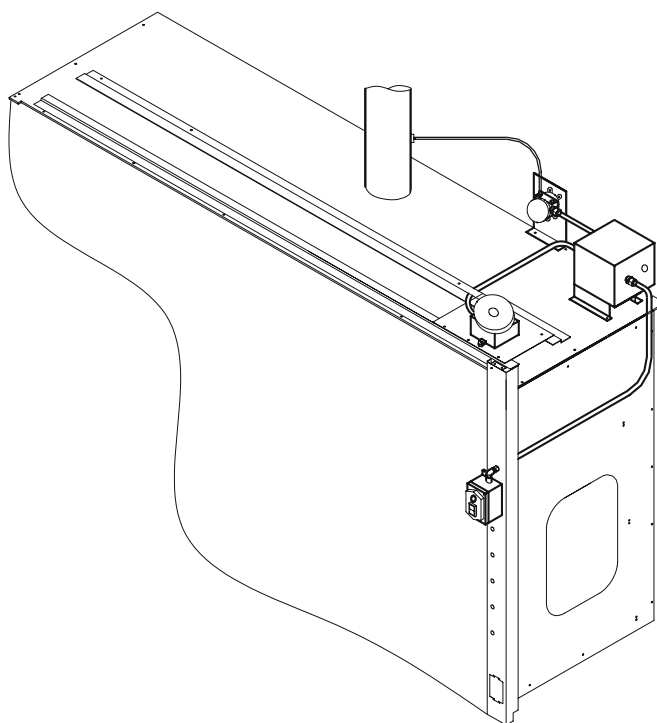


AirGard[®] 410HE
Air Flow Monitor
for Hazardous Environment
Fume Hoods



ALNOR[®]

TSI Incorporated

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Seller warrants the goods sold hereunder, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for twenty-four (24) months, or the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. This limited warranty is subject to the following exclusions:

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- b. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment.
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Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call Customer Service at (800) 424-7427 (USA) and (1) 651-490-2811 (International).

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SECTION 1

Introduction

General Description

The AirGard[®] 410HE Monitor is designed to continuously monitor airflow/pressurization through fume hoods that are defined as explosion-proof or are used in environments in which all equipment must be explosion-proof or intrinsically safe.

The 410HE utilizes a pressure switch as the main sensing component. When pressurization drops below a user-determined level, the monitor activates both audio and visual alarm indicators to alert personnel that the airflow at the face of the hood is inadequate. An alarm relay is also activated.

The monitor is supplied with a pressure averaging tube. The pressure averaging tube is designed to span the entire width of the exhaust duct.

Read this manual entirely before calibrating, configuring, and using the AirGard[®] 410HE. If you need assistance or any further explanation regarding this instrument, please contact TSI or your TSI distributor.

Component Identification

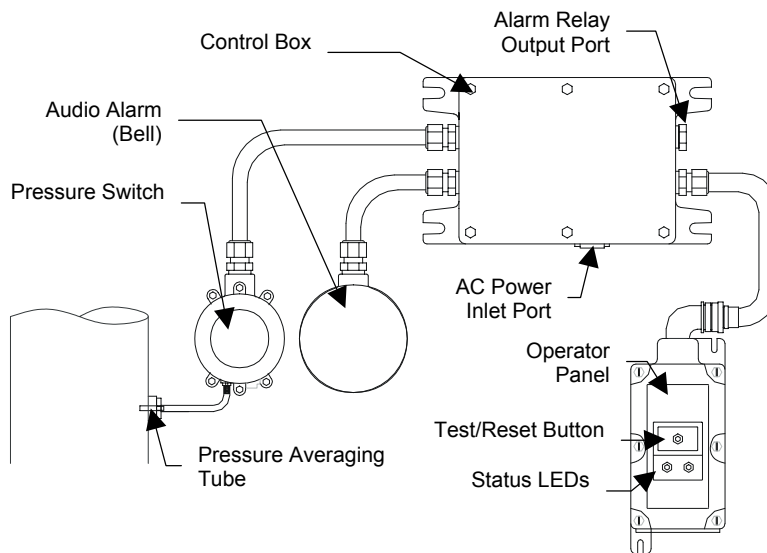


Figure 1 — Overall Schematic Diagram

Pressure Averaging Tube — A 0.625 inch (16 mm) diameter stainless steel tube which extends through the exhaust duct. It is 16.5 inches (419 mm) long and is connected to the pressure switch via a flexible polyurethane hose.

