MUA Controls

Industrial Direct-Fired Heaters - Non-Recirculating and Recirculating Systems

Installation, Operation, and Maintenance Manual

FOR YOUR SAFETY

IF YOU SMELL GAS: OPEN WINDOWS, DO NOT TOUCH ELECTRICAL SWITCHES, EXTINGUISH ANY OPEN FLAMES, IMMEDIATELY CALL YOUR GAS SUPPLIER.

FOR YOUR SAFETY

THE USE AND STORAGE OF GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN OPEN CONTAINERS IN THE VICINITY OF THIS APPLIANCE IS HAZARDOUS!

RECEIVING AND INSPECTION

Upon receiving unit, check for any interior and exterior damage. If damage is found, report it immediately to the carrier. Check that all accessory items are accounted for and are not damaged.

WARNING!!

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment. ALWAYS disconnect power and gas prior to working on heater.

Note To Installer: This manual should be reviewed with the customer and left with the equipment user. Please complete and return the Start-Up Checklist on the back of this manual to validate warranty.

Save these instructions. This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.

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WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 2-years from date of shipment. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and Local codes/regulations.
3. The equipment is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

For questions about installation, warranty, or service, go to **support.captiveaire.com** or **"Technical Support Information" on page 80** for more information.

GENERAL INFORMATION

Listings

This unit is ETL-listed to the American National Standard/CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4, CSA 3.7.

The Safety Control Board is ETL-listed to standard UL 60730-2-9, UL 60730-1, CSA E60730-1, CSA E60730-2-9.

Patents

The Direct Gas Fired Make-Up Air Profile Plates is covered under the following patent: Heated Make-Up Air System: United States Patent No. 6629523 B2.

INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow and electrical supply in accordance with this manual. For questions about installation, warranty, or service, go to **support.captiveaire.com** or **"Technical Support Information" on page 80** for more information.

Inspection on Arrival

1. Inspect the unit on delivery. Photograph any visible damage. Report any damage to the delivery carrier.
2. Request written inspection report from the Claims Inspector to substantiate a claim. File claim with delivery carrier
3. Check unit's rating plate to verify proper electric and fuel type meet job requirements. Compare unit received to description of product ordered.

Mechanical

WARNING: DO NOT RAISE UNIT BY THE INTAKE HOOD, BLOWER, MOTOR SHAFT, OR BEARINGS. USE ALL LIFTING LUGS PROVIDED WITH A SPREADER BAR OR SLING UNDER THE UNIT.

For clearances and unit location, refer to **"Unit Location" on page 6**.

For rigging and lifting units, refer to **"Rigging" on page 7**.

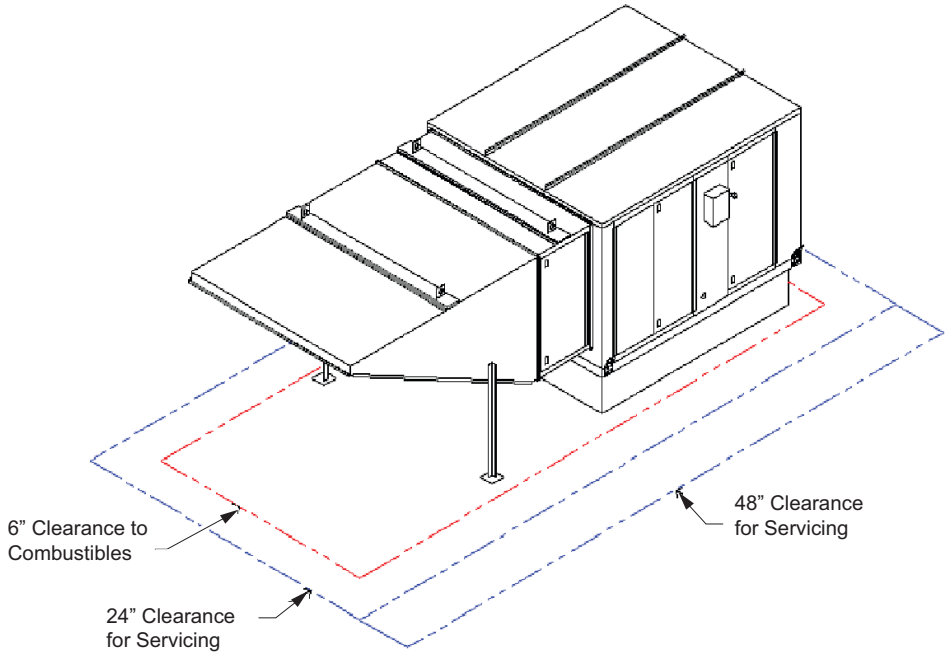
Site Preparation

1. Recirculation of room air may be hazardous in the presence of:
   - Flammable solids, liquids, and gases.
   - Explosive materials (e.g., grain dust, coal dust, gunpowder, etc.).
   - Substances which may become toxic when exposed to heat (e.g., refrigerants, aerosols, etc.).
2. Recirculation is not recommended in uninsulated buildings where outside temperatures fall below 32°F (0°C).
3. Excessive recirculation or insufficient ventilation air, which results in inadequate dilution of the combustion products generated by the heater, may create hazardous concentrations of carbon dioxide, carbon monoxide, nitrogen dioxide, and other combustion products in the heated space.
4. If gas fork trucks or other fossil fuel-powered equipment are utilized in the conditioned area, additional ventilation requirements for the facility must be addressed separately.
5. If the heater utilizes room sensors for limiting room CO2 concentration:
   - The CO2 control set-point shall be no greater than the maximum allowable room concentration of 5000 ppm less the sensor's published accuracy tolerance. The control shall prevent the CO2 concentration in room air from exceeding 5000 ppm.
   - A minimum of one sensor shall be installed per room served by the heater.
   - When a room area, served by a single heater, does not exceed 10,000 ft2 (929 m2), and height does not exceed 20 ft. (6 m), a duct sensor may be installed in the return air opening of the heater.
   - Sensors shall be calibrated per the sensor manufacturer's recommended procedure and frequency or annually, whichever is more frequent.
   - Each heater shall require its own CO2 sensor(s).
   - Sensors shall not be placed near sources of CO2.
   - If using part number A/CO2-R2, 10V DC = 2000 PPM. Voltage reading can be found in HMI under **Service Menu > Variable Values > Inputs > AQ**.

Unit Location

1. Do not locate any gas-fired equipment near corrosive or explosive vapors such as chlorinated or acid vapors. Refer to **Figure 1** for unit clearance spacing.
2. Avoid overhead power lines or other utility access to prevent accidental contact or damage.
3. Provide clearance around the installation site to safely rig and lift the equipment into its final position onto adequate supports. Refer to the manufacturer's estimated weights.
4. Consider general service and installation space when locating the unit. Locate the unit close to the space it will serve to reduce long, twisted duct runs.
5. Do not allow the air intake to face prevailing winds. The airflow sensor may trip in high winds.
6. Situate the unit above ground or at roof level high enough to prevent precipitation from being drawn into its inlet. The inlet must also be located at least 10 feet away from any exhaust vents.
7. The heater inlet must be located in accordance with the applicable building code provisions for ventilation air.
8. All air to the heater must be ducted from the outdoors.
9. Recirculation of room air is not permitted. If in doubt regarding the application, consult the manufacturer.
10. The unit must have adequate structural support, or the equipment or building could be damaged.
11. Do not alter or otherwise restrict combustion or ventilation openings.
12. Direct-fired units should not be installed downstream from cooling systems that use refrigerants for cooling.

Figure 1 - Unit Clearances



COMBUSTIBLE CLEARANCES

The top, back, and front surfaces of this heater may not be installed less than 6 inches from combustible materials. The heater base may be installed on combustible surfaces.

SERVICE CLEARANCES

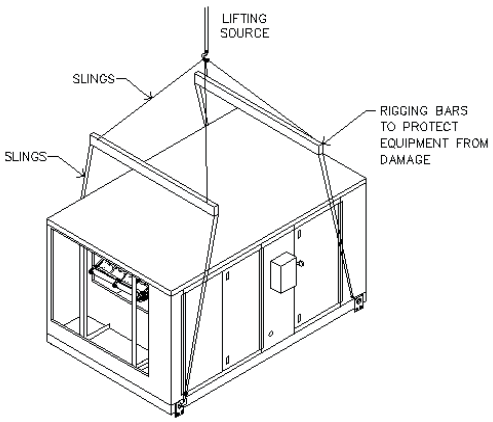
Allow 24 inches or greater minimum service clearance on all sides of this heater. Allow 48 inches or greater on the vestibule and blower door side.

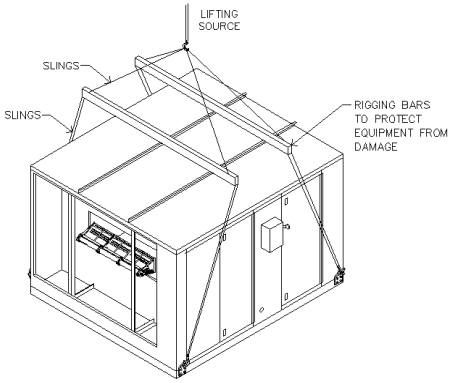
Rigging

1. **Figure 2** shows the proper methods for lifting the unit and accessories.
2. Lift the unit and accessories separately, attach the accessories to the unit once the unit is in place.
3. Size 10, 12, 15, and 18 units are supplied with lifting eyes on the top corners of the casing.
4. Horizontal units are supplied with four lifting lugs on the bottom corners of the casing.
5. Vertical units are supplied with four lifting lugs at the top corners of the casings.
6. The main load should be on these lugs.
7. Always use spreader bars to prevent damage to the unit casing.

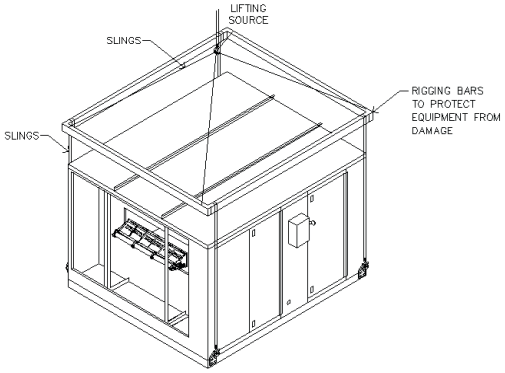
Figure 2 - Rigging

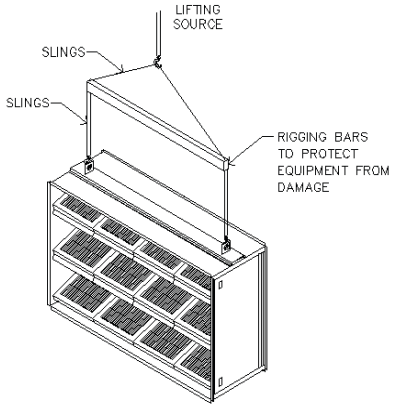
Size 10, 12, 15, 18 — No Spreader Bar





With Spreader Bar — Accessories





CAUTION!
THESE ARE UNBALANCED LOADS. LIFT EQUIPMENT GENTLY. DO NOT MAKE SUDDEN MOVEMENTS.

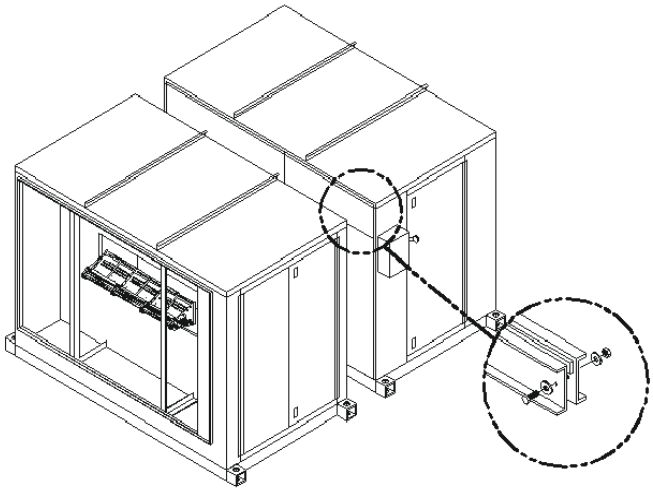
WARNING!
Spreader bars must be used and should extend past the edges of the equipment to avoid damage to the casing. Not using spreader bars may cause damage to the casing.

WARNING!
Damage will result if the equipment is raised by the intake hood, blower, motor shaft, or bearings. Use the provided lifting eyes and brackets on the unit.

Horizontal Split Units

1. Apply weather-proof gasketing to the seam of the horizontal unit, if not present.
2. Use provided fasteners to secure the seam of the unit using the provided pre-punched hole (**Figure 3**). Horizontal units have internal channels and a formed frame.
3. Apply silicone to the outside edge of the seam.
4. Field wire the discharge air sensor using a minimum 18 gauge thermistor wire.

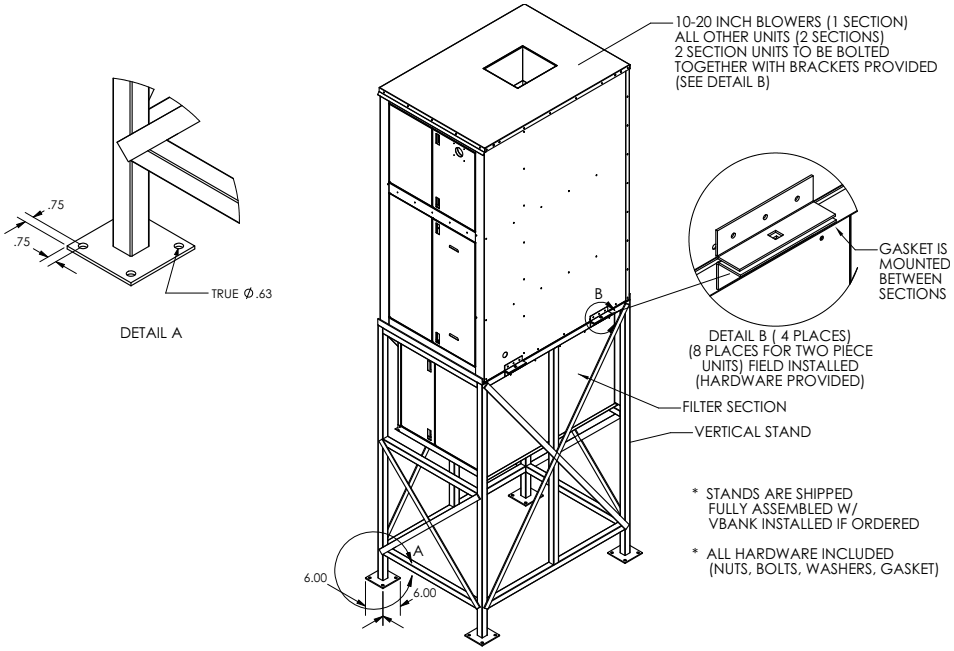
Figure 3 - Horizontal Split Assembly



Vertical Split Units

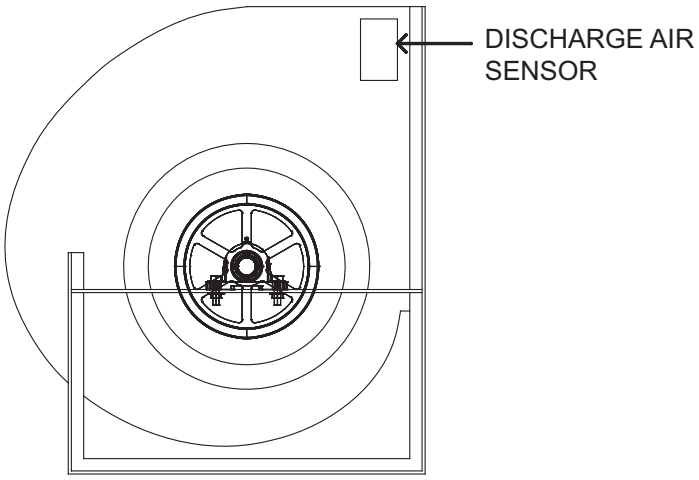
1. Position vertical stand. Lower unit sections onto vertical stand and bolt together. Use brackets provided. Refer to **Figure 4**.
2. Secure and seal ductwork connections to unit.
3. Secure mounting stand to equipment pad.

Figure 4 - Vertical Split Assembly



Discharge Air Sensor

Figure 5 - Sensor Field Assembly

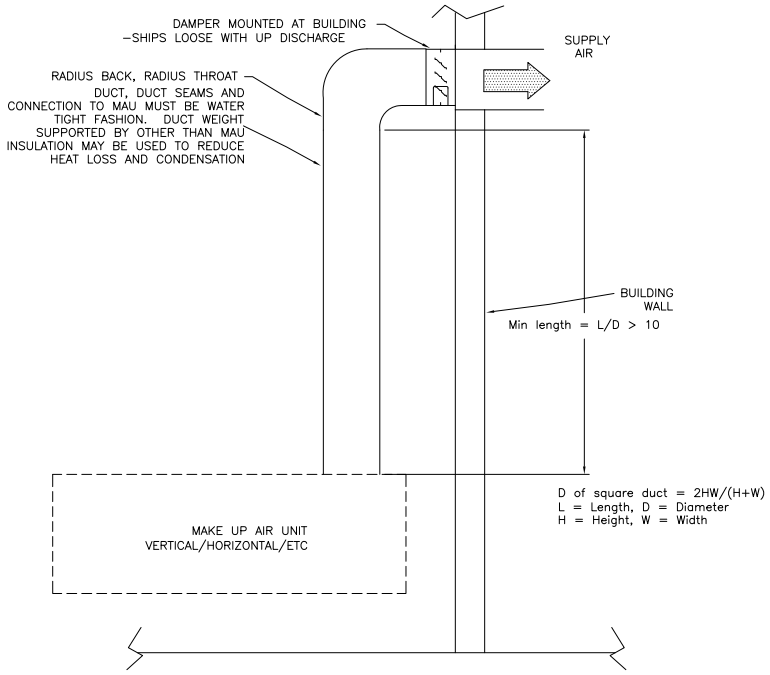


Loose Shipped Intake or Discharge Dampers

In some cases, an intake or discharge damper may be shipped loose. This may be requested by the customer or can be required because of larger units shipping size restrictions. Follow these instructions to attach and wire the loose shipped damper. Factory mounted dampers may be attached to the unit and will not require assembly or field wiring. Refer to **Figure 6**.

1. Attach the damper to the intake or discharge using gasketing, caulk, and #10 sheet metal screws.
2. Up discharge units should have a damper installed at building wall.
3. Field wire the damper using the as-built wiring schematic for the specific unit. Wiring may be different depending on the model and options selected.
4. Refer to the factory-supplied wiring print to verify the field wiring terminals.

Figure 6 - Discharge Damper Location (Top Mount shown)



Curb and Ductwork

This fan was specified for a specific CFM and static pressure. The ductwork attached to this unit will significantly affect airflow performance. When using rectangular ductwork, elbows must be radius throat, radius back with turning vanes. Flexible ductwork and square elbows should not be used. Any transitions and/or turns in the ductwork near the fan outlet will cause system effect. System effect will drastically increase the static pressure and reduce airflow. Units with twin blowers must have a common discharge plenum.

- **Table 1 on page 11** displays the minimum fan outlet duct sizes and straight lengths recommended by the manufacturer for optimal fan performance. Failure to adhere to recommendations may cause performance issues and/or structural damage. Any unit damage caused by not adhering to recommended duct lengths will not be covered under warranty. Refer to **Table 2 on page 11** for return duct sizing.
- Do not use the unit to support ductwork in any way. This may cause damage to the unit.
- **Follow SMACNA guides and manufacturer's requirements for the remaining duct run.** Fans designed for rooftop installation should be installed on a prefabricated or field-built roof curb.
- Follow curb manufacturer’s instructions for proper curb installation.
- Curbs must be field assembled.
- The unit should be installed on a curb and/or rail that meets local code height requirements.
- Make sure the duct connection and fan outlet are properly aligned and sealed.
- Verify all fasteners are secure.
- Adequate building relief shall be provided so as not to over pressurize the building when the heating system is operating at its rated capacity. This can be accomplished by taking into account, through standard engineering methods, the structure’s designed infiltration rate; by providing properly-sized relief openings; or by interlocking a powered exhaust system; or by a combination of these methods.
- Heaters installed with intake ductwork must be purged to replace at least four air changes of the volume of the intake duct.
- If the failure or malfunction of this heater creates a hazard to other fuel-burning equipment in the building (e.g., when the heater is providing makeup air to a boiler room), the unit is to be interlocked to open inlet air dampers or other such devices.
- On outdoor installations, it is recommended that the discharge duct be insulated to prevent condensation during the “OFF” cycle in cold weather.
- Flexible connectors should be used on all ductwork connections. Vibration isolators are optional and can be supplied in the loose parts package.
- Units that are installed in airplane hangars should be installed in accordance with the Standard for Aircraft Hangars, ANSI/NFPA 409. Units that are to be installed in public garages should be installed in accordance with the Standard for Parking Structures, ANSI/NFPA 88A, or the Standard for Repair Garages, ANSI/NFPA 88B, and with CAN/CGA B149 Installation Codes.

Ductwork Sizing

Table 1 - Supply Ductwork

Supply Ductwork Sizing Single Blower		
Blower Size (Inches)	**Duct Size (Inches)**	**Straight Duct Length* (Inches)**
10	14 x 14	54
12	16 x 16	54
15	20 x 20	54
18	24 x 24	78
20	26 x 26	102
22	30 x 30	114
25	32 x 32	156
27	36 x 36	162
30	38 x 38	174
33	44 x 44	174
36	44 x 44	198

Supply Ductwork Sizing Dual Blower		
Blower Size (Inches)	**Duct Size (Inches)**	**Straight Duct Length (Inches)**
222	77 x 28	156
225	88 x 32	168
227	96 x 36	180
230	104 x 38	198
233	116 x 44	204
236	122 x 44	222

Table 2 - Return Ductwork

Return Ductwork Sizing Single Blower		Return Ductwork Sizing Double Blower	
Blower Size (Inches)	**Duct Size (Inches)**	**Blower Size (Inches)**	**Duct Size (Inches)**
10	-	222	14 x 124
12	12 x 30	225	14 x 124
15	12 x 30	227	15 x134
18	13 x 42	230	15 x 134
20	13 x 42	233	-
22	14 x 58	236	-
25	14 x 58		
27	16 x 66		
30	16 x 66		
33	22 x 76		
36	22 x 76		

WARNING!!

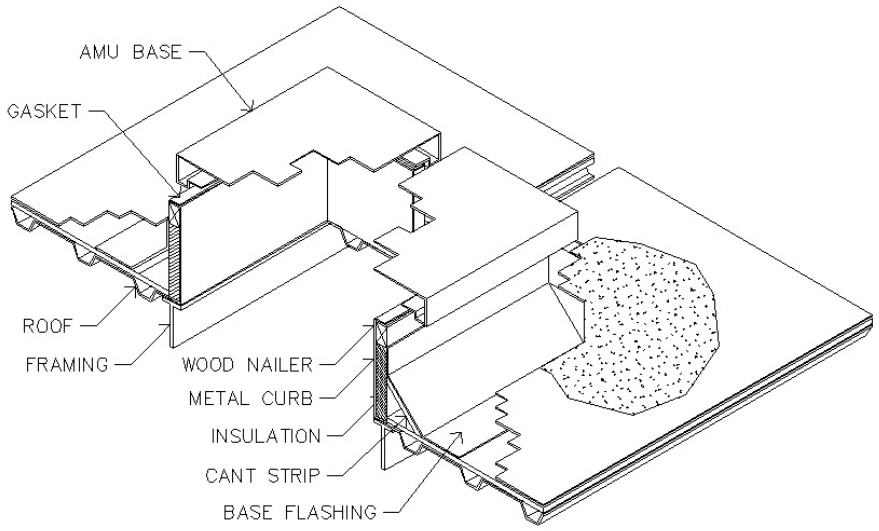
Failure to properly size ductwork may cause system effects and reduce the performance of the equipment.

Curbs

WARNING!
The unit must have adequate structural support or the equipment or building could be damaged.
The curb and unit must be leveled or the unit may leak or damage may occur.
Curbs must be field assembled.

Use gasketing and caulk between the curb and unit. If necessary, use shims to level the unit. Screw or weld the unit's base to the curb to avoid damage to the equipment. Refer to **Figure 7**.

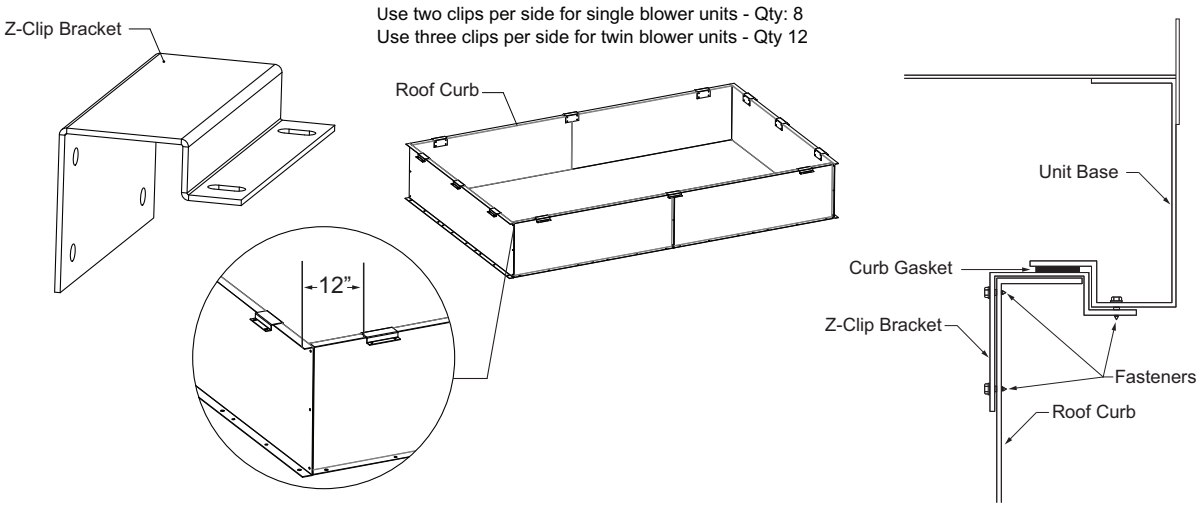
Figure 7 - Curb



Z-Clip Installation

Refer to **Figure 8** for details on Z-Clip installation. Z-Clip brackets can be used to secure the equipment's base to the curb. Z-Clip brackets should be installed on the curb prior to placing equipment in place. Install clips 12" from the edge of the curb on every side. Use two clips per side on single blower units. An additional clip is added to each side on twin blower units.

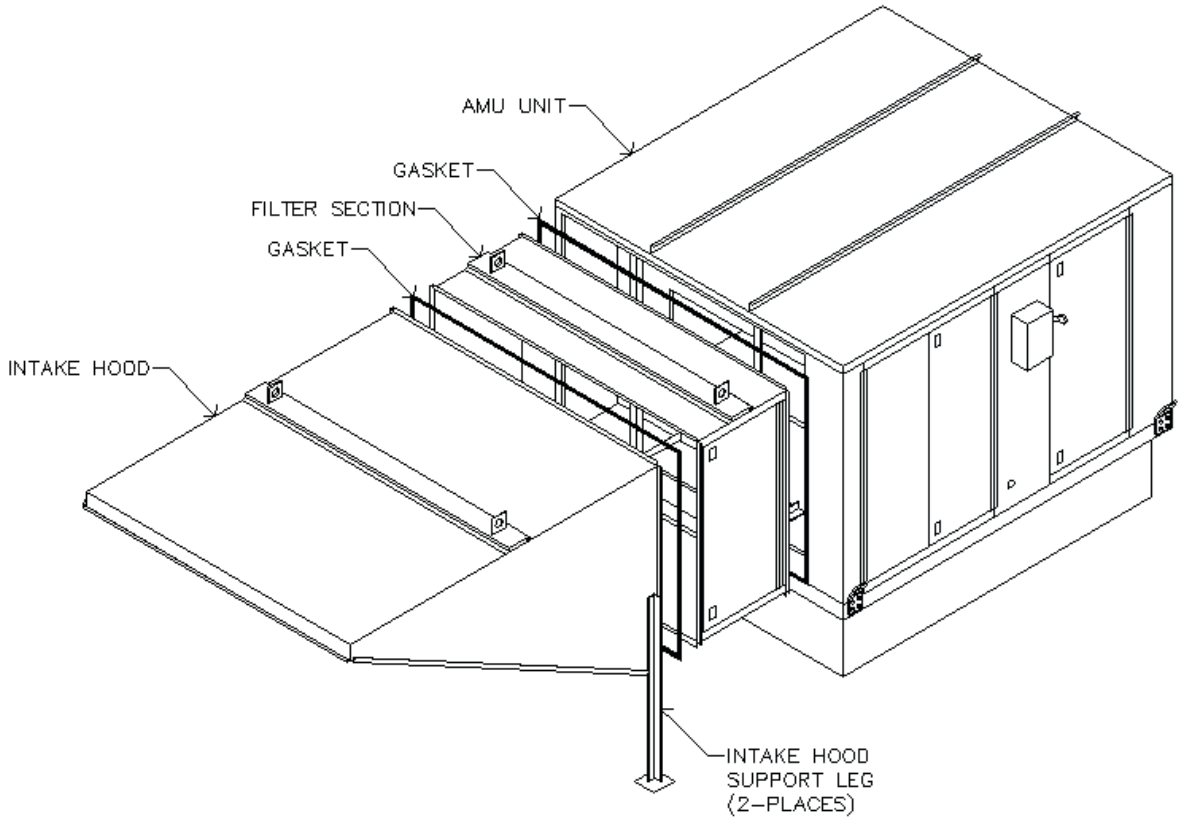
Figure 8 - Z-Clip Installation Details



Accessories

Intake and discharge accessories are shipped loose and unassembled. When attaching accessories to the unit, use gasketing, caulk, and #10 sheet metal screws on all seams. All accessories must be level. Refer to **Figure 9**.

