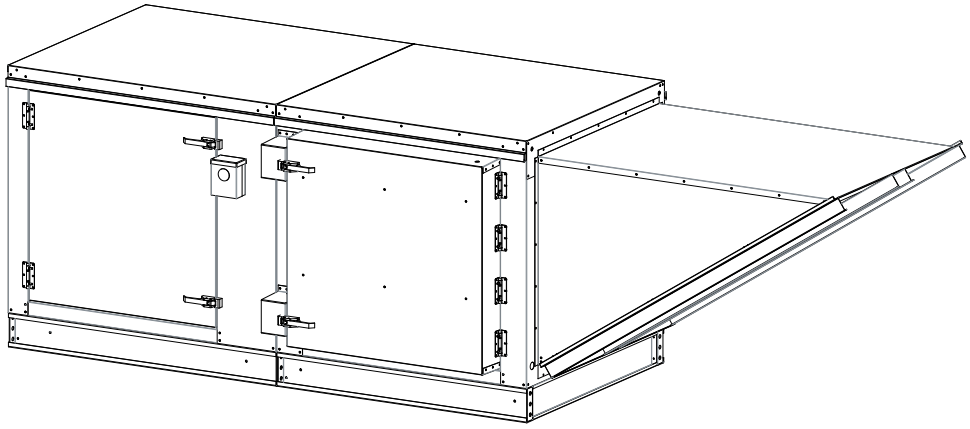
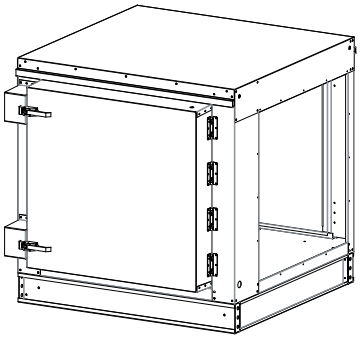
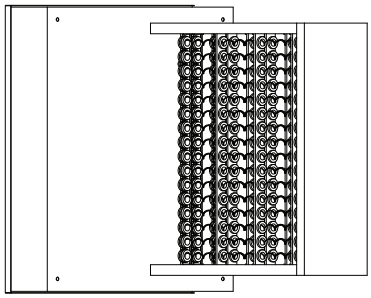
MUA Controls
Standard and Modular Electric Heater and Inserts
Installation, Operation, and Maintenance Manual



Modular Electric Heater



Electric Heat Module



Electric Insert

RECEIVING AND INSPECTION

Upon receiving unit, check for any interior and exterior damage, and if found, report it immediately to the carrier. Also check that all accessory items are accounted for and are damage free.

WARNING!!

Installation of this equipment should only be performed by a qualified professional who has read and understands these instructions and is familiar with proper safety precautions. Improper installation poses serious risk of injury due to electric shock and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. ALWAYS disconnect power prior to working on equipment.

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.

Table of Contents

WARRANTY 4
Patents 4
INSTALLATION 5
Mechanical 5
Service Clearance 5
Common Electric Heater Calculations 5
Applied vs Rated KW Factors 5
Intake Assembly 6
Curb and Ductwork 7
Roof Mount Installation 8
Duct Mount Installation 8
Indoor (Inline) Installation 9
Heat Module Add-On Installation 10
Electrical 11
Motorized Intake Damper 12
Electronically Commutated Motor Speed Control 12
External PWM Signal 12
Fan to Building Wiring Connection 14
Make-up Air (MUA) Board Connectors 15
Duct Static Pressure Control 25
Building Static Pressure Control 25
HMI, Space/Wall Sensor, and Room Temp Sensor 26
HMI (Human Machine Interface) 26
Space HMI Control Panel 27
Room Temp Sensor 27
OPERATION 28
Accessing Menu Configurations 28
General Overview 28
HMI Notification Letters 28
HMI Configuration Menu 29
Communication 29
Advanced Options 29
Status 29
About 29
Scheduling on Unit HMI 30
Scheduling on Space HMI 30
Space HMI Menu 31
Variable Frequency Drive (VFD) 47
Variable Frequency Drive (VFD) Installation 47
Input AC Power 47
..... 47
..... 47
..... 47
VFD Output Power 48
SMV VFD Programming 48
i500 VFD Programming 49
VFD Part Number/Specifications 50
START-UP OPERATION 51
Unit Start-up Procedure 51
Silicon Controlled Rectifier (SCR) Electrical Control 52
SCR Electrical Circuit Check 52
TROUBLESHOOTING 53
Airflow Troubleshooting Chart 53
HMI Fault Codes 54
VFD Fault List 56
Resetting Unit 56
MAINTENANCE 57
General Maintenance 57
2 Weeks After Start-up 57
Every 3 Months 57
Yearly 57
Unit Filters 58
Start-Up and Maintenance Documentation 60
Technical Support Information 60

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 and regulations.
3. The equipment is misused, 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.
6. The equipment is exposed to caustic or corrosive agents.

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 60** for more information.

Patents

This product may be covered by one or more of the following patent number(s): (United States) 6629523, or other U.S. and foreign patents pending.

INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow and electrical supply in accordance with this manual. If there are any questions about any items, refer to **support.captiveaire.com** or **"Technical Support Information" on page 60** for more information.

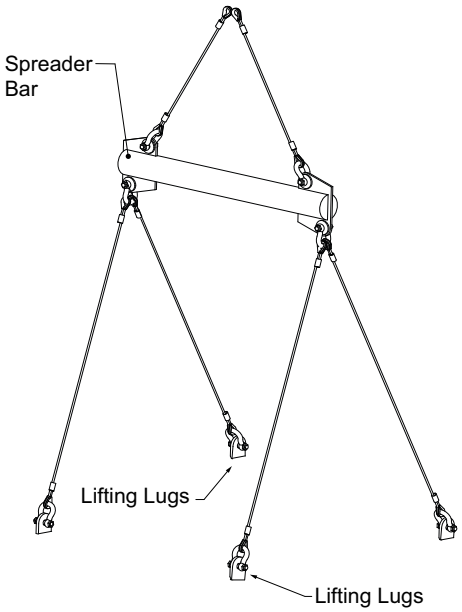
Mechanical

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.

Site Preparation

1. Provide clearance around installation site to safely rig and lift equipment into its final position (**Figure 1**). Supports must adequately support equipment. Refer to manufacturer's estimated weights.
2. Locate unit close to the space it will serve to reduce long, twisted duct runs.
3. Consider general service and installation space when locating unit.
4. Do not allow air intake to face prevailing winds. Support 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. The fan inlet shall be located in accordance with the applicable building code provisions for ventilation air.

Figure 1 - Spreader Bar



Service Clearance

Refer to **Table 1** for unit size clearance specifications. This will allow for enough clearance in the front, back, and sides of the unit for servicing and maintenance of the unit.

Table 1 - Clearance Chart

Unit Size	Clearance
1	24"
2	36"
3	42"
4	48"
5	54"

Common Electric Heater Calculations

Conversion:
1 KW = 3413

Load Requirement:
KW = (CFM x Temperature Rise) / 3160

Line Current (1 Phase):
Amperage = (KW x 1000) / Volts

Applied vs Rated KW Factors

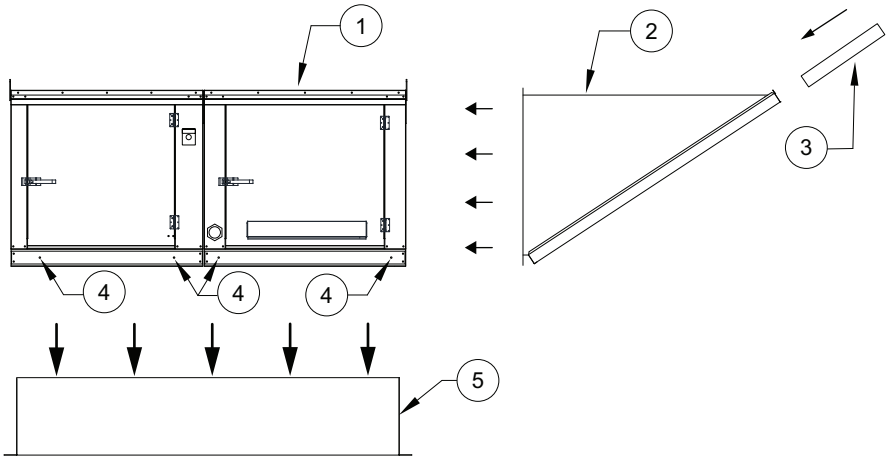
Rated Voltage	Applied Voltage							
	200	208	220	230	240	440	460	480
208	.92	1.00	1.12	1.22	1.33	-	-	-
460	-	-	-	-	-	.91	1.00	1.09
480	-	-	-	-	-	.84	.92	1.00

Intake Assembly

Intakes and curbs (**Figure 2**) are shipped on a separate skid. Upon unit arrival, perform the following steps to assemble the intake to the unit.

1. Apply silicone or weather-proof gasket on the backside of the flanges of the intake hood or V-bank intake.
2. Secure the flanges of the intake hood to the unit with the supplied sheet metal screws.
3. Use caulk on the outside of the screws to prevent water leaks.
4. If the unit is a modular unit with a V-bank or evaporative cooler section, the V-bank or evaporative cooler will bolt to the heater with the bolts provided.
5. Slide the filters down the filter track.

Figure 2 - Intake and Curb Assembly



1. Unit
2. Intake Housing
3. Intake Filter(s)
4. Unit to Curb hardware mounting location
5. Curb

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 should 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.

- **Table 2** 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.
- 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 factory-built roof curb.
- Follow curb manufacturer’s instructions for proper curb installation.
- 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.
- Secure fan to curb through vertical portion of the ventilator base assembly flange. Use a minimum of eight (8) lug screws, anchor bolts, or other suitable fasteners (not furnished). Shims may be required depending upon curb installation and roofing material.
- Verify all fasteners are secure. **Figure 3** through **Figure 5** show different mechanical installations.
- Each unit must have its own dedicated supply & return duct. Use of shared duct between multiple units is not supported and may result in airflow proving issues and/or loss of conditioning.

Table 2 - Required Supply Ductwork

Blower Size (Inches)	Discharge	Duct Size	Straight Duct Length
10	Side	14” x 14”	48”
	Down		
15D, 16Z, 18Z	Side	20” x 20”	72”
	Down	14” x 14”	48”
12	Side	16” x 16”	54”
	Down		
15	Side	20” x 20”	72”
	Down		
20D, 20Z, 22Z	Side	26” x 26”	108”
	Down	20” x 20”	72”
18	Side	24” x 24”	86”
	Down		
24D, 25Z	Side	30” x 30”	108”
	Down	24” x 24”	86”
20	Side	26” x 26”	108”
	Down		
30D, 28Z	Side	32” x 32”	168”
	Down	26” x 26”	108”
25	Side	32” x 32”	168”
	Down		
36D	Side	36” x 36”	189”
	Down	32” x 32”	168”

WARNING: ELECTRIC HEATERS HAVE TWO POWER INPUTS. THE EXTERNAL DISCONNECT INTERRUPTS POWER TO THE MOTOR AND CONTROLS ONLY. THE ELECTRIC COIL POWER IS INTERRUPTED BY THE DISCONNECT SWITCH ON THE ELECTRIC COIL DOOR.

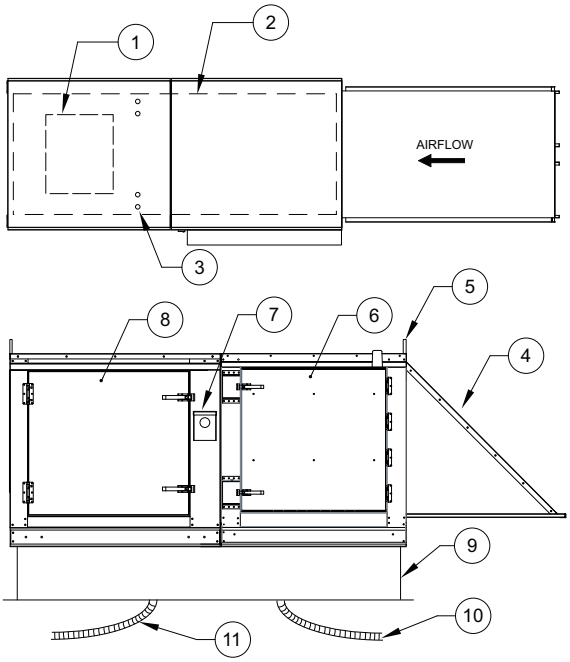
Roof Mount Installation

Note: Refer to submittal drawings for specific unit dimensions.

Figure 3 - Roof Mount Details

1. Discharge Opening
2. Curb Outer Wall
3. Flex Conduit for Field Wiring
4. Intake Housing
5. Lifting Lugs
6. Electric Heat Module
7. Service Disconnect Switch
8. Blower/Motor Access Door
9. Curb with Support Legs or Rail (20” High)
10. Control Drop
11. Motor Drop

Max. Roof Opening 2” Smaller than Curb Outside Dimension.

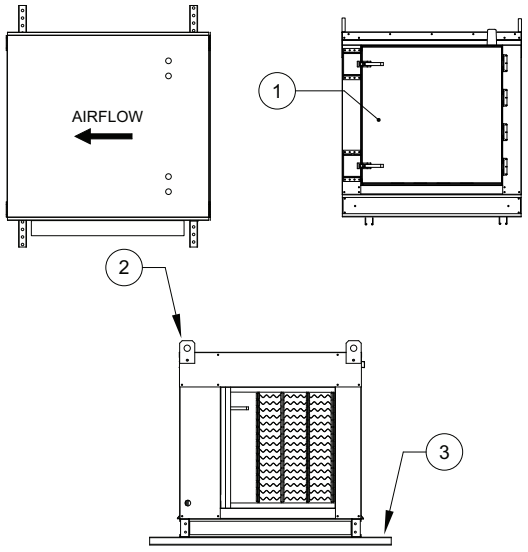


Duct Mount Installation

Note: Refer to submittal drawings for specific unit dimensions.