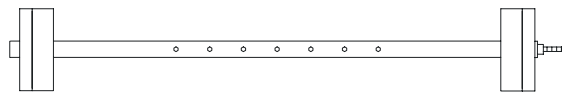


Figure 2 — Pressure Averaging Tube

Pressure Switch — A sensitive, pressure-activated switch housed in an explosion-proof enclosure mounted on the top of the fume hood. The switch is activated when the airflow drops, the static pressure in the duct will also drop. When the pressure goes below a user-set level, the pressure switch activates the monitor's audio and visual alarms as well as the alarm relay.

Control Box — This serves as a junction box which links the monitor's pressure switch, audio alarm indicator, and operator control box. This explosion-proof enclosure also houses the instrument's power and alarm relay connections. It is mounted on the top of the fume hood.

Operator Panel — An explosion-proof box is mounted on the side of the fume hood, the Operator Panel houses the monitor's Test/Reset button and Indicator LEDs.

Test/Reset Button — Silences the audible alarm. May also be used to manually activate the alarm circuits.

Red (Alarm) LED — Lights when a low airflow/pressurization condition is detected.

Green (Normal) LED — Lights when airflow/pressurization is above the pre-set alarm level.

Audio Alarm — An explosion-proof bell which is activated whenever a low airflow/pressurization condition is detected.

SECTION 2

Installation

WARNING:

- *All connections and wiring must conform to U.S. National Electrical Code requirements for Class I, Division 1 hazardous areas.*
- *Only licensed/ experienced electricians should perform this installation*
- *Consult local ordinances for any other hazardous location wiring requirements before starting.*

DANGER:

Always wear eye protection when using power tools. Observe all necessary precautions when installing or repairing monitors near electrical equipment.

Refer to the Installation drawing 116-410-002 (see Appendix) for the general layout of the electrical enclosures. Details of mounting each of the individual devices are given here.

Installing the Pressure Averaging Tube

NOTE: *The Pressure Averaging Tube should be located upstream of the duct damper about one exhaust duct diameter above the hood collar, but not more than 36 inches (91.4 cm) above the collar.*

1. Using the template at the rear of this manual as a guide, mark the three hole locations in one side of the fume hood exhaust duct and then mark the other three locations directly opposite (180°) the first three.
2. Drill the two 3/4 inch (19 mm) diameter holes, located in the middle on each side, directly opposite (180°) the first.
3. Drill the four 3/32 inch (2.4 mm) mounting holes (two on each side, one left and one right of the 3/4 inch holes previously drilled), for the foam-backed mounting bracket.
4. Screw the foam-backed mounting brackets to the fume hood exhaust duct. Four #4 sheet metal screws are provided for this purpose.
5. Connect the Pressure Averaging Tube through the foam-backed mounting brackets. Make sure that the small openings along the length of the tube are pointed directly downstream and that the tube is centered in the duct. On smaller ducts, make sure that the tube protrudes equally from each side of the duct. This helps ensure that the pressure sampling holes are exposed only to the duct static pressure and not room pressure.

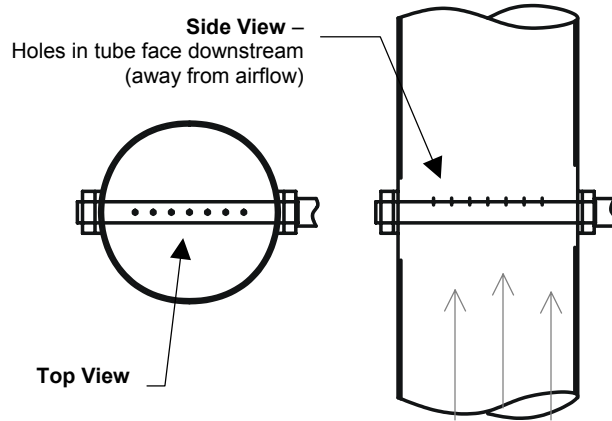


Figure 3 – Pressure Averaging Tube Positioning

6. Attach the flexible hose to the barbed hose fitting on one end of the Pressure Averaging Tube.
7. Connect the opposite end of the flexible tube to the hose fitting on the Pressure Switch enclosure.

Installing the Control Box

Mount the Control Box on the right rear of the fume hood as shown in the installation drawing 116-410-002 (see Appendix).