Figure 9 - Accessories Installation

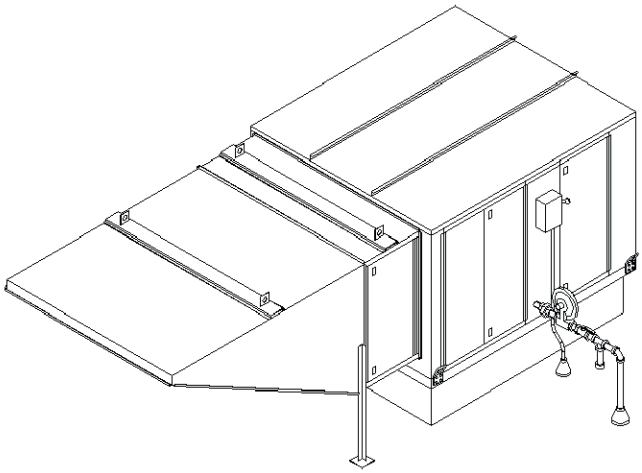


Installation Examples

Horizontal Roof Top Installation

- Down discharge reduces ductwork
- Hood weight supported by support legs
- Union, regulator, and shut-off
- Roof curb supports unit
- Intake facing away from prevailing winds

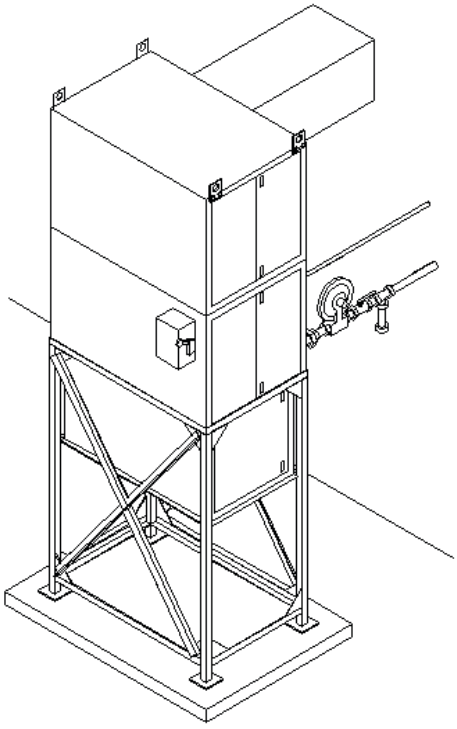
Figure 10 - Horizontal Roof Top Installation



Vertical Outdoor Ground Installation

- Side discharge reduces ductwork
- Support stand on concrete pad
- Union, regulator, and shut-off
- Filter section inside support stand
- Ease of serviceability on ground

Figure 11 - Vertical Outdoor Ground Installation



Gas

Installation of gas piping must conform with local building codes, or in the absence of local codes to the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) – latest edition. In Canada, installation must be in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.

WARNING: INLET GAS PRESSURE MUST NOT EXCEED PRESSURE INDICATED ON NAMEPLATE. SEE UNIT NAMEPLATE FOR PROPER GAS SUPPLY PRESSURE AND GAS TYPE.

1. Always **disconnect power** before working on or near a heater. Lock and tag the disconnect switch or breaker to prevent accidental power-up.
2. Piping to the unit should conform to local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to the Gas Engineer's Handbook for gas line capacities.
3. The incoming pipe near the heater should be sized to match the connection on the outside of the unit. Avoid multiple taps in the gas supply line.
4. Install a ground joint union with brass seat and a manual shut-off valve external to the unit casing. Install shut-off valve adjacent to the unit for emergency shut-off and easy servicing of controls. Refer to **Figure 12 on page 16**.
5. Provide a sediment trap, as shown in **Figure 12 on page 16**, before each unit and where low spots in the pipeline cannot be avoided.
6. Clean out the gas line to remove debris before making connections. Purge gas line to remove air before attempting to start unit. Purging air from gas lines should be performed as described in ANSI Z223.1-latest edition "National Fuel Gas Code," or in Canada as described in CAN/CGA-B149.
7. All field gas piping must be pressure/leak tested before unit operation. Use a non-corrosive bubble forming solution or equivalent for leak testing. The heater and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi.
8. This unit requires the gas pressure to be within the unit's minimum and maximum gas pressure ratings. If the pressure is greater than the maximum, the internal valve components will be damaged. If the pressure is below the minimum, the heater will not perform to specifications.
9. If installing on a paint booth application, a manual shutoff should be located for access in case of a fire or explosion at the heater.

This unit may be supplied with a regulator, located upstream of all valves and switches. The regulator is sized based on the incoming gas pressure and gas supply rate. The outlet pressure of this regulator is sized to safely deliver gas to this equipment.

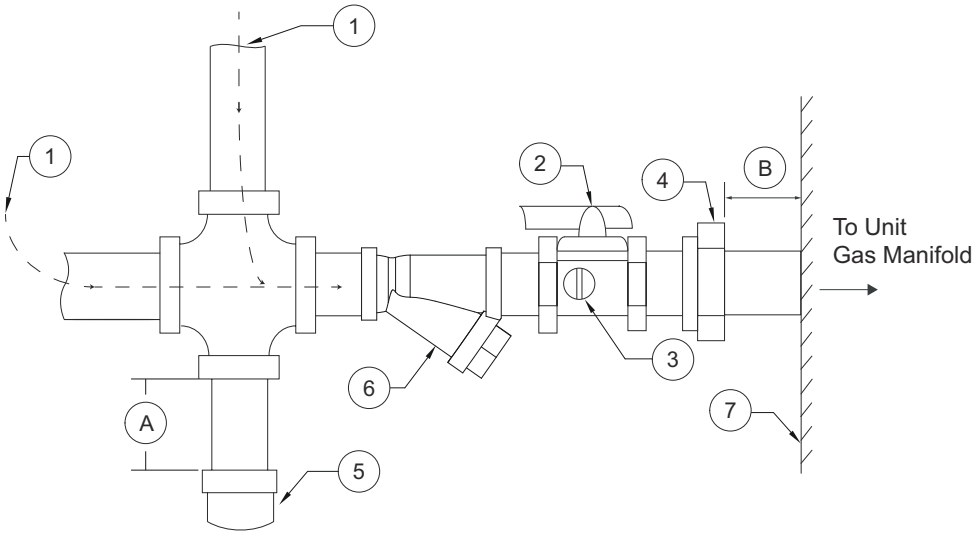
NOTICE

Refer to the heater's rating plate for determining gas supply pressures and requirements.

Gas Train

A strainer must be installed to prevent debris from entering the gas train. Only use new piping. Properly ream and clean metal burrs. Proper care is needed to ensure that the gas flow is in the same direction as indicated on the strainer. Do not over-tighten pipe connections. Use pipe dope on male threads only. Install a drip leg in the gas line in accordance with the Authority Having Jurisdiction (AHJ) guidelines.

Figure 12 - Gas Connection Diagram



1. Gas Supply Line Connection
2. Manual Gas Shut-off Valve
3. Plugged 1/8” NPT Test Gauge Connection
4. Ground Joint Union with Brass Seat
5. Sediment Trap
6. Strainer
7. Unit

A. Minimum Depth = 6”
B. Maximum Length = 12”

Proper clearance must be provided in order to service the strainer. A minimum of a 4” clearance distance must be provided at the base of the strainer.

Table 3 - Gas Strainer Details

Strainer	Size
4417K64	3/4”
4417K65	1”
4417K66	1-1/4”
4417K67	1-1/2”
4417K68	2”
4417K69	2-1/2”
4417K71	3”

Electrical

WARNING!
Disconnect power before installing or servicing unit. High voltage electrical input is needed for this equipment. A qualified electrician should perform this work.

Before connecting power to the heater, read and understand the entire section of this document. As-built wiring diagrams are furnished with each unit by the factory and are attached to the control module's door or provided with paperwork packet.

Electrical wiring and connections must be made in accordance with local ordinances and the National Electric Code, ANSI/NFPA 70. Verify the voltage and phase of the power supply. Confirm the wire amperage capacity is in accordance with the unit nameplate. For additional safety information, refer to AMCA publication 410-96, *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans.*

1. **Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up**.
2. A dedicated branch circuit(s) should supply the motor/control circuits with adequate short circuit protection as required by the national electric code. Every branch circuit should include a properly sized ground connection.
3. Verify that the power source is compatible with the requirements of your equipment. The nameplate identifies the **proper phase and voltage** of the equipment.
4. Units shipped with a remote HMI will require a second drop through the base of the unit. It is important to route the motor wires in a separate conduit from the HMI wiring.
5. Before connecting the unit to the building's power source, verify that the power source wiring is de-energized. Refer to schematics.
6. Secure the power cable to prevent contact with sharp objects. Verify ground connection is secure.
7. Do not kink power cable and never allow the cable to encounter the burner airstream, oil, grease, hot surfaces, or chemicals.
8. Before powering up the unit, make sure that the fan rotates freely. Make sure that the interior of the unit is free of loose debris or shipping materials.
9. Electrically Commutated Motors (ECMs) and Variable Frequency Drives (VFDs) should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.
10. If any of the original wire supplied with the unit must be replaced, it must be replaced with type THHN wire or equivalent.

Table 4 - Copper Wire Ampacity

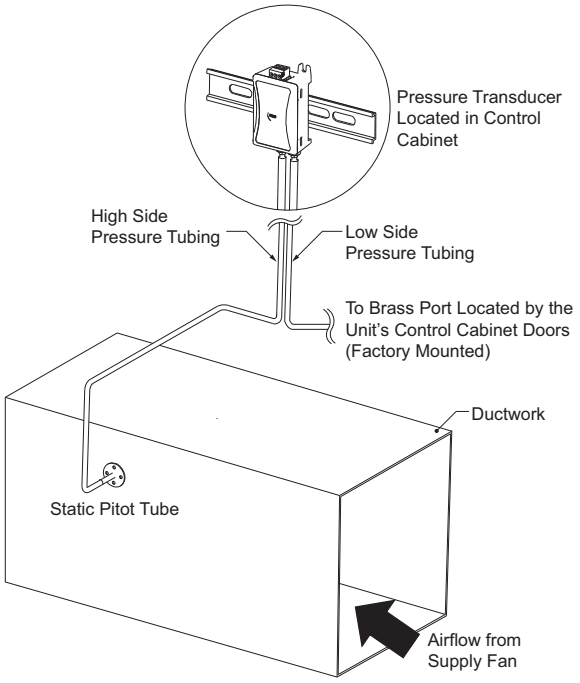
Wire Size AWG	Maximum Amps
14	15
12	20
10	30
8	50
6	65
4	85
3	100
2	115
1	130

Duct Static Pressure Control

Units equipped with an Electrically Commutated Motors (ECMs) or Variable Frequency Drives (VFDs) driven supply fan, the duct static pressure control option can be used to monitor duct pressure.

1. Locate where the pressure transducer is installed in the control cabinet.
2. Install the static pitot tube in a straight section of ductwork where the airflow is laminar and consistent.
3. Connect the high side tubing to the static pitot tube.
4. Route the tubing through the bottom of the unit to the high side port on the pressure transducer.
5. The low side pressure tubing will be connected to a brass port, measuring outdoor ambient pressure. The port is located by the unit's control cabinet doors. This will be connected from the factory.

Figure 13 - Duct Static Pressure Control

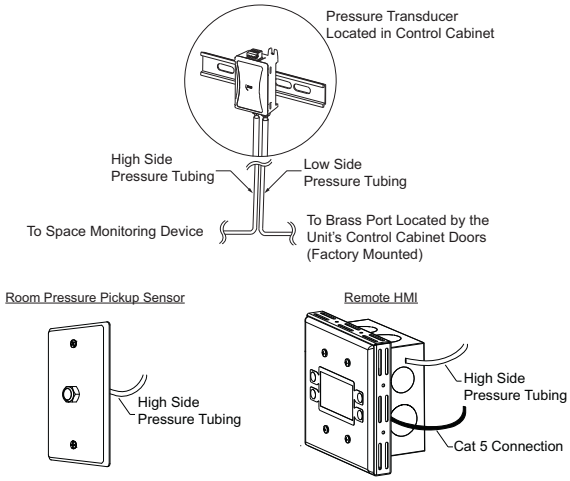


Building Static Pressure Control

Units equipped with an Electrically Commutated Motors (ECMs) or Variable Frequency Drives (VFDs) driven supply fan, the building static pressure control option can be used to monitor space pressure.

1. Locate where the pressure transducer is installed in the control cabinet.
2. Determine the space monitoring device:
   - Room Pressure Pickup Sensor
   - Remote HMI, refer to **"HMI and Remote Room Sensor Installation" on page 19**
3. Install the space monitoring device in the space.
4. Connect the high side tubing to the space monitoring device.
5. Route the tubing through the bottom of the unit to the high side port on the pressure transducer.
6. The low side pressure tubing will be connected to a brass port, measuring outdoor ambient pressure. The port is located by the unit's control cabinet doors. This will be connected from the factory.

Figure 14 - Building Static Pressure Control



HMI and Remote Room Sensor Installation

The HMI (Human Machine Interface) is used to change settings, view operating information, and view fault history. Remote HMI faceplates (**Figure 15**), remote room sensors (**Figure 16**), and smart controls may be ordered and shipped separately. These components measure temperature and humidity and assist in controlling the unit. These components should be installed in a safe location, free of influence from external heat sources. Sensors must be installed in areas indicative of the average room temperature. Mounting the sensor(s) to interior walls will provide reliable measurements. Keep the sensor away from heat-producing appliances, direct sunlight, and away from operable windows/doors.

HMIs and remote room sensors can be installed directly to industry-standard junction boxes, either surface mounted or recessed mounted. HMIs have a built-in temperature/relative humidity (RH) sensor, which is typically used to help control the automatic function of the unit.

The HMI can also be configured to control the unit from a remote location manually. They can be configured not to use the internal temperature/relative humidity sensor. In this configuration, the sensor in the HMI is ignored in automatic operation. Multiple HMIs can be connected to one unit for temperature and R/H averaging. All combination temperature/humidity HMIs will use a vented standoff. Mount the static pressure tube close to the HMI to obtain proper room conditions.

A max of 4 additional HMIs can be daisy-chained together. Place an End-of-Line (EOL) device in the last HMI connected.

Figure 15 - HMI with Standoff

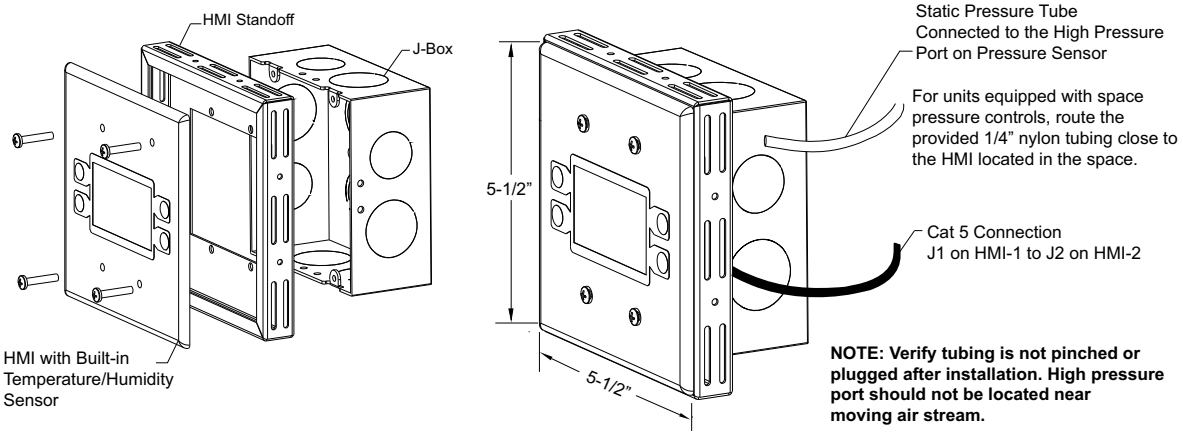
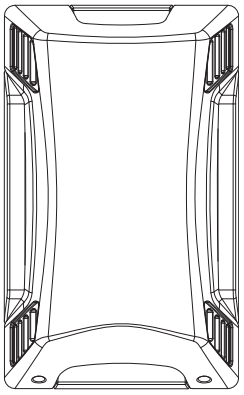


Figure 16 - Remote Temp/RH Sensor



The room temperature/humidity sensor is a 10K ohm thermistor. When connected to the 0-10V humidity sensor connection, the sensor provides constant room temperature and humidity (RH) readings to the controller. The sensor should be installed on a wall somewhere in the room, but not directly in the HVAC diffuser's path or close to heat-producing appliances so that the reading is not affected by heat.

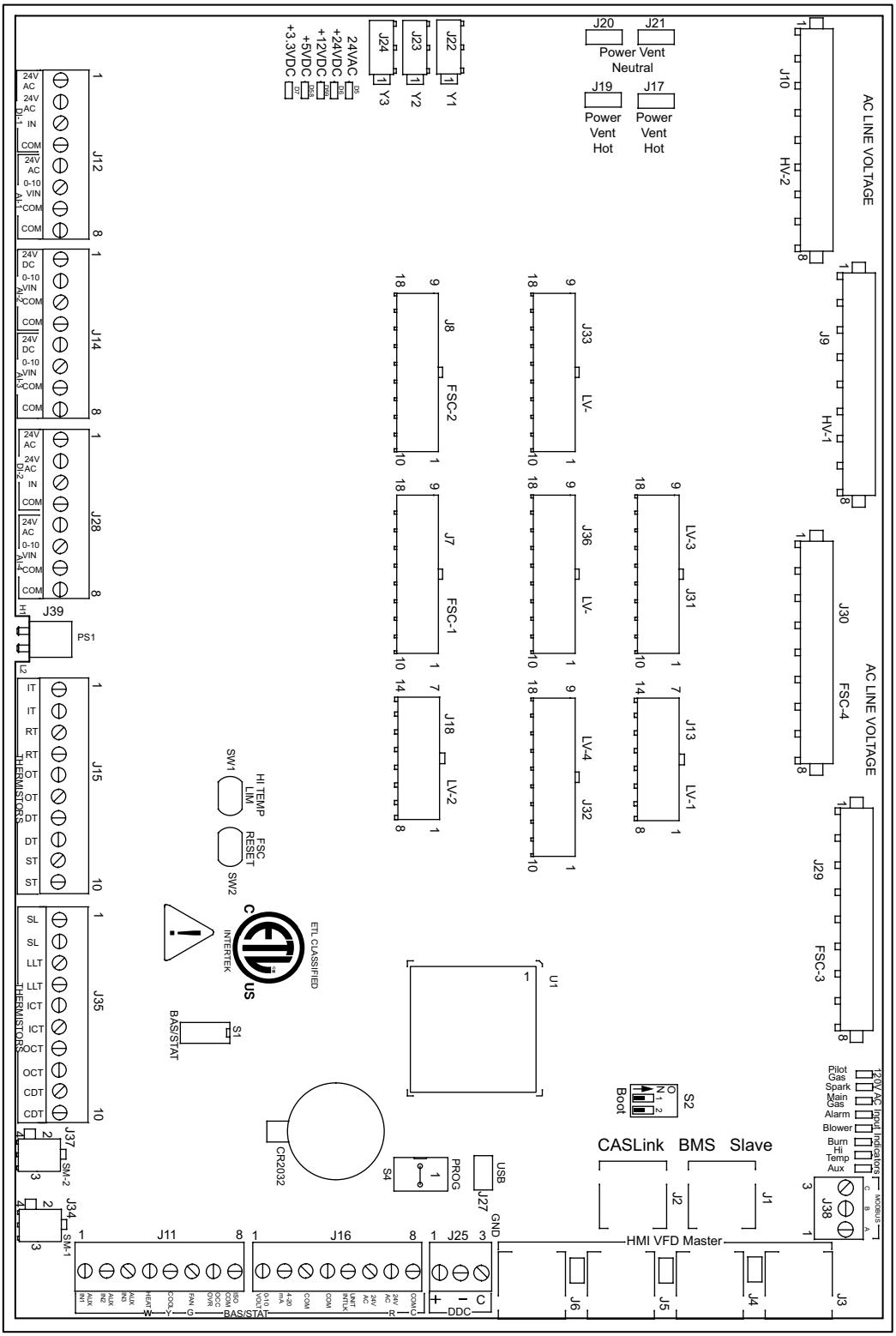
Room sensors are not required for proper control operation, but still can be configured as remote sensors or averaging sensors.

Do not install the room sensor on the ceiling.

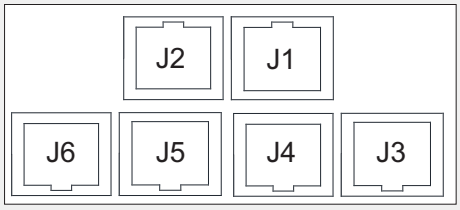
Make-up Air (MUA) Board Connectors

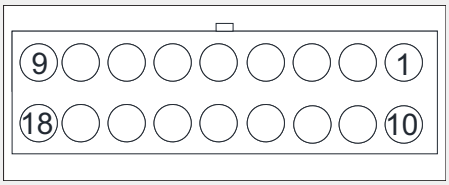
The Make-up Air (MUA) Board (**Figure 17**) is located in the main control cabinet.

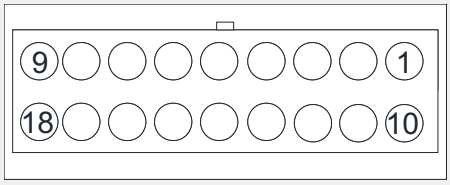
Figure 17 - Make-up Air Board

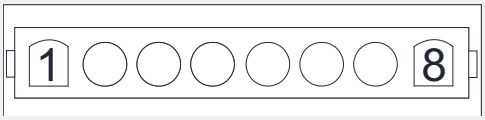


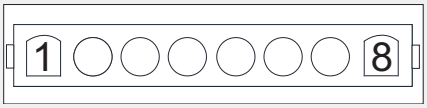
Note: Some connections may not be used dependent on system configurations.

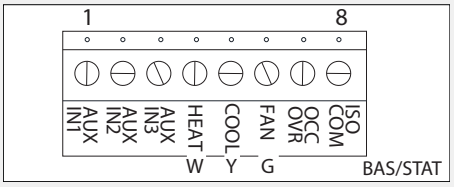
RJ45 connectors. **Connector J1** and **J2** are associated with BMS. **Connector J3** through **J6** are interchangeable and may be used to connect to an HMI or VFD.	
J1 - CASLink/Slave **J2** - CASLink/Slave **J3** - HMI/VFD/Master	**J4** - HMI/VFD/Master **J5** - HMI/VFD/Master **J6** - HMI/VFD/Master

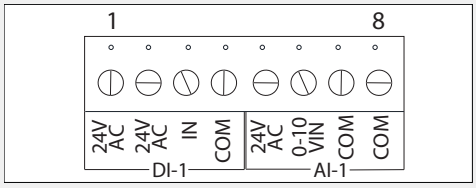
Connector J7 N/A	

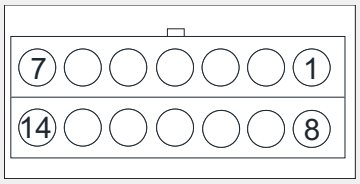
Connector J8 N/A	

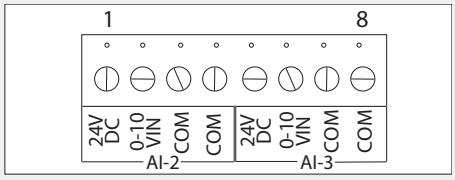
Connector J9 contains 120V AC connections	
Pin 1 - 120VAC Main Input **Pin 2** - 120VAC Input from Discharge Damper End Switch **Pin 3** - 120VAC Input from Fire Micro-Switch **Pin 4** - 120VAC Output to Intake/Discharge Damper Actuator	**Pin 5** - 120VAC Input from Intake Damper End Switch **Pin 6** - N/A **Pin 7** - 120VAC Output to Cabinet Heater **Pin 8** - 120VAC Neutral

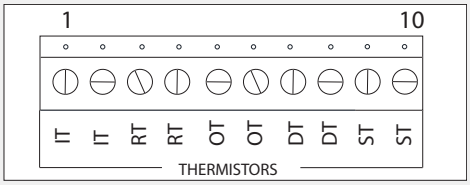
Connector J10 contains 120V AC connections	
Pin 1 through **Pin 4** - N/A	**Pin 5** - 120VAC Input from Supply Overload **Pin 6** - 120VAC Output to Supply Starter Coil **Pin 7** - 120VAC Output to Exhaust Starter Coil **Pin 8** - 120VAC Input from Exhaust Overload

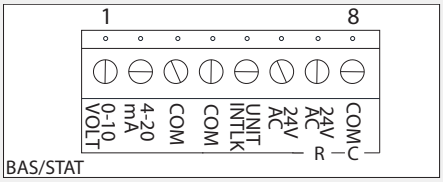
Connector J11 contains low voltage screw terminal connections	
Pin 1 - 24VAC Auxiliary Input/Purge Mode **Pin 2** - 24VAC Auxiliary Input **Pin 3** - 24VAC Auxiliary Input **Pin 4** - 24VAC Call for Heat Input/Burner Interlock	**Pin 5** - 24VAC Call for Cooling Input/AC Interlock **Pin 6** - 24VAC Call for Blower Input **Pin 7** - 24VAC Occupied Override Input **Pin 8** - 24VAC Isolated Common

Connector J12 contains low voltage screw terminal connections	
Pin 1 - 24VAC Output to Smoke Detector **Pin 2** - 24VAC Output to Smoke Detector **Pin 3** - 24VAC Digital Input from Smoke Detector **Pin 4** - 24VAC Common to Smoke Detector	**Pin 5** - 24VAC Output to Air Quality Sensor **Pin 6** - 0-10V Analog Input from Air Quality Sensor **Pin 7** - 24VAC Common to Air Quality Sensor **Pin 8** - 24VAC Common to Air Quality Sensor

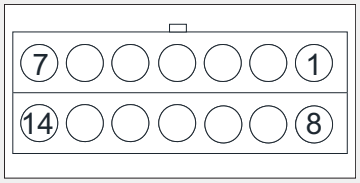
Connector J13 contains low voltage connections	
Pin 1 - N/A **Pin 2** - N/A **Pin 3** - 24VAC Output for Low Gas Pressure Switch **Pin 4** - 24VAC Output for High Gas Pressure Switch **Pin 5** - 24VAC Output for Clogged Filter Switch **Pin 6** - 24VAC Output for Low Airflow **Pin 7** - 24VAC Input for Board Power	**Pin 8** - N/A **Pin 9** - N/A **Pin 10** - 24VAC Input from Low Gas Pressure Switch **Pin 11** - 24VAC Input from High Gas Pressure Switch **Pin 12** - 24VAC Input from Clogged Filter Switch **Pin 13** - 24VAC Input from Low Air Pressure Switch **Pin 14** - 24VAC for Board Power

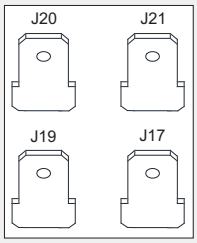
Connector J14 contains screw terminal connections	
Pin 1 - 24VAC Output to Humidity Sensor **Pin 2** - 0-10VDC Analog Input from Humidity Sensor **Pin 3** - 24VAC Common to Humidity Sensor **Pin 4** - 24VAC Common to Humidity Sensor	**Pin 5** - 24VAC Output to Humidity Sensor **Pin 6** - 0-10VDC Analog Input Humidity Sensor **Pin 7** - 24VAC Common Humidity Sensor **Pin 8** - 24VAC Common to Humidity Sensor