Figure 4 - Duct Mount Details

1. Control/Coil Access Door
2. Lifting Lugs
3. Optional Uni-Strut Base



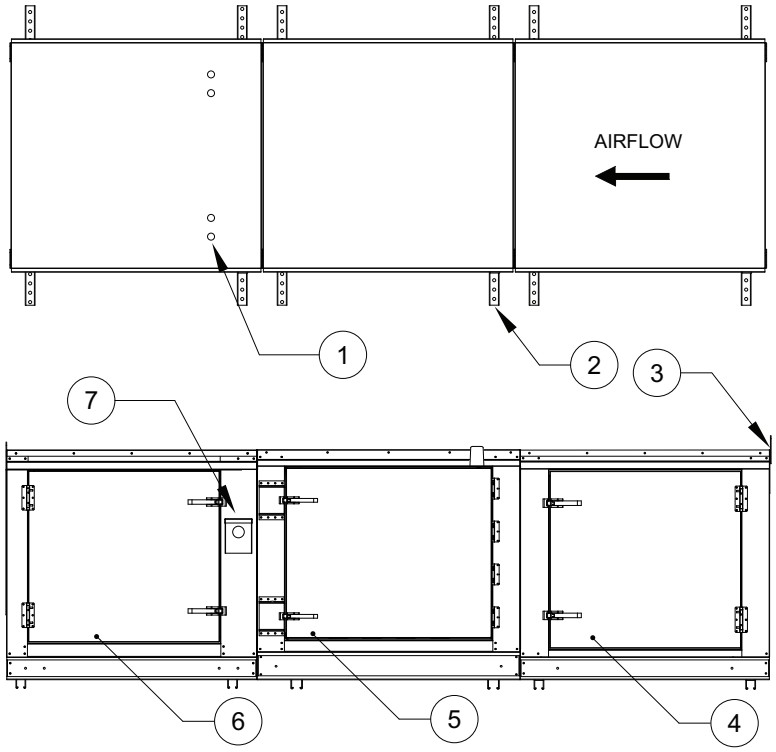
WARNING: ELECTRIC HEATERS HAVE TWO POWER INPUTS. THE EXTERNAL DISCONNECT INTERRUPTS POWER TO THE MOTOR AND CONTROLS ONLY. THE ELECTRIC COIL POWER IS INTERRUPTED BY THE DISCONNECT SWITCH ON THE ELECTRIC COIL DOOR.

Indoor (Inline) Installation

Note: Refer to submittal drawings for specific unit dimensions.

Figure 5 - Indoor Installation Details

1. Flex Conduit for Field Wiring
2. Optional Uni-Strut Base
3. Lifting Lugs
4. Filter Access Door
5. Electric Heat Module
6. Blower/Motor Access Door
7. Service Disconnect Switch

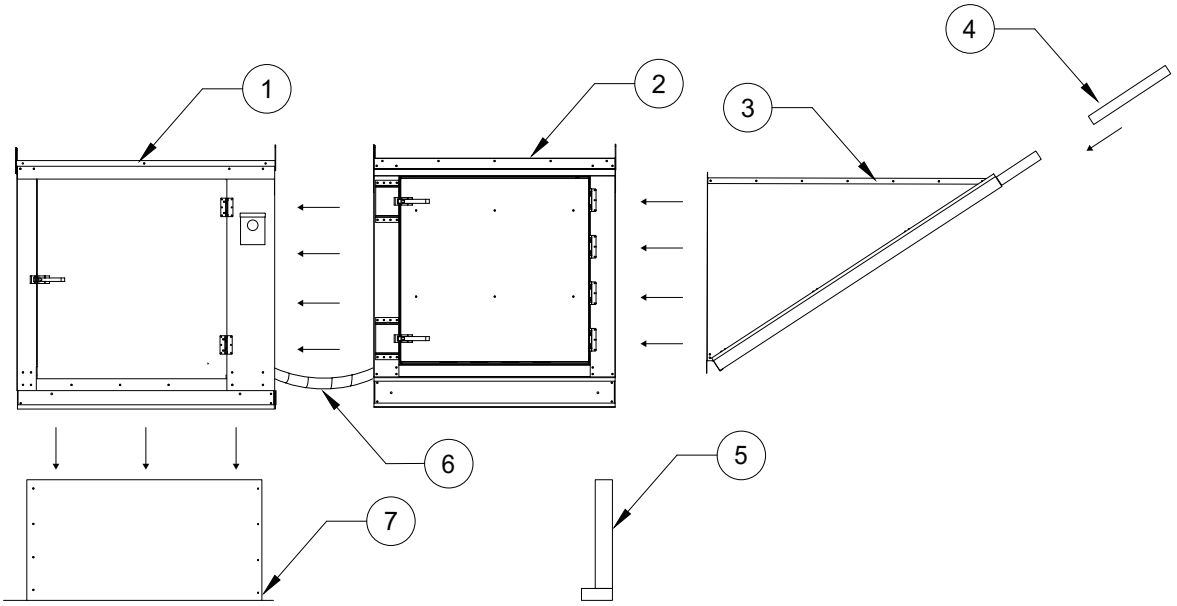


Heat Module Add-On Installation

Modular heat units (**Figure 6**) that are ordered to provide heat onto an existing blower only application require field mechanical and wiring installation.

1. Remove existing intake housing and lifting lugs from the blower section intake side.
2. Attach heat module to blower intake using the provided sheet metal screws and bolts. Tighten screws and bolts to compress the gasket between the heat module and the blower module.
3. Support and level the end of the heat module (opposite end of the blower) with the provided equipment legs/rails.
4. Attach the intake housing to the intake side of the heater module.
5. Drill a hole in the discharge of the blower large enough to insert the discharge control sensor (if provided). Install the sensor through the hole.
6. Wire the sensor and coil as indicated on the supplied wiring schematic. Route all wiring through metal conduit.
7. After the add-on installation is complete, refer to **"Unit Start-up Procedure" on page 51**.

Figure 6 - Heat Module



1. Blower
2. Electric Heat Module
3. Intake Housing
4. Filters
5. Equipment Legs
6. Conduit
7. Curb

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. An electrical drop containing the line voltage power wiring is shipped with every unit. The electrical drop should be brought through one of the conduit openings located in the base of the unit (**Figure 3**). Run the drop through the curb, and connect to a junction box inside the building.

NOTE: An electrical drop is NOT provided with units ordered as single point connection.

3. A dedicated branch circuit should supply the motor circuit with short circuit protection according to the National Electric Code. This dedicated branch should run to the junction box. Every branch circuit should include a properly sized ground connection.
4. If the unit is ordered without single point connection, **a separate power source should supply the electric coil power**. Power from the building breaker should be wired directly to the coil disconnect. This should be done using wire of the proper gauge as indicated in **Table 3**. **A hole must be drilled in the fan enclosure to properly run the electric coil power**.
5. Verify that the power source is compatible with the requirements of your equipment. The nameplate identifies the **proper phase and voltage** of the equipment.
6. 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. Refer to **Figure 3**.
7. Before connecting the unit to the building's power source, verify that the power source wiring is de-energized. Refer to schematics.
8. Secure the power cable to prevent contact with sharp objects. Verify ground connection is secure.
9. Do not kink power cable and never allow the cable to encounter oil, grease, hot surfaces, or chemicals.
10. 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.
11. 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.
12. If any of the original wire supplied with the unit must be replaced, it must be replaced with type THHN wire or equivalent.

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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.

Electronically Commutated Motor Speed Control

Electrically Commutated Motors (ECM) with speed control allow for accurate adjustments of fan speed. The benefit of EC motors is exceptional efficiency, performance, and motor life. ECMs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

External PWM Signal

The fan unit will be shipped with power wiring and communication wiring fed to an internal junction box. The fan is shipped with Shielded Twisted Pair (STP) wire, which is used for wiring to a remote PWM signal. Red wire is used to go to the positive PWM signal, and black wire is used to go to the negative PWM signal.

Reference schematics for all wiring connections. STP is connected to the communication wiring of the motor using wire nuts in the junction box. If a preset length of STP is provided, it will be connected to the junction box from the factory. Run the STP through any available knockout in the fan base.

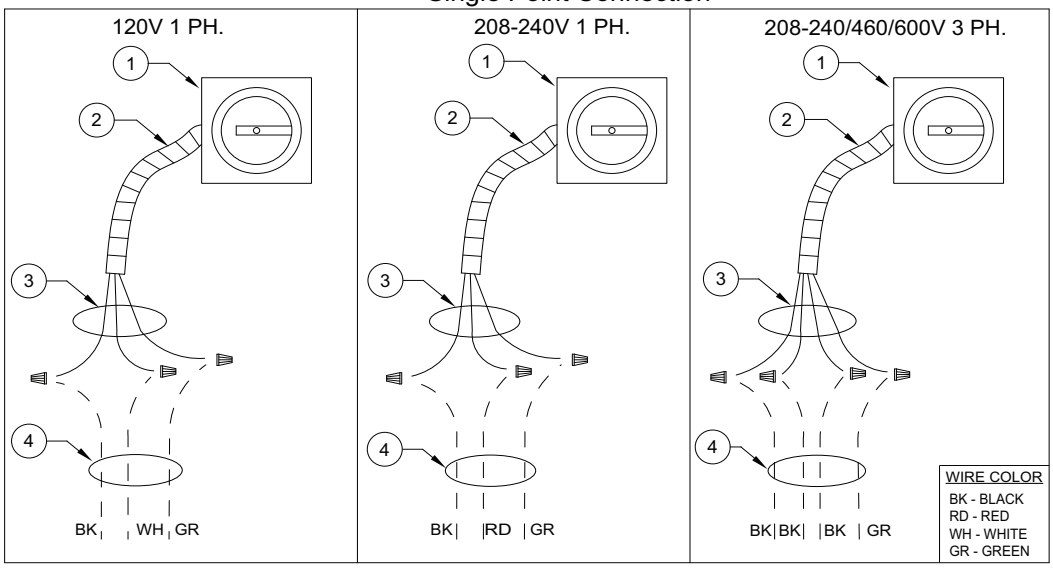
Table 3 - Copper Wire Ampacity

Wire Size AWG	Maximum Amps
14	15
12	20
10	30
8	50
6	65
4	85
3	100
2	115
1	130
1/0	150
2/0	175
3/0	200
4/0	230
250	255
300	285
350	310
400	335
500	380
600	420

Fan to Building Wiring Connection

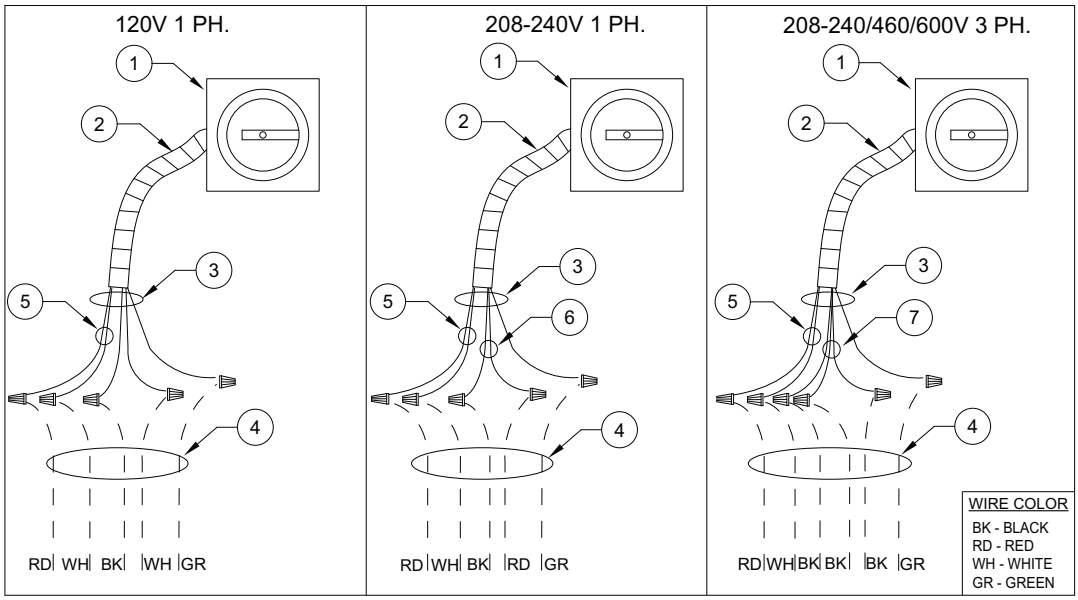
Figure 7 - Wiring Connection Details

Single Point Connection



1. Disconnect Switch
2. Galflex Conduit (In Unit)
3. Factory Wiring
4. Field Supplied Wiring - From building power or pre-wired control panel.

