Setup* menus. The *Display Options* menu option allows specific information to be individually suppressed by deselecting the unwanted items from the *Set Display Options* selection screen. If the HMS-1655 is controlling an exhaust valve that is equipped with a universal valve module (UVM1000), the real-time exhaust air flow may be displayed in the lower window next to the real-time sash height. To display the exhaust air flow, select Exhaust Flow on the Set Display Options popup configuration screen. The air flow output from the UVM must be brought into analog input 4 (AI-4) at the HMS-1655, and this input must be configured as a Flow input using the System Setup menu.

Changing the time and date can be accomplished either by using the hotspots on the main display screen, or by selecting the *Set Time & Date* option. The time and date settings are volatile and do not get saved to non-volatile memory on demo units. However, an operational unit connected to a controller module can retain its time and date settings for up to two hours in the event of a power failure.

**Built-in Diagnostics**

The HMS-1655 incorporates several very useful diagnostic tools that may greatly facilitate diagnosing and troubleshooting the system during the installation and commissioning phase. The *Overrides* option allows both analog and relay outputs to be overridden individually. Each analog output may be locked at the overridden percentage while test and balance makes adjustments to supply or exhaust dampers, for example. While in the overridden state, the analog output is "disconnected" from its PID control loop, if enabled. Cancelling the override effectively resumes the normal PID control loop operation, again if enabled.

A unique feature of the HMS-1655 is the *Real-Time View* option, which allows the user to see in real-time the actual inputs and outputs, along with their voltage levels or states. One of the most useful tools for fine-tuning the PID loop performance is the *Analog I/O Pairs* screen, which displays the analog input and its current setpoint, along with the analog output which is mapped to it. This allows the user to see in real-time the varying analog input signal and its corresponding analog output control signal.

To preserve the configuration settings after verifying that everything is configured properly, the *Save Settings* option on the *Diagnostics* menu will take a snapshot of the current configuration settings for later retrieval. In the event that some of the configuration settings inadvertently get overwritten with invalid settings, typically through unauthorized operator error, they may be restored either to the previously saved user settings or to the factory-default settings.

***For more information on how to program the HMS-1655, contact Triatek of visit www.Triatek.com and download the HMS-1655 Programmer's Guide.***

## 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 = FMS/HMS | ON = CMS-1655 |
| 2. | EMERGENCY PURGE Button | OFF = Disabled | ON = Enabled |
| 3. | Mode Select | OFF = FMS-1655 / CMS-1650 | ON = HMS-1655 |
| 4. | Operational Mode: | OFF = Demo Mode | ON = Run Mode |

| | | |
|---|---|---|
| Pushbutton Switch (SW1): | Reset Button | |
| Pushbutton Switch (SW2): | Reserved | |

## MODULE SETTINGS

### Configuring Main Controller Module Settings

| Analog Input Configuration Dipswitch (S1) | | | |
|---|---|---|---|
| 1. | AI-1 Mode Selection: | OFF = voltage input | ON = current input |
| 2. | AI-2 Mode Selection: | OFF = voltage input | ON = current input |
| 3. | AI-3 Mode Selection: | OFF = voltage input | ON = current input |
| 4. | AI-4 Mode Selection: | OFF = voltage input | ON = current input |
| 5. | AI-1 Voltage Range Selection: | OFF = 0-5Vdc | ON = 0-10Vdc |
| 6. | AI-2 Voltage Range Selection: | OFF = 0-5Vdc | ON = 0-10Vdc |
| 7. | AI-3 Voltage Range Selection: | OFF = 0-5Vdc | ON = 0-10Vdc |
| 8. | AI-4 Voltage Range Selection: | OFF = 0-5Vdc | ON = 0-10Vdc |

**NOTES: To configure HMS-1655 for sidewall velocity sensor, set dipswitch positions 1 and 5 to OFF. To configure HMS-1655 for sash position sensor at AI-3 (default), set dipswitch position 3 to OFF and dipswitch position 7 to ON.". For other inputs, see Table 1.**

| Analog Output Configuration Dipswitch (S3) | | | |
|---|---|---|---|
| 1. | AO-1 Mode Selection: | OFF = current output | ON = voltage output |
| 2. | AO-2 Mode Selection: | OFF = current output | ON = voltage output |
| 3. | AO-3 Mode Selection: | OFF = current output | ON = voltage output |
| 4. | AO-4 Mode Selection: | OFF = current output | ON = voltage output |

| Network Configuration Dipswitch (S3) | | | |
|---|---|---|---|
| 5. | RS485 Network Termination: | OFF = disabled | ON = enabled |
| 6. | RS485 Display Termination: | OFF = disabled | ON = enabled |
| 7. | Protocol Select: see Table 2 below | | |
| 8. | Protocol Select: see Table 2 below | | |

## Configurations & Settings

| Table 1. Analog Input Configuration Settings (S1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mode | S1 - 1 | S1 - 2 | S1 - 3 | S1 - 4 | S1 - 5 | S1 - 6 | S1 - 7 | S1 - 8 |
| AI-1 5Vdc | OFF | | | | OFF | | | |
| AI-1 20mA | ON | | | | OFF | | | |
| AI-1 10Vdc | OFF | | | | ON | | | |
| Not Valid | ON | | | | ON | | | |
| AI-2 5Vdc | | OFF | | | | OFF | | |
| AI-2 20mA | | ON | | | | OFF | | |
| AI-2 10Vdc | | OFF | | | | ON | | |
| Not Valid | | ON | | | | ON | | |
| AI-3 5Vdc | | | OFF | | | | OFF | |
| AI-3 20mA | | | ON | | | | OFF | |
| AI-3 10Vdc | | | OFF | | | | ON | |
| Not Valid | | | ON | | | | ON | |
| AI-4 5Vdc | | | | OFF | | | | OFF |
| AI-4 20mA | | | | ON | | | | OFF |
| AI-4 10Vdc | | | | OFF | | | | ON |
| Not Valid | | | | ON | | | | ON |