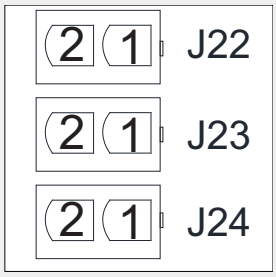
Connector J15 contains low voltage connections	
Pin 1 - Intake Temperature Thermistor Input **Pin 2** - Intake Temperature Thermistor Input **Pin 3** - Return Temperature Thermistor Input **Pin 4** - Return Temperature Thermistor Input **Pin 5** - Outdoor Temperature Thermistor Input	**Pin 6** - Outdoor Temperature Thermistor Input **Pin 7** - Discharge Temperature Thermistor Input **Pin 8** - Discharge Temperature Thermistor Input **Pin 9** - Space Temperature Thermistor Input **Pin 10** - Space Temperature Thermistor Input

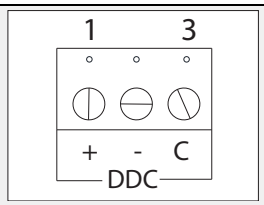
Connector J16 contains low voltage screw terminal connections	
Pin 1 - 0-10VDC Analog Input for Heat Modulation **Pin 2** - 4-20 mA Analog Input for Heat Modulation **Pin 3** - Common **Pin 4** - Common	**Pin 5** - 24VAC Unit Interlock Input **Pin 6** - 24VAC Output (Stat) **Pin 7** - 24VAC Output (R) **Pin 8** - Common

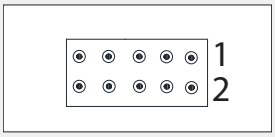
NOTE: Connector J17 is grouped with connectors J-19 through J-21

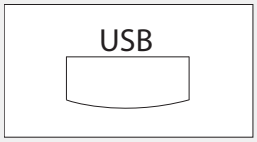
Connector J18 contains low voltage connections	
Pin 1 - 24VDC + Output **Pin 2** - 0-10VDC Analog Output for Recirc Actuator **Pin 3** - 0-10VDC Analog Output for Bypass Damper **Pin 4** - 24VAC Output for DX Float Switch **Pin 5** - 24VAC Output for Door Interlock **Pin 6** - N/A **Pin 7** - 24VAC for Damper Actuator	**Pin 8** - 24VDC - Common **Pin 9** - Common for Recirc Actuator **Pin 10** - Common for Bypass Damper **Pin 11** - 24VAC Input from DX Float Switch **Pin 12** - 24VAC Input from Door Interlock **Pin 13** - N/A **Pin 14** - 24VAC for Damper Actuator

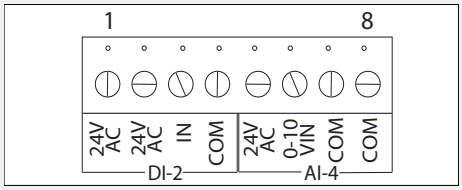
Connector J17 N/A **Connector J19** N/A **Connector J20** N/A **Connector J21** N/A	

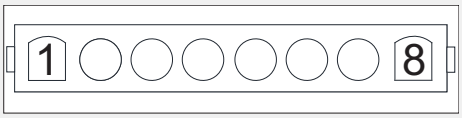
Connector J22 N/A **Connector J23** N/A **Connector J24** N/A	

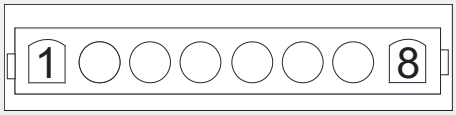
Connector J25 contains low voltage screw terminal connections for DDC Communications Isolated	
Pin 1 - RS-485 + **Pin 2** - RS-485 -	**Pin 3** - RS-485 Common

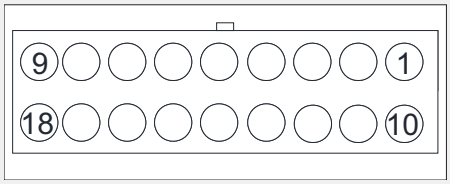
Connector J26 Programming Port0	

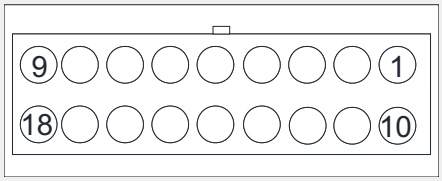
Connector J27 USB Programming Port	

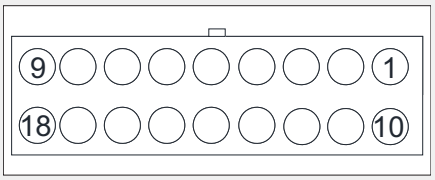
Connector J28 contains low voltage screw terminal connections	
Pin 1 - 24VAC Start Command for 3rd-Party VFD **Pin 2** - 24VAC Output **Pin 3** - 24VAC Trouble Input **Pin 4** - 24VAC Common for 3rd-Party VFD	**Pin 5** - 24VAC Constant Output **Pin 6** - 0-10VDC Analog Input VFD Speed Reference **Pin 7** - 24VAC Common **Pin 8** - 24VAC Common

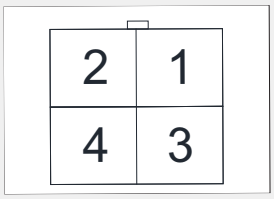
Connector J29 contains 120V AC connections	
Pin 1 - 120VAC Blower Service Switch Input **Pin 2** - 120VAC Burner Service Switch Input **Pin 3** - 120VAC High Temp Limit Input **Pin 4** - 120VAC Output to FSC (6)	**Pin 5** - 120VAC Output to FSC (7) **Pin 6** - N/A **Pin 7** - Purge/Dry Contacts Output **Pin 8** - 120VAC Neutral

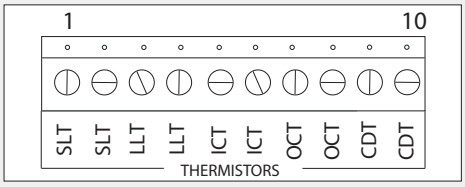
Connector J30 contains 120V AC connections	
Pin 1 - 120VAC Input from Pilot Gas FSC (3) **Pin 2** - 120VAC Pilot Gas Output **Pin 3** - 120VAC Input from Spark FSC (4) **Pin 4** - 120VAC Spark Output	**Pin 5** - 120VAC Input from Main Gas FSC (5) **Pin 6** - 120VAC Main Gas Output **Pin 7** - 120VAC Alarm Input from FSC (A) **Pin 8** - 120VAC Alarm Output

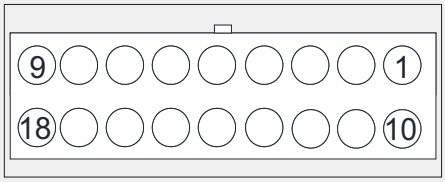
Connector J31 - Contains inputs and outputs for components	
Pin 1 - 24VDC + Output to Profile / Main Airflow Pressure Sensor **Pin 2** - 0-10VDC Analog Input from Profile / Main Airflow Pressure Sensor **Pin 3** - 24VDC/0-10VDC Common from Profile / Main Airflow Pressure Sensor **Pin 4** - N/A **Pin 5** - N/A **Pin 6** - N/A **Pin 7** - 24VDC + Output to Manifold Gas Pressure 1 Sensor **Pin 8** - 0-10VDC Analog Input from Manifold Gas Pressure 1 Sensor **Pin 9** - 24VDC/0-10VDC Common from Manifold Gas Pressure 1 Sensor	**Pin 10** - 24VDC + Output to Manifold Gas Pressure 2 Sensor **Pin 11** - 0-10VDC Analog Input from Manifold Gas Pressure 2 Sensor **Pin 12** - 24VDC/0-10VDC Common from Manifold Gas Pressure 2 Sensor **Pin 13** - 24VDC + output to Clogged Filter Pressure Sensor **Pin 14** - 0-10VDC Analog Input from Clogged Filter Pressure Sensor **Pin 15** - 24VDC/0-10VDC Common from Clogged Filter Pressure Sensor **Pin 16** - 24VDC + Output for Analog or Static Pressure Control for Blower/Damper **Pin 17** - 0-10VDC Analog Input for Analog or Static Pressure Control for Blower/Damper **Pin 18** - 24VDC/0-10VDC Common for Analog or Static Pressure Control for Blower/Damper

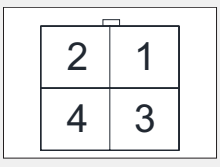
Connector J32 contains inputs and outputs for components	
Pin 1 - N/A **Pin 2** - N/A **Pin 3** - 24VAC Output for Proof Of Closure **Pin 4** - N/A **Pin 5** - 24VAC Output To CO Alarm **Pin 6** - 0-24VDC + Analog Input from Flame Sensor **Pin 7** - 24VDC Powered PWM to Modulating Gas Valve, Full Wave, 16 kHz **Pin 8** - 0-10VDC Out for VFD **Pin 9** - 0-10VDC Out for EF	**Pin 10** - N/A **Pin 11** - N/A **Pin 12** - 24VAC Input from Proof of Closure **Pin 13** - N/A **Pin 14** - 24VAC From CO Alarm **Pin 15** - 24VDC Common From Flame Sensor **Pin 16** - 24VDC Powered PWM to Modulating Gas Valve, Full Wave, 16 kHz **Pin 17** - 0-10VDC Common for VFD **Pin 18** - 0-10VDC Common for EF

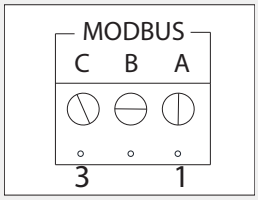
Connector J33 contains inputs and outputs for components	
Pin 1 through **Pin 9** - N/A	**Pin 10** through **Pin 18** - N/A

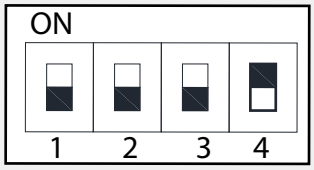
Connector J34 N/A	

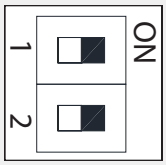
Connector J35 contains sensor inputs for components	
Pin 1 through **Pin 6** - N/A **Pin 7** - 2nd Discharge Sensor	**Pin 8** - 2nd Discharge Sensor **Pin 9** and **10** - N/A

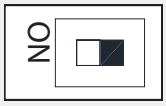
Connector J36 contains sensor inputs for components	
Pin 1 through **Pin 6** - N/A **Pin 7** - 24VAC output to SB (for paintbooth)	**Pin 8** - N/A **Pin 9** - 24VAC input to SC (for paintbooth) **Pin 10** through **Pin 18** - N/A

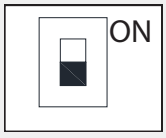
Connector J37 N/A	

Connector J38 Modbus	
Pin 1 (A) - Modbus (-) **Pin 2 (B)** - Modbus (+)	**Pin 3 (C)** - Modbus Ground

Dip Switch S1	
Switch 1, 2, 3 always OFF. Switch 4 Always ON. If Switch 4 is OFF, BAS terminals disabled.	

Dip Switch S2	
Programming - Service Only	

Dip Switch S3	
End of line termination	

Dip Switch S4	
Programming - Service Only	

Variable Frequency Drive (VFD)

WARNING!
- Before installing the VFD drive, ensure the input power supply to the drive is OFF.
- The power supply and motor wiring of the VFD must be completed by a qualified electrician.
- The VFD is factory programmed, only change if replaced or ordered separately.

Not suitable for corner grounded 3 phase input power. Consult the VFD manual and all documentation shipped with the unit for proper installation and wiring of the VFD. The VFD has been programmed by the factory with ordered specific parameters. Use **Table 5** as a guide during installation.

Table 5 - VFD Installation Check List

Check Off	Description
	The installation environment conforms to the VFD manual.
	The drive is mounted securely.
	Space around the drive meets the drive's specification for cooling.
	The motor and driven equipment are ready to start.
	The drive is properly grounded.
	The input power voltage matches the drive's nominal input voltage.
	The input power connections at L1, L2, and L3 are connected and tight. Verify correct size crimp fitting is used.
	The input power protection is installed.
	The motor's power connection at U, V, and W are connected and tight. Verify correct size crimp fitting is used.
	The input, motor, and control wiring are run in separate conduit runs.
	The control wiring is connected and tight.
	NO tools or foreign objects (such as drill shavings) are in the drive.
	NO alternative power source for the motor (such as a bypass connection) is connected - NO voltage is applied to the output of the drive.

VFD Installation

Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage. Refer to **“ACTECH SMV VFD” on page 33**. See installation schematic for exact breaker sizing.
- Every VFD should receive power from its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
- Input AC line wires should be routed in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed. **Do not combine input and output power cables in the same conduit.**
- The VFD should be grounded on the terminal marked PE. A separate insulated ground wire must be provided to each VFD from the electrical panel. This will reduce the noise being radiated in other equipment.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

ATTENTION: Do not connect incoming AC power to output terminals U, V, W. Severe damage to the drive will result. Input power must always be wired to the input L terminal connections (L1, L2, L3).

VFD Output Power

- Motor wires from each VFD to its respective motor MUST be routed in a **separate steel** conduit away from control wiring and incoming AC power wiring. This is to avoid noise and crosstalk between drives. An insulated ground must be run from each VFD to its respective motor. Do not run different fan output power cables in the same conduit.
- VFD mounted in ECP: A load reactor should be used and sized accordingly when the distance between the VFD and motor is greater than specified below. The load reactor should be installed within 10 feet of the VFD output:

  208/230V - Load reactor should be used when distance exceeds 250 feet.
  460/480V - Load reactor should be used when distance exceeds 50 feet.
  575/600V - Load reactor should be used when distance exceeds 25 feet.
- VFD mounted in fan: The load reactor should be sized accordingly when the VFD is mounted in the fan.

  208/230V - Load reactor is optional but recommended for 15 HP and above motors.
  460/480V - Load reactor is optional but recommended for 7.5 HP and above motors.
  575/600V - Load reactors are required for all HP motors.
- If the distance between the VFD and the motor is extremely long, up to 1000 FT, a dV/dT filter should be used, and the VFD should be increased by 1 HP or to the next size VFD. The dV/dT filter should be sized accordingly and installed within 10 feet of the output of the VFD.

  208/230V – dV/dT filter should be used when distance exceeds 400 feet.
  460/480V – dV/dT filter should be used when distance exceeds 250 feet.
  575/600V – dV/dT filter should be used when distance exceeds 150 feet.
- Do not install a contactor between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
- When a disconnect switch is installed between the drive and motor, the disconnect should only be operated when the drive is in a STOP state.

VFD Programming

Programming

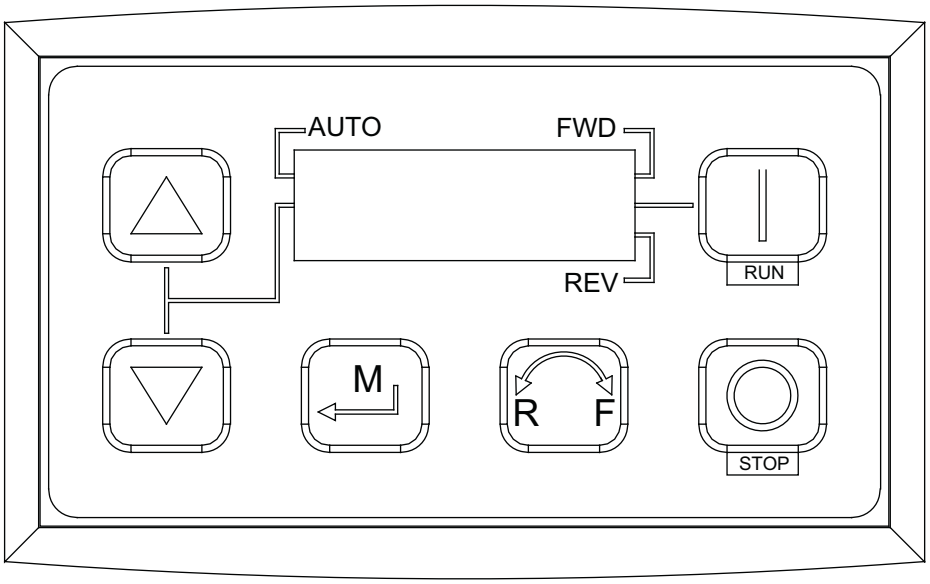
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (refer to **“ACTECH SMV VFD” on page 33**).

To enter the PROGRAM mode to access the parameters:

1. Use the buttons on the VFD screen (**Figure 18**) to adjust VFD settings. Press the Mode (M) button. This will activate the password prompt (PASS).
2. Use the Up and Down buttons to scroll to the password value (the factory default password is “0225”) and press the Mode (M) button. Once the correct password is entered, the display will read “P100”, which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu.
3. Use the Up and Down buttons to scroll to the desired parameter number.
4. Once the desired parameter is found, press the Mode (M) button to display the present parameter setting. The parameter value will begin blinking, indicating that the present parameter setting is being displayed. The value of the parameter can be changed by using the Up and Down buttons.
5. Pressing the Mode (M) button will store the new setting and exit the PROGRAM mode. To change another parameter, press the Mode (M) button again to re-enter the PROGRAM mode. If the Mode button is pressed within 1 minute of exiting the PROGRAM mode, the password is not required to access the parameters. After one minute, the password must be re-entered to access the parameters again.

P500 parameter provides a history of the last 8 faults on the drive. It can be accessed without entering PROGRAM mode.

Figure 18 - VFD Screen



NOTE: When a parameter is changed in the drive, the drive should be de-energized. Wait for the display to go completely dark. Once the display is completely dark, the drive can be re-energized.

ACTECH SMV VFD

Table 6 - Cross-Reference

HP	Part Number	Volts	1Ø Input	3Ø Input	Input Amps 1Ø 120V AC	Input Amps 1Ø 240V AC	Output Amps	Breaker 1Ø 120V AC	Breaker 1Ø 240V AC
0.5	ESV371N01SXB571	120/240V	X	-	9.2	4.6	2.4	15	15
1	ESV751N01SXB571	120/240V	X	-	16.6	8.3	4.2	25	15
1.5	ESV112N01SXB571	120/240V	X	-	20	10	6	30	20

HP	Part Number	Volts	1Ø Input	3Ø Input	Input Amps 1Ø	Input Amps 3Ø	Output Amps	Breaker 1Ø	Breaker 3Ø
0.5	ESV371N02YXB571	240V	X	X	5.1	2.9	2.4	15	15
1	ESV751N02YXB571	240V	X	X	8.8	5	4.2	15	15
1.5	ESV112N02YXB571	240V	X	X	12	6.9	6	20	15
2	ESV152N02YXB571	240V	X	X	13.3	8.1	7	25	15
3	ESV222N02YXB571	240V	X	X	17.1	10.8	9.6	30	20
5	ESV402N02TXB571	240V	-	X	-	18.6	16.5	-	30
7.5	ESV552N02TXB571	240V	-	X	-	26	23	-	40
10	ESV752N02TXB571	240V	-	X	-	33	29	-	50
15	ESV113N02TXB571	240V	-	X	-	48	42	-	80
20	ESV153N02TXB571	240V	-	X	-	59	54	-	90
1	ESV751N04TXB571	480V	-	X	-	2.5	2.1	-	15
1.5	ESV112N04TXB571	480V	-	X	-	3.6	3	-	15
2	ESV152N04TXB571	480V	-	X	-	4.1	3.5	-	15
3	ESV222N04TXB571	480V	-	X	-	5.4	4.8	-	15
5	ESV402N04TXB571	480V	-	X	-	9.3	8.2	-	15
7.5	ESV552N04TXB571	480V	-	X	-	12.4	11	-	20
10	ESV752N04TXB571	480V	-	X	-	15.8	14	-	25
15	ESV113N04TXB571	480V	-	X	-	24	21	-	40
20	ESV153N04TXB571	480V	-	X	-	31	27	-	50
25	ESV183N04TXB571	480V	-	X	-	38	34	-	70
30	ESV223N04TXB571	480V	-	X	-	45	40	-	80
40	ESV303N04TXB571	480V	-	X	-	59	52	-	100
50	ESV373N04TXB571	480V	-	X	-	74	65	-	125
60	ESV453N04TXB571	480V	-	X	-	87	77	-	150
1	ESV751N06TXB571	600V	-	X	-	2	1.7	-	15
2	ESV152N06TXB571	600V	-	X	-	3.2	2.7	-	15
3	ESV222N06TXB571	600V	-	X	-	4.4	3.9	-	15
5	ESV402N06TXB571	600V	-	X	-	6.8	6.1	-	15
7.5	ESV552N06TXB571	600V	-	X	-	10.2	9	-	20
10	ESV752N06TXB571	600V	-	X	-	12.4	11	-	20
15	ESV113N06TXB571	600V	-	X	-	19.7	17	-	30
20	ESV153N06TXB571	600V	-	X	-	25	22	-	40
25	ESV183N06TXB571	600V	-	X	-	31	27	-	50
30	ESV223N06TXB571	600V	-	X	-	36	32	-	60
40	ESV303N06TXB571	600V	-	X	-	47	41	-	70
50	ESV373N06TXB571	600V	-	X	-	59	52	-	90
60	ESV453N06TXB571	600V	-	X	-	71	62	-	110

Temperature Control

Discharge Control: When used in discharge control, the MUA Board receives a call to heat from the intake sensor. The MUA Board will modulate the discharge temperature until the desired set point is reached. The user can choose whether discharge heating/cooling is activated based on intake temperature, space temperature, either, or both.

Space Control: When selected, an HMI with an internal temperature sensor or a temperature sensor wired to ST terminals on the MUA Board can be used to sense space temperature. The user can choose whether the space heating/cooling is activated based on intake temperature, space temperature, either, or both.

Analog Control: If Analog Control is utilized, DIP switch #4 on the MUA Board should be set On. Blower/Heating/Cooling will be controlled by a 0-10V DC or 0-20mA signal based on input source.

Scan for DDC Application Guide

Direct Digital Control (DDC): A 0-10V DC or 0-20mA signal is sent to the MUA Board from the building control system to regulate the blower/heating output of the unit. For DDC information, refer to **DDC Application Guide**.

In all cases, the MUA Board controls the amount of gas to the burner based on the signal from the temperature control components.

Maxitrol Modulating Valve

The operation of the modulating gas valve with regard to voltage is as follows: from 0 volts to approximately 5 volts, the modulating gas valve should be on bypass flow with the heater operating on low or minimum fire. From approximately 5 volts to 15 volts DC, the valve should be performing its modulating function, and the heater should be firing at a modulated flow rate between low and high fire, depending upon the voltage. Above approximately 15 volts DC, the valve should be delivering full flow to the heater and the unit should be on high fire.

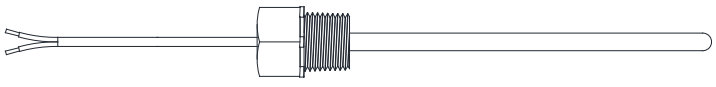
RTC Modulating Valve

The operation of the modulating gas valve with regard to voltage is as follows: From 2 volts to 10 volts DC, the valve should be performing its modulating function, and the heater should be firing at a modulated flow rate between low fire and high fire, depending upon the voltage. The low fire and high fire voltage limits are set in the factory settings.

Thermistor

The temperature sensor (**Figure 19**) is a 10K ohm thermistor. The sensor gives constant feedback to the control board.

Figure 19 - Temperature Sensor



Thermistor Connected to HMI

Thermistors connected to connector J5 on the HMI may be averaged or used as a standalone for space temperature readings.

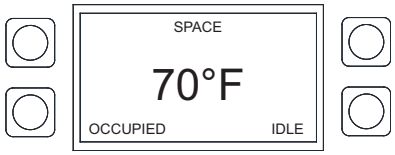
OPERATION

Accessing Menu Configurations

General Overview

The HMI (Human Machine Interface) allows the user to change parameters and options. The user may use the unit HMI only to view operating information regarding sensors, temperatures, and pressures on the HMI screen (**Figure 20**).

Figure 20 - HMI Screen

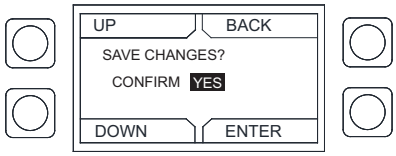


There are four buttons to navigate through the HMI screens.

NOTE: Buttons change functions during certain options and tests. Verify the screen and buttons throughout the menu display.

When the HMI Home Screen is active, the Temp +/- buttons may be used to adjust basic temperature settings. Adjustments made are not permanent, and are based on Occupancy Configuration and Override Duration parameters in Factory Settings which are only accessible from the unit HMI.

Figure 21 - Save Screen



The user can access the Top Menu HMI configurations by pressing the top two buttons simultaneously. To exit this screen, simply press the ‘BACK’ button. When setting certain options or functions, pressing the ‘BACK’ button multiple times will bring up the save screen (**Figure 21**). The user may select ‘YES’ to save the changes, select ‘NO’ to return to factory settings, or select ‘CANCEL.’ When selecting ‘CANCEL,’ any changes made will not be saved, and the screen will return to the top menu.

Unit HMI Control Panel

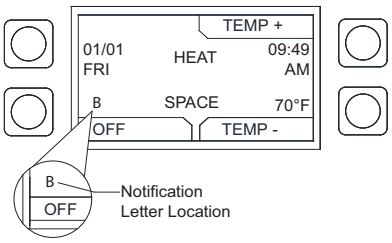
The unit HMI menu system allows full access to every configurable parameter in the HMI. The parameters are factory configured to the specific application. Parameters may need to be modified to fine-tune automatic operation after the original setup. Parameters are locked out by a password and may only be accessed through contacting a service representative.

For information on the Space HMI, refer to **“Space HMI Control Panel” on page 38**.

HMI Notification Letters

The HMI will display notification letters (**Figure 22**) when the unit is in a specific status.

Figure 22 - Notification Letters

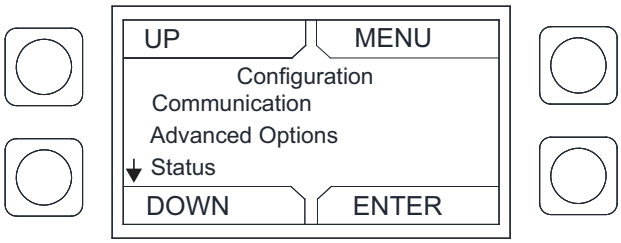


- B = Blower Start or Blower Stop Delay Active
- C = Condenser Min On or Min Off Timer Active. Displayed when any of the condensers are in a Min On/Off Time.
- D = Min or Max Discharge Temp Reached.
- M = Max Temp Rise Reached.
- R = OA Reset.
- Δ = Dynamic SP Applied.

HMI Configuration Menu

To enter the configuration menu (**Figure 23**), press the bottom two buttons simultaneously on the HMI faceplate. In this menu screen, you may adjust Communication and Advanced Options, check Status, and About information.

Figure 23 - Configuration Menu



Communication

Under the communication menu, the user may adjust the following settings:

- **Modbus Address** - Default is 55 for the first HMI. For every additional HMI, increase the address by one. For example, if a second HMI is used, the Modbus Address should be 56. For a third HMI, the Modbus Address should be 57.
- **Baud** - Do not adjust this setting. The baud rate address is 115200.
- **Parity** - Do not adjust this setting. The default setting should always be set to 'EVEN.'

Advanced Options

Under advanced options, the user may adjust the following settings:

- **Contrast** - The user may adjust the setting from 0 to 10. Setting the contrast to 0 is the lowest setting available, and 10 is the highest contrast setting available. The factory default contrast setting is 5.
- **Audio Enable** - User may set the audio to off.
- **Dimming Enable** - Default is set to Off. If set to On, the 'HMI Dimming Timer' option will be available.
- **Set Time** - The user may adjust dimming setting from 10-60 seconds. The default time is 30 seconds.
- **RH Chip** - Relative Humidity sensor manufacturer. This setting is auto-detected. **DO NOT CHANGE SETTING**.
- **Temp Offse**t - Applies a temperature offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 20°F. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.
- **RH Offset** - Applies a relative humidity offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 30%. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.
- **PS Offset** - Applies a pressure offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 200 mb. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.

Status

User may monitor board temperature status, Uptime (how long the board has been active since last restart), HW RH (HMI hardware humidity sensor), HW Temp (HMI hardware temperature sensor).

About

User may view SCADA HMI Software Version, Modbus Address (assigned to HMI), Baud (115200).