120V Optional

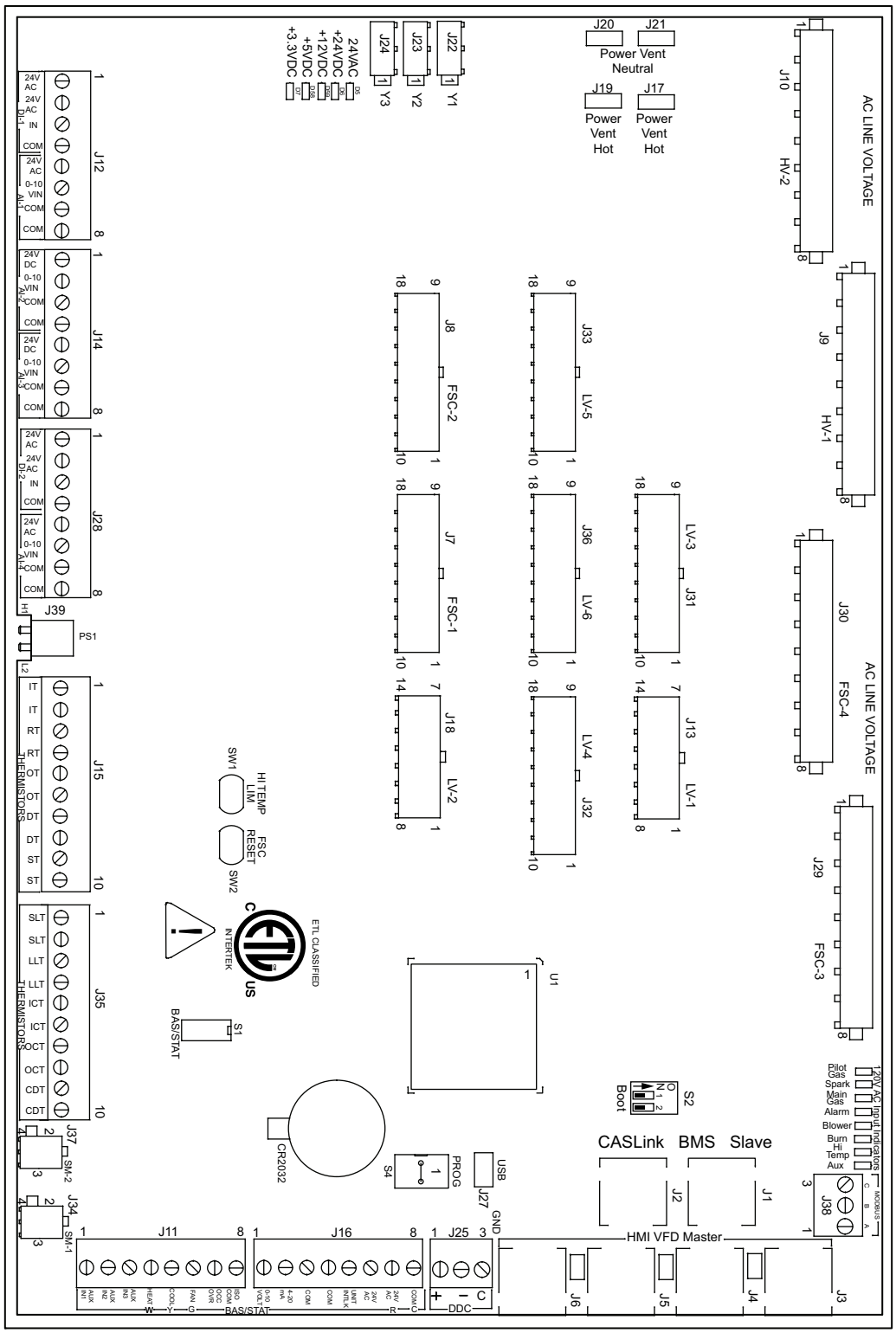


1. Disconnect Switch
2. Galflex Conduit (In Unit)
3. Factory Wiring
4. Field Supplied Wiring - From building power or pre-wired control panel.
5. 120V Single Phase Standing Power
6. 208-240 Single Phase
7. Three Phase

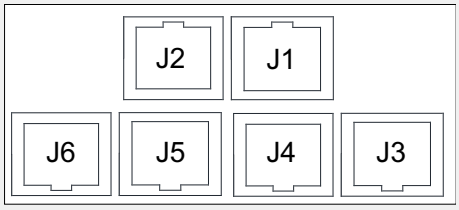
Make-up Air (MUA) Board Connectors

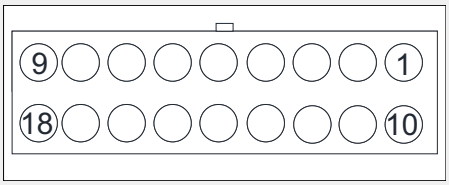
The Make-up Air (MUA) Board (**Figure 8**) is located in the main control cabinet.

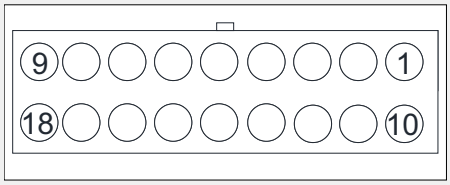
Figure 8 - Make-up Air Board

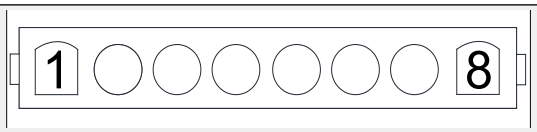


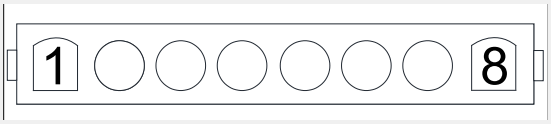
Note: Some connections may not be used dependent on system configurations

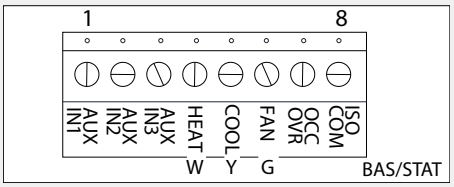
RJ45 connectors. **Connector J1** and **J2** are associated with BMS. **Connector J3** through **J6** are interchangeable and may be used to connect to an HMI or VFD.	
J1 - CASLink/Slave **J2** - CASLink/Slave **J3** - HMI/VFD/Master	**J4** - HMI/VFD/Master **J5** - HMI/VFD/Master **J6** - HMI/VFD/Master

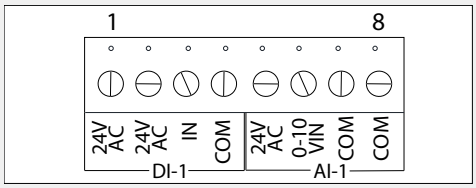
Connector J7 - FSC-1	
Pin 1 - Electric Heat Dry Contact **Pin 2** through **Pin 9** - N/A	**Pin 10** - Electric Heat Dry Contact

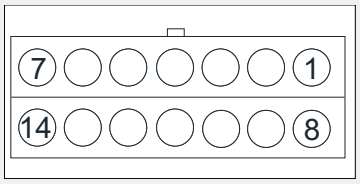
Connector J8 - N/A	

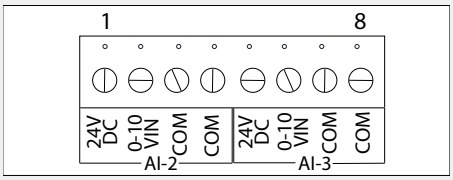
Connector J9 contains 120V AC connections	
Pin 1 - 120VAC Main Input **Pin 2** - 120VAC Input from Discharge Damper End Switch **Pin 3** - 120VAC Input from Fire Micro-Switch **Pin 4** - 120VAC Output to Intake/Discharge Damper Actuator	**Pin 5** - 120VAC Input from Intake Damper End Switch **Pin 6**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

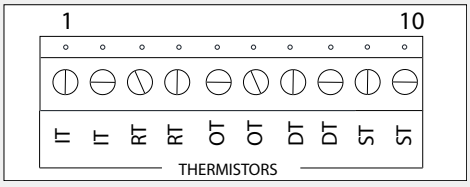
Connector J10 contains 120V AC connections	
Pin 1 - 120VAC Input from Evap Cooler Pressure Switch **Pin 2** - 120VAC Input from Evap Cooler Float Switch **Pin 3** - 120VAC Output to Evap Cooler Water Solenoid **Pin 4** - 120VAC Output to Evap Cooler 3-way Drain Valve	**Pin 5** - 120VAC Input from Supply Overload **Pin 6** - 120VAC Output to Supply Starter Coil **Pin 7** - 120VAC Output to Exhaust Starter Coil **Pin 8** - 120VAC Input from Exhaust Overload

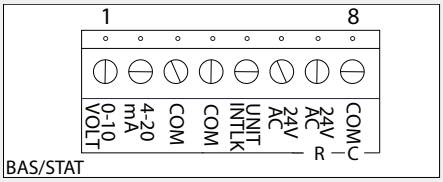
Connector J11 contains low voltage screw terminal connections	
Pin 1 - 24VAC Auxiliary Input **Pin 2** - 24VAC Auxiliary Input **Pin 3** - 24VAC Auxiliary Input **Pin 4** - 24VAC Call for Heat Input/Burner Interlock	**Pin 5** - 24VAC Call for Cooling Input/AC Interlock **Pin 6** - 24VAC Call for Blower 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

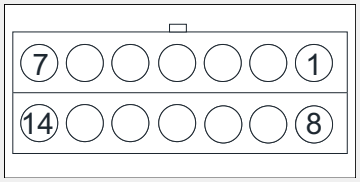
Connector J13 contains low voltage connections	
Pin 1 - N/A **Pin 2** - PWM + Output for Supply ECM **Pin 3** - N/A **Pin 4** - N/A **Pin 5** - 24VAC Output for Clogged Filter Switch **Pin 6** - 24VAC Output for Low Airflow **Pin 7** - 24VAC Input for Board Power	**Pin 8** - N/A **Pin 9** - PWM Output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

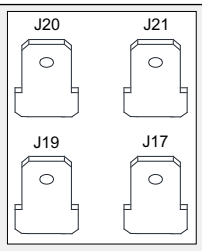
Connector J14 contains screw terminal connections	
Pin 1 - 24VAC Output to Humidity Sensor **Pin 2** - 0-10VDC Analog Input from Humidity Sensor **Pin 3** - 24VAC Common to Humidity Sensor **Pin 4** - 24VAC Common to Humidity Sensor	**Pin 5** - 24VAC Output to Humidity Sensor **Pin 6** - 0-10VDC Analog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

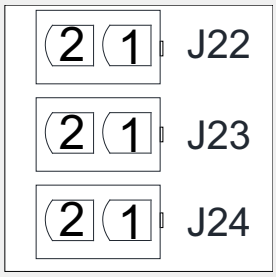
Connector J15 contains low voltage connections	
Pin 1 - Intake Temperature Thermistor Input **Pin 2** - Intake Temperature Thermistor Input **Pin 3** - Return Temperature Thermistor Input **Pin 4** - Return Temperature Thermistor Input **Pin 5** - Outdoor Temperature Thermistor Input	**Pin 6** - Outdoor 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

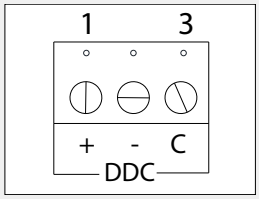
Connector J16 contains low voltage screw terminal connections	
Pin 1 - 0-10VDC Analog Input for Pressure Transducer **Pin 2** - 4-20 mA Analog Input for Heat Modulation **Pin 3** - 24VAC Common **Pin 4** - 24VAC Common	**Pin 5** - 24VAC Unit Interlock Input **Pin 6** - 24VAC Output (Stat) **Pin 7** -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

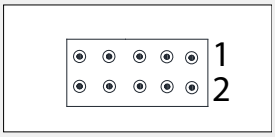
NOTE: Connector J17 is grouped with connectors J-19 through J-21

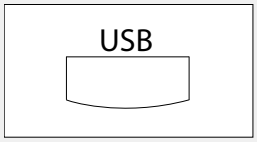
Connector J18 contains low voltage connections	
Pin 1 - 24VDC + Output **Pin 2** - 0-10VDC Analog Output for Mixing Box Actuator **Pin 3** - N/A **Pin 4** - 24VAC Output for DX Float Switch **Pin 5** - 24VAC Output for Door Interlock **Pin 6** - 24VAC Warm Liquid Bypass Output **Pin 7** - 24VAC for Damper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

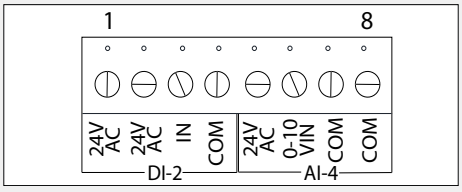
Connector J17 - N/A **Connector J19** - N/A **Connector J20** - N/A **Connector J21** - N/A	

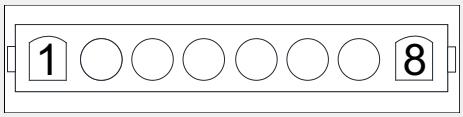
Connector J22 (Y1) Condenser 1 **Connector J23** (Y2) Condenser 2 **Connector J24** (Y3) Condenser 3	
J22 Pin 1 - 24VAC Output to Condenser 1 **J22 Pin 2** - 24VAC Common to Condenser 1 **J23 Pin 1** - 24VAC Output to Condenser 2	**J23 Pin 2** - 24VAC Common to Condenser 2 **J24 Pin 1** - 24VAC Output to Condenser 3 **J24 Pin 2** - 24VAC Common to Condenser 3

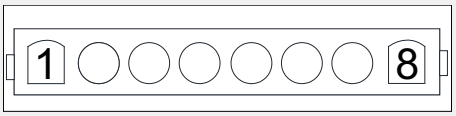
Connector J25 contains low voltage screw terminal connections for DDC Communications Isolated	
Pin 1 - RS-485 + **Pin 2** - RS-485 -	**Pin 3** - RS-485 Common

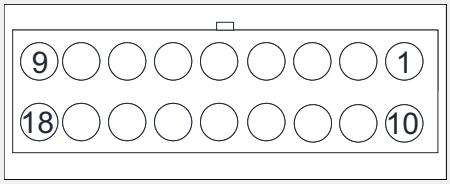
Connector J26 Programming Port	

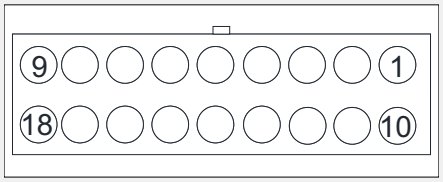
Connector J27 USB Programming Port	

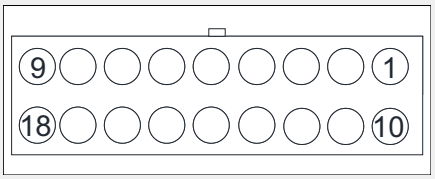
Connector J28 contains low voltage screw terminal connections	
Pin 1 - 24VAC Start Command for 3rd-Party VFD **Pin 2** - 24VAC Output **Pin 3** - 24VAC Trouble Input **Pin 4** - 24VAC Common for 3rd-Party VFD	**Pin 5** - 24VAC Constant Output **Pin 6** - 0-10VDC Analog Input VFD Speed Reference **Pin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

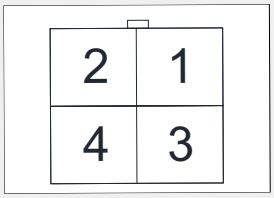
Connector J29 contains 120V AC connections	
Pin 1 - N/A **Pin 2** - N/A **Pin 3** - 120VAC High Temp Limit Input **Pin 4** - 120VAC Output to FSC (6)	**Pin 5** - 120VAC Output to FSC (7) **Pin 6** - N/A **Pin 7** - N/A **Pin 8** - 120VAC Neutral