| Table 2. Protocol Selection Settings (S3) | | |
|---|---|---|
| Protocol Selection | S3-7 | S3-8 |
| Reserved | OFF | OFF |
| Metasys® N2 | ON | OFF |
| LonWorks® | OFF | ON |
| BACnet® MS/TP (default) | ON | ON |

| Controller Configuration Dipswitch (S4) | | |
|---|---|---|
| 1. AO-1 Voltage Range Selection: | OFF = 0-10Vdc | ON = 0 - 5Vdc |
| 2. AO-2 Voltage Range Selection: | OFF = 0-10Vdc | ON = 0 - 5Vdc |
| 3. AO-3 Voltage Range Selection: | OFF = 0-10Vdc | ON = 0 - 5 Vdc |
| 4. AO-4 Voltage Range Selection: | OFF = 0-10Vdc | ON = 0 - 5 Vdc |

| Controller Configuration Slideswitch (S2) | Controller Configuration Slideswitch (S5): |
|---|---|
| LEFT = Analog Outputs powered by remote source | LEFT = Digital Inputs pulled-high (triggered by active low input - default) |
| RIGHT = Analog Outputs powered locally by HMS-1655 (default) | RIGHT = Digital Inputs pulled-low (triggered by active high input, up to 24Vdc) |

## MODULE SETTINGS

### 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 (default: Fume Hood Face Velocity) | Read-Only |
| AI - 2 | Analog Input 2 (default: Secondary Face Velocity) | Read-Only |
| AI - 3 | Analog Input 3 (default: Sash Position Sensor) | Read-Only |
| AI - 4 | Analog Input 4 (default: Exhaust Air Flow Volume) | Read-Only |
| AI - 5 | Thermistor Input 1 (default: Ambient Temperature) | Read-Only |
| AI - 6 | Thermistor Input 2 (default: Duct Temperature) | Read-Only |
| **Analog Outputs** | | |
| AO - 1 | Analog Output 1 (default: Exhaust Damper Position) | Read-Only |
| AO - 2 | Analog Output 2 (spare control output) | Read-Only |
| AO - 3 | Analog Output 3 (spare control output) | Read-Only |
| AO - 4 | Analog Output 4 (spare control output) | Read-Only |
| **Binary Inputs** | | |
| BI - 1 | Digital Input 1 (default: Fume Hood Sash Switch) | Read-Only |
| BI - 2 | Digital Input 2 (default: spare digital input) | Read-Only |
| BI - 3 | Digital Input 3 (spare digital input) | Read-Only |
| BI - 4 | Digital Input 4 (spare digital input) | Read-Only |
| **BInary Outputs** | | |
| BO - 1 | Relay Output 1 (default: Primary Alarm Relay Output) | Read-Only |
| BO - 2 | Relay Output 2 (default: Secondary Alarm Relay | Read-Only |
| BO - 3 | Relay Output 3 (spare relay output) | Read-Only |
| BO - 4 | Relay Output 4 (spare relay output) | Read-Only |
| **Binary Values** | | |
| BV-1 | Occupancy Status | Read/Write |
| BV-2 | Emergency Purge (MAX FLOW) | Read/Write |

| Analog Values | | |
|---|---|---|
| AV - 1 | AI-1 Setpoint (Fume Hood Face Velocity Setpoint) | Read/Write |
| AV - 2 | AI-2 Setpoint (Secondary Face Velocity Setpoint) | Read/Write |
| AV - 3 | AI-3 Setpoint | Read/Write |
| AV - 4 | AI-4 Setpoint | Read/Write |
| AV - 5 | TI-1 Setpoint (Ambient Temperature Setpoint) | Read/Write |
| AV - 6 | TI-2 Setpoint | Read/Write |
| AV - 7 | Air Change Rate based on Flow Input at AI-1 | Read/Write |
| AV - 8 | Air Change Rate based on Flow Input at AI-2 | Read/Write |
| AV - 9 | Air Change Rate based on Flow Input at AI-3 | Read/Write |
| AV - 10 | Air Change Rate based on Flow Input at AI-4 | Read/Write |
| AV - 11 | Alarm Relay 1 High Setpoint | Read/Write |
| AV - 12 | Alarm Relay 1 Low Setpoint | Read/Write |
| AV - 13 | Alarm Relay 2 High Setpoint | Read/Write |
| AV - 14 | Alarm Relay 2 Low Setpoint | Read/Write |
| AV - 15 | Alarm Relay 3 High Setpoint | Read/Write |
| AV - 16 | Alarm Relay 3 Low Setpoint | Read/Write |
| AV - 17 | Alarm Relay 4 High Setpoint | Read/Write |
| AV - 18 | Alarm Relay 4 Low Setpoint | Read/Write |
| AV - 19 | AI-1 Low Alarm Setpoint (Low Face Velocity Alarm) | Read/Write |
| AV - 20 | AI-1 Low Warning Setpoint (Low Face Velocity Warning) | Read/Write |
| AV - 21 | AI-1 High Warning SetpointHigh Face Velocity Warning) | Read/Write |
| AV - 22 | AI-1 High Alarm Setpoint (High Face Velocity Alarm) | Read/Write |
| AV - 23 | AI-2 Low Alarm Setpoint | Read/Write |
| AV - 24 | AI-2 Low Warning Setpoint | Read/Write |
| AV - 25 | AI-2 High Warning Setpoint | Read/Write |
| AV - 26 | AI-2 High Alarm Setpoint | Read/Write |
| AV - 27 | AI-3 Low Alarm Setpoint | Read/Write |