Position the box so that the $\frac{3}{4}$ " NPT hole for the input power is facing the front of the fume hood.

Use the available sheet metal mounting strips or any solid metallic component on the roof of the hood to attach the Control Box mounting bracket. (Some hoods may vary slightly in their construction.)

Place the mounting bracket on top of the fume hood as a template to mark holes for the screws. **ONLY MARK LOCATIONS ON THE SHEET METAL MOUNTING BRACKETS.**

Drill marked locations with a $\frac{1}{8}$ " drill. **DO NOT DRILL THROUGH THE FUME HOOD WALLS OR CEILING.**

NOTE: Three #8 sheet metal screws provided should be placed on the two outer edges of the roof to avoid roof puncture and ultimately leakage of gases from the hood (outer edges are solid and are safe for penetrating). A strip of double-sided tape is provided for use at the fourth corner that is further inwards (also to avoid roof puncture).

Attach the Control Box mounting plate with the #8 Sheet metal screws. Use the double-sided tape to secure the most inward corner of the mounting bracket.

Attach the Control Box to the mounting plate with the mounting hardware supplied per installation drawing provided.

Installing the Pressure Switch

Mount the Pressure Switch on the second available sheet metal mounting strip on the fume hood as shown in the installation drawing, or to any solid metallic component (again avoid puncture of the roof).

Use the mounting bracket as a template to mark the holes.

Drill the marked locations with a $\frac{9}{32}$ " drill.

Use the available sheet metal mounting strips to attach the Pressure Switch mounting bracket.

Attach the Pressure Switch to the mounting bracket with mounting hardware provided per installation drawing. **IMPORTANT: NOTE PROPER ORIENTATION OF THE PRESSURE SWITCH. SWITCH SHOULD BE MOUNTED WITH PRESSURE INLET PORT POINTED DOWNWARDS IN SIX O’CLOCK POSITION AS SHOWN ON THE INSTALLATION DRAWING. SWITCH FUNCTION MAY BE IMPAIRED IF INVERTED.**

Attach the 3/16” diameter hose between the Pressure Switch hose barb and the hose barb on the Pressure Averaging Tube. Cut to length as required.

Installing the Alarm Bell

Mount the Alarm Bell to the first available sheet metal mounting strip, or a solid/metallic component on the fume hood as shown in the installation drawing.

Use the mounting bracket as a template to mark the holes.

Drill the marked locations with a 1/8” (3mm) drill.

Use the available sheet metal mounting strips to attach the Alarm Bell mounting bracket.

Attach the grounding assembly to the Alarm Bell, tightening properly for hazardous locations sealing.

Tighten properly until grounding box cover faces forward or upward.

Attach the Alarm Bell and grounding box assembly to the mounting bracket with the mounting hardware supplied per installation drawing.

IMPORTANT: NOTE PROPER ORIENTATION OF THE BELL. BELL SHOULD BE MOUNTED SUCH THAT THE AC WIRING INPUT IS POINTED TO THE RIGHT AT THREE O’CLOCK POSITION AS SHOWN ON THE INSTALLATION DRAWING. BELL FUNCTION MAY BE IMPAIRED IF INVERTED.

Installing the Operator Panel

Attach 90° elbow (part not supplied) to Operator Panel.

Tighten properly for hazardous location and align the elbow to point towards the fume hood when fully tightened.

Use the Operator Panel as a template to mark two mounting holes and one clearance hole for electrical connection to the right side of the fume hood as shown on the installation drawing.

Drill the two marked locations with a 13/64” (5 mm) drill for mounting and an appropriate clearance hole (1.75”, 44 mm recommended for use with McMaster Carr rubber grommet 9307-K84 specified on installation drawing) for the electrical connection to the 90° elbow.

If using Metal Clad Hazardous Location, MCHL cable (not supplied), cut to length, terminate using proper techniques and attach to the 90° elbow.

Feed end of MCHL cable through clearance hole and attach Operator Panel to the fume hood using mounting hardware supplied per installation drawing.

If using other approved hazardous location wiring, see installation drawing and configure appropriately.

Installing the MCHL Cable/Glands

Although the use of Metal Clad Hazardous Location Cable is widely accepted, consult local ordinances for exact requirements.

NOTE: SOME ORDINANCES MAY REQUIRE SOLID METAL CONDUIT.

The installation drawing is shown for a typical MCHL installation. Since the MCHL cable and cable glands are not provided, details on how to cut and terminate these cables are not provided here. Consult the cable and cable gland manufacturer for these details.