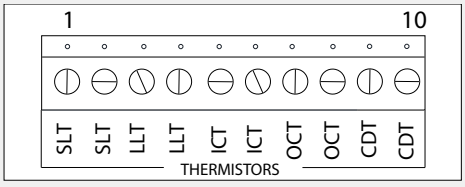
Connector J30 - N/A	

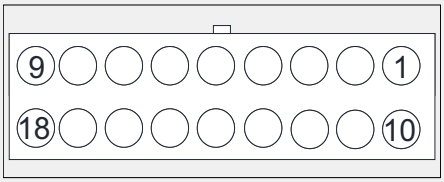
Connector J31 - Contains inputs and outputs for components	
Pin 1 - 24VDC + Output to Main Air Flow Pressure Sensor **Pin 2** - 0-10VDC Analog Input from Main Air Flow Pressure Sensor **Pin 3** - 24VDC/0-10VDC Common Main Air Flow Pressure Sensor **Pin 4** - N/A **Pin 5** - N/A **Pin 6** - N/A **Pin 7** - N/A **Pin 8** - N/A **Pin 9** - N/A	**Pin 10** - N/A **Pin 11** - N/A **Pin 12** - N/A **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

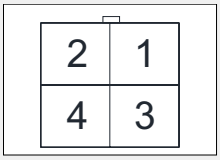
Connector J32 contains inputs and outputs for components	
Pin 1 - N/A **Pin 2** - N/A **Pin 3** - N/A **Pin 4** - N/A **Pin 5** - 24VAC Output To CO Alarm **Pin 6** - N/A **Pin 7** - N/A **Pin 8** - 0-10VDC Out for VFD **Pin 9** - 0-10VDC Out for EF	**Pin 10** - N/A **Pin 11** - N/A **Pin 12** - N/A **Pin 13** - N/A **Pin 14** - 24VAC From CO Alarm **Pin 15** - N/A **Pin 16** - N/A **Pin 17** - 0-10VDC Common for VFD **Pin 18** - 0-10VDC Common for EF

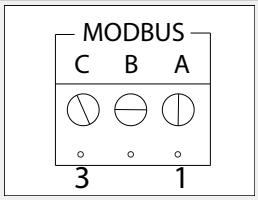
Connector J33 contains inputs and outputs for components	
Pin 1 through 8 - N/A **Pin 9** - 0-10VDC Analog Input for CFM	**Pin 10 through 17** - N/A **Pin 18** - 0-10VDC Common for CFM

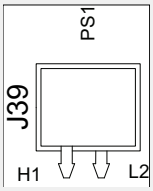
Connector J34 - N/A	

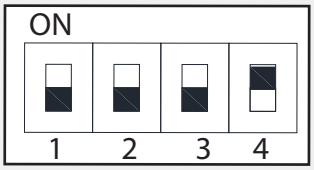
Connector J35 N/A	

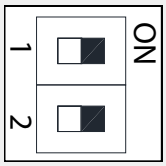
Connector J36 N/A	

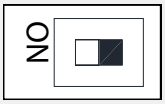
Connector J37 N/A	

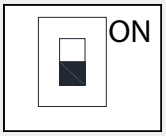
Connector J38 Modbus	
Pin 1 (A) - Modbus (-) **Pin 2 (B)** - Modbus (+)	**Pin 3 (C)** - Modbus Ground

Connector J39 Onboard Airflow Switch	
H1 - High Side	**L2** - Low Side

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	

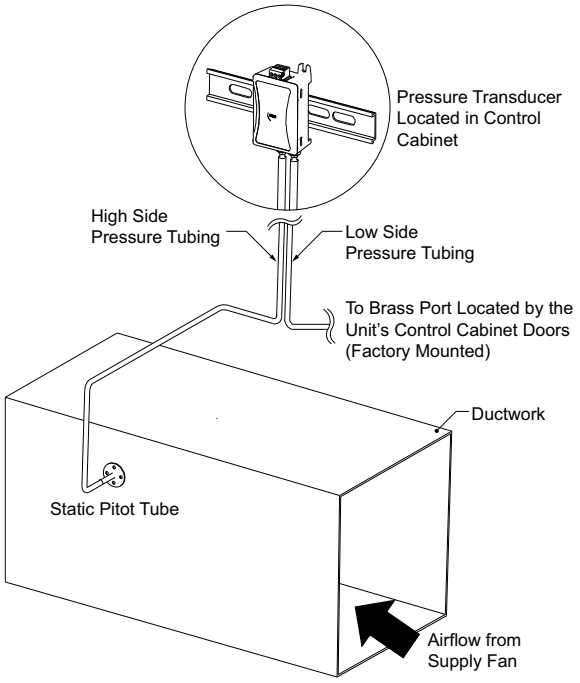
Dip Switch S4	
Programming - Service Only	

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 9 - Duct Static Pressure Control

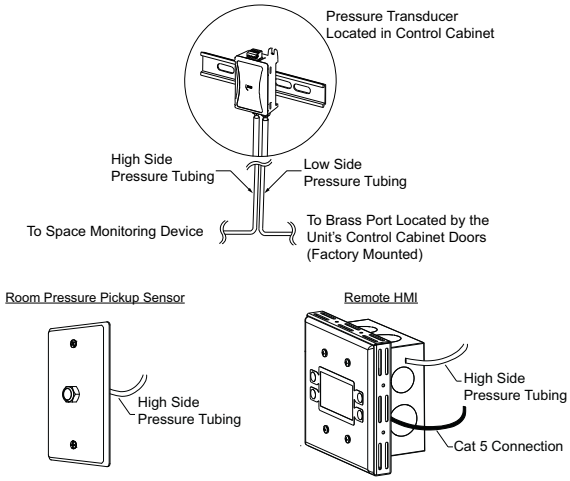


Building Static Pressure Control

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, Space/Wall Sensor, and Room Temp Sensor" on page 26**
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 10 - Building Static Pressure Control



HMI, Space/Wall Sensor, and Room Temp Sensor

NOTE: 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.

HMI (Human Machine Interface)

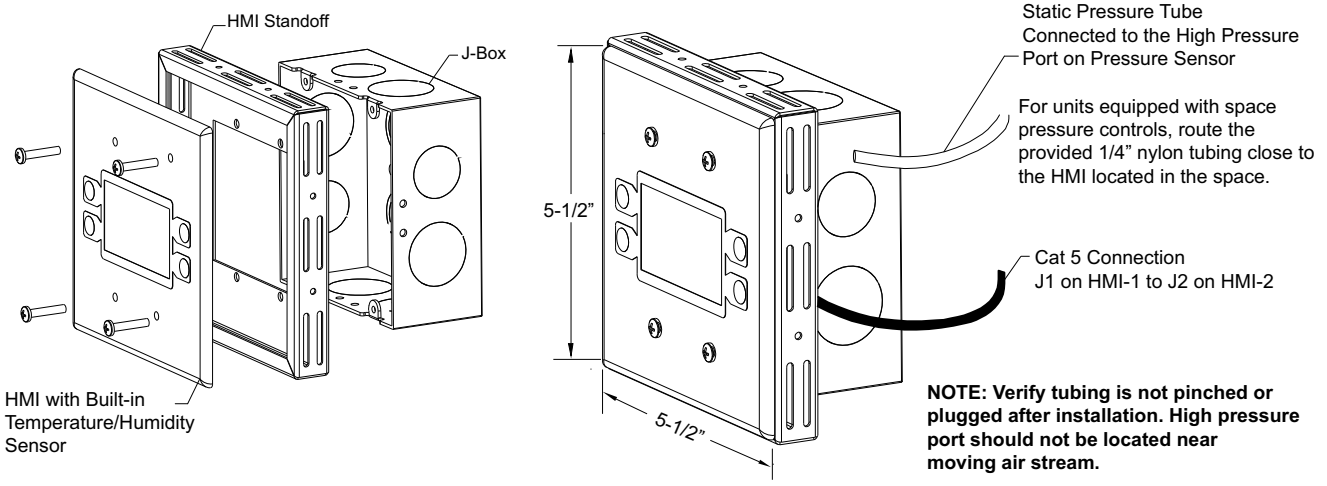
The HMI is used to change settings, view operating information, and view fault history. Remote HMI faceplates (**Figure 11**), remote room sensors (**Figure 13 on page 27**), and smart controls may be ordered and shipped separately. These components measure temperature and humidity and assist in controlling the unit. 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 11 - HMI with Standoff



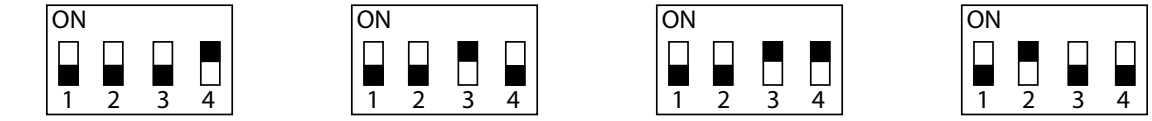
NOTE: These components should be installed in a safe location, free of influence from external heat sources. Sensors must be installed in areas indicative of the average room temperature. Mounting the sensor(s) to interior walls will provide reliable measurements.

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. Refer to **"Space HMI Menu" on page 31** for space HMI menu navigation.

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 12. The switches are on the back of the sensor.

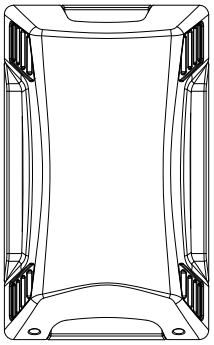
Figure 12 - CAS Wall Sensor DIP Switches



MODBUS Address = 56 MODBUS Address = 57 MODBUS Address = 58 MODBUS Address = 59

Room Temp Sensor

Figure 13 - 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.

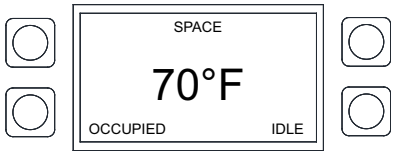
OPERATION

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 14**).

Figure 14 - HMI Screen

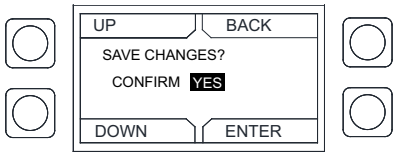


There are four buttons to navigate through the HMI screens.

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 15 - 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 15**). 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.

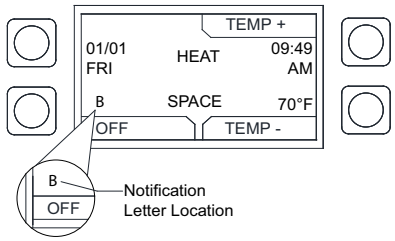
For information on the Space HMI, refer to **"Space HMI Control Panel" on page 27**. For menu navigation, refer to **"Space HMI Menu" on page 31**.

HMI Notification Letters

Figure 16 - Notification Letters

The HMI will display notification letters (**Figure 16**) when the unit is in a specific status.

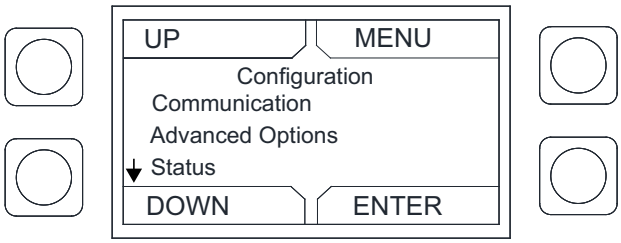
- B = Blower Start or Blower Stop Delay Active
- C = Condenser Min On or Min Off Timer Active. Displayed when any of the condensers are in a Min On/Off Time.
- F = Fault (Space HMI Only)
- D = Min or Max Discharge Temp Reached.
- R = OA Reset.
- Δ = Dynamic SP Applied.
- EM = Emergency Mode Active



HMI Configuration Menu

To enter the configuration menu (**Figure 17**), 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 17 - 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 18**), 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)**

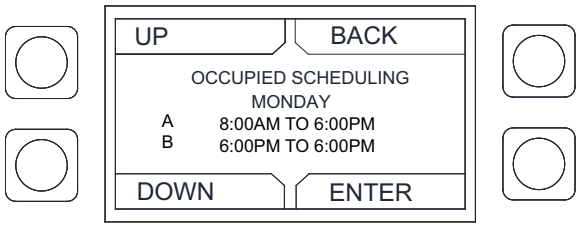
Once scheduling is enabled and the temperature set points are configured, you may enter your scheduled days and times: **User Settings > Scheduling**

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 18 - 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/Discharge 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

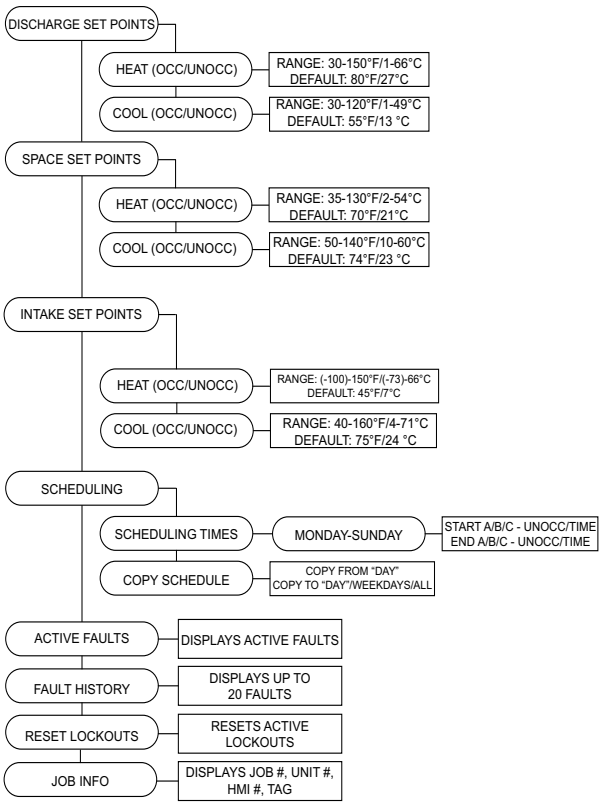
Schedule B Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

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

Space HMI Menu

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.
- **Intake Set Points** - User Adjustable SP for heat and cool intake activation.
  - **Heat** - Heating will activate if the intake temperature is below this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Heating Type must be set to a heating configuration.
  - **Cool** - Cooling will activate if the intake temperature is above this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. 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.



Menu Descriptions

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

Factory settings: Factory settings (password required from service) are job-specific and configured from the plant. Any changes to the factory settings will require the user to save the updated changes.