## BACnet® Objects

| | | |
|---|---|---|
| AV - 28 | AI-3 Low Warning Setpoint | Read/Write |
| AV - 29 | AI-3 High Warning Setpoint | Read/Write |
| AV - 30 | AI-3 High Alarm Setpoint | Read/Write |
| AV - 31 | AI-4 Low Alarm Setpoint | Read/Write |
| AV - 32 | AI-4 Low Warning Setpoint | Read/Write |
| AV - 33 | AI-4 High Warning Setpoint | Read/Write |
| AV - 34 | AI-4 High Alarm Setpoint | Read/Write |
| AV - 35 | TI-1 Low Alarm Setpoint | Read/Write |
| AV - 36 | TI-1 Low Warning Setpoint | Read/Write |
| AV - 37 | TI-1 High Warning Setpoint | Read/Write |
| AV - 38 | TI-1 High Alarm Setpoint | Read/Write |
| AV - 39 | TI-2 Low Alarm Setpoint | Read/Write |
| AV - 40 | TI-2 Low Warning Setpoint | Read/Write |
| AV - 41 | TI-2 High Warning Setpoint | Read/Write |
| AV - 42 | TI-2 High Alarm Setpoint | Read/Write |
| AV - 43 | Writable Network Variable – Humidity | Read/Write |
| AV - 44 | Writable Network Variable – Temperature | Read/Write |
| AV - 45 | Writable Network Variable – Air Changes | Read/Write |
| AV - 46 | Writable Network Variable – Differential Pressure | Read/Write |
| AV - 47 | Device ID Offset (range: 0 – 4,194,000) | Read/Write |
| AV - 48 | Duct Air Flow based on AI-1 flow input | Read-Only |
| AV - 49 | Duct Air Flow based on AI-2 flow input | Read-Only |
| AV - 50 | Duct Air Flow based on AI-3 flow input (Supply Flow) | Read-Only |
| AV - 51 | Duct Air Flow based on AI-4 flow input (Exhaust Flow) | Read-Only |
| AV - 52 | Volumetric Offset (Supply Flow – Exhaust Flow) | Read-Only |
| AV - 53 | Volumetric Offset Setpoint | Read/Write |
| AV - 54 | AO-1 Override Level | Read/Write |
| AV - 55 | AO-2 Override Level | Read/Write |
| AV - 56 | AO-3 Override Level | Read/Write |
| AV - 57 | AO-4 Override Level | Read/Write |
| AV - 58 | AI-1 Deadband Setting | Read/Write |
| AV - 59 | AI-2 Deadband Setting | Read/Write |
| AV - 60 | AI-3 Deadband Setting | Read/Write |
| AV - 61 | AI-4 Deadband Setting | Read/Write |
| AV - 62 | TI-1 Deadband Setting | Read/Write |
| AV - 63 | TI-1 Deadband Setting | Read/Write |
| **Multistate Objects** | | |
| MSO - 1 | Fume Hood Operating Mode: 1=occupied, | Read/Write |
| MSO - 2 | Secondary Operating Mode: 1=occupied, | Read/Write |
| MSO - 3 | Fume Hood Face Velocity Alarm Status: 1=normal, | Read-Only |
| MSO - 4 | Secondary Face Velocity Alarm Status: 1=normal, | Read-Only |
| MSO - 5 | AI-3 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| MSO - 6 | AI-4 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| MSO - 7 | TI-1 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| MSO - 8 | TI-2 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |

## MODULE SETTINGS

## Metasys® N2 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 N2 integration.

| Object Instance | Functional Description | Read or Write | ADF - 4 | Secondary Alarm Relay High Setpoint | Read/Write |
|---|---|---|---|---|---|
| | | | ADF - 5 | Secondary Alarm Relay Low Setpoint | Read/Write |
| **Analog Inputs** | | | ADF - 8 | AI-1 Low Alarm Setpoint (Low Face Velocity Alarm) | Read/Write |
| AI - 1 | Analog Input 1 (default: Fume Hood Face Velocity) | Read-Only | ADF - 9 | AI-1 Low Warning Setpoint (Low Face Velocity Warning) | Read/Write |
| AI - 17 | Analog Input 2 (default: Secondary Face Velocity) | Read-Only | ADF - 10 | AI-1 High Warning Setpoint (High Face Velocity Warning) | Read/Write |
| AI - 18 | Analog Input 3 (default: Sash Position Sensor) | Read-Only | ADF - 11 | AI-1 High Alarm Setpoint (High Face Velocity Alarm) | Read/Write |
| AI - 19 | Analog Input 4 (default: Exhaust Air Flow Volume) | Read-Only | ADF - 13 | PID Control Loop 2 Setpoint | Read/Write |
| AI - 20 | Thermistor Input 1 (default: Ambient Temperature) | Read-Only | ADF - 14 | PID Control Loop 3 Setpoint | Read/Write |
| AI - 21 | Thermistor Input 2 (default: spare temperature input) | Read-Only | ADF - 15 | PID Control Loop 4 Setpoint | Read/Write |
| **Analog Outputs** | | | ADF - 16 | Air Change Rate based on Flow Input at AI-1 | Read-Only |
| AO - 1 | Analog Output 1 (default: Primary Exhaust Damper Control) | Read-Only | ADF - 17 | Air Change Rate based on Flow Input at AI-2 | Read-Only |
| AO - 11 | Analog Output 2 (default: Supply/Exhaust Damper Control) | Read-Only | ADF - 18 | Air Change Rate based on Flow Input at AI-3 | Read-Only |
| AO - 12 | Analog Output 3 (spare control output) | Read-Only | ADF - 19 | Air Change Rate based on Flow Input at AI-4 | Read-Only |
| AO - 13 | Analog Output 4 (spare control output) | Read-Only | ADF - 20 | Alarm Relay 3 High Setpoint | Read/Write |
| **Binary Inputs** | | | ADF - 21 | Alarm Relay 3 Low Setpoint | Read/Write |
| BI - 3 | Digital Input 1 (default: Fume Hood Sash Switch) | Read-Only | ADF - 22 | Alarm Relay 4 High Setpoint | Read/Write |
| BI - 4 | Digital Input 2 (default: spare digital input) | Read-Only | ADF - 23 | Alarm Relay 4 Low Setpoint | Read/Write |
| BI - 5 | Digital Input 3 (spare digital input) | Read-Only | ADF - 24 | AI-2 Low Alarm Setpoint | Read/Write |
| BI - 6 | Digital Input 4 (spare digital input) | Read-Only | ADF - 25 | AI-2 Low Warning Setpoint | Read/Write |
| **Binary Outputs** | | | ADF - 26 | AI-2 High Warning Setpoint | Read/Write |
| BO - 1 | Relay Output 1 (default: Primary Alarm Relay Output) | Read-Only | ADF - 27 | AI-2 High Alarm Setpoint | Read/Write |
| BO - 2 | Relay Output 2 (spare relay output) | Read-Only | ADF - 28 | AI-3 Low Alarm Setpoint | Read/Write |
| BO - 3 | Relay Output 3 (spare relay output) | Read-Only | ADF - 29 | AI-3 Low Warning Setpoint | Read/Write |
| BO - 4 | Relay Output 4 (spare relay output) | Read-Only | ADF - 30 | AI-3 High Warning Setpoint | Read/Write |
| **Internal Float Values** | | | ADF - 31 | AI-3 High Alarm Setpoint | Read/Write |
| ADF - 1 | PID Control Loop 1 Setpoint (Fume Hood Face Velocity | Read/Write | ADF - 32 | AI-4 Low Alarm Setpoint | Read/Write |
| ADF - 2 | Primary Alarm Relay High Setpoint | Read/Write | ADF - 33 | AI-4 Low Warning Setpoint | Read/Write |
| ADF - 3 | Primary Alarm Relay Low Setpoint | Read/Write | ADF - 34 | AI-4 High Warning Setpoint | Read/Write |

## Metasys® N2 Objects

| | | |
|---|---|---|
| ADF - 35 | AI-4 High Alarm Setpoint | Read/Write |
| ADF - 36 | TI-1 Low Alarm Setpoint | Read/Write |
| ADF - 37 | TI-1 Low Warning Setpoint | Read/Write |
| ADF - 38 | TI-1 High Warning Setpoint | Read/Write |
| ADF - 39 | TI-1 High Alarm Setpoint | Read/Write |
| ADF - 40 | TI-2 Low Alarm Setpoint | Read/Write |
| ADF - 41 | TI-2 Low Warning Setpoint | Read/Write |
| ADF - 42 | TI-2 High Warning Setpoint | Read/Write |
| ADF - 43 | TI-2 High Alarm Setpoint | Read/Write |
| ADF - 44 | Humidity Network Variable (writable) | Read/Write |
| ADF - 45 | Temperature Network Variable (writable) | Read/Write |
| ADF - 46 | Air Changes Network Variable (writable) | Read/Write |
| ADF - 47 | Differential Pressure Network Variable (writable) | Read/Write |
| ADF - 48 | Air Flow based on Flow Input at AI-1 | Read-Only |
| ADF - 49 | Air Flow based on Flow Input at AI-2 | Read-Only |
| ADF - 50 | Air Flow based on Flow Input at AI-3 (default: Supply Flow) | Read-Only |
| ADF - 51 | Air Flow based on Flow Input at AI-4 (default: Exhaust | Read-Only |
| ADF - 52 | Volumetric Offset (Supply Flow – Exhaust Flow) | Read-Only |
| ADF - 53 | Volumetric Offset Setpoint | Read/Write |
| ADF - 54 | AO-1 Override Level | Read/Write |
| ADF - 55 | AO-2 Override Level | Read/Write |
| ADF - 56 | AO-3 Override Level | Read/Write |
| ADF - 57 | AO-4 Override Level | Read/Write |
| ADF - 58 | AI-1 Deadband Setting | Read/Write |
| ADF - 59 | AI-2 Deadband Setting | Read/Write |
| ADF - 60 | AI-3 Deadband Setting | Read/Write |
| ADF - 61 | AI-4 Deadband Setting | Read/Write |
| ADF - 62 | TI-1 Deadband Setting | Read/Write |
| ADF - 63 | TI-2 Deadband Setting | Read/Write |
| **Internal Integer Values** | | |
| ADI - 1 | Fume Hood Operating Mode: 1=occupied, 2=unoccupied, | Read/Write |
| ADI - 7 | Secondary Operating Mode: 1=occupied, 2=unoccupied, | Read/Write |
| ADI - 8 | AI-2 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| ADI - 9 | AI-3 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| ADI - 10 | AI-4 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| ADI - 11 | TI-1 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |
| ADI - 12 | TI-2 Alarm Status: 1=normal, 2=warning, 3=alarm | Read-Only |