Scheduling on Unit HMI

To set a schedule on the HMI (**Figure 24**), you must first enable scheduling on the unit HMI: **Factory Settings > Occupancy Config > Scheduling > On**

Set your sensor temperature set points for occupied and unoccupied schedules: **User Settings > Temp Set Points > (Varies)**

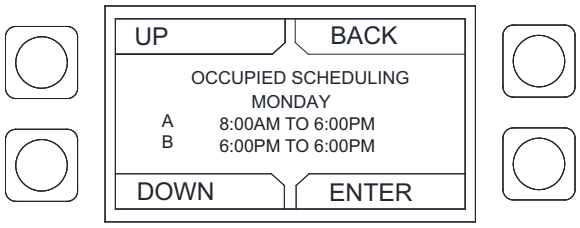
Once scheduling is enabled and the temperature set points are configured, you may enter your scheduled days and times: **User Settings > Scheduling**

Schedule A Default
- Monday - Friday 8:00AM to 6:00PM
- Saturday and Sunday Unocc

Schedule B Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Schedule C Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Figure 24 - Scheduling Screen



To adjust the settings, highlight the parameter and press **ENTER**.
- The first parameter to be highlighted will be the day. Press **UP** or **DOWN** to select the day an occupied time schedule is required.
- Press **ENTER** to continue to set a start time. Press **UP** or **DOWN** to set start time.
- Press **ENTER** to set an end time. Press **UP** or **DOWN** to set end time.

The system will run between these days, time, and desired temperature settings. When in the UNOCCUPIED setting, the system will run at the unoccupied temperature settings.

Scheduling on Space HMI

When scheduling is enabled in Factory Settings, the space HMI will have scheduling available.

Set your Space/Discharge temperature set points for occupied and unoccupied schedules: **Space/Dischage Set Points > (Varies)**

Once scheduling is enabled and the temperature set points are configured, you may enter your scheduled days and times: **Scheduling**

Schedule A Default
- Monday - Friday 8:00AM to 6:00PM
- Saturday and Sunday Unocc

Schedule B Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Schedule C Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Space HMI Control Panel

The space HMI(s) will be located in an area where the user may make comfort adjustments to the space. On units shipped with a space HMI, a Cat 5 cable will need to be run from J4, J5, or J6 (refer to schematics) on the main MUA Board to J2 on the HMI. If additional space HMIs have been added, they can be daisy-chained from the first HMI. In the event there is a slave MUA Board, HMIs can also be powered from J1 or J2 of the slave board. An end of line resistor should be added to the last HMI in the chain.

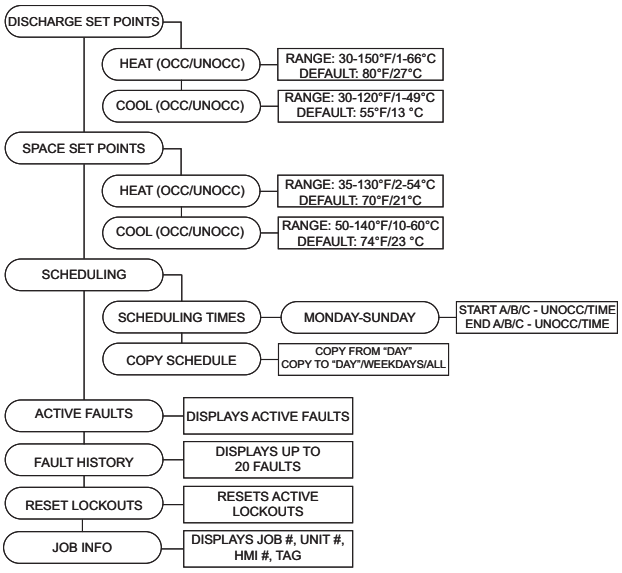
NOTE: Some space HMIs may be CAS Wall Sensors, which function and look like HMIs but without a screen or buttons. To assign MODBUS Address, refer to Figure 25. The switches are on the back of the sensor.

Figure 25 - CAS Wall Sensor DIP Switches

Space HMI Menu Tree

The user can access the Space Top Menu HMI configurations by pressing the top two buttons simultaneously.

- **Discharge Set Points** - User adjustable SP for heating and cooling discharge tempering targets.
  - **Heat** - The unit will target this discharge temperature in heating mode. Tempering mode must be set to discharge or stat. Heating Type configuration must be set.
  - **Cool** - The unit will target this discharge temperature in cooling mode. Tempering mode must be set to discharge or stat. Cooling Type configuration must be set.
- **Space Set Points** - User adjustable SP for heat and cool space activation and tempering.
  - **Heat** - Heating will activate if the space temperature is below this value. The unit will target this space temperature after heating is active. “Activate Based On” must be set to Space, Both, or Either. Heating Type must be set to a heating configuration.
  - **Cool** - Cooling will activate if the space temperature is above this value. The unit will target this space temperature after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.
- **Scheduling** - Only active when the scheduling is set to On.
  - **Schedule Times** - Each day contains the option for three occupied time periods. If the time is set past 11:59 pm, it will display ‘UNOCC’.
  - **Copy Schedule** - This will allow the user to copy an existing schedule from one day of the week to individual days in the week, to Week Days, or All.
- **Active Faults** - Contains the current faults on the board.
- **Fault History** - Displays time-stamped history of the last 20 faults, most recent fault showing first.
- **Reset Lockouts** - Displayed when a lockout fault has occurred. Enter menu to reset fault(s).
- **Job Info** - Non-editable parameters. Displays Job #, Unit #, HMI #, Tag (HMI Name e.g, Office/Hallway/Break Room) entered at the factory.



Unit Options

Communication Module (Optional)

The Communication Module, PN: **SCADA**, is included in all CASlink equipped panels. It obtains operational data from various connected components. This communication wiring is either RS-485 shielded twisted pair wiring or RJ45 Cat 5 Ethernet wiring.

Building Signal Damper Control

When this option is ordered, the outdoor air (supply) and return dampers will modulate based on a 0-10V DC signal from the Building automation system. 0V = max outside air, 10V = max return air. Direct fired units cannot go below 20% outside air, maximum output voltage may differ.

Electric Cabinet Heater

Units can be shipped with an optional 120V electric cabinet heater powered from the MUA Board. There is a temperature sensor built onto the MUA Board that will regulate when the cabinet heater activates. To enable this option go to **Factory Settings > Unit Options > Cabinet Heater > Enable**. Temperature readings and adjustments can be made through the HMI. Go to **User Settings > Temp Set Points > Option Set Points > Cab Heat Set Points**.

Motorized Intake Damper

On units shipped with the optional motorized intake damper, a power transformer is supplied with the unit if the main incoming voltage is greater than 120V. No external wiring to the damper motor is required.

Recirculating Control Unit Options

Manual Control - The dampers can be controlled from the HMI in the unit or from a space HMI if one is provided to any position from 20% to 100% fresh air. This is a 0-10V setting, which is available under user settings, 100% Outdoor Air (0 volts), 80% Return Air (equivalent voltage). This will allow to manually set the dampers to match the building ventilation requirements. On a power failure, the return air damper will close by spring return.

Two Position Control - The dampers can be controlled by a two-position switch (a field-supplied switching device) to open the fresh air to 100%. The MUA Board sends out a constant voltage. The field supplied switch will cut or allow the signal from the MUA Board to the recirculating damper. On opening of the circuit, power failure, or if the unit is shut off, the return air damper will close by spring return. If the circuit is closed, the MUA Board will allow the return air damper to open per the set point.

Outdoor Air % - The dampers can be controlled from the HMI in the unit or from a space HMI if one is provided to any position from 20% to 100% fresh air. There is an outdoor air percentage setting that is available under user settings. This will allow the user to manually set the dampers to match the building ventilation requirements.

- When preset OA is On, the unit will use preset values for recirculating OA% by directly associating OA voltage to OA percentages. A calibration can be run from the service menu to store and use real-world results rather than provided defaults.
- When preset OA is Off, the MUA Board utilizes an internal algorithm to alter its 0-10V output to the recirculating damper in order to maintain an exact outdoor air percentage. When this recirculating option is selected, a recirculating dead-band comes into play. This setting checks the delta T between outdoor and return air. If the difference between these two temperatures is less than or equal to the recirculating dead-band setting, the MUA Board will not alter its output to the recirculating damper (default setting is 5 degrees). On a power failure, or if the unit is turned off, the return air damper will close by spring return.

Analog Control - When this is set to ON, a 0-10V input will drive the damper output to modulate linearly between the min and max OA voltage for both occupied and unoccupied modes.

Static Pressure Control - Damper position will modulate to maintain building pressure. Building pressure below the set point will increase the amount of outdoor air supplied to increase pressure. Building pressure above the set point will decrease the amount of outdoor air supplied to decrease pressure.

CO2 Control - When the unit senses the CO2 input to be above the threshold setting, the unit will decrease recirculating output until the CO2 falls below threshold setting.

Menu Descriptions

User Settings: Allows the user to change or set certain temperatures and configurations on the unit.

Factory Settings: Requires a password (1111) to enter this menu. These will be set job-specific from the plant. Any changes to the factory settings will require the user to save the updated changes.

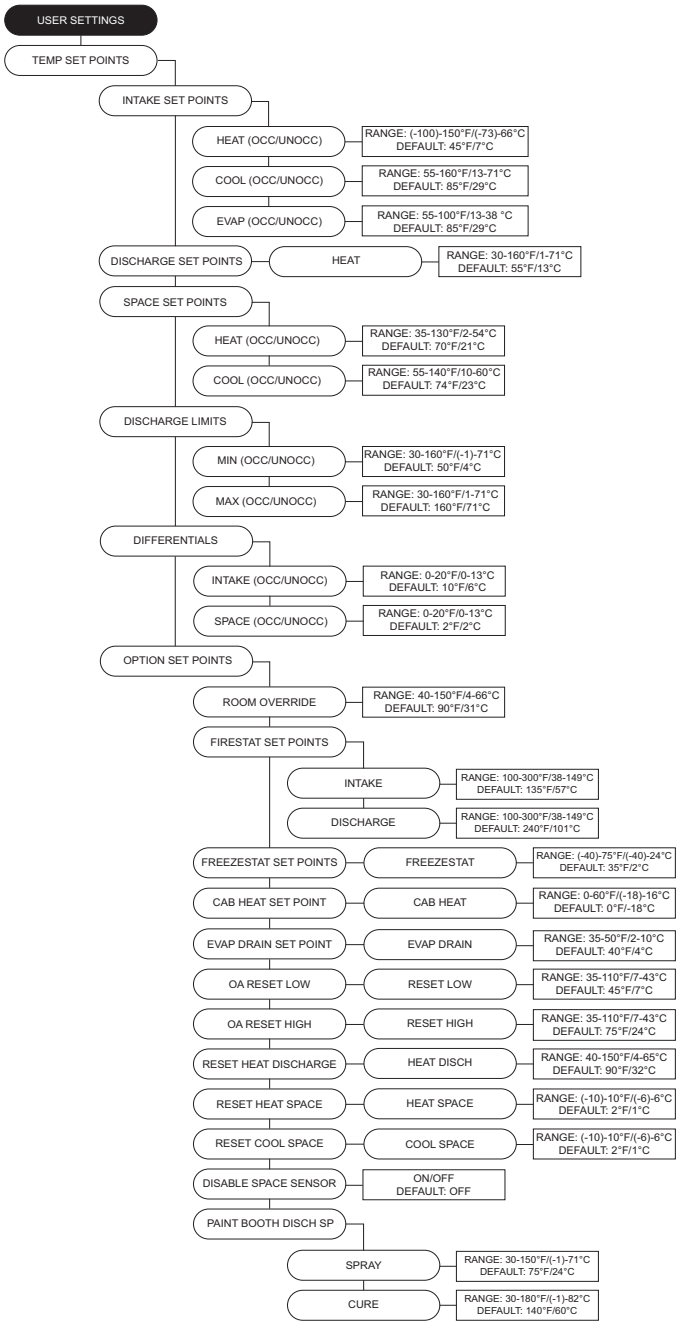
Service: Requires a password (1234) to enter this menu. Allows a certified technician to monitor the unit and test components in the system.

About: Unit type and software revision information.

User Settings

Temp Set Points - Some or all of these set points may not be available based on settings. If scheduling is enabled, there will be occupied and unoccupied values for each set point. The user will be allowed to check or adjust the set points/limits.

- **Intake Set Points** - User adjustable set points for intake activation.
  - **Heat** - Activate Based On must be set to Intake, Both, Either, or Stat. Heating stage must = 1.
  - **Cool** - Activate Based On must be set to Intake, Both, Either, or Stat. Cooling type set to DX or Both.
  - **Evap** - Activate Based On must be set to Intake, Both, Either, or Stat. Cooling type set to Evap or Both.
- **Discharge Set Points** - User adjustable set points for heat discharge activation.
  - **Heat** - Tempering mode must be set to discharge. Heating stage must = 1.
- **Space Set Points** - User adjustable set points for heat, and cool space activation.
  - **Heat** - Activate Based On must be set to Space, Both, or Either. Heating stage must = 1
  - **Cool** - Activate Based On must be set to Space, Both, Either, or Stat. Cooling type set to DX, Evap or Both.
- **Discharge Limits** - User adjustable set points for discharge limits.
  - **Min** - Cannot be greater than maximum discharge heat set point.
  - **Max** - Cannot be less than minimum discharge heat set point.
- **Differentials** - User adjustable intake and space differential set points.
  - **Intake** - Activate Based On must be set to Intake. Cool tempering mode set to Intake.
  - **Space** - Activate Based On must be set to Space. Cool tempering mode set to Space.
- **Option Set Points** - Adjustable set points for options that are enabled to “ON” in Factory Settings.
  - Room Override, Firestat Set Points, Freezestat Set Points, Cab Heat Set Point, Evap Drain Set Point, OA Reset Low, OA Reset High, Reset Heat Discharge, Reset Heat Space, Reset Cool Space, Disable Space Sensor, Paint Booth Disch SP.



Dry Mode Config - View/adjust set points/limits when the option is enabled.

Scheduling - Active when scheduling is set to On.

- **Scheduling Times** - Each day contains the option for three occupied time periods. Settings cannot overlap.
- **Schedule Copy** - User may copy an existing schedule.

Fan Speed - Enabled when the supply fan is controlled by a VFD or ECM. The range is limited by the min/max set points under Factory Settings. When the fan is set to VFD, the settings will be displayed in Hertz. When the fan is set to ECM, the PWM percentage will be displayed.

Clogged Filter SP - Displayed when “Filter Mon” is set to sensor in **Factory Settings > Unit Options > Monitoring Sensors**. This adjustable SP will display a fault on the HMI when the reading is below SP for five minutes.

Recirc Setting - Recirc will allow outdoor air in vs. return air. 0V out is equal to 100% OA and 0% RA.

Pressure Config - Settings based on **Factory Settings > Unit Options > Pressure Config**.

- **Blower PS SP** - Adjustable blower pressure set points.
- **OA PS SP** - Adjustable OA pressure set points.

Single Zone VAV - Depending on Single Zone VAV Factory Settings, the unit will modulate linearly between min and max discharge. Blower values based on Blower Control settings. Damper values based on Recirc Config settings.

- **Blower Speed Heat** - Blower to modulate with the discharge temp min discharge, min blower speed. Max discharge, max blower speed. Scaled linearly between min/max discharge to min/max blower speed.
- **Damper Pos Heat** - Damper to modulate with the discharge temp min discharge, min damper position. Max discharge, max damper position. Scaled linearly between min/max discharge to min/max damper position.
- **Blower Speed Cool** - Blower speed will change depending on how many cooling stages are active. Evap counts as 1st stage of cooling.
- **Damper Pos Cool** - Damper position will change depending on how many cooling stages are active. Evap counts as 1st stage of cooling.

Active Faults - Contains the current faults on the board.

Fault History - Displays time-stamped history of the last 20 faults. The most recent fault will show first.

Reset Lockouts - Reset lockout faults.

Dynamic SP Diff - Temperature differential for dynamic SP.

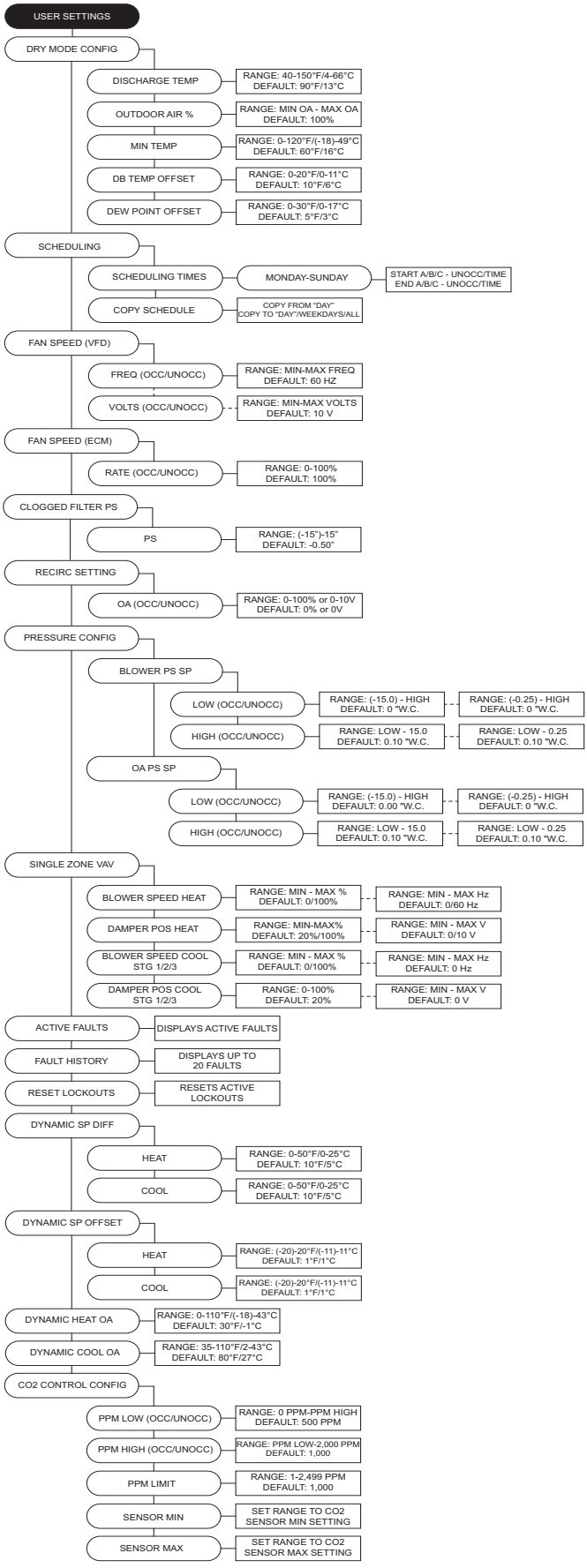
Dynamic SP Offset - Setting will adjust dynamically based on outdoor air conditions. For more information, refer to “Dynamic Set Point” on **page 53** in Factory Settings.

Dynamic Heat OA - Outdoor air dynamic heat set point.

Dynamic Cool OA - Outdoor air dynamic cool set point.

CO2 Control Config - CO2 Parts Per Million (PPM) set points and sensor settings.

- **PPM Low/High** - CO2 PPM threshold set points for the space, used in CO2 Override.
- **PPM Limit** - CO2 PPM threshold limit set point.
- **Sensor Min/Max** - Set minimum and maximum range setting for CO2 sensor.



Factory Settings Menu Password = 1111

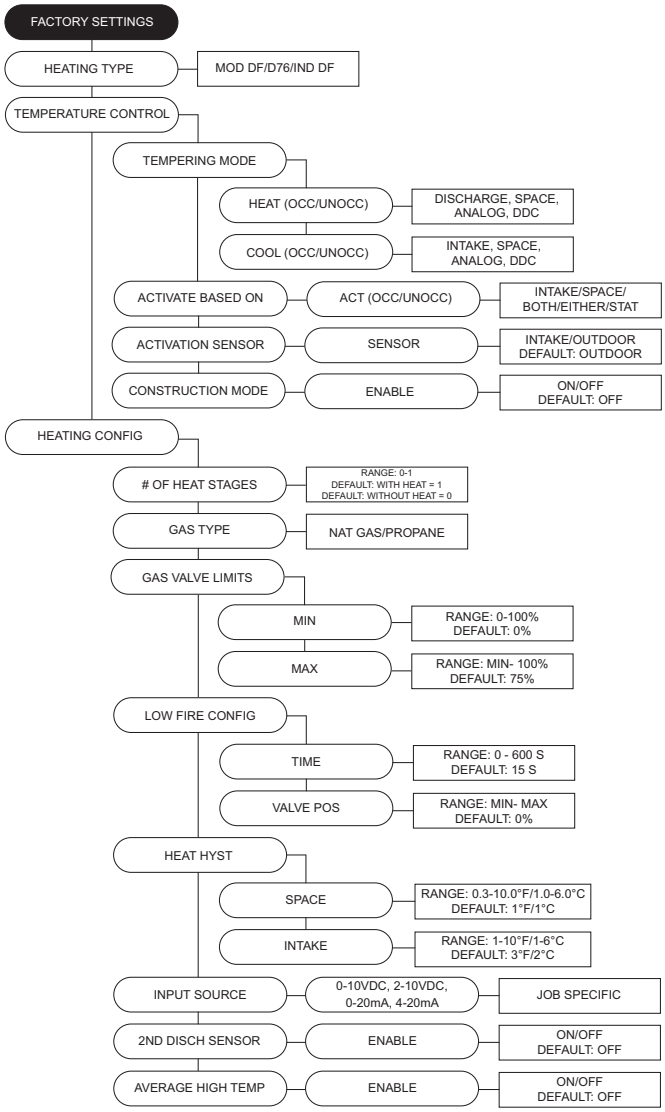
Heating Type - User may select heating unit type.

Temperature Control - The MUA board monitors temperature control set points (SP) and components.

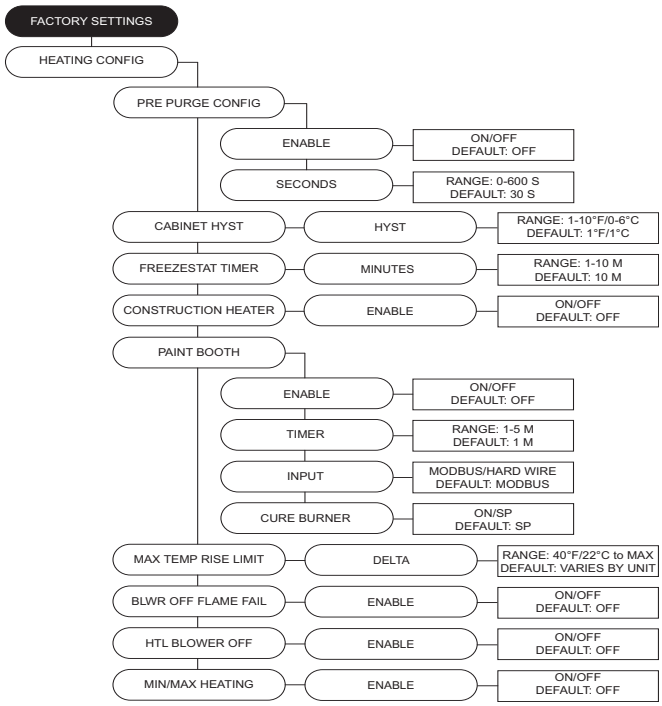
- **Tempering Mode** - The options for controlling the output of the tempering mode in heat/cool (if equipped). Available options are Intake/Discharge/Space/Analog Control/ Direct Digital Control (DDC).
- **Activate Based On** - Select how the unit will activate based on temperature readings: Intake/Space/Both/ Either/Stat (field installed thermostat). These settings can be altered for occupied and unoccupied preferences.
  - When Activate Based On is set to Stat, thermostat inputs and intake temperatures are monitored to activate heating/cooling.
- **Activation Sensor** - Allows selection of intake or outdoor sensor for unit to activate.
- **Construction Mode** - Configurable option for units used in construction settings. When construction mode is enabled on, the following factory settings will be overridden: HMI, Discharge Control, 100% Outside Air, Activate Based on Intake, Blower Mode set to Manual.

Heating Config - Various heating configurations.

- **# of Heat Stages** - Default is set to 0 for units without gas heat. If the unit is equipped with gas heat, select 1.
- **Gas Type** - Gas type selection: natural gas or propane.
- **Gas Valve Limits** - Adjustment for unit's gas valve range. Adjustable Min or Max percentage range.
- **Low Fire Config** - Sets low fire time and valve position settings.
  - **Time** - The amount of time the low fire setting is applied before modulation will occur.
  - **Valve Pos** - Gas valve position before modulation.
- **Heat Hyst** - Intake/Space tempering sensor must go this amount of degrees above the SP before heating turns off.
- **Input Source** - Informs board what signal (volts/milliamps) to expect from the analog control system. **Only valid for analog tempering mode.**
- **2nd Disch Sensor** - When an additional thermistor is added, the two thermistor readings will be averaged.
- **Average High Temp** - When the "2nd Disch Sensor" is On, this menu will be available. When "Average High Temp" is Off, if either discharge sensor goes above high temp limit, the unit will go into high temp lockout. When "Average High Temp" is On, both thermistors readings will be used to determine high temp lockout.



- **Pre Purge Config** - When On, this option will purge any gas that may not have combusted in the unit before the unit lighting off. You may set the amount of time the purge cycle will operate.
- **Cabinet Hyst** - The cabinet temp must reach this many degrees above the activation SP to turn off.
- **Freezestat Timer** - If the discharge temperature is below the freezestat SP for half the duration of the freezestat timer, the heat will shut off momentarily. If the freezestat trips for a second time, the heat will shutdown immediately. Reset the lockout manually on the HMI.
- **Construction Heater** - When On, overrides any other airflow proving values and high-temperature settings.
- **Paint Booth** - When On, current high limit SPs canceled.
  - **Timer** - A delayed time setting when the unit switches from Cure Mode to Spray Mode.
  - **Input** - When hard wired, 0V on connector J36-pin 9 = Cure mode. 24V AC on connector J36-pin 9 = Spray mode. When in Modbus, 0 = Cure mode, 1 = Spray mode.
  - **Cure Burner** - When set to “ON,” the burner will always operate targeting the Paint Booth Disch SP - Cure set point (located under User Settings). When set to “SP,” the burner will operate targeting “Activation Based On” discharge set points.
- **Max Temp Rise Limit** - Compares max rise limit to calculated max temp rise. Software will always utilize the lower of the two values.
- **Blwr Off Flame Fail** - When On, the blower will shut down if a flame lockout occurs. The blower may go back into operation after the fault is cleared.
- **HTL Blower Off** - The blower will shut off when the high temperature limit trips.
- **Min/Max Heating** - When enabled On, low fire percentage is adjustable for testing under **Service > Test Menu > Test Heating > Low Fire**.

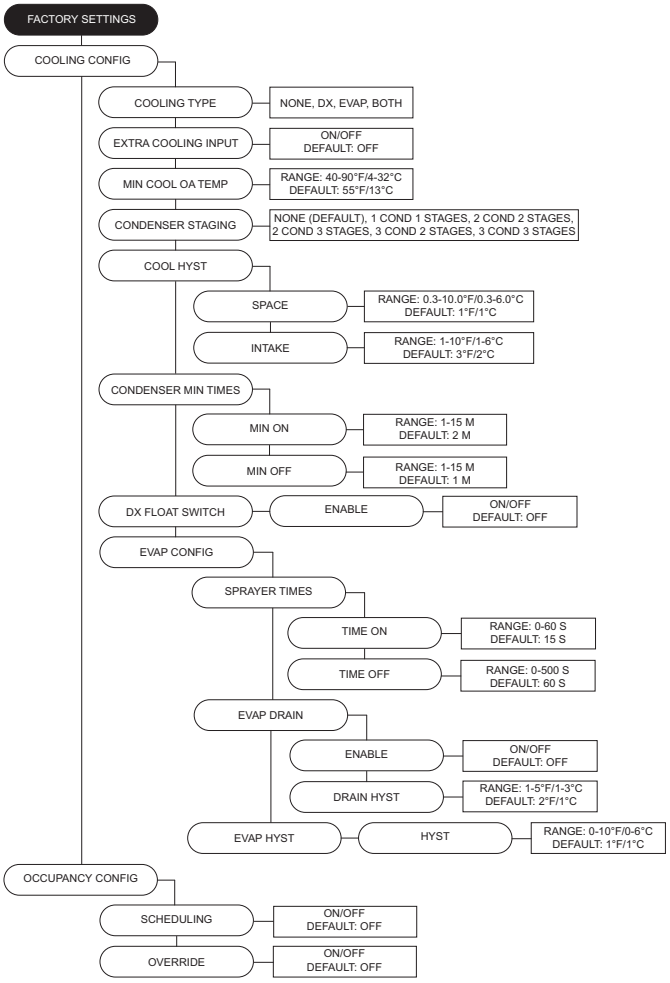


Cooling Config - Allows the user to set various cooling configurations and set points (SP).