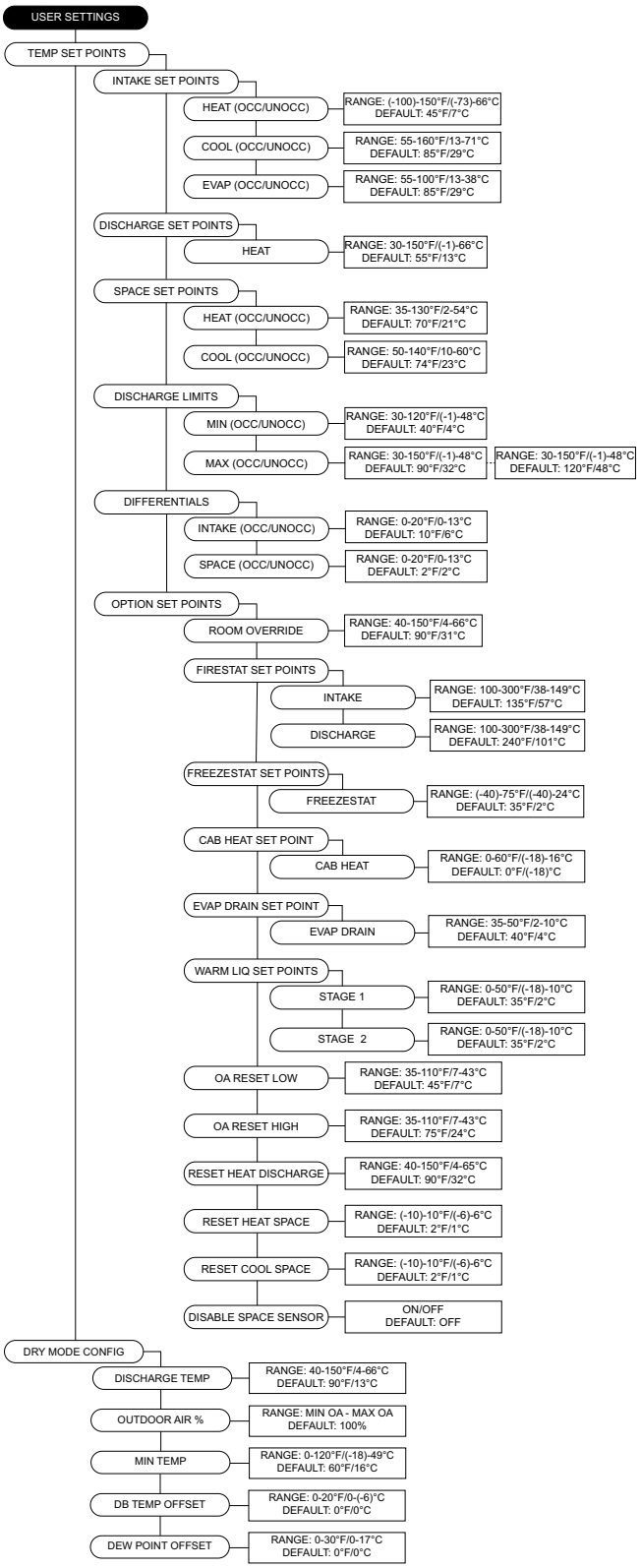
Service: Requires a password (1234) to enter this menu. Allows a certified technician to monitor the unit and test components in the system.

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.
  - **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.
- **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.
  - **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 space heat and cool 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, Warm Liq Set Points, OA Reset Low, OA Reset High, Reset Heat Discharge, Reset Heat Space, Reset Cool Space.
  - **Disable Space Sensor** - Use this option when a space sensor is broken/missing. When enabled, the unit will temper based on discharge.

Dry Mode Config - View or adjust dry mode setpoints/limits when the option is enabled.



Scheduling - Active when the 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 and max setpoints under factory settings. When the fan is set to VFD, the settings are in Hz. When the fan is set to ECM, PWM percentage is displayed. When occupied scheduling is On, occupied and unoccupied settings are available.

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.

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

Pressure Config - Settings vary 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 - When single zone VAV is enabled to the blower, damper, or both, depending on settings, will modulate linearly between min and max discharge.

- **Blower Speed Heat** - Blower modulates with the min discharge temp, 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 min discharge temp, 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.

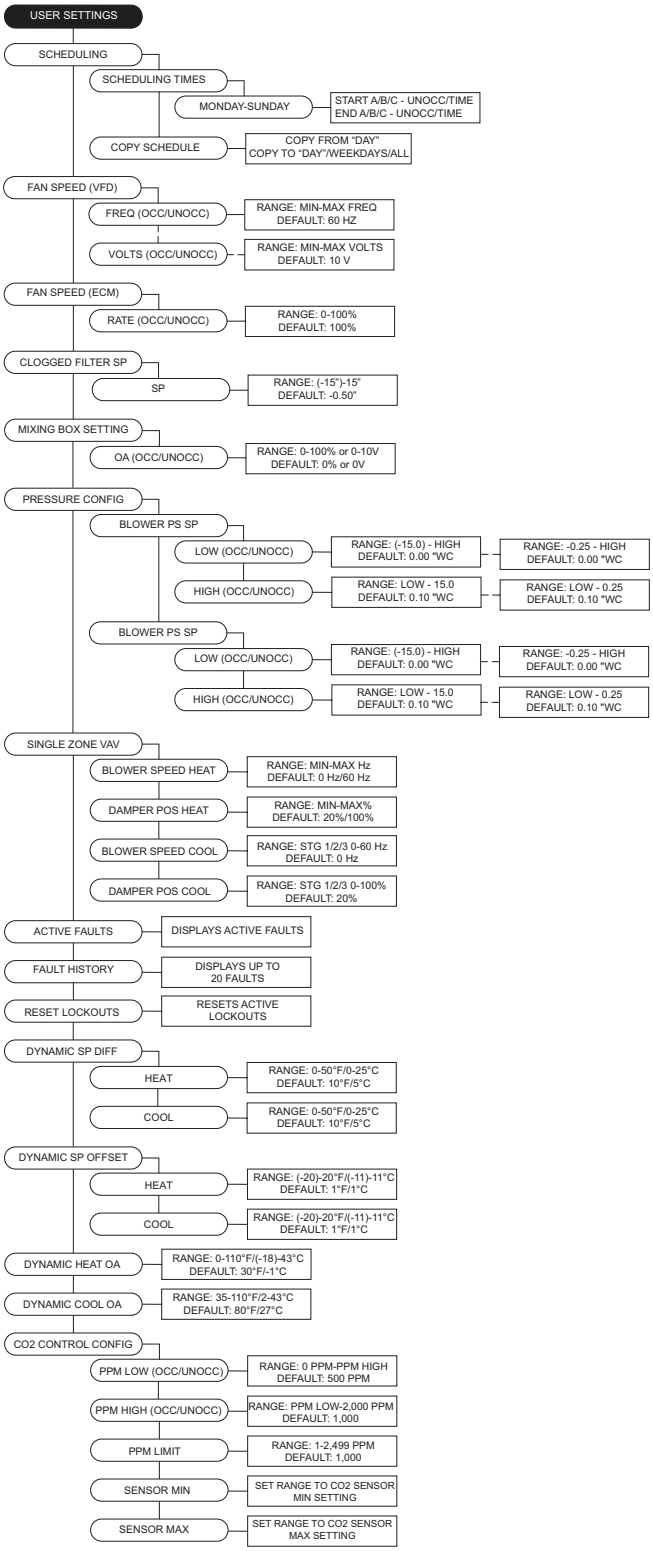
Dynamic SP Offset - Setting will adjust dynamically based on outdoor air conditions. For more information, refer to “Dynamic Set Point” on **page 44**.

Dynamic Heat OA - Outdoor air dynamic heat setpoint.

Dynamic Cool OA - Outdoor air dynamic cool setpoint.

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

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



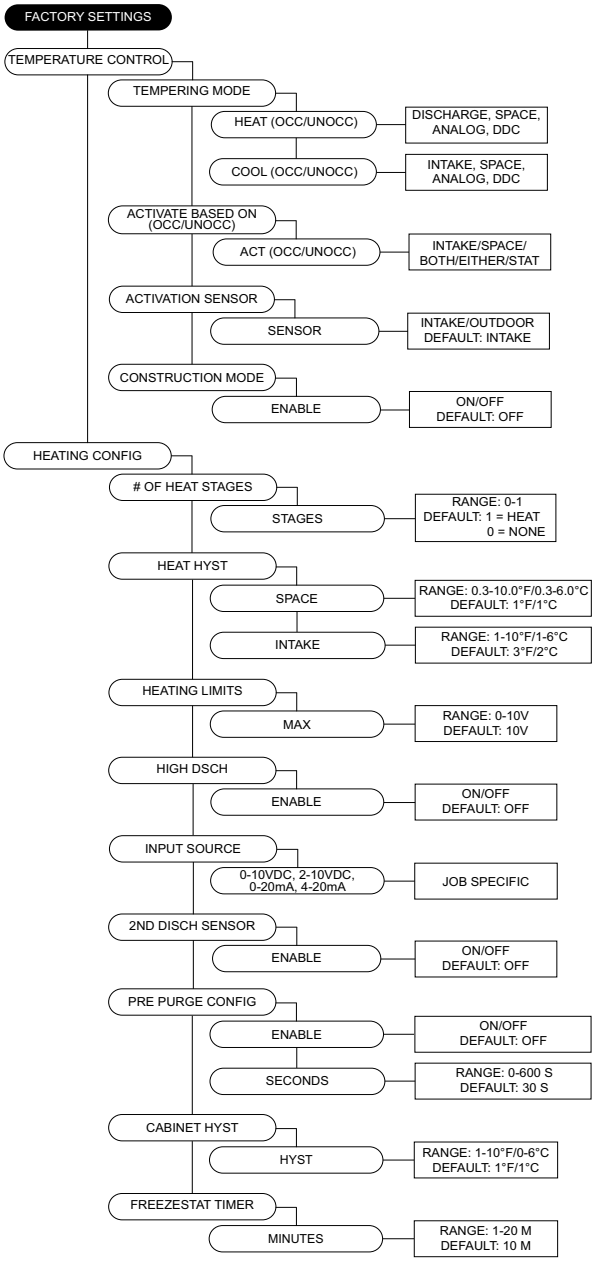
Factory Settings

Temperature Control - The MUA board monitors temperature control setpoints 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.
- **Activation Sensor** - Allows selection of intake or outdoor sensor for unit to activate.
- **Construction Mode** - Configurable option for units used in construction settings.

Heating Config - Allows the user to set 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.
- **Heat Hyst** - Intake or Space tempering sensor must go this amount of degrees above the setpoint before heating turns off.
- **Heating Limits** - Maximum voltage setting for electric heater.
- **High Disch** - When enabled On, the heat max discharge limit allowed will be increased.
- **Input Source** - This lets the board know what signal (volts or milliamps) to expect from the analog control system. **Only valid for analog tempering mode.**
- **2nd Disch Sensor** - On/Off selection. When an additional thermistor is added, the two thermistor readings will be averaged together.
- **Pre Purge Config** - When enabled, 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.
- **HTL Blower Off** - The blower will shut off when the high temperature limit trips.
- **Cabinet Hyst** - The cabinet temp must reach this many degrees above the activation setpoint to turn off.
- **Freezestat Timer** - If the discharge temperature is below the freezestat setpoint 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 shut down immediately. Reset the lockout manually on the HMI.

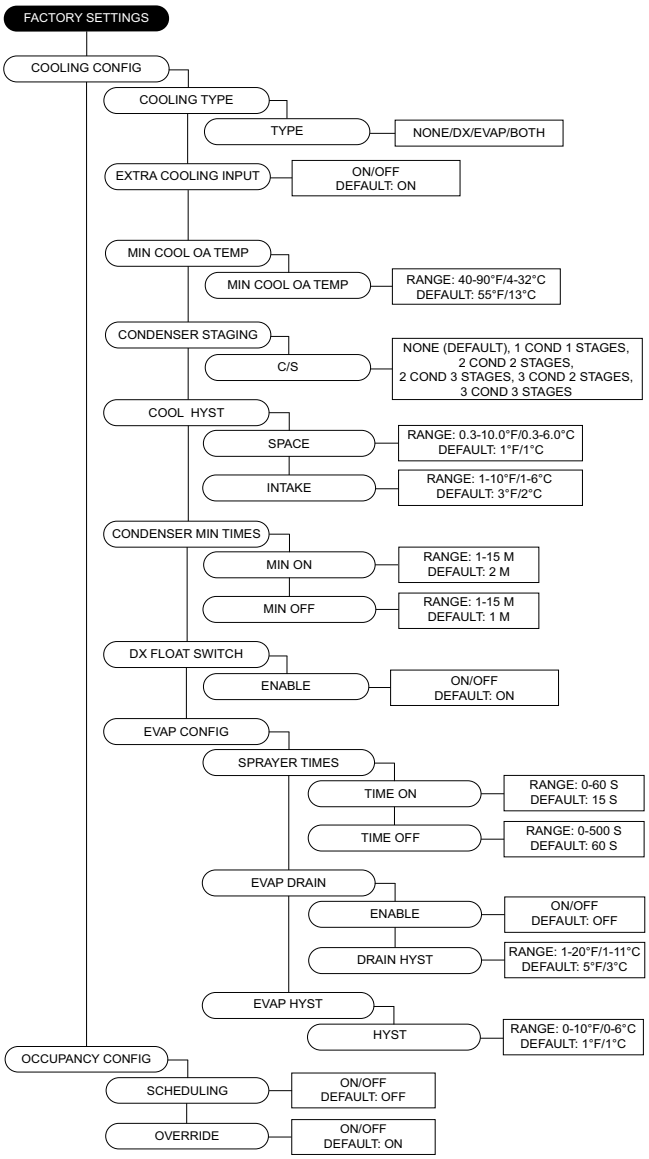


Cooling Config - Allows the user to set various cooling configurations.

- **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 setpoint, 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 setpoint for 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.