# CLEANING THE HMS DISPLAY

## Cleaning the HMS-1655 Display

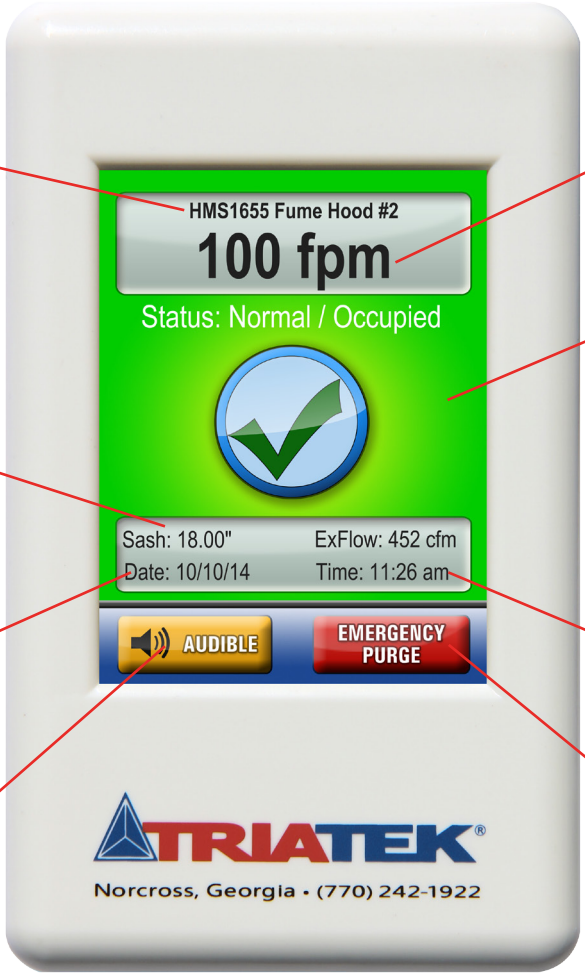
- The cloth may be used dry, or lightly dampened with a mild cleaner or Ethanol.
- Be sure the cloth is only lightly dampened, not wet. Never apply cleaner directly to touch panel surface; if cleaner is spilled onto touch panel, soak it up immediately with absorbent cloth.
- Cleaner must be neither acid nor alkali (neutral pH).
- Wipe the surface gently; if there is a directional surface texture, wipe in the same direction as the texture.
- Never use acidic or alkaline cleaners, or organic chemicals such as: paint thinner, acetone, tolulene, xylene, propyl or isopropyl alcohol, or kerosene.

Touching the current hood name text brings up an alphanumeric keyboard to quickly change the name of the monitored fume hood.

Touching left portion of lower LCD window brings up Display Options popup to quickly enable or disable Sash or Temperature displays if not needed

Touching DATE brings up the Date Entry popup to quickly change the current displayed date.

Automatically reverts back to audible mode when alarm condition is removed.




Touching the engineering units selection brings up a popup to quickly change velocity measurement units.

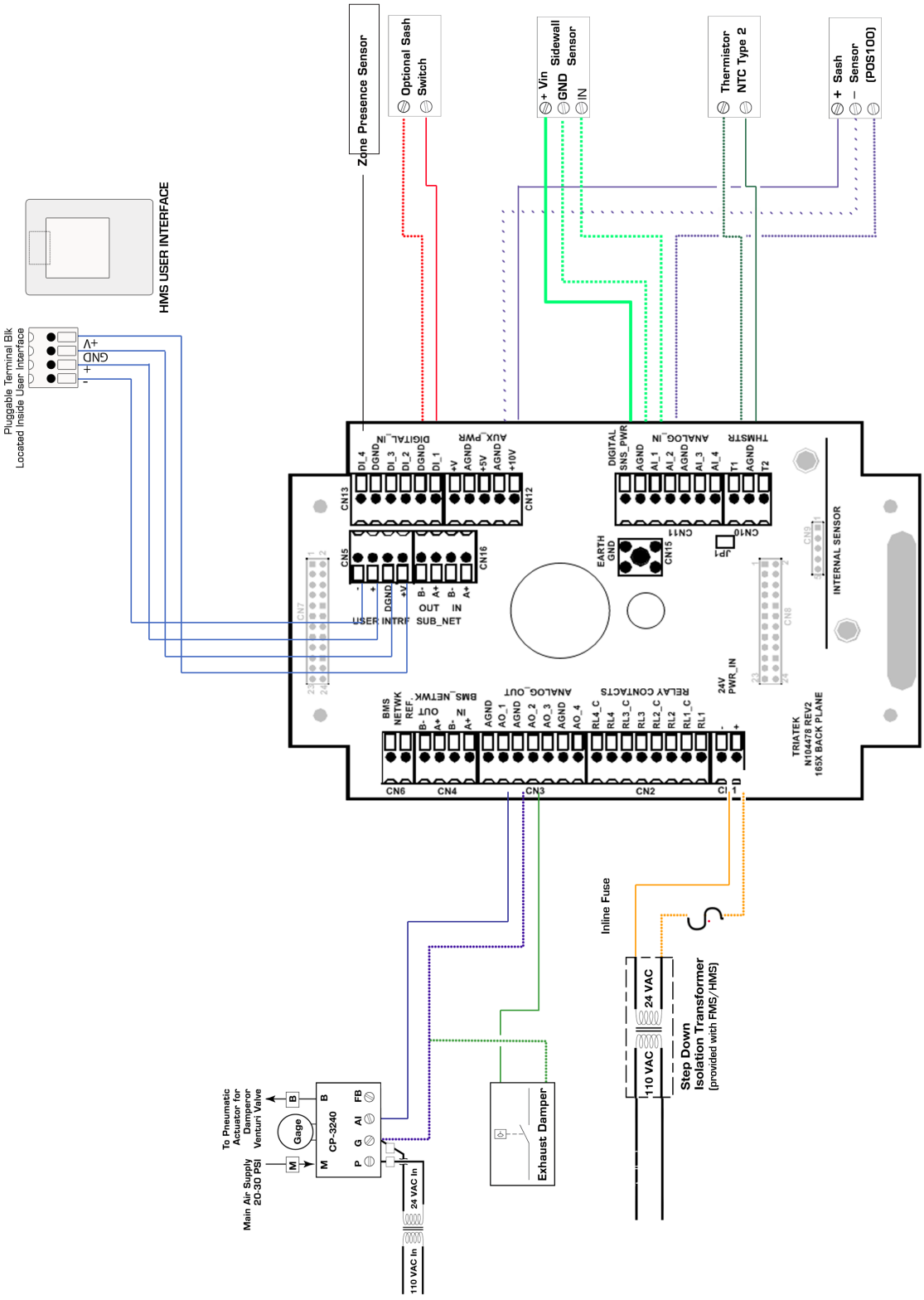
Touching anywhere else on the screen enters the Main Setup Menu if no password is stored. Otherwise, a password must be entered before the Main Setup Menu can be accessed.