- **Cooling Type** - Selections are None, DX, Evap, Both. If “None” is selected, all cooling options under user settings are hidden.
- **Extra Cooling Input** - When the DX cooling stage is set to 2 or greater, the cooling input will utilize all stages of cooling.
- **Min Cool OA Temp** - When the space temperature is calling for cooling, and the outdoor air temperature is below the SP, the unit will shut the condensers off. The blower will start and use outdoor air to cool the space.
- **Condenser Staging** - Selections None, 1, 2, or 3 condensers. Within the 2 and 3 condenser selection, there is another sub-menu that allows for 2 or 3 stages. For 2 condenser units, 3 stages should only be selected when the condensers are of unequal tonnages.
- **Cool Hyst** - Intake or Space tempering sensor must fall this many degrees below the SP before cooling turns off.
- **Condenser Min Times** - Minimum time each condensing stage must remain on after becoming activated. This is to prevent stage cycling. **A “C” will be present in the lower-left corner of the home screen when any of the condensers are in a MIN ON/OFF TIME.**
- **DX Float Switch** - Enables DX float switch option.
- **Evap Config**
  - **Sprayer Times**
    - **Time On** - Time the evaporative cooler will spray in the cycle.
    - **Time Off** - Time the evaporative cooler will be idle in the cycle.
  - **Evap Drain** - Units that use evap drain should be set to On.
    - **Drain Hyst** - Temperature differential setting before the drain shuts off.
  - **Evap Hyst** - Temperature differential before the evap cooling shuts off.

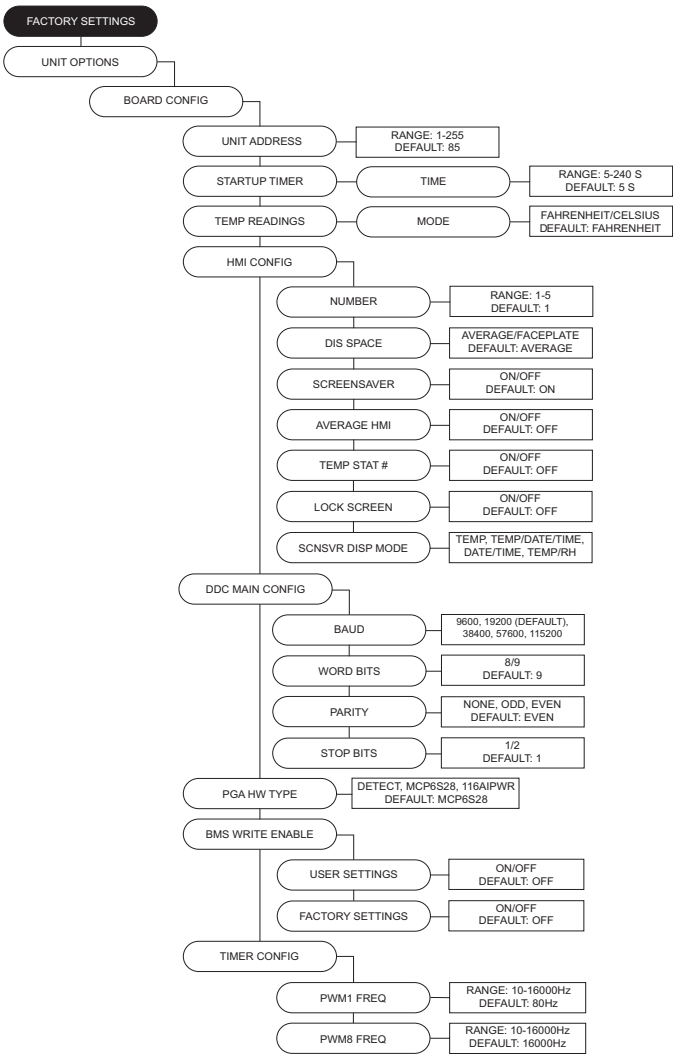
Occupancy Config - Allows access to setting scheduling and/or override On or Off.

- **Scheduling** - This menu is where the scheduling can be turned On or Off.
- **Override** - This menu is where the occupancy override can be turned On or Off.



Unit Options - Allows user access to various options included with the unit.

- **Board Config**
  - **Unit Address** - Modbus address of the MUA Board.
  - **Startup Timer** - Time upon power-up where the board will sit idle.
  - **Temp Readings** - Allows user to set temperature readings between Fahrenheit or Celsius. Changing between the two will reset all set points.
  - **HMI Config** - Allows access to adjust HMI settings and options.
    - **Number** - Set the number of HMIs connected to the MUA board.
    - **Dis Space** - Select display space temperature option. Faceplate will display the room's current temperature. Average will display an average of all faceplates, excluding HMI in the unit, and all wired space sensor readings.
    - **Screensaver** - Default is set to On. If set to Off, the home screen will not time out to the screensaver.
    - **Average HMI** - If there are multiple space HMIs connected, this menu allows you to select which will be included in the space temperature and relative humidity averaging. If a thermistor or relative humidity sensor is connected into the ST screw terminals, it will automatically be averaged into any HMIs included. When in Space Tempering Mode, a minimum of one HMI must have "Average HMI" set to On, or a separate remote sensor must be used that is wired back to the MUA board.
    - **Temp Stat #** - On/Off option to turn on temperature averaging for wired HMI thermistors.
    - **Lock Screen** - If the option is set to On, a password (9999) will be required; when the screensaver option is enabled or if any button functions are not pressed for 5 minutes.
    - **Scnsvr Disp** - Displays date, time, and/or temperature/RH when screensaver is active.
  - **DDC Main Config** - **Network settings should not be changed if the unit is equipped with BACNET**.
    - **Baud** - Modbus communication baud rate.
    - **Word Bits** - The amount of data bits over Modbus communications.
    - **Parity** - The parity selection for Modbus communications.
    - **Stop Bits** - The stop bits selection for Modbus communications.
  - **PGA HW Type** - (DO NOT CHANGE SETTINGS)
  - **BMS Write Enable**
    - **User Settings** - Allows BMS to write to user settings.
    - **Factory Settings** - Allows BMS to write to factory settings.
  - **Timer Config** - (DO NOT CHANGE SETTINGS)



- **Blower Config**
  - **Blower Control** - Select one of the following:
    - **120V Contactor** - 120V output on the MUA board to energize the coil of a contactor. This option should be selected when the MUA is used in conjunction with a DCV package.
    - **VFD Manual** - HMI selectable VFD frequency.
    - **VFD Jog** - For use with VFD using photohelic control. Aux pins are used to control the VFD. Powering aux 1 will speed the fan up, powering aux 2 will slow the fan down. When aux 1 or aux 2 are not powered, the VFD will hold current speed.
    - **VFD 0-10V** - For use when an external 0-10V signal is being provided to control the speed of the VFD. 0 Volts will equal VFD min, 10V will equal VFD max, and all voltages in between will be scaled linearly. This option will utilize 0-10V J28-(6) and 0-10V common J28-(7) screw terminals, and will require field wiring.
    - **VFD Pressure** - For use with VFDs that use a pressure transducer (0-10V output).
    - **Electronically Commutated Motor (ECM)** - HMI selectable PWM rate.
    - **ECM 0-10V** - For use when an external 0-10V signal is being provided to modulate the ECM supply output between min and max speed.
    - **ECM Pressure** - For use with ECMs that use a pressure transducer (0-10V output).
    - **ECP** - For use when the unit is controlled by an Electrical Control Package (ECP). MUA board will still energize 120V supply contactor when there is a call for blower. Power to FSC cuts out at shutdown for 30 seconds.
  - **Blower Mode**:

- If “Occ” is set to On, the menu screen for the blower mode will allow you to choose ON/AUTO OFF for Occupied or Unoccupied.
- If “Occ” is set to Off, the menu screen for the blower mode will allow you to choose MANUAL/AUTO/INTERLOCK. In blower auto mode, the blower will only run when it gets a call for heating/cooling.
- In blower manual/on mode, the blower will run as long as the fan button is enabled regardless of whether the unit is heating/cooling. In blower off mode, closing contacts J16-5 (unit intlk) and J16-6 (24V AC) will cause the blower to run.

  - **Air Profile Limits** - Low PS cannot be adjusted below min setting, and High PS cannot be adjusted above max setting. Adjusting limit settings between min/max values may affect unit operation.
  - **Blower Presets** - Blower preset option On/Off.
  - **Post Purge Config** - When enabled, this option will run the blower for the set time after heating shutdown.
  - **Door Interlock** - When enabled, if the door is open, the supply fan will shut down immediately.

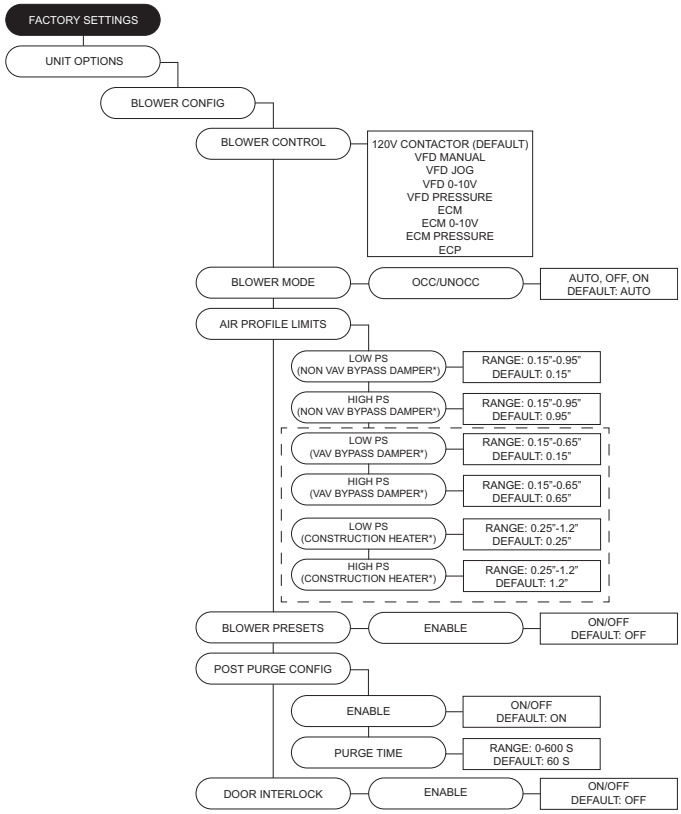


Table 7 outlines the aux pins on Connector J11 for preset settings associated with fan speed and damper position found in **Factory Settings > Unit Options**.

Table 7 - Aux Presets

Presets	Aux 1	Aux 2	Aux 3
Normal Operation (Selected Blower Mode)			
Fan Speed/Damper Position 1	X		
Fan Speed/Damper Position 2		X	
Fan Speed/Damper Position 3	X	X	
Fan Speed/Damper Position 4			X
Fan Speed/Damper Position 5	X		X
Fan Speed/Damper Position 6		X	X
Fan Speed/Damper Position 7	X	X	X

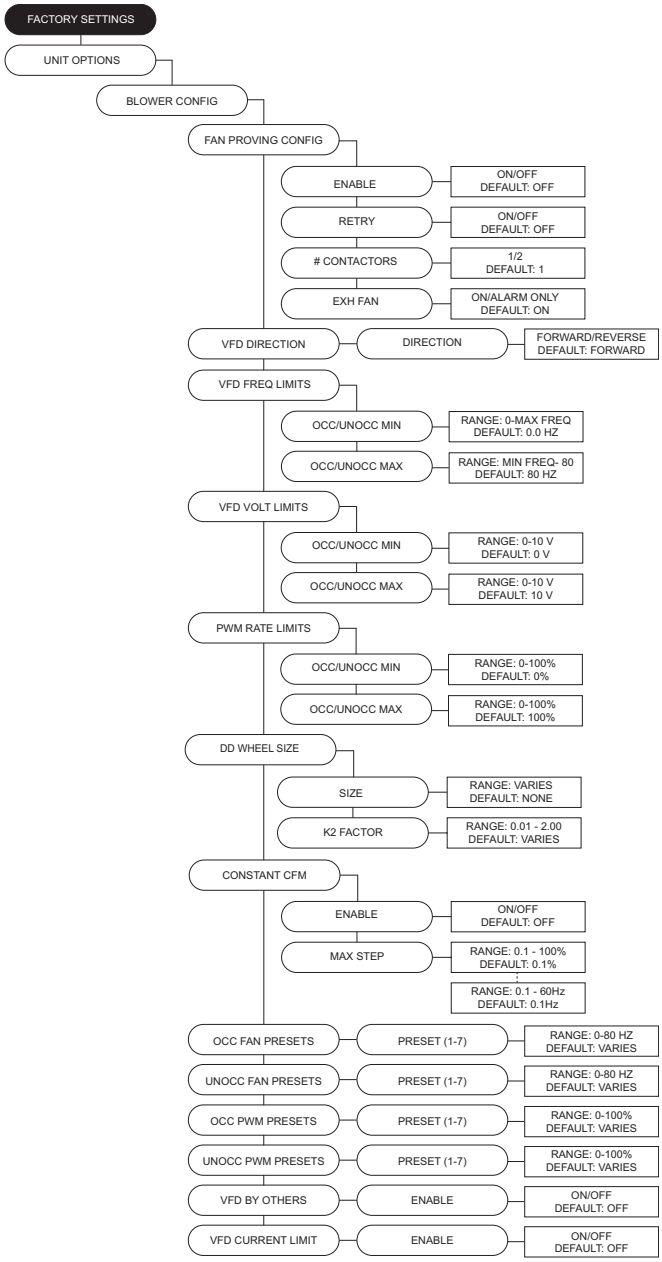
- **Fan Proving Config** - The exhaust contactor must be set to Before Airflow or After Airflow. When enabled, the user may set the number of contactors used. Contactor 1 = Aux 2. Contactor 2 = Aux 3.
  - **Enable** - When enabled, a fault detected will display when not operating.
  - **Retry** - When enabled, the unit will try to automatically reset upon airflow proving failure. After a second failed attempt, a manual reset will be required.
  - **# Contactors** - Number of exhaust fan contactors.
  - **Exh Fan** - If exhaust contactor fails proving, while “Exh Fan” is set to On, all fans shut down. When “Exh Fan” is set to Alarm Only, only post proving faults but allow fans to keep running.
- **VFD Direction** - Sends a command to the VFD to run in forward or reverse.
- **VFD Freq Limits** - Min/Max settings for fan speed.
- **VFD Volt Limits** - Min/Max settings for 3rd-party VFDs.
- **PWM Rate Limits** - Min/Max settings for fan speed.
- **DD Wheel Size** - Selection for wheel size and settings.
  - **Size** - This selection is utilized for CFM monitoring. Dual blower models will have a ‘2’ assigned after the wheel size model number.
  - **K2 Factor** - Used for supply CFM calculations.
- **Constant CFM** - When enabled On, blower will modulate to maintain constant CFM.
  - **Max Step** - Modulation adjustment; EC motors = %, VFD = Hertz (HZ).
- **Occ Fan Presets** - After the blower has started, the blower setting will use the aux pins to drive the preset occupied value.
- **Unocc Fan Presets** - After the blower has started, the blower setting will use the aux pins to drive the preset unoccupied value.

- Fan Preset Default: 1 = 40Hz, 2 = 50Hz, 3 = 0Hz, 4 = 60Hz, 5 = 0Hz, 6 = 0Hz, 7 = 0Hz.

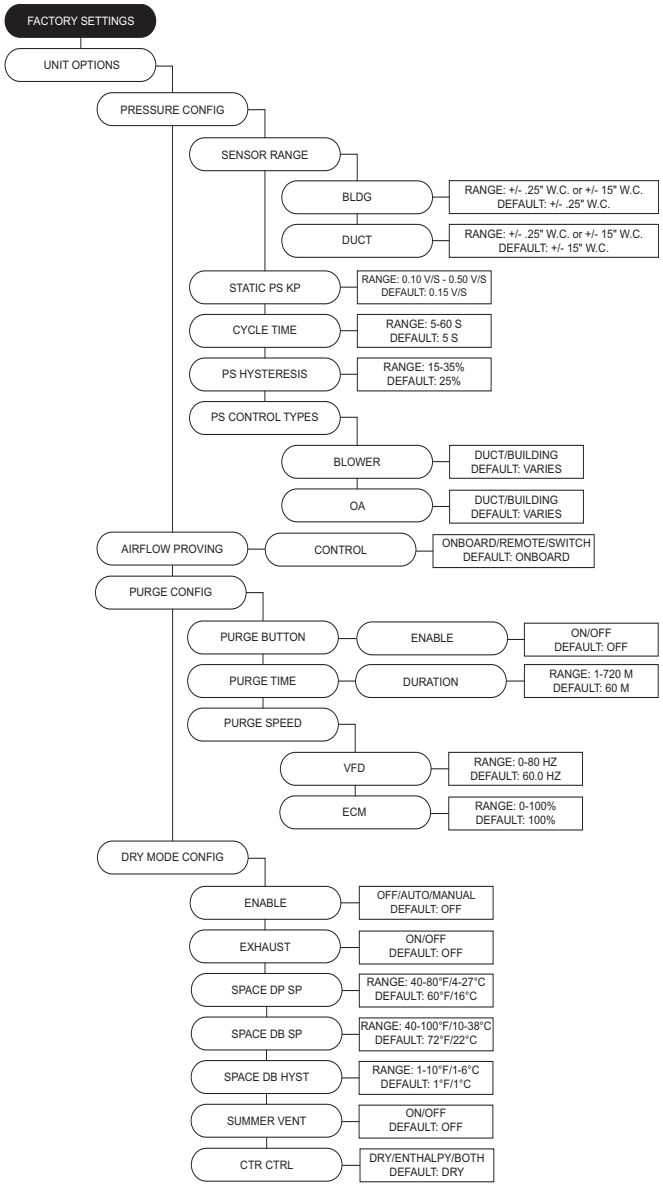
- **Occ PWM Presets** - After the blower has started, the blower setting will use the aux pins to drive the preset unoccupied value.
- **Unocc PWM Presets** - Allows user to set unoccupied preset blower speed value.

- PWM Preset Default: 1 = 80%, 2 = 90%, 3 = 0%, 4 = 100%, 5 = 0%, 6 = 0%, 7 = 0%.

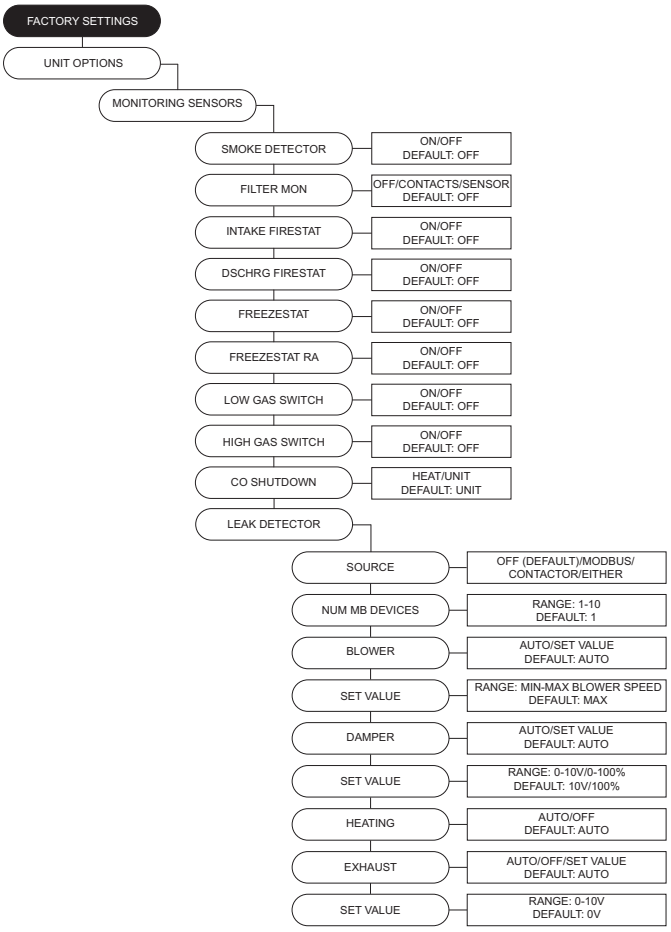
- **VFD By Others** - This option will be used when a factory provided Modbus control VFD is not utilized. A start command, as well as a 0-10 V output will be provided to the VFD.
- **VFD Current Limit** - This limits the max current to the VFD.



- **Pressure Config**
  - **Sensor Range** - Menu is available when any blower pressure or recirculating pressure option is selected.
  - **Static PS KP** - Proportionally constant value for static pressure measured in V/sec.
  - **Cycle Time** - Cycle time is the time between two consecutive readings.
  - **PS Hysteresis** - The percentage band between high and low static set points. This will reduce cycling of blower or damper. Increase this value if the blower speed or damper does not settle into a SP.
  - **PS Control Types** - The blower/outdoor air pressure control may be set to monitor Building/Duct pressure.
- **Airflow Proving** - Unit may be set to prove by an external airflow switch, remote 0-10 V input signal, or from the onboard switch (connector J39).
- **Purge Config**
  - **Purge Button** - When the purge button is pressed, the damper will open to max outdoor air and turn on the exhaust contactor, if enabled. Purge Button must be enabled for Dry Mode operation.
  - **Purge Time** - This is the amount of time that the unit will run the purge process if the user does not stop the purge manually.
  - **Purge Speed** - Adjustable between VFD or ECM. Min and Max frequencies the fan will run during the purge cycle.
- **Dry Mode Config** - When this option is active (automatically or through manual button press), dry mode will run when:
  - Space Dew Point rises above Space DP set point (SP). Dry mode only.
  - In addition, if Summer Vent is ON, Space Dry Bulb rises above Space Dry Bulb SP and space enthalpy is greater than outside air enthalpy.
  - The unit will go to Dry Mode Discharge when there is a call for heat.
  - Space dew point is the average of the Space RH input with any additional HMI inputs.
  - If OA dew point < Space dew point, the mixing box should go to outdoor air set point. This should override any other mixing box functionality.
  - If OA dew point > Space dew point, the mixing box should go to min OA%.
  - Purge should run until the purge timer expires or the user cancels the purge.
    - **Exhaust** - Enables/disables exhaust contactor during dry mode.
    - **Space DP SP** - Dew point threshold for automatic dry mode activation.
    - **Space DB SP** - Dry bulb threshold for automatic dry mode activation.
    - **Summer Vent** - Dew point activation will enhance with enthalpy activation when set to On.
    - **CTR CTRL** - J29-7 will energize per the selected option.

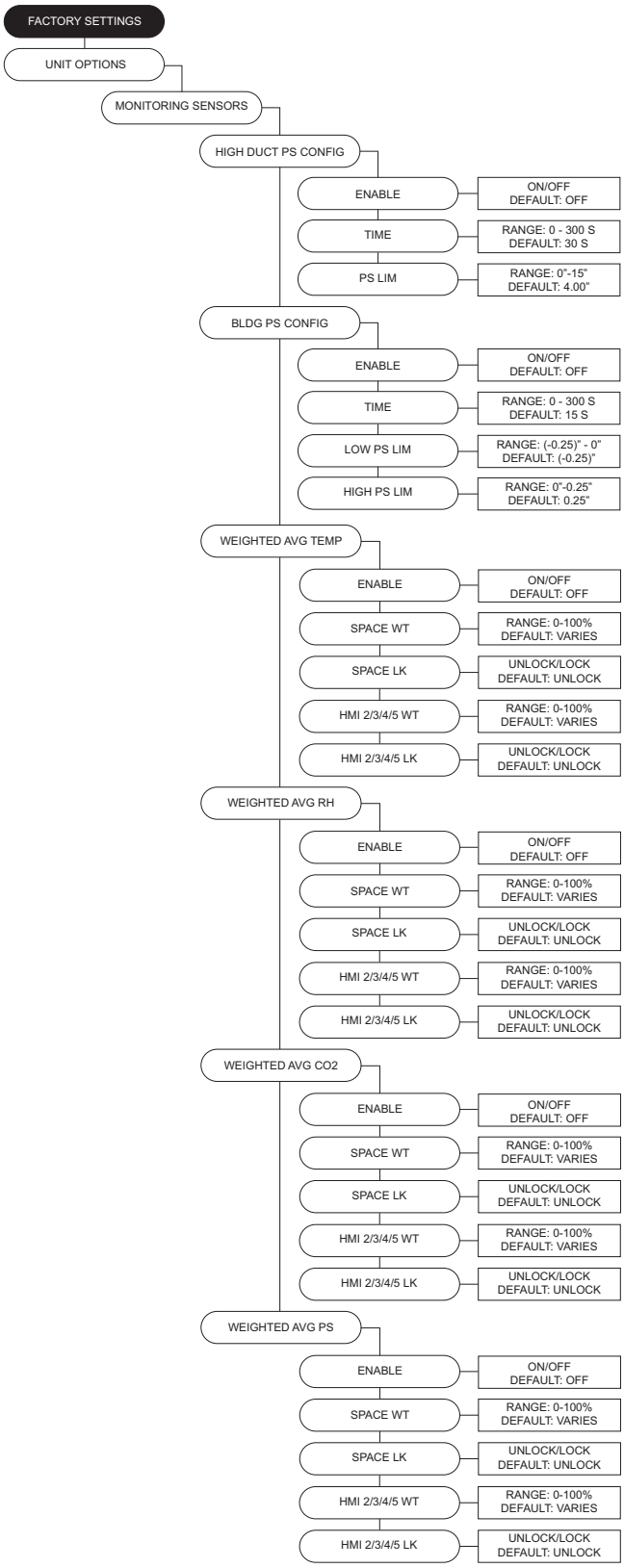


- **Monitoring Sensors** - This menu enables optional components from the factory or when field installed.
  - **Smoke Detector** - Enables for smoke detection.
  - **Filter Mon** - The option may be set to Off, Contacts or Sensor (J31-14). When set to Contacts or Sensor, if the input is active a fault will be displayed on the HMI.
  - **Intake Firestat** - When enabled, if the intake sensor is above the intake firestat set point, the unit will shut down immediately. A manual reset must be performed on the HMI.
  - **Discharge Firestat** - When enabled, if the discharge sensor is above the discharge firestat set point, the unit will shut down immediately. A manual reset must be performed on the HMI.
  - **Freezestat** - When enabled, if the freezestat sensor trips, the unit will shut down immediately. A manual reset must be performed on the HMI.
  - **Freezestat RA** - When the freezestat trips, the unit will go to full return air.
  - **Low Gas Switch** - When enabled, if the pressure drops below the threshold heating will shut down.
  - **High Gas Switch** - When enabled, if the pressure rises above the threshold heating will shut down.
  - **CO Shutdown** - When enabled, if J12-6 reaches 10V, shut down the unit (blower, heating, and cooling).
  - **Leak Detector** - Enables A2L sensor.
    - **Source** - Off = no leak detection present, Contactor = 24V DC input, Modbus = Modbus Communication, Either = Contactor or Modbus.
    - **Num MB Devices** - Number of leak detectors communicating via Modbus.
    - **Blower** - When Auto is selected, the blower will run at normal design speed. When Set Value is selected, the blower will run at the set value.
    - **Set Value** - Speed the blower will operate at when a leak is detected.
    - **Damper** - When Auto is selected, the damper will open to normal operating setting. When Set Value is selected, the damper will open to the set value.
    - **Set Value** - Position the damper will open at when a leak is detected.
    - **Heating** - When Auto is selected, heating will run at normal operation. When Off, heating will immediately shut off and not operate if a leak is detected.
    - **Exhaust** - When Auto is selected, powered exhaust will run at normal operation. When Off, powered exhaust will immediately shut off and not operate if a leak is detected.
    - **Set Value** - Speed the power exhaust will operate at when a leak is detected.