See below for general wiring instructions.

Electrical Wiring

Wiring components: For convenience, TSI has provided information on typical flexible hazardous location wiring components. If this is allowed in the location where the installation is being performed, the description of the components found on the installation drawing 116-410-002 should be sufficient to get all required materials. If these are not allowed, consult a local expert in hazardous location wiring. (NOTE: USE OF SOLID METAL CONDUIT MAY BE REQUIRED BY SOME LOCAL ORDINANCES. IF METAL CONDUIT IS USED, CONDUIT SHOULD BE THOROUGHLY SEALED AT TERMINATION WITH EPOXY SEAL PER CLASS I, DIV. 1 FOR HAZARDOUS LOCATION ENVIRONMENT.)

All electrical enclosures should be mounted before wiring.

See the wiring diagram 116-410-003 (see Appendix) for detailed wiring information. Connection tables have been provided to identify proper connections between various alarm system components.

All specified flexible cables have a separate uninsulated ground conductor. Use this ground conductor to connect the ground screws (located in the four housings) together.

AC Power — The 120 VAC, 60 Hz power connection (hot and neutral) is made on the terminal board inside the Control Box. The ground connection is made on the grounding screw fastened to the base of the box. The AC wiring is brought into the box through the Power In port on the side of the box. See installation drawing.

Optional Auxiliary Alarm Relay — The alarm signal may be output to an auxiliary device such as a light or remote horn via an alarm relay located on the terminal board inside the Control Box. This relay has a nominal switching capacity of 1 amp at 30 VDC and 0.5 amp at 125 VAC. It may be wired for either normally open (N.O.) or normally closed (N.C.) operation.

SECTION 3

Calibration

Overview

The AirGard 410HE Airflow Monitor must be calibrated before first use and checked regularly thereafter.

Fume hoods vary in design and performance. Because each hood installation and its airflow pattern is unique, this monitor must be calibrated in the field on the fume hood in which it is installed.

WARNING: *Calibration of this instrument should only be performed by qualified personnel. Proper guidelines for monitoring any ventilation apparatus are established on the basis of toxicity or hazards of the materials used, or the operation conducted within the ventilation apparatus. Personnel calibrating the AirGard 410HE must be completely aware of the regulations and guidelines specific to its application.*

If you need a reference on performing traverses on fume hoods, please consult ANSI/ASHRAE 110-1995 *Method of Testing Performance of Laboratory Fume Hoods*, section 6.2 Face Velocity Measurements.

Tools Required

1. Calibrated thermo-anemometer rated for hazardous environments.
Suggested instruments include the Anor Model 9880 and 9850 which have the following safety rating: UL Listed intrinsically safe for use in hazardous locations for Class I, Groups C and D, Class II, Groups E, F, and G, and Class III, when recommended batteries are used.
2. Small slotted screwdriver.

Procedure

1. Double check installation to verify that the 410HE monitor, power supply, and any ancillary equipment are properly installed.
2. Allow at least 10 minutes for the pressure switch to warm up.
3. Determine the alarm set point. This is the condition where the monitor will indicate a low flow condition. The red LED on the Operator Panel will light at this point. Consult the facility's Industrial Hygiene Officer for the proper set point.

NOTE: *This device senses the duct static pressure. Different hoods may require different duct static pressure to generate the same face velocity.*

4. Set the sash at the working height and adjust the fume hood airflow to the low alarm set point (as determined in step 3, above). One method is to close the volume damper (if available) of the ductwork. This damper must be downstream of the pressure tap / pressure averaging tube.

WARNING: *This method is only used as a temporary means of setting the low flow set point. Make certain that airflow is restored to the proper level after calibration.*

5. Using a properly calibrated thermo-anemometer, determine the velocity through the face of the hood by taking a detailed velocity traverse. Divide the face area of the hood into equal partitions. One reading per square foot of face area is recommended for an accurate traverse. Compute the average velocity for this area.

NOTE: *The pressure switch response time may be as long as 10 to 25 seconds when the applied pressures are near the set point.*

-
6. If the red LED is initially lit, slowly turn the adjustment screw on the pressure switch clockwise until the green LED lights and then slowly turn the adjustment screw counter-clockwise until the red LED again lights.

If the green LED is initially lit, slowly turn the adjustment screw on the pressure switch counter-clockwise until the red LED lights.