Touching TIME brings up Time Entry popup to quickly change the current displayed time.

Touch *EMERGENCY PURGE* to send exhaust damper to maximum open position in the event of an emergency.

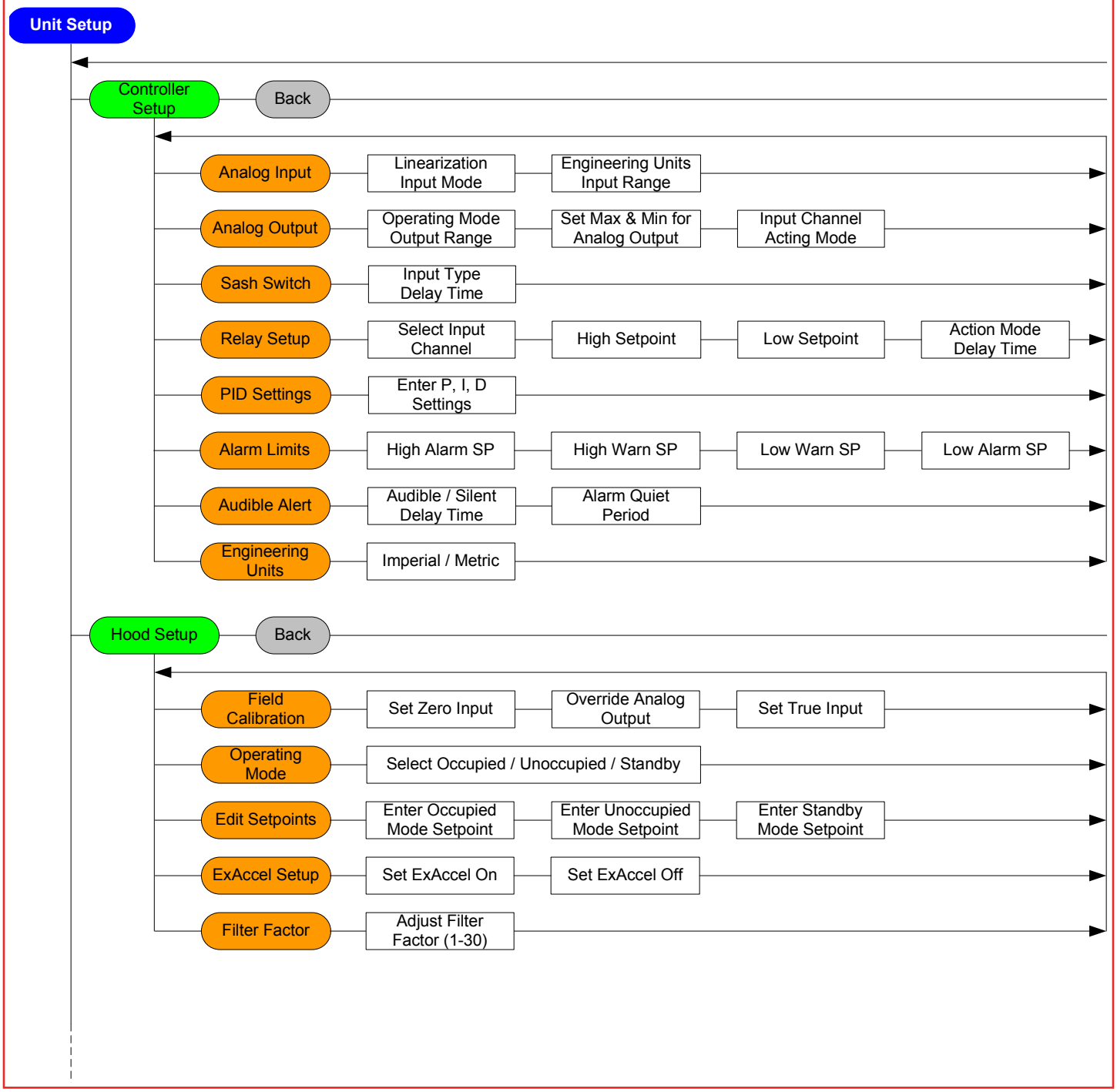
**Hot-Spot Features of HMS-1655 Touchscreen Display**