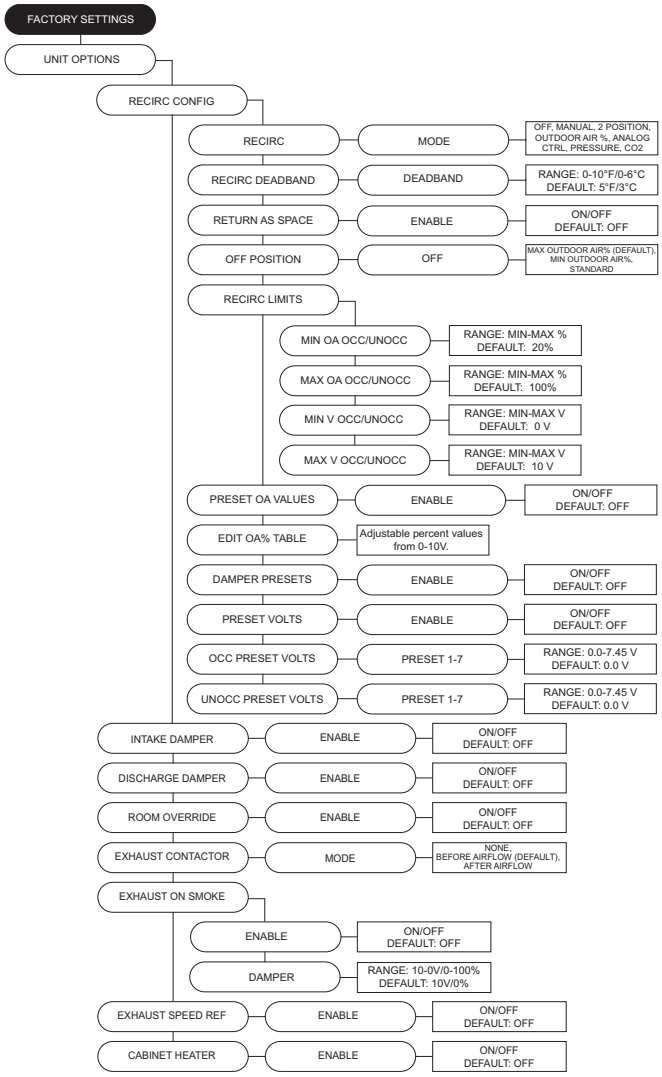


- **High Duct PS Config** - When enabled, if the duct pressure is greater than the set point for longer than the set time, heating/cooling will shut down. A fault will be displayed on the HMI.
  - **Time** - Setting for how long the unit can be outside of its pressure range.
  - **PS Lim** - Duct pressure alarm set point.
- **Bldg PS Config** - When enabled, if the building pressure is lower/greater than the set point for longer than the set time, heating/cooling will shut down. A fault will be displayed on the HMI.
  - **Time** - Setting for how long the unit can be outside of its pressure range.
  - **Low PS Lim** - Low pressure alarm set point.
  - **High PS Lim** - High pressure alarm set point.
- **Weighted Avg Temp** - Averages Temperature
- **Weighted Avg RH** - Averages Relative Humidity
- **Weighted Avg CO2** - Averages CO2
- **Weighted Avg PS** - Averages Pressure

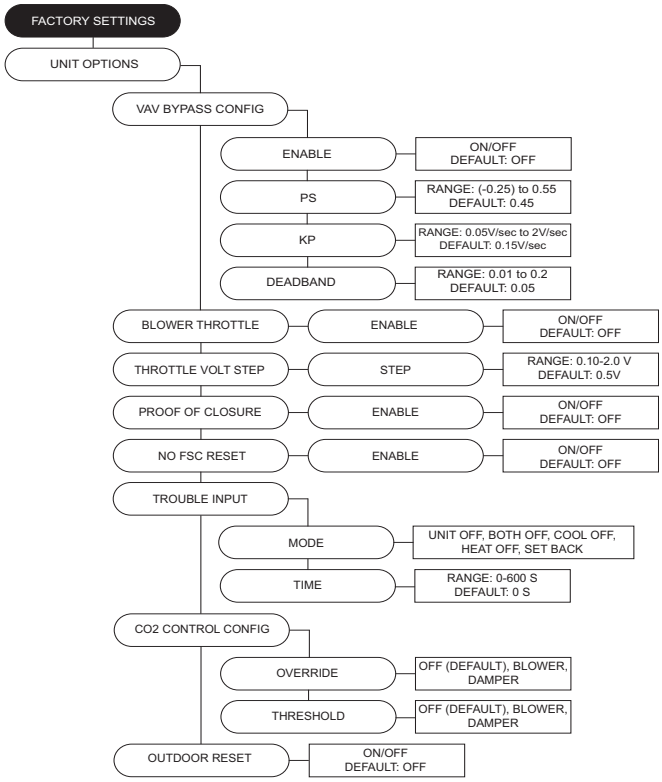
- When Weighted settings are enabled On, weight (WT) and lock (LK) adjustments are active. Use WT to assign Space priority monitoring. Use LK when you want specific WT assignments on certain HMIs.



- **Recirc Config**
  - **Recirc** - Off, Manual, 2 Position, Outdoor Air %, Analog Control, Pressure, CO2.
  - **Recirc Deadband** - If the temperature difference between the outdoor and return sensor is less than or equal to this SP, the MUA board will not attempt to adjust the output voltage until it matches the outdoor air percentage SP. This setting only takes effect when either outdoor air % or schedule is selected.
  - **Return As Space** - Setting this to On will not require a space sensor or HMI. This setting will use the return air thermistor (RT) in place of the space sensor.
  - **Off Position** - Allows user to select how the dampers will be positioned when the supply fan is off. Standard (default), Max Outdoor Air %, or Min Outdoor Air %.
  - **Recirc Limits** - Minimum and maximum settings for recirc. Percentage or voltage based on recirc selection.
  - **Edit OA% Table** - User may edit voltages for equivalent to outdoor air percent table (% of movement of recirc damper. No value may be the same.
  - **Damper Presets** - This allows the user to set damper preset option On or Off.
  - **Preset Volts** - Uses aux pins to control damper actuator.
  - **Occ/Unocc Preset Volts** - When scheduling is On, Occ Preset Volts and Unocc Preset Volts with be available.
- **Intake Damper** - User can adjust intake damper to be On or Off.
- **Discharge Damper** - User can adjust discharge damper to be On or Off.
- **Room Override** - Uses room override SP rather than Discharge SP. This setting will only have an effect when the heat tempering mode setting is discharge and activate based on is not set to intake.
- **Exhaust Contactor** - This allows the user to assign a contactor for an interlocked exhaust fan. There are occupied and unoccupied settings.
  - **None**
  - **Before airflow** - Exhaust fan will start before the airflow proving switch has been activated.
  - **After airflow** - Exhaust fan will start after the airflow proving switch has proved there is airflow.
- **Exhaust On Smoke** - When the input is enabled, if it receives a 24V signal from a fire system, this will shut down the supply fan and enable the exhaust contactor. The 24VAC signal must originate from the MUA Board.
  - **Damper** - When Outdoor Air Control is set to manual = Volts. When Outdoor Air Control is not set to manual = Percentage. If powered exhaust on fire is enabled, powered exhaust on fire will override the damper position setting.
- **Exhaust Speed Ref** - When enabled On, the exhaust speed will match supply blower VFD.
- **Cabinet Heater** - This allows the user to enable the cabinet heater, if applicable. If enabled, the temperature sensor on MUA board controls the cabinet heater.



- **VAV Bypass Config** - When enabled On, the settings available will maintain burner profile pressure for proper combustion. Required for industrials with VAV option.
  - **PS** - Profile pressure setting for VAV bypass damper.
  - **KP** - Kp value will determine the rate of change for the VAV damper output.
  - **Deadband** - VAV Bypass damper deadband setting.
- **Blower Throttle** - The throttle function is to maintain profile pressure across the burner.
- **Throttle Volt Step** - Increases/decreases fan speed when a third party VFD is used.
- **Proof of Closure** - For gas valves that contain a proof of closure switch, the user may set this option On. Before heating occurs, a 24V AC input must be present at connector J32 pin 12.
- **No FSC Reset** - When this option is set to On, the flame safety control will not reset on a failure to prove flame. If the flame fails, a manual reset is required immediately via the push button or HMI.
- **Trouble Input**
  - **Mode** - If connector J28 pin 3 receives 24 volts, the unit will act based on mode setting:
  - **Unit Off** - Shuts down blower (heating/cooling will also shutdown). Bypass any timers.
  - **Both Off** - Turns off/lockout heating and cooling. Bypass min on/off timers.
  - **Heat Off** - Turns off/lockout heating.
  - **Cool Off** - Turns off/lockout cooling. Bypass min on/off timers.
  - **Set Back** - Forces unit to unoccupied state.
  - **Time** - Setting for off/lockout time.
- **CO2 Control Config** - Monitors CO2. Will adjust blower speed/damper position depending on CO2 SP.
  - **Override** - The unit will try to maintain space CO2 Parts Per Million (PPM) levels based on min/max threshold set points set by the user. The unit will modulate the blower/damper linearly between their corresponding min/max settings.
  - **Threshold** - CO2 Parts Per Million (PPM) maximum threshold set points for the space. When the space CO2 PPM reading exceeds the threshold setting, the blower/damper will go to their max setting.
- **Outdoor Reset** - Functions for outdoor reset:
  - Discharge Heat Tempering: If outside air is below OA Reset Low SP, heat will discharge to Reset Heat Discharge setting.
  - Space Heat Tempering: If outside air is below OA Reset Low SP, the space SP will adjust to Reset Heat Space setting.
  - Intake Cool Tempering: If outside air is above OA Reset High SP, cooling will go to max staging. If both evap and dx are present, unit will run all.
  - Intake Space Cool Tempering: If outside air is below OA Reset Low SP, the space SP will adjust to Reset Cool Space setting.



- **Dynamic Set Point** - below are scenarios for dynamic functionality.
  - When heating: If the measured outside air temperature is below the Dynamic Heat OA set point (SP) minus the differential SP, the space or discharge SP will increase/ decrease by the offset setting.
- **Single Zone VAV** - When Mode is set to blower, damper, or both, adjustable set points can be found in “User Settings.”
  - **Invert** - Normal operation, the blower/damper will go to max settings. Inverse operation, the blower/damper will go to min settings.
- **Alarm Output** - User may set to All or Fireye. If All is selected, output will energize when any fault occurs. If Fireye is selected, output will energize when Fireye faults occur. Connector J30 pin 8 will be energized.
- **Pool Room** - Enable this option for pool room applications.
  - **Pool Room DP SP** - When above the dew point setpoint (SP), the blower will modulate to the pool room’s blower speed setting.
  - **PR Blower Speed** - Blower speed adjustment for high dew point pool rooms.
- **PR DP Hyst** - Hysteresis value is applied to dew point SP.
- **Unit Performance** - Adjustable points for monitoring. For service settings, go to **Service > Unit Performance**.
  - **CFM** - Design CFM
  - **Min/Max Duct SP** - Design duct static pressure.
  - **Min/Max Bldg SP** - Design building static pressure.
  - **Mtr Eff** - Motor Efficiency.
  - **BHP** - Brake Horsepower.
  - **D Freq**- Design Frequency.
  - **D ECM** - Design Percentage.

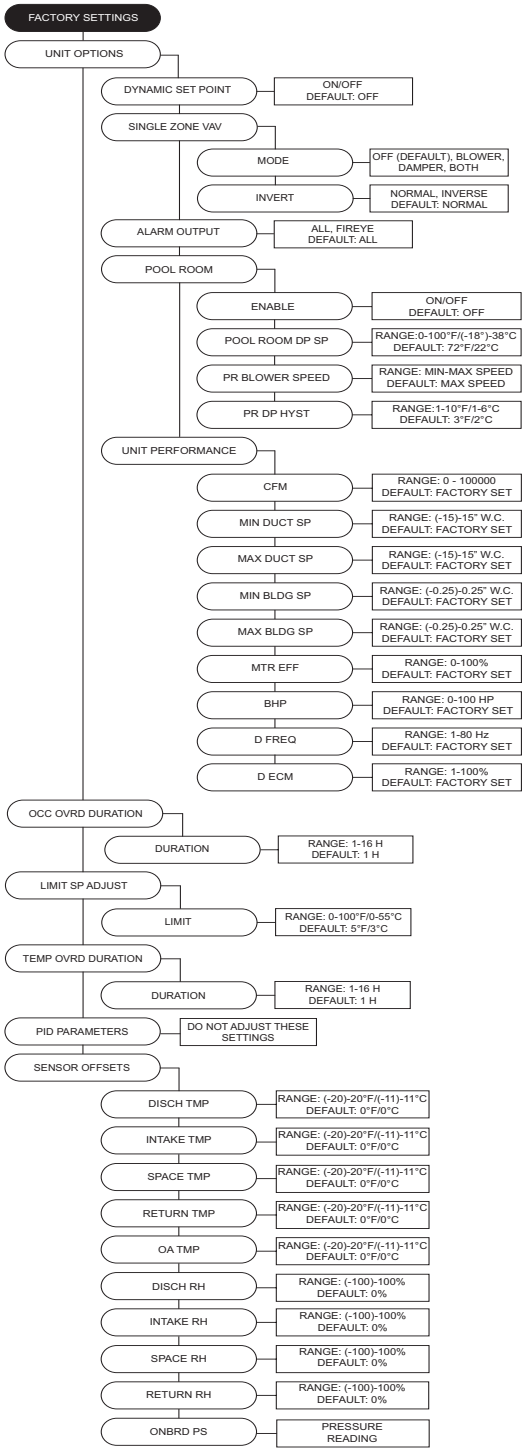
Occ Ovrd Duration - Length of override timer. If override is active, it can be manually stopped by pressing the end override button on the HMI.

Limit SP Adjust - This allows the user to change the current temperature SP through the home screen. The range adjustment is 0-100 degrees. When the SP is set to 0°F, the adjustment buttons (+/-) will not be visible.

Temp Ovrd Duration - Length of temperature override timer.

PID Parameters - (DO NOT CHANGE THESE PARAMETERS)

Sensor Offsets - Offset adjustment for Discharge, Space, Intake, Return, Outdoor Air, and On-Board Pressure sensor parameter settings.



NOTE: For heating, every multiple of Dynamic Set Point Differential would multiply the effect of the Dynamic Offset setting.

Service Menu Password = 1234

Job Info - Non-editable parameters. Displays Job #, Unit #, HMI #, Tag (HMI Name e.g, Office/Hallway/Break Room) entered at the factory.

Temperatures - Monitors various temperature values.

Relative Humidity - Current humidity readings per HMI.

CO2 Values - Current CO2 reading per HMI.

Pressure Values - Current Pressure readings per HMI.

Open/Closed Status - Open/closed status of all inputs.

Variable Values - Monitor all variable input/output values.

VFD Status - Allows the user to monitor VFD parameters.

High Temp Limit - Displays the high temp limit.

Airflow Limits - Displays the high/low airflow limits.

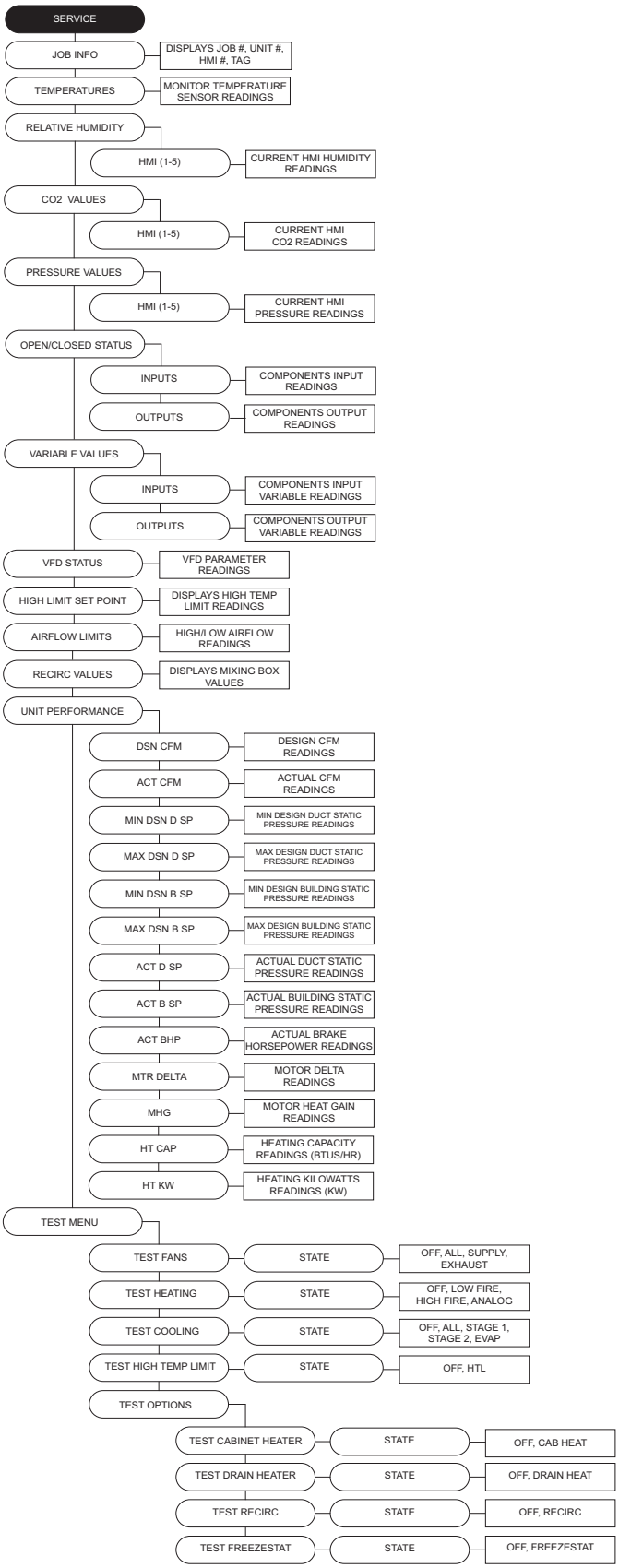
Recirc Values - Allows the user to monitor recirc values.

Unit Performance - Compares **Unit Options > Unit Performance** to current unit's operational values.

- **Dsn CFM** - Design CFM. Job specific unit CFM.
- **Act CFM** - Actual CFM. Current unit CFM reading.
- **Min/Max Dsn D SP** - Design duct static pressure. Job specific external static pressure.
- **Min/Max Dsn B SP** - Design building static pressure. Job specific external static pressure.
- **Act D SP** - Actual duct static pressure. Current external static pressure.
- **Act B SP** - Actual building static pressure. Current external static pressure.
- **Act BHP** - Actual Brake Horsepower.
- **Mtr Delta** - Motor Delta. Temperature rise caused by motor heat.
- **MHG** - Motor Heat Gain. BTU rise caused by motor heat.
- **HT Cap** - Heating capacity output in MBH.
- **HT KW** - Heating output in kilowatts.

Test Menu - When in a testing state, you must set the 'State' back to OFF to cancel the test.

- **Test Fans** - User may test fan operations.
- **Test Heating** - Contains high fire, low fire, and analog tests for heating stages. If "Heating Config" is set to 0, then "No Heat Stage Set" will display. Allows blower and damper to modulate.
  - In test mode, the high limit setting will be based on intake temp + max temp rise + 10 degrees or the unit's high limit setting, whichever is higher.
  - If recirc is On, set to 0V or 100% OA.
  - Exiting test mode will reset the PID.
- **Test Cooling** - Test cooling or heat pump system. Also, monitors cooling system specifications. Allows blower and damper to modulate.
- **Test High Temp Limit** - Simulates high temp limit fault.
- **Test Options**
  - **Test Cabinet Heater** - Will activate the cabinet heater.
  - **Test Drain Heater** - Will activate the drain heater.
  - **Test Recirc** - Test will create an output to the outdoor air control. The test will begin at 0 volts. The up and down buttons allow for modulation of the output.
  - **Test Freezestat** - Test menu will allow user access to adjust set points to verify freezestat operation in various types of ambient conditions.



Clear Fault History - This will clear the entire fault history. If there is an active fault when cleared, that fault will show up until it is fixed.

Set Clock - Adjustment for Day and Time settings.

Calibrate Onboard PS - Calibrates onboard pressure sensor. Must disconnect all pressure tubes before calibration.

Calibrate Recirc - Calibration process to update factory default values to building site conditions.

Reset Recirc Values - Resets recirc back to default values.

Calibrate Filter PS - Calibrates clogged filter pressure. Must disconnect all pressure tubes before calibration.

Calibrate PS1 - Calibrates static pressure sensor input at connector J31 pin 17. Must disconnect all pressure tubes before calibration.

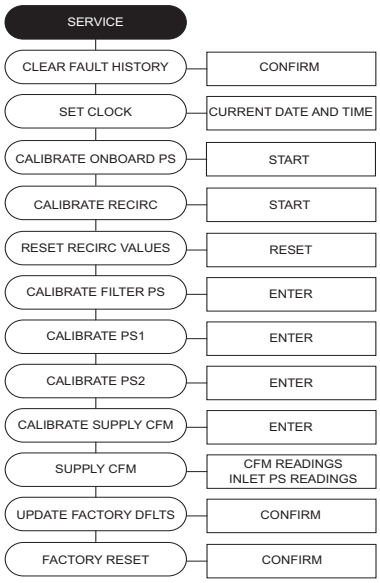
Calibrate PS2 - Calibrates static pressure sensor input at connector J16 pin 1. Must disconnect all pressure tubes before calibration.

Calibrate Supply CFM - Calibrates pressure differential in the venturi to calculate approximate fan CFM. Must disconnect all pressure tubes prior to calibration.

Supply CFM - Displays measured CFM readings. This readout is only valid for units with direct-drive wheels.

Update Factory Defaults (DFLTS) - Original factory default settings will be overridden. Confirming the updated settings will now be used when “Factory Reset” is used.

Factory Reset - Confirming will reset to factory saved defaults, or last saved updated factory defaults.



QR Codes

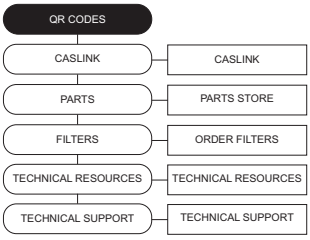
CASLink - Provides access to CASLink webpage. The user will need an account to log in to see informations.

Parts - Provides access to the online parts store for parts available for product groups on the job number.

Filters - Provides access to the online parts store for available filters for product groups on the job number.

Technical Resources - Provides access to the online resources page for technical documentation.

Technical Support - Provides access to the service page for Technical Support.



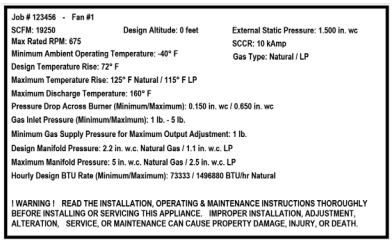
Start-Up Procedure

1. Check for signs of damage. Do not operate if damage exists and contact your manufacturer sales representative. Units are easier to fix before the equipment is installed.
2. Check all installation clearances.

Clearance from Combustibles	Clearance for Serviceability
Top: 6” Sides: 6” Base: 0”	Unit: 24” Service Accesses: 48”

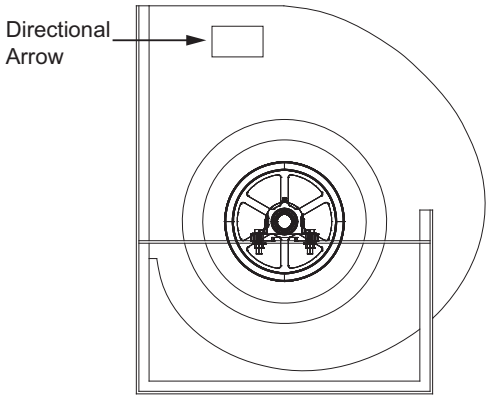
3. Check that the unit has been set level and secured.
   - Unit must have adequate structural support, or the equipment or building may be damaged.
   - Curb and unit must be leveled, or the unit may leak or be damaged.
   - Gasket and caulk the seam between the curb and unit base.
   - Screw or weld the unit’s base to the curb to avoid damage to the equipment.
4. Check that the accessories are set level and secured.
   - Accessories must have adequate structural support, or the equipment or building may be damaged.
   - Gasket, caulk, and screw each accessory to unit seam.
5. Check that the unit’s intake and discharge are free of debris.
6. Check that the filters are installed in the (optional) filter section or intake hood in accordance with the airflow direction.
7. Check that the unit’s ductwork size and length match the minimum ductwork size chart, see **Table 1**.
8. Check that all field wiring has been completed in accordance with the factory-supplied wiring diagram. Field wires are shown as dashed lines on the wiring prints.
9. Check that all terminal screws are tight and that wires are in place.
10. If applicable, check pulley alignment. Refer to **“Pulley Alignment/Proper Belt Tension” on page 61**. Correct if necessary.
11. Check that the power supply matches the nameplate voltage, phase, and amperage. Record the voltage on the Start-up Sheet.

Figure 26 - Gas Pressure Type



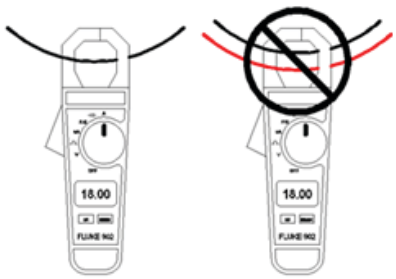
12. Check that the gas type and pressure match the nameplate type and pressure (**Figure 26**).
13. Contact the service department if the power or gas supply needs to be changed in the field. Different parts might be necessary for the change.
14. Turn the unit ON.
    - Bump the blower motor starter to check the blower wheel rotation.
    - The decal is located on the blower housing (**Figure 27**).
    - If the rotation is backwards, turn off the power and correct the wiring.
    - The rotation can be corrected by interchanging two legs of 3-phase (must be between VFD and motor on VAV units).

Figure 27 - Fan Direction



15. Use the HMI to turn the fan ON. The (optional) intake or discharge damper motor will start to open. Once the damper is 90% open, the damper motor internal end switch will close and energize the blower motor starter.
16. Check the motor's amp draw (**Figure 28**).

Figure 28 - Amp Draw Check



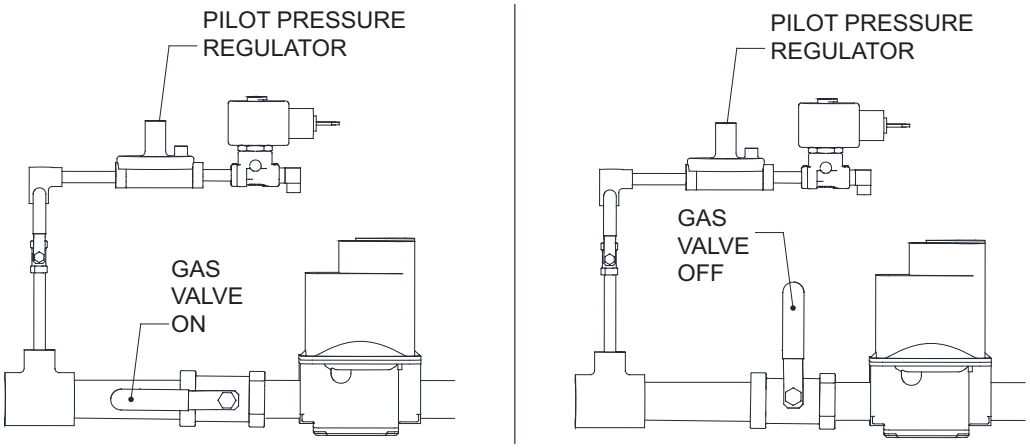
- The motor's amp draw should be less than the FLA (full load amps) of the blower motor.
- The fan RPM may need to be reduced to decrease motor amps.
- Opening the motor pulley decreases RPM and motor amps.
- Closing the motor pulley increases RPM and motor amps.
- Record the motor amps on the Start-up Sheet.

17. If the RPM was adjusted in the field, use a tachometer to record the new RPM on the Start-up Sheet.
18. If applicable, check the belt tension after any RPM adjustments. Refer to **"Pulley Alignment/Proper Belt Tension" on page 61**.

Gas Train Start-Up Procedure

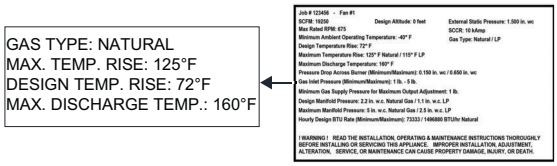
1. Use the HMI to verify profile pressure differential, go to **Service > Variable Values > Inputs > Onbd Prof PS**.
   - The airflow sensor on single-speed units is a low airflow sensor only and opens below **0.15 in w.c**.
   - The target pressure drop range for the single-speed unit is **0.40 – 0.50 in w.c**.
   - Do not adjust airflow.
   - Use the profile plates or blower RPM to increase or decrease the pressure drop. If adjusting by blower RPM, you will need to adjust the blower pulley or VFD, if equipped.
   - Record the pressure drop on the Start-Up Sheet.
2. Close the burner gas shut-off valve. This will allow the unit to fire the pilot only and will be opened at a later time.
3. Turn the fan ON.
4. Use the HMI to test heating, go to **Service > Test Menu > Test Heating > State > High Fire**.
5. The Fireye Flame Safety Control energizes the ignition transformer and pilot gas valve.
6. After the pilot flame is established, the main gas valves will open. At this time, the pilot will be the only flame in the burner.
7. The pilot regulator should be adjusted so the pilot flame signal is stable at 6-18 VDC. Use the HMI to read the flame signal located under **Service > Test Menu > Test Heating**.
8. Record the flame signal in the start-up sheet.