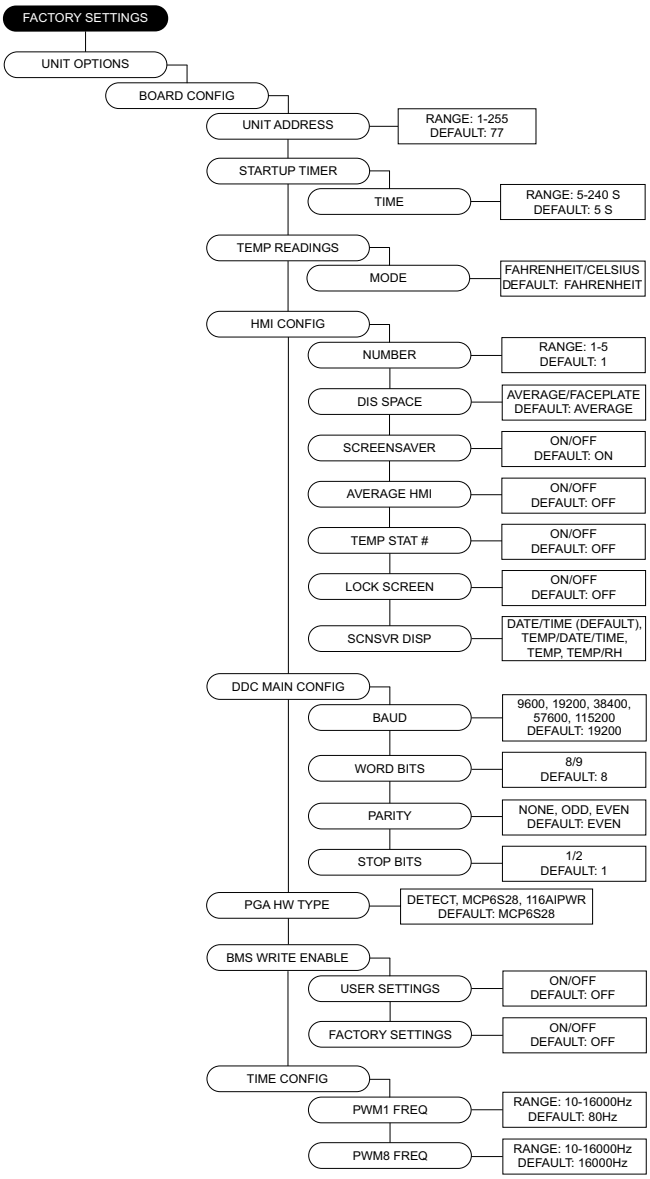
Occupancy Config - Allows access to setting scheduling and/or override On or Off.

- **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 - Access to various options enabled on 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 setpoints.
  - **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; screensaver option is enabled or if any button functions are not pressed for 5 minutes.
    - **Scnsvr Disp** - Displays date, time, and/or temperature when screensaver is active.
  - **DDC Main Config** - **Network settings should not be changed if the unit is equipped with BACNET**.
    - **Baud** - Baud rate of the Modbus communications.
    - **Word Bits** - The amount of data bits over Modbus communications.
    - **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)



NOTE: When Average HMI is set to more than 1, each HMI will have an averaging On/Off setting.

For DDC information, refer to **DDC Application Guide**.

- **Blower Config** (refer to **Table 4** for aux pin settings)
  - **Blower Control** - Allows user to select between 120V Contactor, VFD Manual, VFD Jog, VFD 0-10V, ECM, ECM 0-10V, ECM Pressure, ECP.
    - **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 VFDs 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. The VFD output from this input will be based on the VFD min and max freq set under protected params in factory settings. 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).
  - **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.
  - **Blower Delay Config** - When enabled, this option will run the blower for the set time after heating has shut down.
  - **Blower Presets** - User may set blower preset option On/Off.
  - **Door Interlock** - When enabled, if the door is open, the supply fan will shut down immediately.

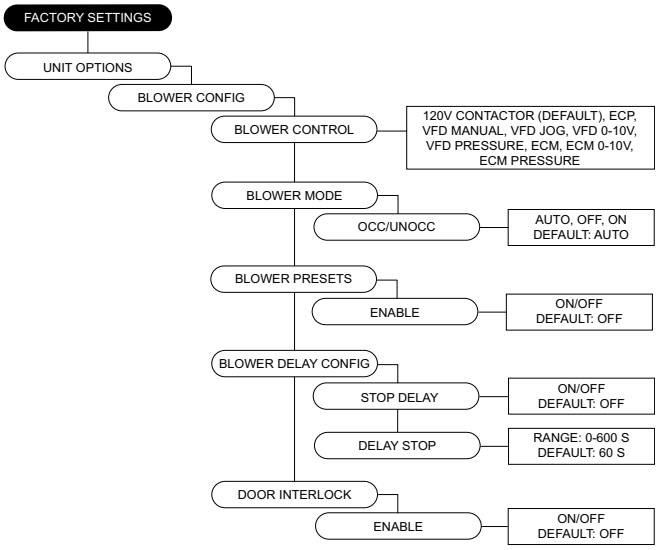


Table 4 outlines the aux pins on Connector J11 for preset settings associated with fan speed and damper position found in **Factory Settings > Unit Options**.

Table 4 - 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

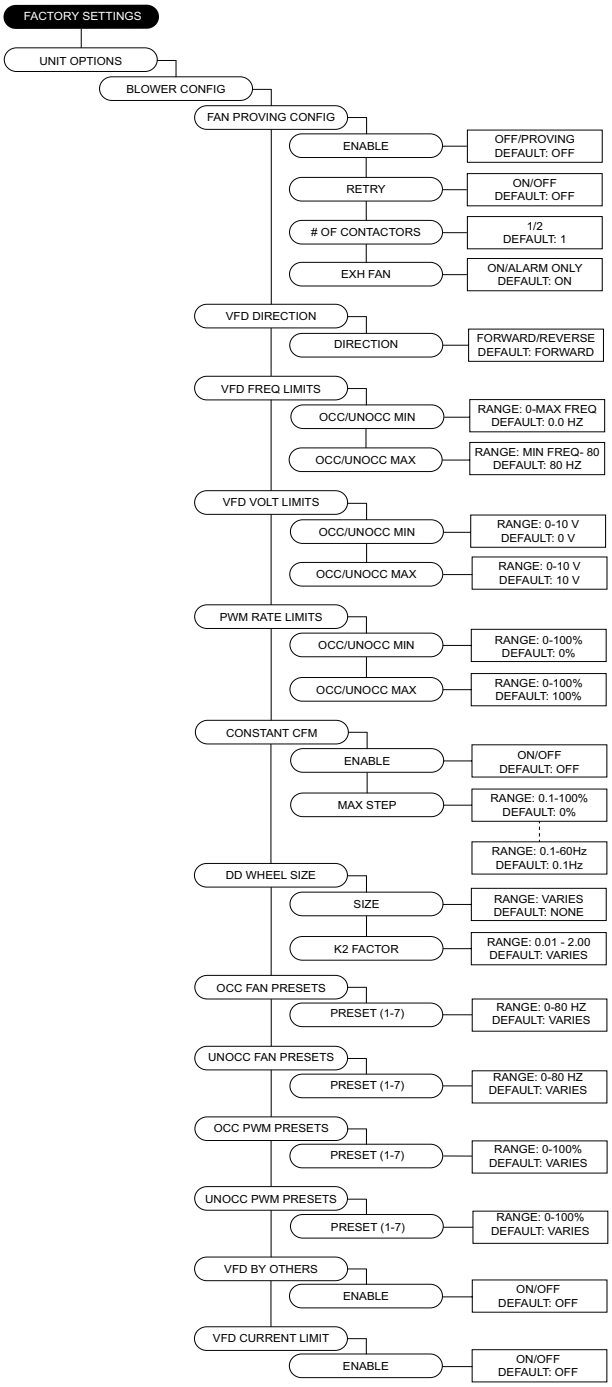
- **Fan Proving Config** - To set fan proving, the Exhaust Contactor must be set to Before Airflow or After Airflow. When enabled, the user may set the number of contactors used. Contactor 1 = Aux 2. Contactor 2 = Aux 3.
  - **Enable** - When enabled, a fault detected will display when not operating.
  - **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 to Max range settings for fan speed.
- **VFD Volt Limits** - Min to Max range settings for third party VFDs.
- **PWM Rate Limits** - Range Min to Max settings for fan speed.
- **Constant CFM** - When enabled On, blower will modulate to maintain constant CFM.
  - **Max Step** - Modulation adjustment; EC motors = %, VFD = Hertz (HZ).
- **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.
- **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.

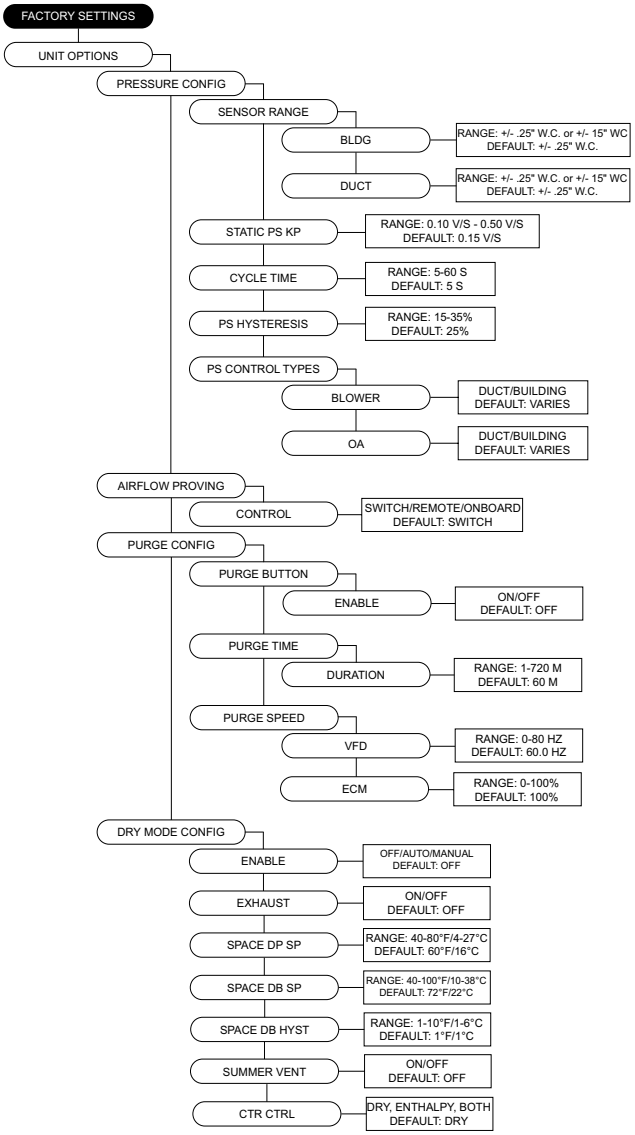
- **Occ PWM Presets** - After the blower has started, the blower setting will use the aux pins to drive the preset unoccupied value.
- **Unocc PWM Presets** - Allows user to set unoccupied preset blower speed value.

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

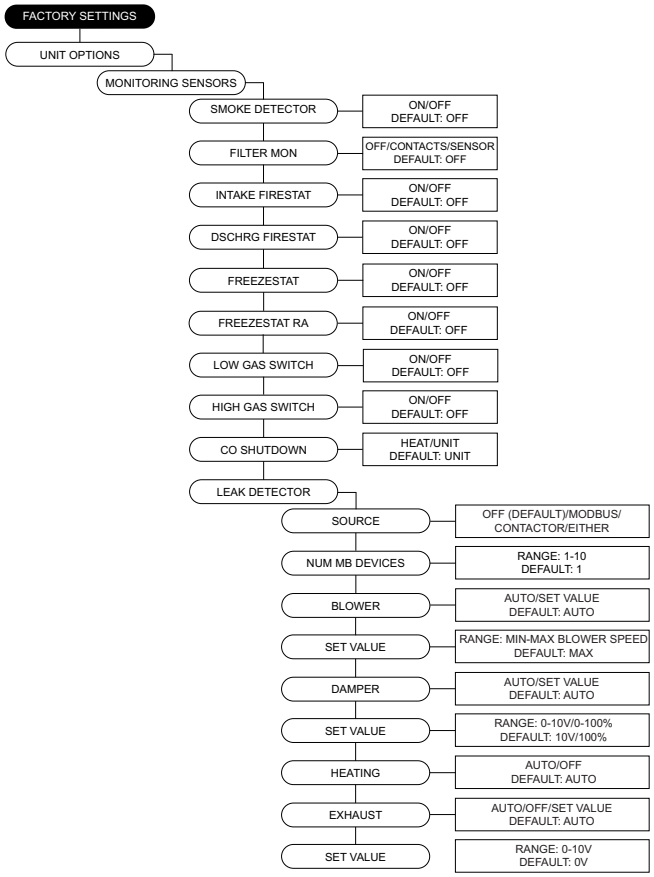
- **VFD By Others** - This option will be used when a factory provided Modbus control VFD is not utilized. A start command, as well as a 0-10 V output will be provided to the VFD.
- **VFD Current Limit** - This limits the max current to the VFD.



- **Pressure Config**
  - **Sensor Range** - Menu is available when any blower pressure or mixing box 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** - 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 set point.
  - **PS Control Types** - Pressure control may be set to monitor Building or 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 use.
  - **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 frequency 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.
      - **Space DP Hyst** - Hysteresis value applied to dew point setting.
      - **Summer Vent** - Dew point activation will enhance with enthalpy activation when set to On.
      - **CTR CTRL** - J29-7 will energize per the selected option.