## COMPREHENSIVE WIRING DIAGRAM

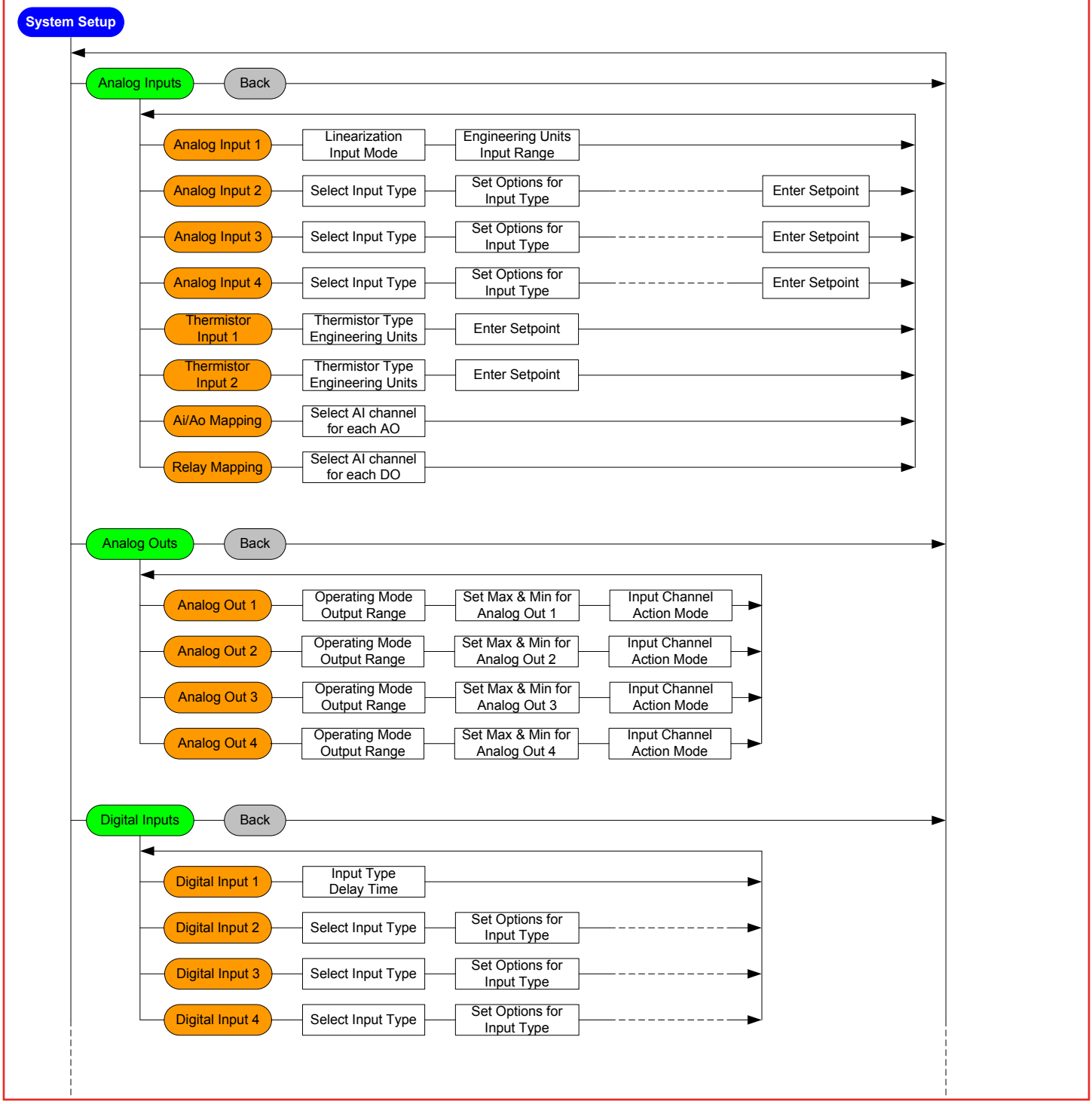


# FLOW DIAGRAMS

## Unit Setup Tree

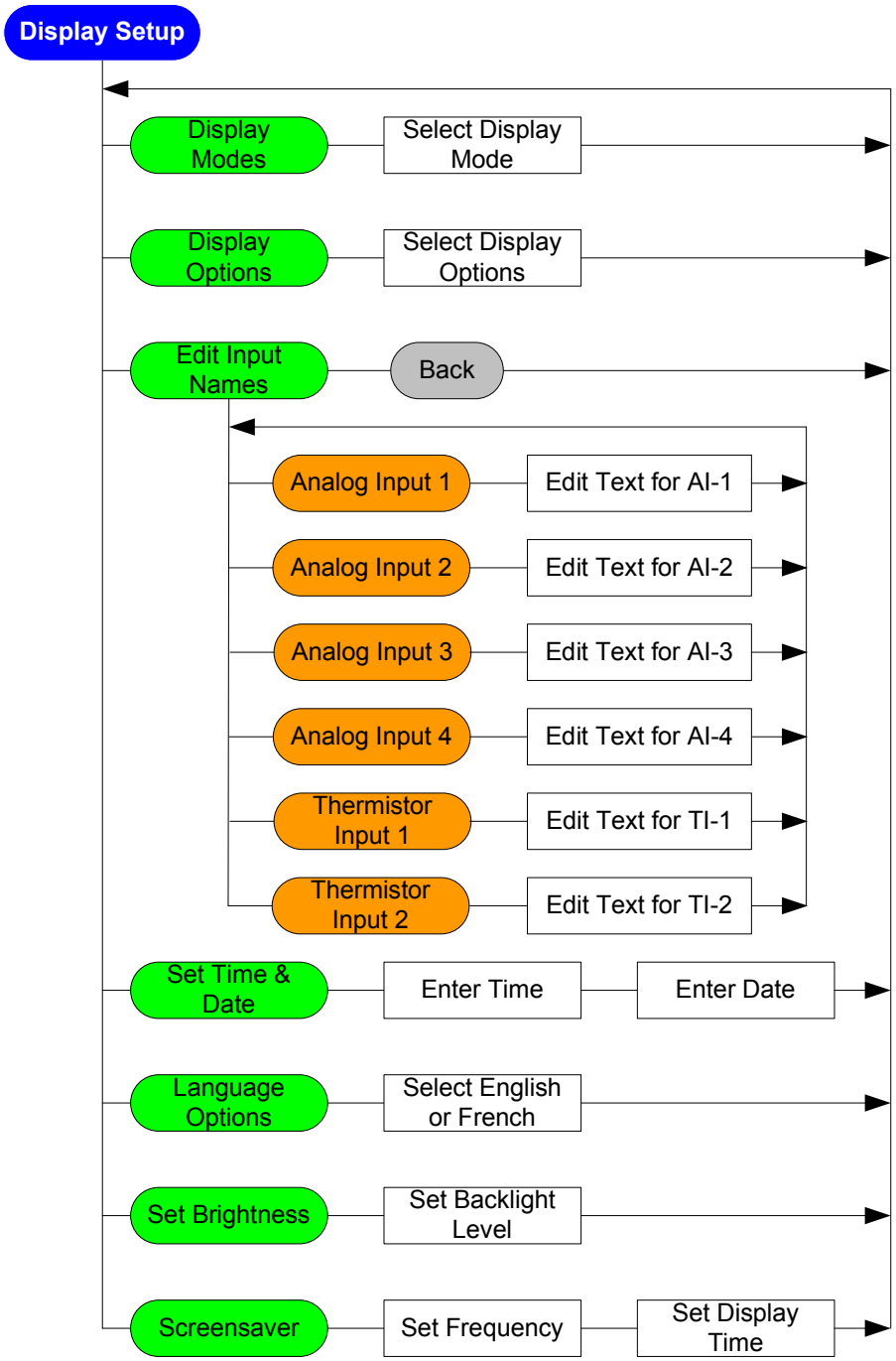


## System Setup Tree

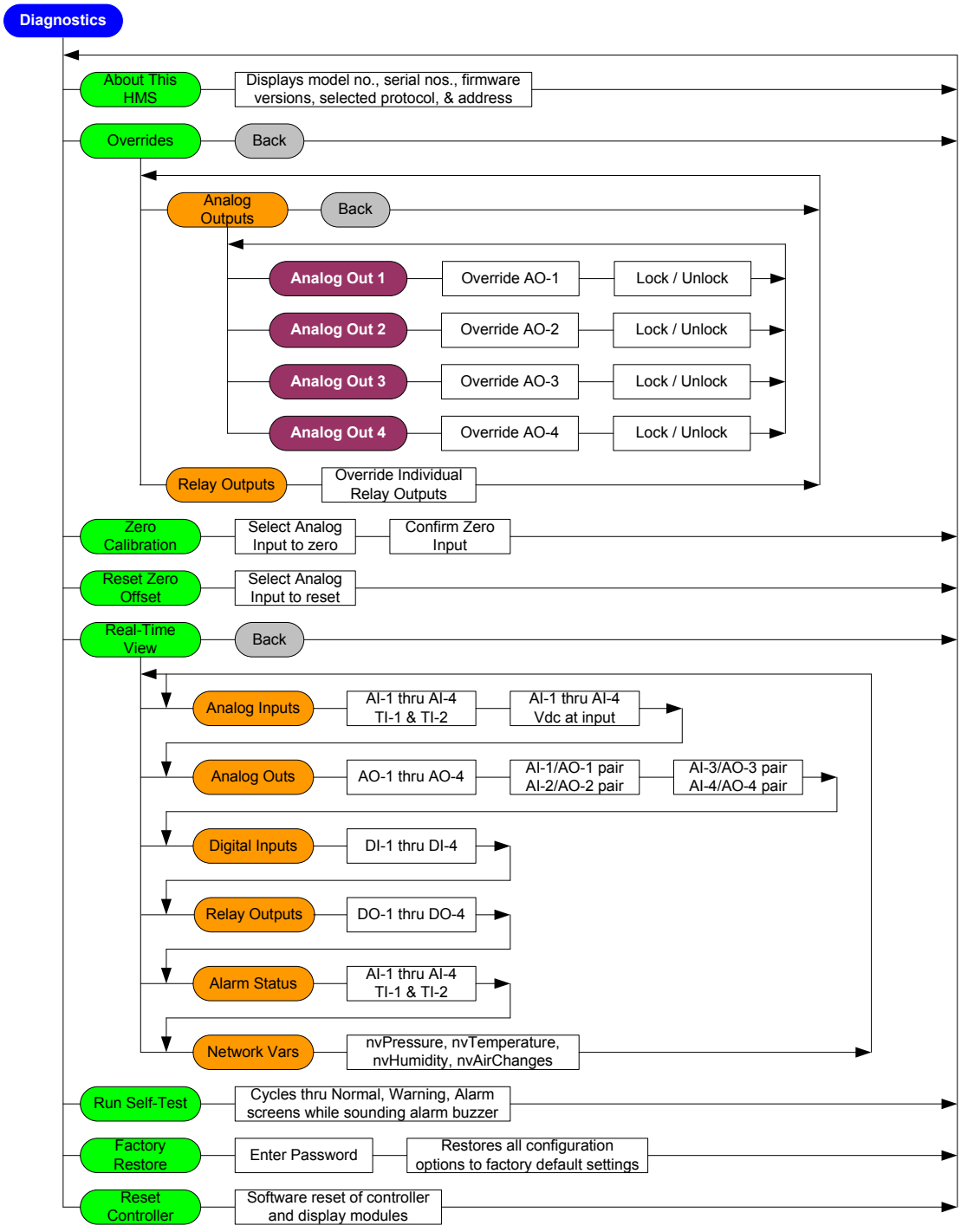


## FLOW DIAGRAMS

### Display Setup Tree



## Diagnostics Tree



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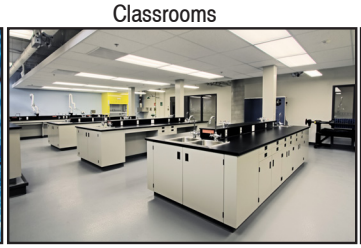
Laboratories

Classrooms



Vivariums

Hospitals