Figure 29 - Gas Train



Setting High Fire

Figure 30 - Gas Nameplate

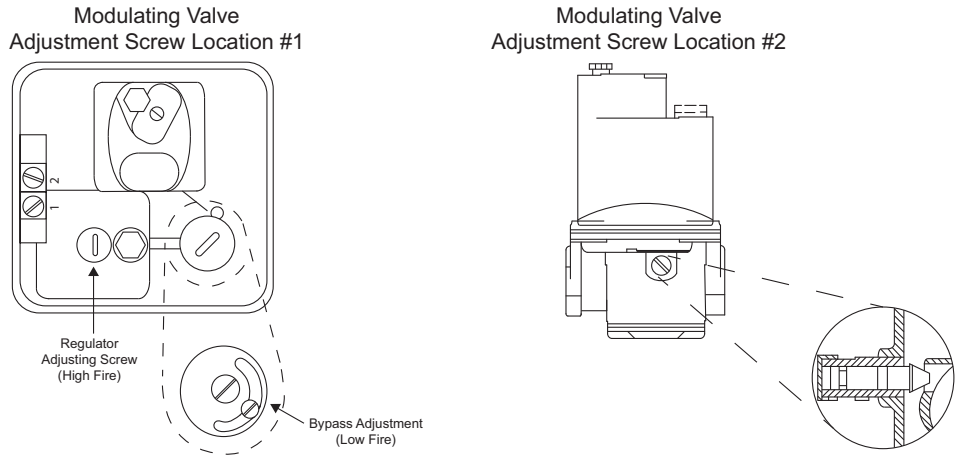


1. Open the Burner Gas Shut Off Valve. Refer to **Figure 29**.
2. Measure the intake air temperature.
3. Add the intake air temperature to the units nameplate design temperature rise. This result will be the desired high fire discharge temperature.

   Refer to Figure 30 for an example: Intake Temp (70°F) + Design Temp Rise (72°F) = Discharge Temp (142°F)
4. Use the service test menu to lock the unit in high fire: **Service > Test Menu > Test Heating > State > High Fire**. Press Enter.
5. Adjust the manifold gas pressure to achieve the desired discharge air temperature.
6. Measure the discharge temperature using a thermometer. Laser thermometers are not as accurate as a thermocouple type.
7. If the discharge ductwork outlet is hard to reach, you may feed a thermocouple into the mixing tube inside the blower discharge.
8. Use the regulator pressure adjusting screw, adjust the high fire manifold pressure to **5 inches wc** maximum for natural gas, and **2.5 inches wc** maximum for propane gas. High fire should be set to generate the design temperature rise. If the high fire screw is at the end of its adjustment and more pressure is needed, then adjust the main building gas pressure regulator spring (located external to the unit) to achieve the proper manifold pressure. Turning the regulator screw clockwise will increase pressure, and counter-clockwise will decrease pressure.

NOTE: When the unit is locked into high fire via test menu, the voltage should read 24V DC. The normal operation value reading is 15V-24V DC.

Figure 31 - High Fire/Low Fire Bypass Screw Setting



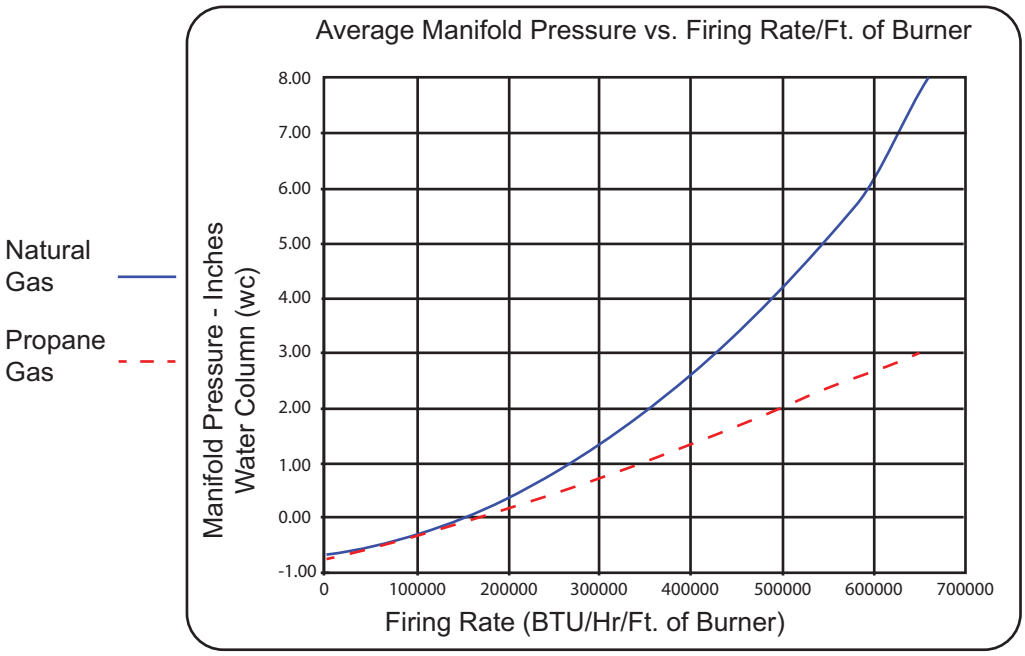
Firing Mode: Low Fire = 0-5V DC, Modulation = 5-15V DC, High Fire = 15-24V DC

Setting Low Fire

1. Use the service test menu to lock the unit in low fire: **Service > Test Menu > Test Heating > State > Low Fire**. Press Enter.
2. Check the DC voltage across the terminals on the modulating valve to verify 0V DC. This will confirm the unit is in the low fire.
3. Use the bypass screw (located on the side of the M511 and M611 valves, or under the cap of the MR212 valve). Adjust the low fire manifold pressure until there is a very thin flame along the entire length of the burner. No dark spots should be seen in the burner. The burner may be observed through the view-port located on the external wall of the heater. Replace the cap to the valve and restore all of the original wiring and gas components.
4. A final gas leak check shall be performed to verify the gas-tightness of the heater's components and piping under normal operating conditions. This can be done by measuring the gas pressure at the 1/4" gas plug just downstream of the modulating valve.

Design Manifold Gas Pressure

Figure 32 - Pressure vs. Firing Rating



Final Start-up Procedure

1. With the air and burner systems in full operation and all ducts attached, measure the system airflow. The motor sheave (pulley) is variable pitch, and allows for an increase or decrease of the fan RPM. If an adjustment is needed, refer to **“Pulley Adjustment” on page 61**.
2. Once the proper airflow is achieved, measure and record the fan speed with a reliable tachometer. **Caution - Excessive speed will result in motor overloading and/or bearing failure. Do not set fan RPMs higher than specified in the maximum RPM chart.** Refer to **“TROUBLESHOOTING” on page 70**.
3. Measure and record the **voltage** and **amperage** to the motor and compare with the motor nameplate to determine if the motor is operating under safe load conditions.
4. Once the rpm of the ventilator has been properly set, disconnect power and recheck belt tension and pulley alignment, refer to **Figure 34**.

Start-up Procedure Variable Air Volume

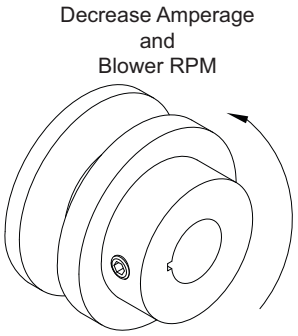
The Start-Up procedure for variable air volume units is the same as the single-speed unit, except there are additional steps for checking the burner pressure drop and setting high/low fire. Use the single-speed procedure along with these additional steps for the VAV start-up procedure.

- Use the HMI to verify profile pressure differential, go to **Service > Variable Values > Inputs > Onbd Prof PS**. Check the pressure drop through the entire airflow range.
- The airflow sensor on VAV units is a low (0.15) and (0.65) high switch.
- Do not adjust airflow sensor.
- Use the profile plates or blower RPM to increase or decrease the pressure drop. Blower RPM can be adjusted in the HMI under **User Setting > Fan Speed**.
- Record the pressure drops on the Start-up Sheet.
- Verify the flame limiting device is functioning properly in low speed on units with a VFD.
- Verify the low fire setting at minimum flow rate as well.

Pulley Adjustment

The adjustable motor pulley is factory set for the RPM specified. Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in speed represents a substantial increase in horsepower required by the unit. Motor amperage should always be checked to avoid serious damage to the motor when the speed is varied. Always torque set screws according to the torque specifications shown in **Figure 33**.

Figure 33 - Adjustable Pulley



Setscrew Thread Size	Torque (in-lbs)
No. 10 (bushing)	32
1/4” (bushing)	72
5/16”	130

Pulley Alignment/Proper Belt Tension

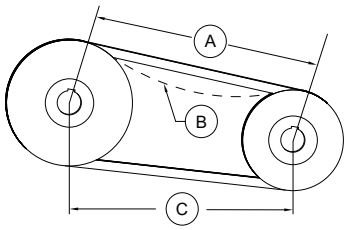
1. Belts tend to stretch and settle into pulleys after an initial start-up sequence. **Do not tension belts by changing the setting of the motor pulley**, this will change the fan speed and may damage the motor.
   - To re-tension belts, turn OFF power to the fan motor.
   - Loosen all fasteners that hold the blower motor plate to the blower housing.
   - Rotate the motor to the left or right to adjust the belt tension. Belt tension should be adjusted to allow 1/64” of deflection per inch of belt span. Use extreme care when adjusting V-belts as not to misalign pulleys. Any misalignment will cause a sharp reduction in belt life and produce squeaky noises. Over-tightening will cause excessive belt and bearing wear as well as noise. Too little tension will cause slippage at startup and uneven wear.
   - **Whenever belts are removed or installed, never force belts over pulleys without loosening motor first to relieve belt tension.** When replacing belts, use the same type as supplied by the manufacturer. On units shipped with double groove pulleys, matched belts should always be used.
2. All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.

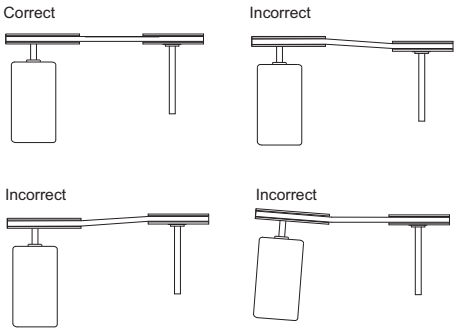
Belt tension examples:

- Belt span 12” = 3/16” deflection
- Belt span 32” = 1/2” deflection

Figure 34 - Pulley Alignment/Belt Tension

A. Belt Span Length
B. Deflection
C. Center Distance





100% Profile Adjustments & Test/Balance

Test and Balance

The burner profile area has been set according to the design conditions submitted with the order. At the design SCFM, the profile pressure drop will be 0.45 in w.c. Any variations of the design conditions will lead to a variance of the unit's CFMs. Increase or decrease the RPMs as needed to achieve the design burner profile pressure drop, or follow the below profile adjustments. An accurate duct traverse is not possible without an adequate length of straight ductwork available.

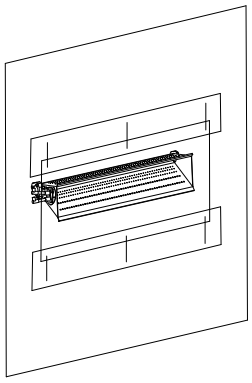
WARNING!
Disconnect power and close all gas valves before and while making burner profile adjustments.

Single-Speed Profile

The pressure drop should be checked with the burner OFF if ambient temperature is greater than 60 degrees Fahrenheit. If the ambient temperature is lower than 60 degrees Fahrenheit, the burner should be operating and discharging approximately 70 degrees Fahrenheit. Use the HMI to check profile pressure differential. Use the HMI to verify profile pressure differential, go to **Service > Variable Values > Inputs > Onbd Prof PS**.

- If the pressure drop is too low, adjust the profile opening to be smaller, which will increase the pressure drop.
- If the pressure drop is too high, adjust the profile opening to be larger, which will decrease the pressure drop

Figure 35 - Single-Speed Profile

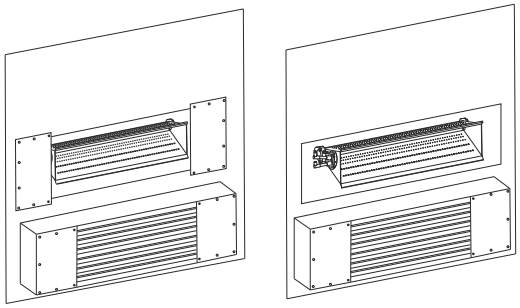


Variable Air Volume Profile

The direct-fired gas make-up heater requires the correct airflow velocity across the burner. The airflow sensor monitors the profile pressure differential and will open the burner circuit if the pressure difference is not within the allowed range. The airflow sensor has low and high pressure settings for variable air volume units. The pressure drop should not be near the minimum and maximum of the airflow sensor. Profile adjustment may be required to fine-tune the burner profile pressure drop. See the specifications and instructions below on air balancing a 100% fresh air heater.

- In low speed, adjust the burner profile opening smaller to increase pressure drop or larger to lower pressure drop.
- In high speed, adjust the bypass damper opening larger to decrease the pressure drop and smaller to increase the pressure drop.

Figure 36 - VAV Profile



80/20% Air Balancing

The direct-fired gas make-up heater requires the correct airflow velocity across the burner. The burner profile opening creates a pressure drop, which increases the air velocity across the burner. The airflow sensor monitors the pressure difference, and will open the burner circuit if the pressure difference is not correct. The airflow sensor has low and high pressure settings. The pressure drop should not be near the minimum and maximum of the airflow sensor. Balancing may be required to fine-tune the burner profile pressure drop. The airflow pressure drop should be checked in fresh and return air modes on the recirculating heaters. Refer to **Table 8** for airflow specifications.

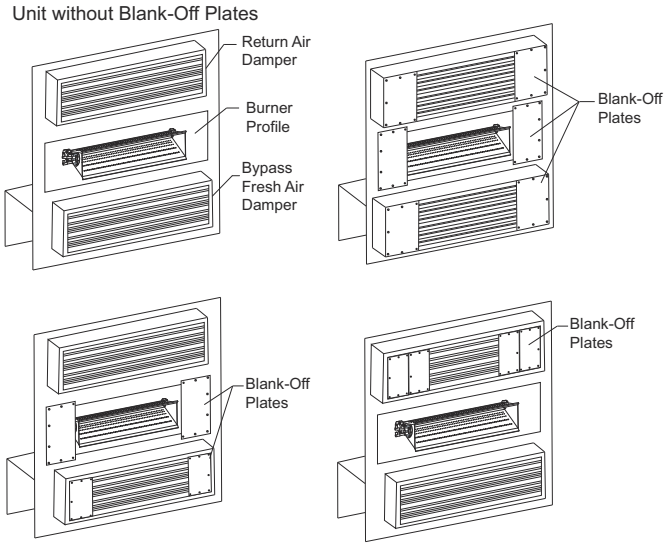
Table 8 - Recirculating Airflow Sensor

Airflow Sensor P/N	Low Setting Inches W.C.	High Setting Inches W.C.	Target Pressure Drop Inches W.C. Natural Gas	Target Pressure Drop Inches W.C. Propane Gas
HIH8131-000-001	0.15”	0.95”	0.45”-0.65”	0.45”-0.65”

The pressure drop should be checked with the burner off or operating at 70-degree discharge if ambient temperature is less than 65 degrees. With the blower On, use the HMI to verify profile pressure differential. Go to **Service > Variable Values > Inputs > Onbd Prof PS**. This should be repeated in fresh and return air modes.

WARNING!
Disconnect power and close all gas valves before and while making burner profile adjustments.

Figure 37 - Blank-Off Plates



The heater’s profile and damper openings are sized to the unit’s designed airflow. While balancing the unit to jobsite static pressures the profile and damper blank-off plates may need to be moved to achieve the correct airflow pressure drop. Refer to **Figure 37**.

If the pressure drop is too high in fresh and return air mode, remove or adjust the bypass fresh air and return air damper blank-off panels. This will decrease the pressure drop. If the correct airflow pressure drop is still not achieved, adjust the blower drives to decrease blower RPM.

If the pressure drop is too low in fresh and return air mode, add more blank-off panels to the burner profile opening and bypass fresh air and return air damper, which will increase the pressure drop. There must be at least 2 inches of area minimum around the burner. If the correct airflow pressure drop is still not achieved, adjust the blower speed to increase the blower’s RPM.

If the pressure drop is too high in fresh mode only, remove or adjust the bypass damper blank-off panels, which will decrease the pressure drop. The return air damper opening may need to be adjusted to maintain the correct airflow pressure drop when switching back to return air mode.

Modulating Gas System

The Maxitrol Modulating Gas System is directly controlled from the MUA (Make-Up Air) Board at connector J32 pin 7(+) and 16(-). A modulating 0-24V DC signal is utilized to modulate the gas valve signal. The signal is a 16 kHz full-wave rectified signal.

The RTC Modulating Gas System is directly controlled from the MUA Board at connectorJ7 pin 6. A modulating 2-10V DC signal is utilized to modulate the gas valve signal.

The Modulating Gas System consists of an Intake Temp Sensor, a Discharge Temp Sensor, a Space Temp Sensor (only on space temperature control options), and modulating gas valve(s). The intake air sensor, the space sensor, or a combination of the two can be used to give a call for heat signal to the MUA Board.

The MUA board uses a PID loop and checks the difference between the temperature sensor readings in order to modulate the heat appropriately.

- For kitchen MUA heating applications, intake air set point should be set at 45°F, whereas the discharge set point should be set at 55°F. The defaults may be adjusted per field conditions.
- For all other applications, the set point should be set appropriately based on end-user preferences and on-site conditions.

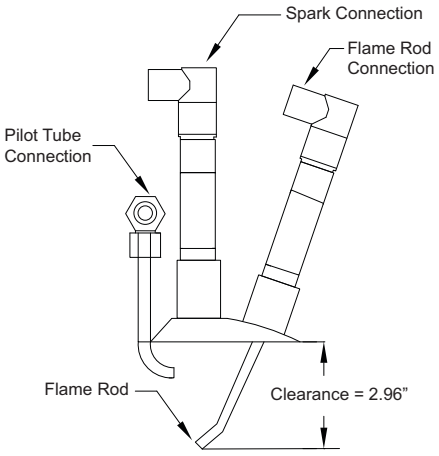
High Temperature Limit

One of the backup safety devices is the high-temperature limit lockout. This temperature sensor measures the temperature inside the unit, downstream of the burner. If the factory-set temperature of 175°F/150°F (Recirc) is exceeded, it will signal the FSC to turn off the burner. This requires a manual reset of the high-temperature limit. Refer to **“Resetting Unit” on page 77**.

Pilot Adjustment

1. Restart the fan and check the gas supply pressure at the inlet gas gauge upstream of all electronic valves. The inlet pressure should be **7 inches wc - 5 psi**. If the inlet pressure is too high, install an additional pressure regulator external to the unit.
2. Open the field-installed manual gas shut-off valve.
3. Close the ball valve located inside the cabinet.
4. Call for heat using the HMI **Service > Test Menu > Test Heating > High Fire.** If the pilot does not light, purge the pilot line. If air purging is required, disconnect the pilot line at the outlet of the pilot valve.
5. Check the **pilot flame voltage** on the HMI. The voltage reading should be **12V-15V DC**. The Flame LED on the Flame Safety Controller should be illuminated too. A weak pilot flame can be caused by low gas pressure or a dirty pilot orifice.
6. To adjust the pilot flame, remove the cap from the pilot adjustment screw on the combination gas valve, refer to **Figure 12**. Increase the pilot gas flow by turning the screw counter-clockwise. Decrease the pilot gas flow by turning the screw clockwise. The flame signal voltage should read **12V-15V DC** on the HMI under **Service > Test Menu > Test Heating**.
7. Once the pilot has been established, open the main manual gas shut-off valve downstream of the electronic valves. Verify the main gas valve opens and gas flows to the burner.

Figure 38 - Pilot Assembly



Airflow Sensor

The MUA Board contains an onboard pressure sensor (**Figure 39**) for airflow monitoring. There are both high and low **airflow tubing connections** connected to a sensor, measuring the pressure drop across the burner. This is to verify that there is proper airflow across the burner and proper combustion at all times. For units with VAV Bypass Damper airflow 0.15 to 0.65 inch wc. For units without VAV Bypass Damper airflow 0.15 to 0.95 inch wc.

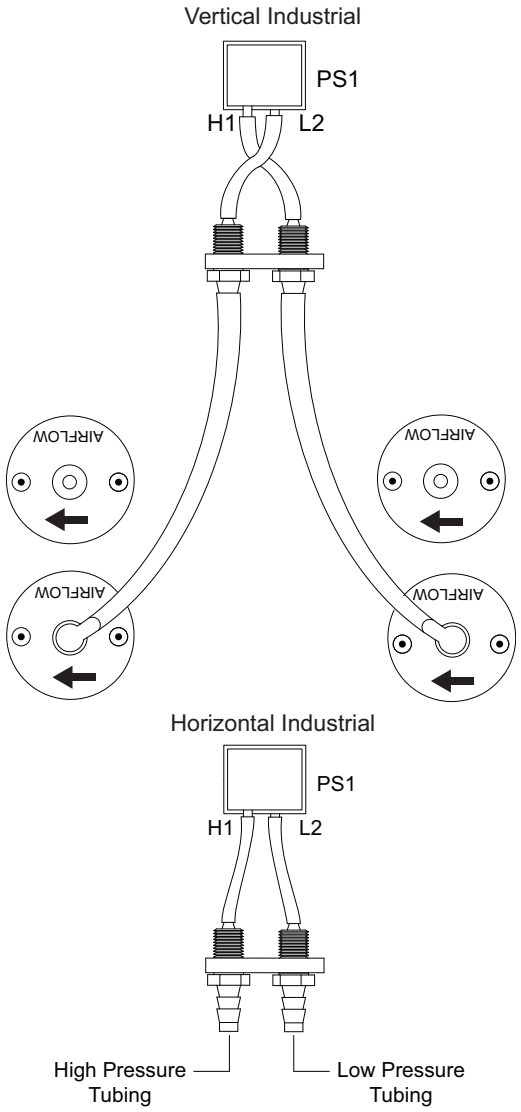
There are two airflow tubes in the heater, located near the burner and profile plate assembly (profile plates surround the burner and control air into the burner section).

In the case of a broken belt, blocked intake, excessive duct or static pressure, the correct burner differential pressure may not be achieved. This will prevent the low airflow sensor to close. The airflow sensor protects against profile plate failures that cause excessive airflow through the burner. In the event that the pressure drop across the burner is not in the range of the airflow sensor, gas flow to the burner is stopped by the Flame Safety Control.

NOTE: With the blower running, verify the airflow pressure reading is a positive value. Reverse the airflow tubes if the reading is negative.

To view burner profile pressure on the HMI, go to **Service > Variable Values > Inputs > Onbd Prof PS**.

Figure 39 - Board Airflow Sensor



Sequence of Operation

To better understand the heater, it is easier to break the unit out into smaller individual systems. There are two main systems, a make-up air fan and a heater. The make-up air fan consists of a blower and motor. The heater may be further broken down into two control systems, the Flame Safety Control (FSC) and the Modulating Gas System (MGS). The burner mixes air with the gas (Natural or LP), which heats the air.

Flame Safety Control

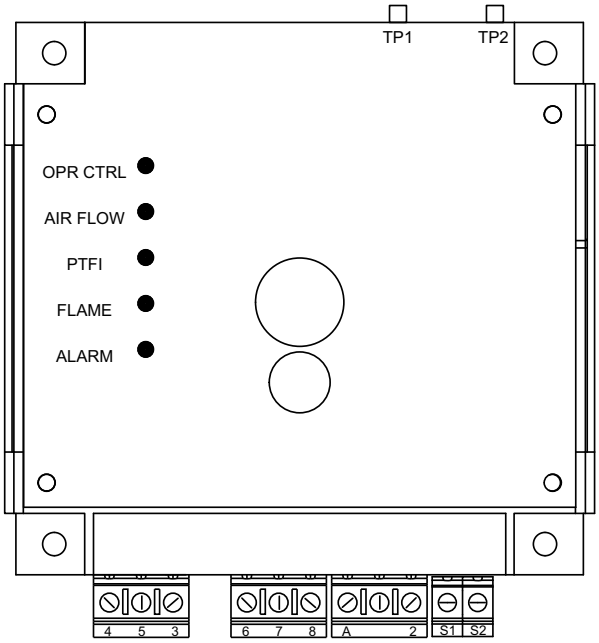
The first system to understand is the Flame Safety Controller (**Figure 40**). The FSC is there ***only*** to monitor the flame, **NOT** to control the temperature. The FSC uses a flame rectification sensor mounted on the pilot assembly to detect the presence of flame in the burner.

Flame strength and presence can be measured at the FSC by reading the rectified flame signal. Use a DC voltage meter, attach meter leads to the test jacks (TP1 and TP2) on the top edge of the FSC. Flame is present when DC voltage reads between 6 and 18V DC. Ideal flame intensity produces a signal of 12V DC or higher. Flame signal may also be read on the HMI by entering **Service > Variable Values > Inputs > Flame Sensor**.

The board monitors the flame signal voltage at connector J32 pin 6 (+) and 15 (-). The FSC receives an airflow signal from the MUA Board, which tells it whether there is proper airflow through the unit (not *just* any airflow, but *proper* airflow). Proper airflow occurs; for units with VAV Bypass Damper: airflow 0.15” wc to 0.65” wc. For units without VAV Bypass Damper: airflow 0.15” wc to 0.95” wc.

When the airflow through the heater produces differential pressure in this range, the FSC indicates so by illuminating the AIRFLOW LED. The FSC controls the opening of the redundant solenoid gas valves and the operation of the spark igniter to initiate a pilot flame upon start-up.

Figure 40 - Flame Safety Controller

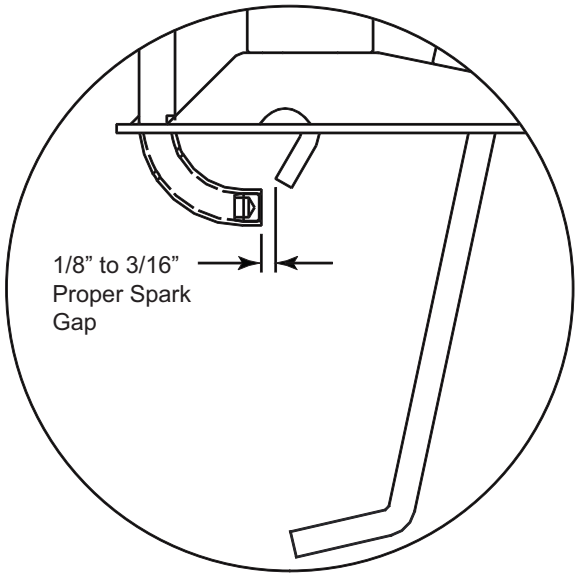


DC Voltage	Flame Status
0 to 5V DC	No Flame
6 to 11V DC	Weak Flame
12 to 18V DC	Strong Flame

The **OPR CTRL** LED indicates that there is power to the FSC. Next, the **AIRFLOW** LED will come on if there is proper airflow through the unit. Third, the unit will pause to purge any gases or combustible vapors before attempting flame ignition. Then, there is a Pilot Trial For Ignition (PTFI), and the **PTFI** LED comes on. During PTFI, the FSC opens the pilot gas valve and allows gas to flow to the pilot assembly. At the same moment, the spark igniter is started, causing the spark to ignite the pilot gas. When the flame rod sensor detects the flame, it turns on the **FLAME** LED, turns off the PTFI LED, and powers the modulating gas system. This is the system's normal operating mode. The FSC continues to monitor the flame and airflow. Once this occurs, the unit is in the main flame cycle and thus powers the main gas valve and the modulating gas system. This is the normal operating mode. The FSC continues to monitor the flame and airflow.

The last LED on the FSC is the **ALARM** LED. The alarm will turn on when the FSC determines an unsafe condition has occurred and will not allow the unit to recycle for heat until it has properly been reset. Anytime the FSC goes into "Alarm" mode, the issue must be diagnosed and corrected to avoid further lockouts after resetting. If the unit fails to light the first time, the unit will try one more time before locking out. This retry will not occur if the No FSC reset option is enabled. To begin troubleshooting, or to reset the FSC, refer to **"Resetting Unit" on page 77**.