IMPORTANT: *To allow for the delayed reaction of the pressure switch, these adjustments must be made in small increments, at intervals up to 25 seconds each.*

7. Restore normal airflow to the fume hood.

NOTE: *Due to the hysteresis of the pressure switch, the sash of the fume hood may need to be nearly closed to generate sufficient duct static pressure to reset the pressure switch to a “good” flow (green LED lit) condition. Upon restoring the airflow to the normal level, drop the sash down to reset the alarm to a non-alarm status and then return the sash to the working height. The green LED should remain lit.*

8. Verify the alarm setting by establishing a low flow condition (as in step 4). If the alarm does not activate, repeat steps 5 through 8.

SECTION 4

Normal Operation

Normal Conditions

When proper airflow/pressurization conditions are maintained in the fume hood, the green LED on the Operator Panel will be lit.

Alarm Conditions

In the event that a low airflow/pressurization condition is detected, the audible alarm (bell) will sound and the red LED on the Operator Panel will light. The alarm relay will also be energized. Due to the response time of the pressure switch, there may be a delay of 10 to 25 seconds from the onset of the low airflow alarm condition to the activation of the alarm indicators.

Press the Test/Reset button on the Operator Control Box to acknowledge the alarm. This will silence the bell. The red LED will remain lit and the alarm relay will remain energized until the airflow/pressurization is restored to a normal level.

NOTE: *Due to the hysteresis of the pressure switch, the sash of the fume hood may need to be nearly closed to generate sufficient duct static pressure to reset the pressure switch to a “good” flow (green LED lit) condition. Upon restoring the airflow to the normal level, drop the sash down to reset the alarm to a non-alarm status and then return the sash to the working height. The green LED should remain lit.*

System Test

The audible alarm, alarm relay, and status LEDs can be tested by pressing and holding the Test/Reset button for at least 2 seconds when airflow/pressurization is at a normal level (green LED lit). The system will return to normal operation when the Test/Reset button is released.

SECTION 5

Troubleshooting and Service

Troubleshooting Guide

Problem	Possible Cause / Corrective Action
Neither LED lit.	Power is off; restore power as required.
Alarm does not activate immediately.	Pressure sensor response may be delayed 10 to 25 seconds. This is normal.
Alarm condition not detected.	Hose connecting pressure averaging tube and pressure switch not properly attached. Check and correct as required. Pressure switch requires adjustment.
Frequent or continuous alarm conditions	Insufficient airflow. Pressure switch requires adjustment. Hood performance may be affected by other hoods or poorly placed air diffusers nearby.
Static pressure in duct too high for the pressure switch. Alarm cannot be set properly.	Contact TSI to obtain pressure switch with a higher range. 0.15 – 0.5 in H ₂ O P/N 464-410-050

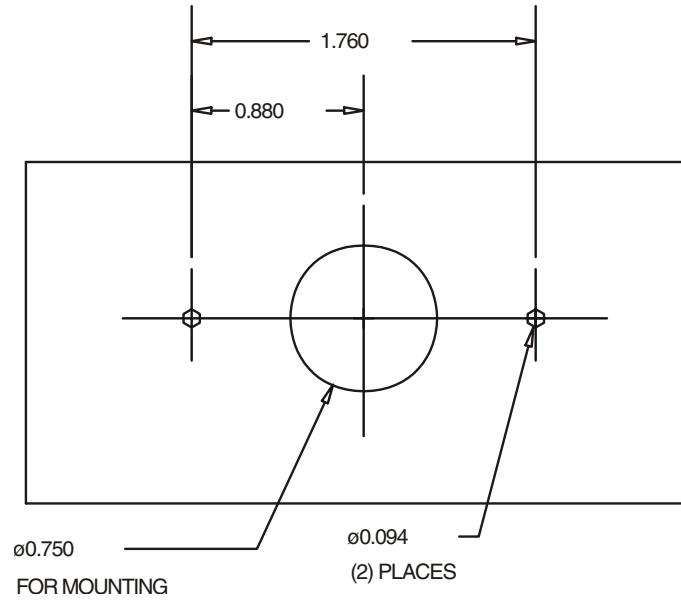
Service Requests

If you need assistance, please contact TSI.