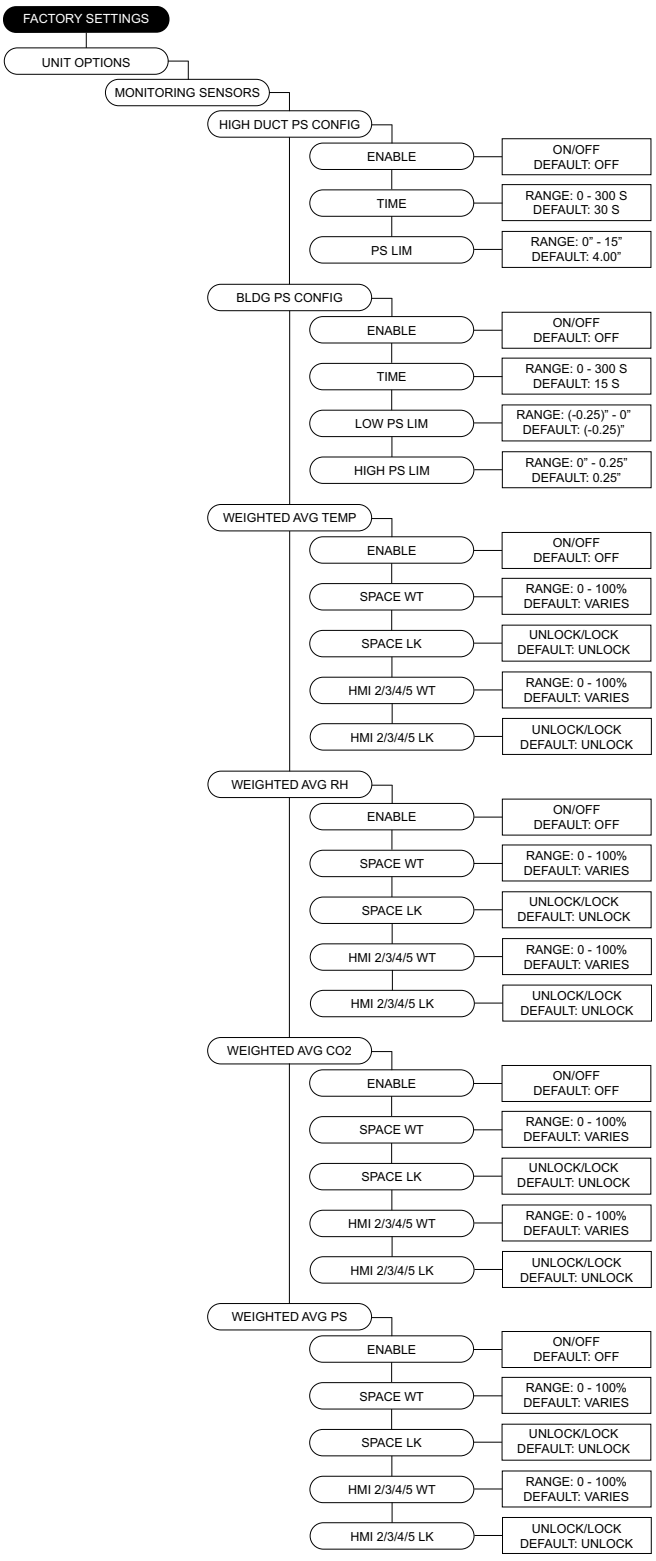


- **Monitoring Sensors** - This menu enables optional components from the factory or when field installed.
  - **Smoke Detector** - Enables for smoke detection.
  - **Filter Mon** - The option may be set to Off, Contacts or Sensor (J31-14). When set to Contacts or Sensor, if the input is active a fault 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.

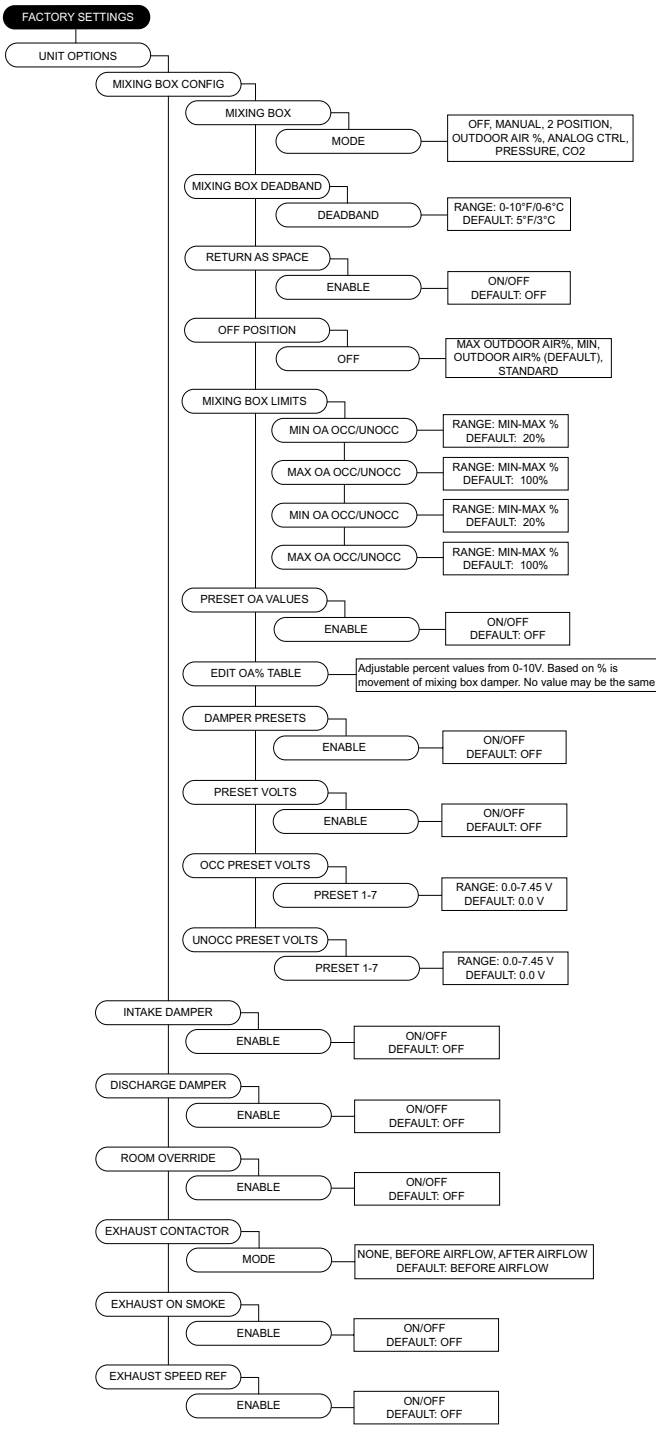


- **High Duct PS Config** - When enabled, if the duct pressure is greater than the set point for longer than the set time, heating/cooling will shut down. A fault will be displayed on the HMI.
  - **Time** - Setting for how long the unit can be outside of its pressure range.
  - **PS Lim**- Duct pressure 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

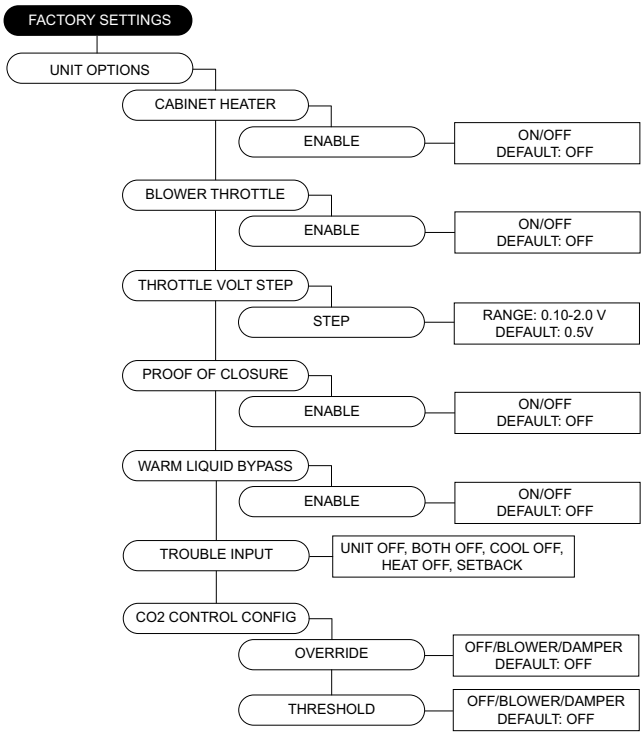
  - When weighted settings are enabled On, weight (WT) and lock (LK) adjustments are active. Use WT to assign Space priority monitoring. Use LK when you want specific WT assignments on certain HMIs.



- **Mixing Box Config**
  - **Mixing Box** - Off, Manual, 2 Position, Outdoor Air %, Analog Control, Pressure, CO2.
  - **Mixing Box Deadband** - If the temperature difference between the outdoor and return sensor is less than or equal to this set point, the MUA board will not attempt to adjust the output voltage until it matches the outdoor air percentage set point. 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 %.
  - **Mixing Box Limits** - Minimum and maximum settings for mixing box. Percentage or voltage based on mixing box selection.
  - **Preset OA Values** - On/Off option. If set to On, the voltage values equivalent to air percentage.
  - **Edit OA% Table** - User may edit voltages for the equivalent to outdoor air percent table.
  - **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 24VAC 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. When this option is enabled, to adjust set points, go to **User Settings > Temp Set Points > Option Set Points > Cab Heat Set Points**.
- **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.
- **Warm Liquid Bypass** - Prevents freezing of condensing coil in low ambient temperatures.
- **Trouble Input** - While connector J28 pin 3 receives 24 volts, the unit will act based on one of the following settings:
  - **Unit Off** - Shuts down blower (heating/cooling will also shutdown). Timers will be bypassed.
  - **Both Off** - Turn 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.
- **CO2 Control Config** - Monitors CO2 and will adjust blower speed/damper position depending on CO2 set point.
  - **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.



- **Dynamic Set Point** - below are scenarios for dynamic functionality. For heating, every multiple of the Dynamic Set Point Differential would multiply the effect of the Dynamic Offset setting.
  - When heating: If the measured outside air temperature is below the Dynamic Heat OA set point minus the differential set point, the space or discharge set point will increase/decrease by the offset setting.
  - When cooling: If the measured outside air temperature is above the Dynamic Cool OA set point minus the differential set point, the space or discharge set point 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.
- **Pool Room** - Enable this option for pool room applications.
  - **Pool Room DP SP** - When above the dew point set-point (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.

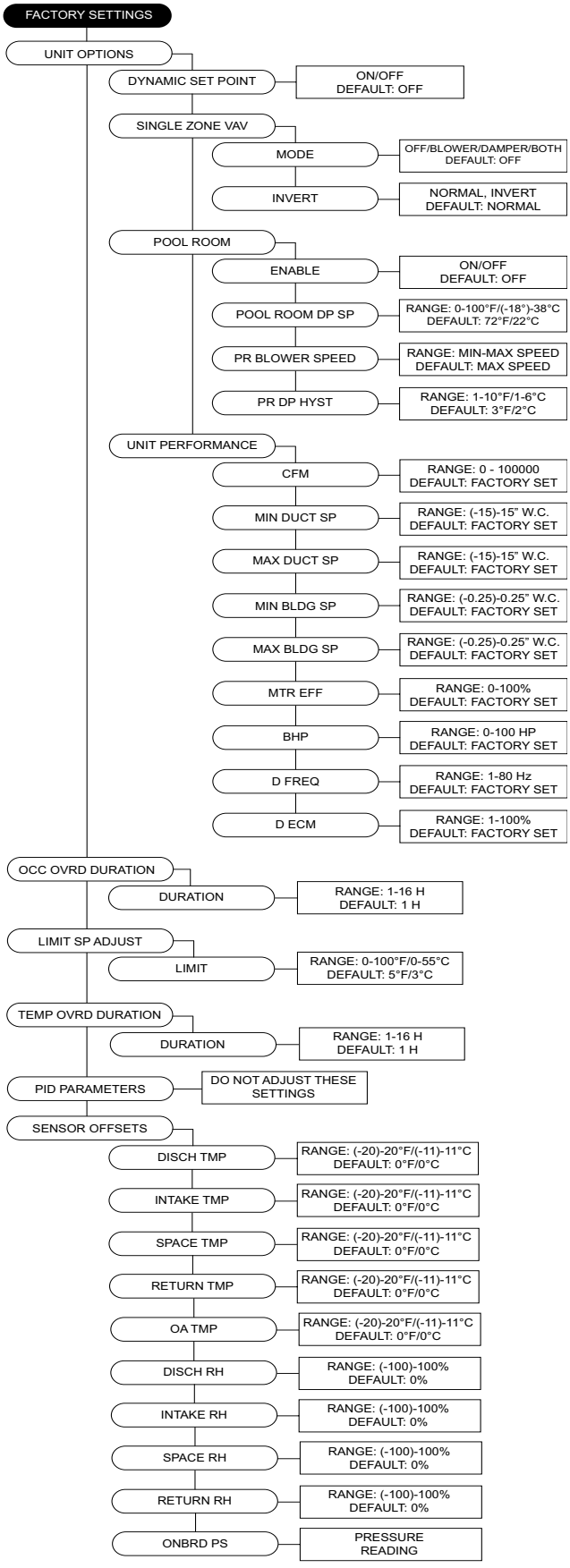
Occ Ovrd Duration - Length of override timer. If override is active, it can be manually stopped by pressing the end override button on the HMI.

Limit SP Adjust - This allows the user to change the current temperature set point through the home screen. When the set point 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.



Service Settings **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 - Monitor various temperature values.

Relative Humidity - Current humidity readings per HMI.

CO2 Values - Current CO2 readings per HMI.

Pressure Values - Current Pressure readings per HMI.

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

Variable Values - Monitor variable input/output values.

VFD Status - Monitor VFD parameters.

High Temp Limit - Displays the high temp limit.

Airflow Limits - Displays the high/low airflow limits.

Mixing Box Values - Monitor mixing box values.

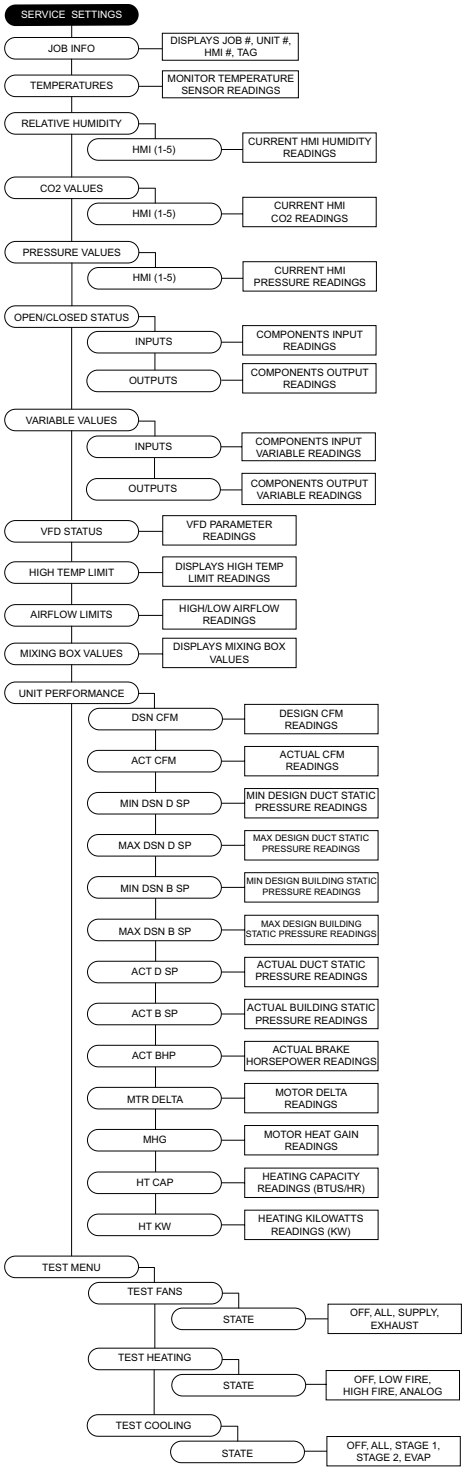
Unit Performance - Compares **Unit Options > Unit Performance** to current unit's operational values.