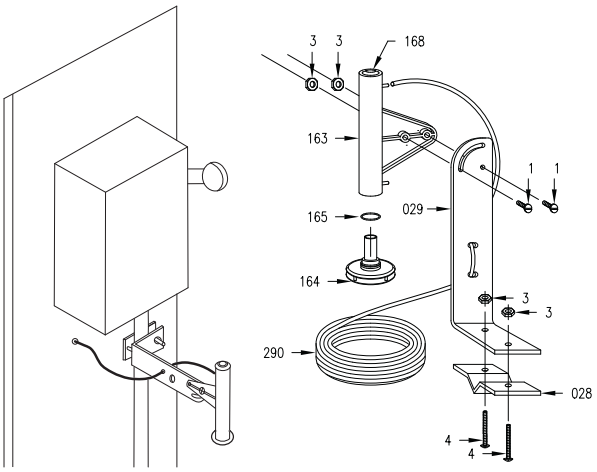
Figure 41 - Proper Spark Gap



Static Pressure Sensor Installation

For indoor mounted units using pressure control, the A-306 kit (**Figure 42**) should be used for sensing outside pressure. Use the installation instructions shipped with the sensor kit for installation guidance.

Figure 42 - A-306 Sensor



Item Number	Description
1	10-32 x 1/2” Machine Screw (2)
3	10-32 Nut (4)
4	10-32 x 1-3/4” Machine Screw (2)
028	Antenna Clamp
029	Mounting Bracket
163	Pick Up Body
164	Static Pressure Plates
165	“O” Ring Seal
168	Hole Plug
290	Tubing - 50’

Component Check/Testing

Clogged Filter Switch (PS-10)

1. The vent tube should be connected to the low side port (**Figure 43**). A fault will occur when the switch senses a negative pressure.
2. If the “Clogged Filters” fault is active:
   - Check the filters. If the filters are clogged or damaged, replace as needed. Check for any other obstructions in the unit.
   - Verify the electrical connections are secure and tight. Verify vent tube is not pinched or damaged.
   - When the unit is powered ON:
     - There should be **24-28V AC** at connector J13 pin 5 to ground. If the voltage reading is incorrect, check the wiring harness and voltage at the circuit board.
     - There should be **0V AC** at connector J13 pin 12 to ground. If there is voltage at pin 12, check the adjustment of the switch.

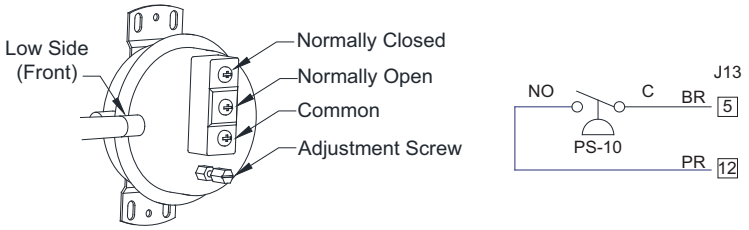
Clogged Filter Switch Field Adjustment

Follow these steps if performing a part replacement, or to calibrate the switch.

- Install the switch. Install the vent tube on the low side port.
- Install the electrical connections. Power the unit ON. Set dampers to 100% open for outdoor air. Monitor the HMI screen.
- Use a screwdriver to turn the adjustment screw clockwise until it is completely seated in the switch. Use material suitable to block 50-75% of the intake from the outside of the unit.

Turn the adjustment screw counter-clockwise in one turn increments (waiting 3 seconds per adjustment) until the “Clogged Filters” fault is active. Turn the adjustment screw a 1/4 to 1/2 turn clockwise until the fault is no longer active.

Figure 43 - Clogged Filter Switch

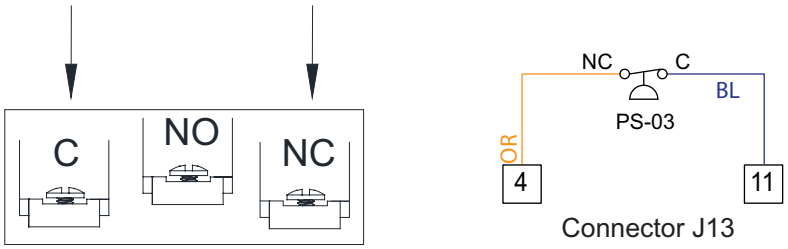


High Gas Pressure Switch (PS-03)

1. Turn the unit ON. Reset the lever on the switch. Gas pressure must be lower in the chamber for the reset latch to be set properly. Verify the high gas pressure switch is set to **12 in. w.c.**
2. Remove the cover. Make sure the wiring is set up for Normally Closed (N.C.) contact (**Figure 44**).
3. Verify the ON/OFF gas valve, and modulating valve are set properly. Refer to **"Gas Train Start-Up Procedure" on page 57**.
4. Check for voltage:

- Back probe connector J13 pin 4 to ground. There should be **24-28V AC**.
- Back probe connector J13 pin 11 to ground. There should be **24-28V AC**.
  - If the voltage reading is incorrect, check the wiring for an open or short circuit. If the wiring is correct, the switch has failed. Replace the switch.
  - If the voltage reading is correct, and the switch reset corrected the fault, there may have been an intermittent fault.

Figure 44 - High Gas Pressure Switch



Low Gas Pressure Switch (PS-04)

1. Turn the unit ON. Verify the inlet pressure gauge is reading the correct pressure.

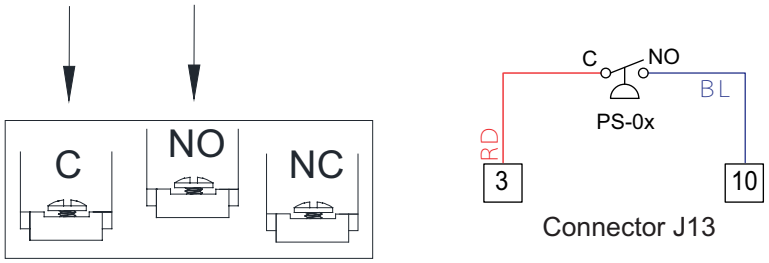
- Natural gas - **7 in. w.c. – 14 in. w.c**.
- Propane - **11 in. w.c. – 14 in. w.c.**

NOTE: If the reading is incorrect, contact the gas supply company.

2. Reset the lever on the switch. Gas pressure must be higher in the chamber for the reset latch to be set properly. If the reset did not work, continue with the next step.
3. Remove the cover. Make sure the wiring is set up for Normally Open (N.O.) contact (**Figure 45**).
4. Check for voltage:

- Back probe connector J13 pin 3 to ground. There should be **24-28V AC**.
- Back probe connector J13 pin 10 to ground. There should be **0V AC**.
  - If the voltage reading is incorrect, check the wiring for an open or short circuit. If the wiring is correct, the switch has failed. Replace the switch.
  - If the voltage reading is correct, and the switch reset corrected the fault, there may have been an intermittent fault.

Figure 45 - Low Gas Pressure Switch



TROUBLESHOOTING

The troubleshooting section lists causes and corrective actions for possible problems with the equipment. Review this section prior to consulting the manufacturer.

Airflow Troubleshooting Chart

Problem	Potential Cause	Corrective Action
Fan Inoperative	Blown fuse/Open circuit breaker	Check amperage.
		Check fuse, replace if needed.
		Check circuit breaker.
	Disconnect switch in “OFF” position	Place switch to the “ON” position.
	Incorrect wiring to motor	Inspect motor wiring. Verify connections with wiring diagram located on fan motor.
	Motor starter overloaded	Check amperage.
		Reset starter.
Motor Overload	Incorrect fan rotation	Verify that the fan is rotating in the direction shown on rotation label.
	Fan speed is too high	Reduce fan RPM.
	Incorrect wiring to motor	Inspect motor wiring. Verify connections with wiring diagram located on fan motor.
	Overload in starter set too low	Set overload to motor’s FLA value.
	Motor HP too low	Determine if HP is sufficient for job.
	Duct static pressure lower than design	Reduce fan RPM.
Insufficient Airflow	Incorrect fan rotation	Verify that the fan is rotating in the direction shown on rotation label.
	Poor outlet conditions	Check duct and connections. There should be a straight duct connection to the outlet.
	Intake damper not fully open	Inspect damper linkage. If the linkage is damaged, replace damper motor.
	Duct static pressure higher than design	Check ductwork. Adjust/resize to eliminate or reduce duct losses.
	Blower speed too low	Increase fan RPM. Do not overload motor.
	Supply grills or registers closed	Open/Adjust.
	Dirty/clogged filters	Clean filters. Replace filters if they cannot be cleaned or are damaged.
Excessive Airflow	Fan speed is too high	Reduce fan RPM.
	Filters not installed	Install filters.
	Duct static pressure lower than design	Reduce fan RPM.
Excessive Vibration and Noise	Damaged/Unbalanced wheel	Replace wheel.
	Fan is operating in unstable region of fan curve	Refer to performance curve for fan.
	Bearings need lubrication/Damaged bearing	Lubricate bearings, replace if damaged.
	Fan speed is too high	Reduce fan RPM.
	Dirty/oily belt(s)	Clean belt(s).
	Belt(s) too loose	Adjust, replace if necessary.
	Worn belt(s)	Replace belt(s).
	Misaligned pulleys	Align pulleys.

Burner Troubleshooting

Problem	Potential Cause	Corrective Action
Pilot Does Not Light/Stay Lit	Main gas is off	Open main gas valve.
	Air in gas line	Purge gas line.
	Dirt in pilot orifice	Clean orifice with compressed air.
	Gas pressure out of range	Adjust to proper gas pressure.
	Pilot valve is off	Turn pilot valve on.
	Leak at pilot orifice	Tighten pilot orifice.
	Excessive drafts	Redirect draft away from unit.
	Safety device has cut power	Check limits and airflow sensor.
	Dirty flame sensor	Clean flame sensor.
	Defective flame rod	Replace flame rod.
	No call for heat	Adjust heat set point.
	No spark at igniter	Check wiring, sensor, and ignition controller. Check spark gap, refer to **Figure 41 on page 67**.
Main Burner Does Not Light (Pilot is lit)	Defective valve	Replace combination valve.
	Loose valve wiring	Check wiring to valve.
	Shut-off valve closed	Open shut-off valve.
	Defective flame safety controller	Replace flame safety controller.
	Pilot fails as main gas valve opens, and main gas flows.	Plug the first burner port next to the pilot gas tube with burner cement.
Not Enough Heat	Main gas pressure too low	Increase main gas pressure - do not exceed 5 PSI.
	Too much airflow	Decrease airflow if possible.
	Burner undersized	Check design conditions.
	Gas controls not wired properly	Check wiring.
	Heat set point too low	Increase heat set point.
	Faulty HMI Sensor	Replace HMI.
	Faulty Discharge Sensor	Check wiring. Replace sensor.
	Unit locked into low fire	Check wiring.
Too much heat	Defective modulating gas valve	Check/replace modulating valve.
	Heat set point too high	Decrease heat set point.
	Unit locked into high fire	Check wiring.
	Faulty HMI Sensor	Replace HMI.
	Faulty Discharge Sensor	Check wiring. Replace sensor.

Flame Safety Service

Troubleshooting Tips

- Verify that there is a solid earth ground wire brought to the panel that the Fireye base is mounted to.
- In a rectification system, verify that terminal S1 is connected to an earth ground connection. Confirm that the flame rod is aligned so it does not droop near the ignition spark.
- Confirm that there is no measurable voltage present between the ground screw and terminal 2 (neutral).
- Confirm that the 120 volt AC supply has its neutral leg earth grounded at the supply, (floating isolation transformers can cause problems).
- Confirm that the ignition transformer's secondary winding is connected to an earth ground connection. The grounding method is usually through the transformer case. Dirt, paint, loose mounting hardware, etc., can all be factors.
- There may be a problem with transients in the main power supply. If you think this may be the problem, you may want to run a ground wire directly from the pilot assembly back to the electrical panel where the Fireye control is mounted.

Situation #1 - Normal Lockout - If there is NO HEAT. Check OPR CTRL (Operator Control) and ALARM LED are on. Use the HMI to check flame voltage, there should be 6-18V. Shut the gas supply valve off. Wait 5 minutes. Reset control.

1. Is there a call for heat? If there is a call for heat, go to step 2. If there is not a call for heat, adjust set points to make the unit call for heat.
2. Did the OPR CTRL LED come on? If the LED did come on, go to step 3. If the LED did not come on, go to Situation #2.
3. Did the airflow LED come on? If the LED did come on, go to step 4. If the LED did not come on, go to Situation #3.
4. Did the PTFI (Pilot Trial For Ignition Period) LED come on after a suitable delay? If the LED comes on after a suitable delay, go to step 5. If the LED did not come on after a suitable delay, replace the FSC-01 board.
5. Did the FLAME LED come on? If the flame LED did come on, go to step 6. If the LED does not come on, go to step 8.
6. Did the PTFI LED go off after a suitable delay? If the LED did go off after a suitable delay, go to step 7. If the LED did not go off after a suitable delay, replace the FSC-01 board.
7. Is the system running? If the system is running, the reset was successful. If the system is not running, repeat Situation #1.
8. Check for a 120V AC across the following pins:
   - Pins 2 and 3 (Pilot voltage)
   - Pins 2 and 4 (Ignition voltage)
   - Pins 2 and 5 (Main voltage)

   If the voltage is incorrect, check wiring and connections to the FSC-01 board. If the connections and wiring are correct, replace the FSC-01 board. If the voltage is correct, go to step 9.
9. Check the flame on the burner. If the flame is weak, make proper burner adjustment. If the flame is strong, go to step 10.

CAUTION: When powered on, depending on voltage connection, there may be 260V AC across S1, S2; 560V AC across S1, S2.

10. Verify that the S1 and S2 wiring connections are secure and tight. Check for AC voltage across pins S1 and S2. If the voltage is correct, replace the FR-01 (Flame Rod). If the voltage is incorrect, replace FSC-01 board.

Situation #2 - No Heat, no LED's on.

1. Check for 120V AC across the following pins:
   - Pins 1 and 2
   - Pins 2 and 7

   If the voltage reading is correct, go to step 2. If the voltage reading is incorrect, go to step 3.
2. Check wiring to the FSC-01 board. Check for loose or broken wires. If damaged wiring or loose connections are found, repair or replace. If the wiring and connections are okay, replace the FSC-01 board.
3. Check breaker or FSC-01 board fuse. If the breaker tripped, reset breaker. If the fuse is blown, replace the FSC-01 board. If there are no faults found with the breaker or fuse, check system wiring.

Situation #3 - No Heat, check OPR CTRL (Operator Control) LED is on.

1. Check for 120V AC across the following pins: Pins 2 and 8
   If the voltage reading is correct, go to step 2. If the voltage reading is incorrect, replace the FSC-01 board.
2. Is the blower on? If the blower is on, go to step 3. If the blower is not on, check the blower system.
3. Check for 120V AC across the following pins: Pins 2 and 6

   If the voltage reading is correct, replace the FSC-01 board. If the voltage reading is incorrect, check the airflow sensor and tubing.

Situation #4 - No Heat, check OPR CTRL (Operator Control), FLAME ON and ALARM LED are on.

1. Is the flame present in the burner? If the flame is not present, go to step 2. If the flame is present, check the burner's wiring, and check the gas valves.
2. Is the flame LED on? If the flame LED is not on, refer to Situation #1. If the flame LED is on, replace the FSC-01 board.

HMI Fault Codes

Fault	Potential Cause	Corrective Action
Fire Detect	The board is receiving an input from the fire detector.	Possible fire present.
		Check wiring. Repair broken or loose wiring connections.
		Faulty fire detector, replace fire detector.
Smoke Detect	The board is receiving an input from the smoke detector.	Verify the smoke detector functionality.
		Check wiring. Repair broken or loose wiring connections.
		Faulty smoke detector, replace smoke detector.
Supply Overload/ Exhaust Overload	Motor overload has tripped.	Check motor for debris.
		Check contactor/motor wiring connections.
		Check overload reset button.
		Check overload amperage setting.
		Check motor bearings.
Master ROM CRC	Software mismatch.	Contact technical support.
Flame Lockout	The Flame Safety Control (FSC) verifies that airflow is sensed by the airflow sensor.	Verify spark gap. Refer to **Figure 41 on page 67**.
		Faulty flame rod.
		Faulty FSC, replace FSC.
Max FSC Cycles Fault	FSC cycles on and off greater than 20 times in 60 minutes.	Verify heating activation, check for faulty Space/ Intake/Discharge sensor.
Intake Firestat	Intake temperature exceeds the firestat set point.	Inspect intake area of the unit for unexpected heat source.
		Reset fault with HMI.
Discharge Firestat	Discharge temperature exceed the firestat set point.	Check for faulty regulators or modulating valves.
		Reset fault with HMI.
		Inspect discharge area of the unit for unexpected heat source.
Freezestat	The discharge temperature was below the freezestat temperature set point for the duration of the freezestat timer set point.	Check gas pressure.
		Check for proper burner firing.
		Check discharge sensor values. Go to **Service > Temperatures> Discharge**.
		Reset fault with HMI.
High Temp Limit	Unit discharge temperature exceeds maximum limit.	Check for proper airflow.
		Measure discharge sensor (ohm reading should be 10k @ 77°F).
Fireye Alarm	Fireye detected improper burner operation.	Gas is off, turn gas on.
		Faulty ignition transformer, replace transformer.
		Faulty Fireye, replace Fireye.
		Improper flame/lighting, refer to **"Burner Troubleshooting" on page 71**.
Fireye Main	Output signal is lost between the Fireye and main gas valve during heating operation.	Check wiring between connector J30-5 to Fireye. Repair broken or loose wiring connections.
		Check wiring between connector J30-6 to the main gas valve. Repair broken or loose wiring connections.

Fault	Potential Cause	Corrective Action
Gas High PS	The board lost input on the gas pressure high terminal. There should be an input when gas pressure is at the proper level.	Adjust regulator or add regulator.
		Check wiring. Repair broken or loose wiring connections.
		Faulty high pressure gas switch, replace the switch.
Gas Low PS	The board lost input on the gas pressure low terminal. There should be an input when gas pressure is at the proper level.	Check wiring. Repair broken or loose wiring connections.
		Faulty low pressure gas switch, replace the switch.
CO Alarm	The board is receiving an input from the CO detector.	Check for proper exhaust ventilation.
		Check wiring. Repair broken or loose wiring connections.
		Faulty CO detector, replace CO detector.
Supply VFD Comm	Modbus communication fault.	Check Modbus wiring and connections.
		Verify Modbus address.
		Verify Min and Max settings of the VFD to the MUA Board settings. Go to **Factory Settings > Unit Options > Blower Config > VFD Freq Limits**.
Modbus Fault VFD/MSC #	VFD or MSC not connected or powered properly.	Check Modbus connections.
		Verify Modbus address is correct on VFD or MSC.
Door Interlock	Safety feature that will shut down supply fan when door signal lost.	Verify door is closed.
		Check wiring. Repair broken or loose wiring connections.
		Faulty door switch, replace the switch.
Intake Damper End/ Discharge Damper End	End limit input not received.	Check wiring. Repair broken or loose wiring connections.
		Board damper output/input failed.
		Faulty damper, replace damper.
Supply (Blower) Air Proving	Airflow proving pressure value is less than 0.05” w.c.	Kinked/blocked/damaged hose.
		Blockage in duct.
		Confirm proper CFM.
		Faulty airflow sensor, replace sensor.
		Burner profile pressure out of range.
Low PS Fault	Profile pressure is less than low profile pressure setpoint, but greater than lower pressure limit (0.05” w.c.).	Adjust profile pressure. **Factory Settings > Unit Options > Blower Config > Air Profile Limits**.
		Increase blower speed.
		Restrict airflow by adjusting blank off plates.
High PS Fault	Profile pressure is greater than high profile pressure setpoint.	Adjust profile pressure. **Factory Settings > Unit Options > Blower Config > Air Profile Limits**.
		Decrease blower speed.
		Open airflow by adjusting blank off plates.
Clgd Fltr Mtnce	Input for clogged filters activated.	Clean or replace filters.
		Check clogged filter switch adjustment.
		Faulty switch, replace switch.

Fault	Potential Cause	Corrective Action
Missing Sensor Intake/ Discharge/Space/ Outside Air/Return	When a sensor is not wired or there is an open circuit.	Check wiring. Repair broken or loose wiring connections.
		Install missing sensor.
		Replace faulty sensor.
Broken Sensor Intake/ Discharge/Space/ Outside Air/Return	Sensor or wiring shorted to ground.	Check wiring. Repair grounded wiring.
		Faulty sensor, replace sensor.
Broken Pressure Sensor	Pinched/missing airflow tubing. Faulty airflow sensor.	Check tubing at the airflow pressure sensor on the MUA Board. Refer to **"Board Airflow Sensor" on page 65**.
RTC 1 Temp Sensor	Real-Time Clock (RTC) temperature sensor located on MUA Board.	Verify there is no damage to the MUA Board or the wiring to the MUA Board.
HMI Temp Invalid	HMI internal temperature sensor readings incorrect.	Replace HMI.
Proof of Closure	Input not received when there is a call for heat.	Check wiring. Repair broken or loose wiring connections.
		Faulty gas valve, replace gas valve.
Low Flame Voltage	The board is receiving poor flame voltage signal.	Check wiring. Repair broken or loose wiring connections.
		Improper flame. Adjust pilot and low fire settings.
		Faulty Fireye, replace Fireye.
Communication Fault - Check Configuration	HMI communication fault or software setting.	Improper software setting. If more than one HMI is installed, check all HMIs.
HMI MB Comm		Faulty Cat 5 cable, replace cable.
		Faulty HMI, replace the HMI.
CO2 Override	High source of CO2, above PPM threshold.	Check for proper exhaust ventilation.

VFD Fault List

Refer to VFD manufacturer manual for further details.

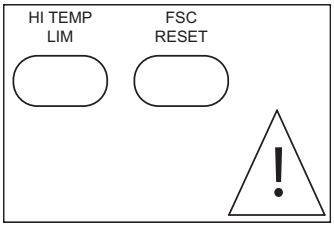
Fault Number	Description
0	No Fault
1	IGBT Temperature Fault
2	Output Fault
3	Ground Fault
4	Temperature Fault
5	Flying Start Fault
6	High DC BUS
7	Low DC BUS
8	Overload Fault
9	OEM Fault
10	Illegal Setup Fault
11	Dynamic Brake Fault
12	Phase Lost
13	External Fault
14	Control Fault
15	Start Fault
16	Incompatible Parameter Set
17	EPM Hardware Fault
18 - 27	Internal Fault
28	Remote Keypad Lost
29	Assertion Level Fault
30 - 33	Internal Fault
34	Comm. Module Failure
35 - 44	Network Fault

Resetting Unit

If the flame safety control is locked out (alarm light on), reset the unit by:

1. Press the FSC Reset push-button, refer to **Figure 46**. If pressing the reset fails, continue to step 2.
2. Turn OFF power to the unit.
3. Turn power to the unit back ON.

Figure 46 - Reset Buttons (MUA Board)



MAINTENANCE

To guarantee trouble-free operation of this heater, the manufacturer suggests following these guidelines. Most problems associated with fan failures are directly related to poor service and maintenance.

Please record any maintenance or service performed on this fan.

WARNING: DO NOT ATTEMPT MAINTENANCE ON THE HEATER UNTIL THE ELECTRICAL SUPPLY HAS BEEN COMPLETELY DISCONNECTED AND THE MAIN GAS SUPPLY VALVE HAS BEEN SHUT OFF.

General Maintenance

- Fan inlet and approaches to ventilator should be kept clean and free from any obstruction.
- All fasteners and electrical connections should be checked for tightness each time maintenance checks are performed before restarting unit.
- These units require very little attention when moving clean air. Occasionally oil and dust may accumulate, causing imbalance. If the fan is installed in a corrosive or dirty atmosphere, periodically inspect and clean the wheel, inlet, and other moving parts to ensure smooth and safe operation.
- Motors are normally permanently lubricated. **CAUTION: Use care when touching the exterior of an operating motor. Components may be hot enough to burn or cause injury.**
- If bearings require lubrication, very little is needed. A general rule is one-half pump from a grease gun for 1/2" to 1-7/16" shaft diameters and one full pump for 1-11/16" and large diameter shafts for every 1500 to 3000 hours of operation. A lithium-based grease should be used. Bearings should be rotated as they are lubricated to evenly distribute the grease, either by hand or via extended grease lines. Do not attempt to grease bearings from inside the enclosure while the motor is energized. **CAUTION: Bearings are sealed, over-greasing can cause damage to the bearings. Do not grease until grease comes out of seals. Only add the appropriate amount of grease.**

2 Weeks After Start-up

- All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.
- For belt drive units, belt tension should be checked after the first 2 weeks of fan operation. **See "Pulley Alignment/Proper Belt Tension" on page 57.**

Every 3 Months

- Filters need to be cleaned and/or replaced quarterly, and more often in severe conditions. Washable filters can be washed in warm soapy water. When re-installing filters, be sure to install with the **airflow in the correct direction** as indicated on the filter.
- All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.
- Belt tension should be checked quarterly. **See "Pulley Alignment/Proper Belt Tension" on page 57.** Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

Yearly

- Inspect bolts and screws for tightness. Tighten as necessary.
- Inspect motor for cleanliness. Clean exterior surfaces only. Remove dust and grease from the motor housing to ensure proper motor cooling. Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
- Check for gas leak and repair if present.
- Clean flame sensor by rubbing with steel wool to remove any rust build-up.
- Inspect bearings for wear and deterioration. Replace if necessary.
- Inspect belt wear and replace torn or worn belts.
- Inspect the unit assembly. Check all modules, curbs, and mounting equipment (rails/Uni-Strut).
- For heating season, inspect the burner assembly.
- For cooling season, inspect the cooling module. Refer to cooling manufacturer's recommendations.

Burner Maintenance

Burner maintenance should be performed annually when entering heating season.

- Verify the unit is off.
- Inspect the pilot assembly, refer to **“Pilot Adjustment” on page 64**. Replace if required.
- Inspect the burner plates.
- Clean the burner plates. Make sure the baffles are secure and attached to the burner.
- Clean burner with wire brush and make sure the burner ports are free of debris. Refer to **Table 9** for drill size(s) to clear ports. Wipe the burner with a clean rag.
- After cleaning the system, turn the system. Visually inspect the flame.

Table 9 - Burner Orifice Drill Size

Orifice	Drill Size
Gas Port	1/8”
Air Port	42

Emergency Shutdown of Unit

To shut down the unit in the event of an emergency, do the following:

1. Turn power OFF to the unit from main building disconnect.
2. Turn the external disconnect switch to the OFF position.
3. CLOSE the inlet gas valve located on the heater.

Prolonged Shutdown of Unit

For prolonged shutdown, the following steps should be done:

1. Turn the external disconnect switch to the OFF position.
2. CLOSE the inlet gas valve located on the heater.

To re-start the unit, the following steps should be done:

1. Turn the external disconnect switch to the ON position.
2. OPEN the inlet gas valve located on the heater.

To order Filters, Scan the QR Code:

Start-Up and Maintenance Documentation

START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED AND WITH THE HEAT ON (Warranty will be void without completion of this form)

Job Information

Job Name		Service Company	
Address		Address	
City		City	
State		State	
Zip		Zip	
Phone Number		Phone Number	
Fax Number		Fax Number	
Contact		Contact	
Purchase Date		Start-up Date	

Heater Information

Refer to the start-up procedure in this manual to complete this section.

Name Plate and Unit Information		**Field Measure Information**	
Model Number		Motor Voltage	
Serial Number		Motor Amperage*	
Hardware Rev.		RPM	
Software Rev.		Burner Differential Pressure	Inches WC
Motor Volts		Pilot Flame Signal	VDC
Motor Hertz		Low Fire Flame Signal	VDC
Motor Phase		High Fire Flame Signal	VDC
Motor FLA		High Fire Inlet Gas Pressure	Inches WC
Motor HP		Low Fire Manifold Gas Pressure	Inches WC
Min. Btu/Hr		High Fire Manifold Gas Pressure	Inches WC
Max. Btu/Hr		Thermostat Set Point	
Gas Type		Gas Type	
		Low Speed RPM**	
		High Speed RPM	
		Low Speed Differential Pressure**	
		High Speed Differential Pressure**	

*If measured amps exceed the FLA rating on the nameplate, fan RPM must be reduced to decrease the measured amps below the nameplate FLA rating. **Low speed readings used on variable air volume units.

Temperature Control	Discharge	
	Space	
Airflow Direction	Correct	
	Incorrect	
Activate Based On	Space	
	Intake	
	Both	
	Either	

Max Recirc Voltage	
Max RA %	
DP Reading	
Purge On/Off	
Dry Mode On/Off	

As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER'S website for up to date documentation.

Technical Support Information

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Technical Support

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