SECTION 6

Mounting Template

Pressure Averaging Tube



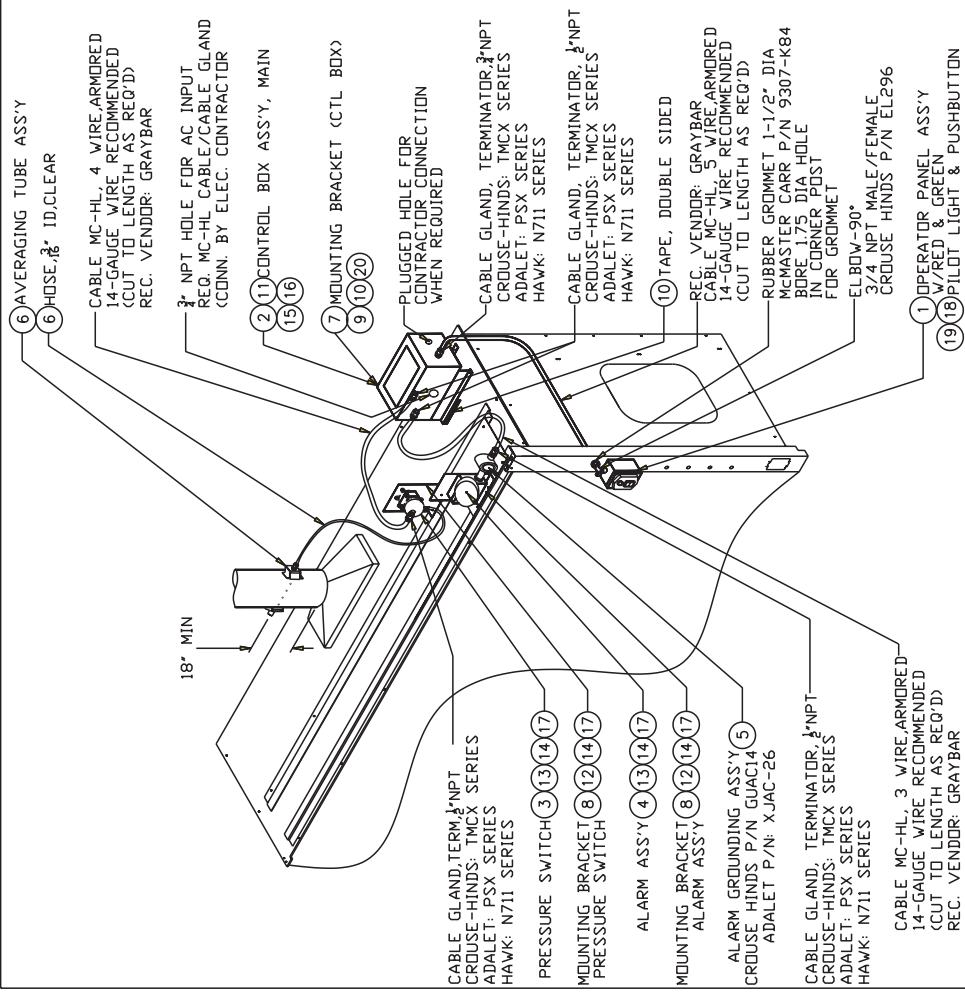
APPENDIX

Installation and Wiring Drawings

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NOTE:

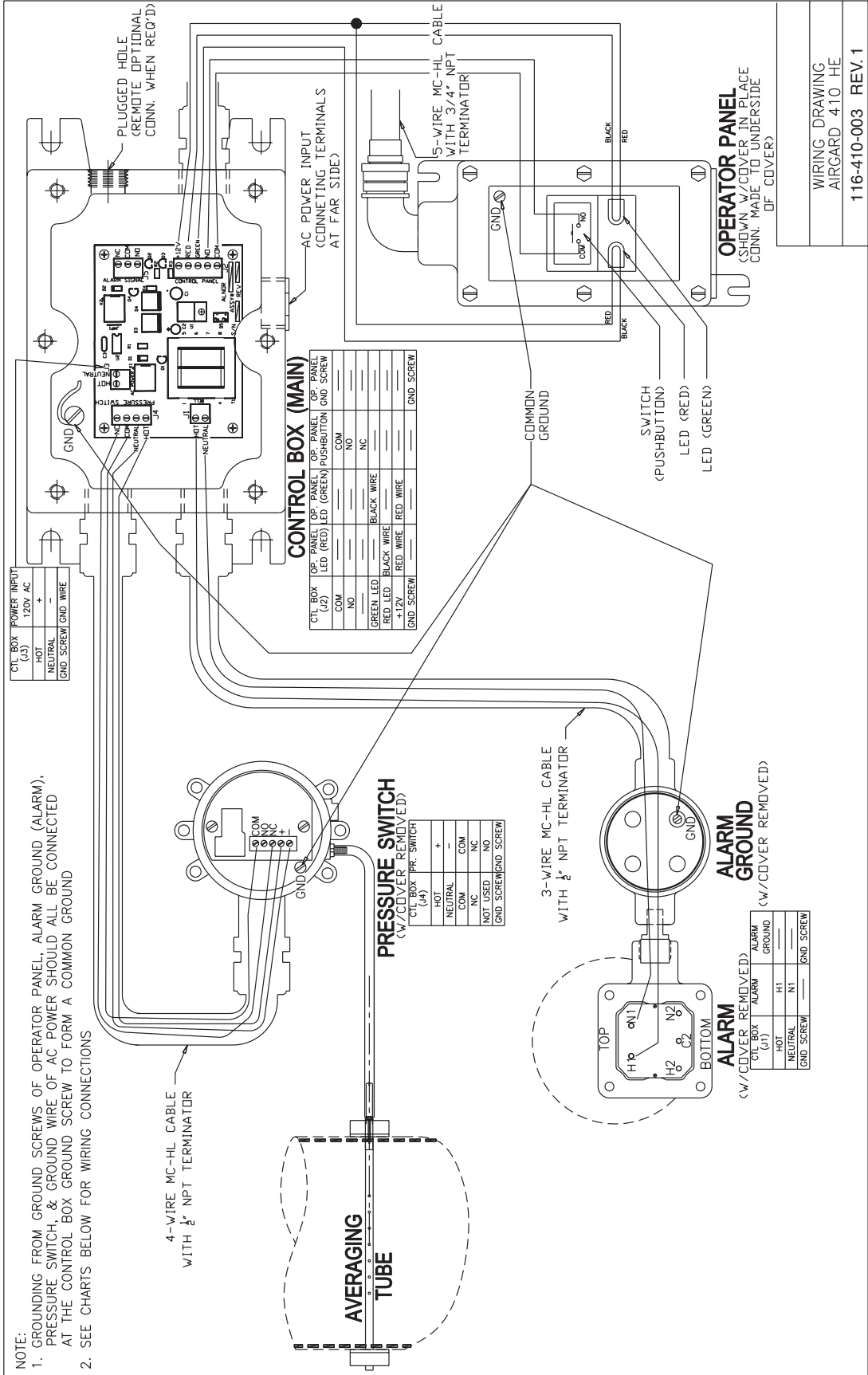
1. PARTS SUPPLIED BY ALNOR LISTED IN BOW ARE SHOWN WITH BALLOON DESIGNATIONS ITEMS 1 THRU 20
2. AC WIRING MUST BE GROUNDED TO MEET UL STANDARDS CLASS 1, DIV. 1. CABLES MUST BE UL LISTED & SUPPLIED WITH GROUND WIRE AND MEET CLASS 1, DIV. 1 HAZARDOUS LOCATION ENVIRONMENT.
3. IF SOLID METAL CONDUIT IS USED IN INSTALLATION INSTEAD OF MCHL CABLES, CONDUIT SHOULD BE SEALED WITH EPOXY PER CLASS 1, DIV. 1 FOR HAZARDOUS LOCATION ENVIRONMENT
4. OPERATOR PANEL ASSY ITEM #1 TO BE MOUNTED TO VERTICAL CORNER POST OF HOOD AT AN ERGONOMICALLY SUITABLE HEIGHT DEPENDING ON THE HOOD SIZE.
5. CABLE SHOULD BE WIRED TO OPERATOR PANEL ITEM #1 FIRST. GROMMET & TERMINATOR LUBED, THEN TERMINATOR END PUSHED THROUGH AND THEN WIRED INTO CONTROL BOX ITEM #2.
6. CONTROL BOX ITEM #2 SHOULD BE MOUNTED TO THE OUTSIDE EDGE AS SHOWN, WHERE THREE SCREWS CAN BE TAPPED INTO THE METAL STRIPS AT BOTH THE HORIZONTAL & VERTICAL EDGES. FOURTH SCREW LOCATION SHOULD BE SUBSTITUTED WITH A STRIP OF DOUBLE SIDED TAPE TO AVOID TAPPING SCREW DIRECTLY INTO HOOD TOP COVER WHICH IS MADE OF SOFT POLYRESIN MATERIAL (MUST AVOID PUNCTURE OF POLYRESIN TOP COVER).
7. ALARM & PRESSURE SWITCH ITEMS #3 & #4 TO BE MOUNTED WITH SAME BRKT ITEM #7 WHICH SHOULD BE MOUNTED DIRECTLY TO THE METAL STRIPS RUNNING LENGTHWISE THE TOP OF THE HOOD AS SHOWN. (AGAIN AVOID PUNCTURE OF POLYRESIN TOP COVER).
8. ALARM GROUNDING ASSY ITEM #5 TO BE MOUNTED ONTO ALARM ASSY ITEM #4 AS SHOWN FOR PROVIDING THE GROUNDING FACILITY OF THE ALARM AS SHOWN.
9. AVERAGING TUBE ITEM #6 TO BE MOUNTED TO EXHAUST DUCT MIN. 18" DOWNSTREAM THE CONTINUOUS SECTION OF THE HOOD AS SHOWN.



ITEM/PART NUMBER	DESCRIPTION	QTY	REMARKS
BILL OF MATERIAL			
20	270-319-600	WASHER FLAT, 196X656X.031,SS	3 SUPPLIED BY ALNOR
19	231-412-030	SCREW SHEET METAL, #14	2 SUPPLIED BY ALNOR
18	270-328-100	WASHER FLAT, 19732X578,SS	2 SUPPLIED BY ALNOR
17	281-400-004	NUT, 1/4-20	4 SUPPLIED BY ALNOR
16	270-334-306	WASHER FLAT, 5/16"	4 SUPPLIED BY ALNOR
15	281-500-006	NUT, 5/16-18	4 SUPPLIED BY ALNOR
14	273-028-704	WASHER STAR, #1/4"	4 SUPPLIED BY ALNOR
13	201-418-470	SCREW HEX HD, 1/4-20X7/8" L	4 SUPPLIED BY ALNOR
12	201-408-470	SCREW HEX HD, 1/4-20X1/2" L	4 SUPPLIED BY ALNOR
11	201-516-470	SCREW HEX HD, 5/16-18X1" L	4 SUPPLIED BY ALNOR
10	107-002-009	TAPE, DOUBLE SIDED	6" SUPPLIED BY ALNOR
9	230-812-030	SCREW SELF TAPPING, 8-32X3/4" L	3 SUPPLIED BY ALNOR
8	570-410-172	MTG BRKT ASSY, PR SW/ALARM	2 SUPPLIED BY ALNOR
7	570-410-171	MTG BRKT ASSY, CTL BOX	1 SUPPLIED BY ALNOR
6	670-410-077	AVERAGING TUBE ASSY	1 SUPPLIED BY ALNOR
5	670-410-165	ALARM GROUNDING ASSY	1 SUPPLIED BY ALNOR
4	670-410-055	ALARM ASSY	1 SUPPLIED BY ALNOR
3	670-410-044	PRESSURE SWITCH ASSY	1 SUPPLIED BY ALNOR
2	670-410-522	CONTROL BOX ASSY	1 SUPPLIED BY ALNOR
1	670-410-533	OPERATOR PANEL ASSY	1 SUPPLIED BY ALNOR

FRONT VIEW OF HOOD

INSTALLATION DRAWING
AIRGARD 410 HE
116-410-002 REV. 1



AIRGARD[®] 410HE MONITOR SPECIFICATIONS

Operator Control	Test/Reset button.
Visual Indicators	Green LED — airflow OK; Red LED — low airflow.
Audible Indicator	Minimum audible rating 88 db at 10 ft (3.05 m)
Pressure Switch Specifications	
Operating Range	0.07 to 0.15 in H ₂ O
Approximate deadband	
@ minimum setpoint	0.04 in H ₂ O
@ maximum setpoint	0.06 in H ₂ O
Alarm Relay Output	Nominal switching capacity 1A at 30 VDC, 0.5A at 125 VAC; form C relay.
Safety Rating	Designed to meet the requirements of the U.S. National Electrical Code (NEC) for use in Class I, Division 1, Group C and D environments.
Operating Conditions	55° to 86°F (12.8° to 30°C); 5% to 95% non-condensing RH.
Power Requirement	120 VAC (±10%), 60 Hz., 0.25 amp maximum.



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