- **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 from motor's 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** - All, Supply, Exhaust.
- **Test Heating** - Contains high/low fire tests for stages. If "Heating Config" is set to 0, then "No Heat Stage Set" will display. Allows blower and damper modulation.
  - 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 mixing box is On, set to 0V or 100% OA.
  - Exiting test mode should reset the PID.
- **Test Cooling** - Test cooling or heat pump system. Also, monitors cooling system specifications. Allows blower and damper modulation.
- **Test High Temp Limit** - Test menu allows user to set limit to simulate a high temp fault.

NOTE: Heating/Cooling parameters are displayed below State selection



- **Test Options**
  - **Test Cabinet Heater** - Activates cabinet heater.
  - **Test Drain Heater** - Activates drain heater.
  - **Test Mixing Box** - Beginning this 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** - 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 Mixing Box - Calibration process to update factory default values to building site conditions.

Reset MB To Defaults - Resets mixing box to defaults.

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

Calibrate Onboard PS - Calibrates onboard pressure sensor. 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.

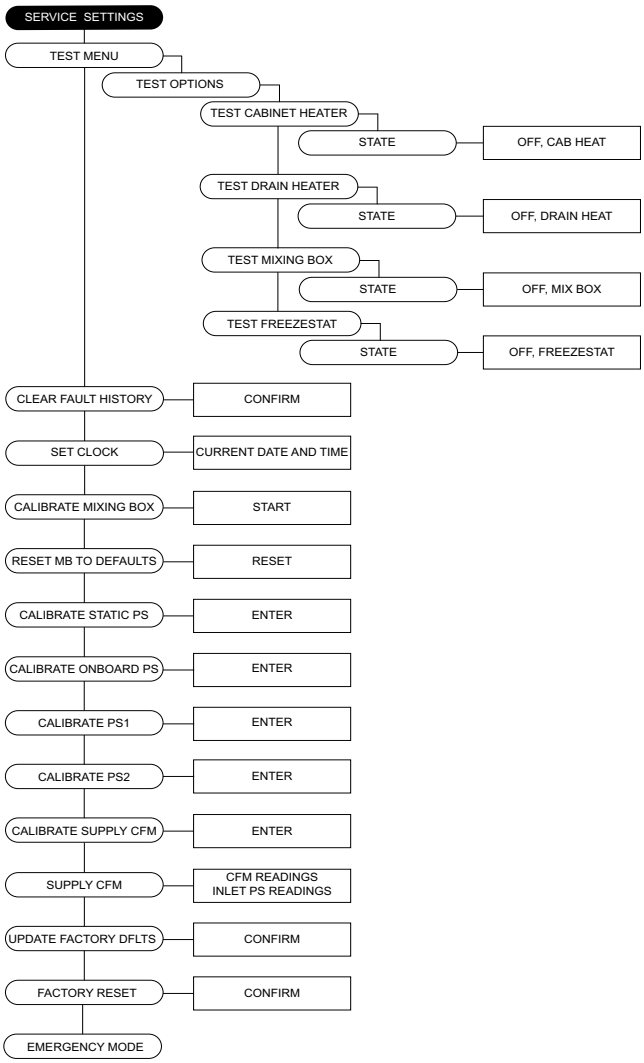
Calibrate Supply CFM - Calibrates pressure differential in the venturi to calculate approximate fan CFM. Must disconnect all pressure tubes before calibration.

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

Update Factory Defaults (DFLTS) - This allows the original factory default settings to be overridden. When confirming the updated settings, these settings will now be used when “Factory Reset” is used.

Factory Reset - Will reset to the last time the unit was commissioned or an update factory defaults was set.

Emergency Mode - Emergency Mode should only be activated by a CAS certified technician or administrator. Unauthorized activation will void warranty of the unit.



QR Codes

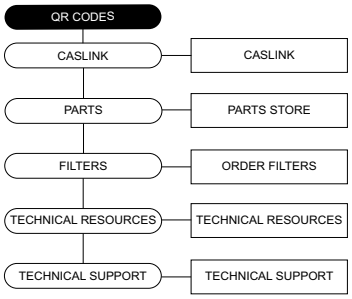
CASLink - Provides access to CASLink webpage. The user will need an account to log in to see informations.

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.



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. **Input power must always be wired to the input L terminal connections (L1, L2, L3).**
	The input power protection is installed.
	The motor's power connection at U, V, and W are connected and tight.
	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.

Variable Frequency 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 **"VFD Part Number/Specifications" on page 50**. 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 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.
- 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.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

SMV VFD Programming

Programming

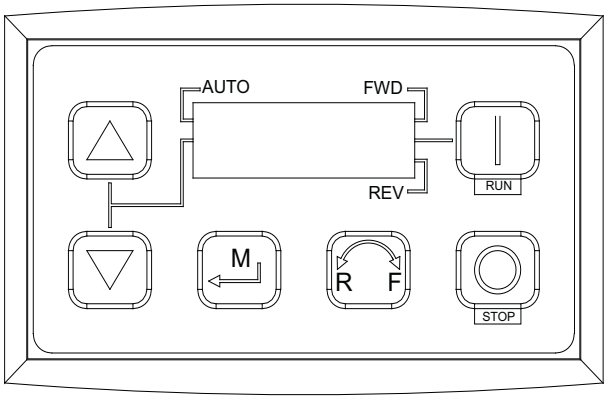
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. Refer to **“VFD Part Number/ Specifications” on page 50**. P108 is calculated as Motor FLA x 100 / Drive Output Rating.

To access the SMV parameters:

1. Use the buttons on the VFD screen (**Figure 19**) 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 19 - VFD Screen



i500 VFD Programming

1. The Drive should be programmed for the proper motor voltage.

• **i500 Drives**: P208.01 will be set to [0] for 208V/230V, [2] for 460V or 480V, [3] for 120V, and [6] for 575V or 600V. If your voltage value is not listed, set to the nearest voltage of P208.01. For example: If your input voltage is 220V, set to [0]. If your input voltage is 110V, set to [3].

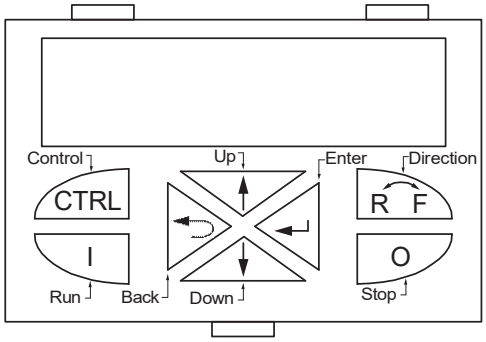
2. The Drive should be programmed for the proper motor overload value. Refer to **"VFD Part Number/ Specifications" on page 50.**

• **i500 Drives**: P308.01 will be set to 150%.

To access the i500 parameters:

1. If the i500 does not have a keypad, find and insert the keypad module into the VFD.
2. Use the buttons on the VFD screen to adjust VFD settings (**Figure 20**).
3. Press Enter to access the menus. Use the Up and Down arrows to enter the password. Press Enter.
4. Use the arrow keys to find the group required (0-8). Press Enter. The first number of the parameter indicates the parameter's group (except for Group 0). For example: Parameter P220.00 is in Group 2, P510.01 is in Group 5, etc.
5. Use the arrow keys to find the parameter required. Press Enter. For example: P220.00 which is in Group 2.
6. Check the value of the parameter. Only change this value if necessary.
7. Once the new value is set, press Enter to save the value.

Figure 20 - i500 VFD Screen



For troubleshooting i500 Series Drives, refer to "VFD Fault List" on page 56.

VFD Part Number/Specifications

Table 6 - VFD Part Number/Specifications

HP	Part Number	i500 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	i51BP137A0000ACBSS	120/240V	X	-	9.2	4.6	2.4	15	15
1	ESV751N01SXB571	i51BP175A0000ACBSS	120/240V	X	-	16.6	8.3	4.2	25	15
1.5	ESV112N01SXB571	i51BP211A0000ACBSS	120/240V	X	-	20	10	6	30	20

HP	Part Number	i500 Part Number	Volts	1Ø Input	3Ø Input	Input Amps 1Ø	Input Amps 3Ø	Output Amps	Breaker 1Ø	Breaker 3Ø
0.5	ESV371N02YXB571	i51BP137D0000ACBSS	240V	X	X	5.1	2.9	2.4	15	15
1	ESV751N02YXB571	i51BP175D0000ACBSS	240V	X	X	8.8	5	4.2	15	15
1.5	ESV112N02YXB571	i51BP211D0000ACBSS	240V	X	X	12	6.9	6	20	15
2	ESV152N02YXB571	i51BP215D0000ACBSS	240V	X	X	13.3	8.1	7	25	15
3	ESV222N02YXB571	i51BP222D0000ACBSS	240V	X	X	17.1	10.8	9.6	30	20
5	ESV402N02TXB571	i51BP255C0000ACBSS (7.5 HP)	240V	-	X	-	18.6	16.5	-	30
7.5	ESV552N02TXB571		240V	-	X	-	26	23	-	40
10	ESV752N02TXB571	i55AP275C0030ACBSS	240V	-	X	-	33	29	-	50
15	ESV113N02TXB571	i55AP311C0030ACBSS	240V	-	X	-	48	42	-	80
20	ESV153N02TXB571	i55AP315C0030ACBSS	240V	-	X	-	59	54	-	90
1	ESV751N04TXB571	i51BP175F0000ACBSS	480V	-	X	-	2.5	2.1	-	15
1.5	ESV112N04TXB571	i51BP211F0000ACBSS	480V	-	X	-	3.6	3	-	15
2	ESV152N04TXB571	i51BP215F0000ACBSS	480V	-	X	-	4.1	3.5	-	15
3	ESV222N04TXB571	i51BP222F0000ACBSS	480V	-	X	-	5.4	4.8	-	15
5	ESV402N04TXB571	i51BP240F0000ACBSS	480V	-	X	-	9.3	8.2	-	15
7.5	ESV552N04TXB571	i51BP255F0000ACBSS	480V	-	X	-	12.4	11	-	20
10	ESV752N04TXB571	i51BP275F0000ACBSS	480V	-	X	-	15.8	14	-	25
15	ESV113N04TXB571	i55AP311F0031ACBSS	480V	-	X	-	24	21	-	40
20	ESV153N04TXB571	i55AP315F00301CBSS	480V	-	X	-	31	27	-	50
25	ESV183N04TXB571	i55AP318F00301CBSS	480V	-	X	-	38	34	-	70
30	ESV223N04TXB571	i55AP322F00301CBSS	480V	-	X	-	45	40	-	80
40	ESV303N04TXB571	i55AP330F00301CBSS	480V	-	X	-	59	52	-	100
50	ESV373N04TXB571	i55AP337F00801CBSS	480V	-	X	-	74	65	-	125
60	ESV453N04TXB571	i55AP345F00801CBSS	480V	-	X	-	87	77	-	150
1	ESV751N06TXB571	i51BP175G00*0ACBSS	600V	-	X	-	2	1.7	-	15
2	ESV152N06TXB571	i51BP215G00*0ACBSS	600V	-	X	-	3.2	2.7	-	15
3	ESV222N06TXB571	i51BP222G00*0ACBSS	600V	-	X	-	4.4	3.9	-	15
5	ESV402N06TXB571	i51BP240G00*0ACBSS	600V	-	X	-	6.8	6.1	-	15
7.5	ESV552N06TXB571	i51BP255G00*0ACBSS	600V	-	X	-	10.2	9	-	20
10	ESV752N06TXB571	i51BP275G00*0ACBSS	600V	-	X	-	12.4	11	-	20
15	ESV113N06TXB571	i55AP311G0030ACBSS	600V	-	X	-	19.7	17	-	30
20	ESV153N06TXB571	i55BP315G0030ACBSS	600V	-	X	-	25	22	-	40
25	ESV183N06TXB571	i55BP318G0030ACBSS	600V	-	X	-	31	27	-	50
30	ESV223N06TXB571	i55BP322G0030ACBSS	600V	-	X	-	36	32	-	60
40	ESV303N06TXB571	i55BP330G0030ACBSS	600V	-	X	-	47	41	-	70
50	ESV373N06TXB571	i55BP345G00701CBSS (60 HP)	600V	-	X	-	59	52	-	90
60	ESV453N06TXB571		600V	-	X	-	71	62	-	110

START-UP OPERATION

Before starting up or operating the unit, verify all fasteners are secure and tight. Check the set screw in the wheel hub. With power **OFF** to the unit or before connecting the unit to power, turn the fan wheel by hand. Verify it is not striking the inlet or any obstructions. If necessary, re-center.

Special Tools Required: Standard Hand Tools, AC Voltage Meter, Tachometer

Unit Start-up Procedure

1. Check all electrical connections are secure and tight.
2. Inspect the condition of the intake damper and damper linkage, if applicable.
3. Remove intake filters if not already installed, inspect the air stream for obstructions. Install intake filters.
4. Compare the supplied **motor voltage** with the fan's nameplate voltage. If this does not match, correct the problem. Compare the supplied **coil voltage** with the coil's nameplate voltage. If this does not match, correct the problem. If this does match, turn the coil disconnect to the **ON** position.
5. Place the external disconnect to the **ON** position to start the unit. Immediately place the disconnect switch off. **Check the rotation of the fan** with the directional arrow on the blower scroll. Reversed rotation will result in poor air performance, motor overloading and possible burnout. For units equipped with a single-phase motor, check the motor wiring diagram to change rotation. For 3-phase motors, any two power leads can be inter-changed to reverse motor direction.
6. When the fan is started, observe the operation and check for any unusual noises.
7. Place the external disconnect switch back to the **ON** position. The system should be in full operation with all ducts attached. Measure the system airflow.
8. Once the proper airflow is achieved, measure and record the fan speed with a reliable tachometer. **Caution - Excessive speed will result in motor overloading or bearing failure. Do not set fan RPMs higher than specified in the maximum RPM chart**. Refer to **"TROUBLESHOOTING" on page 53** for more information.
9. Measure and record the **voltage** and **amperage** to the motor. Compare with the motor's nameplate to determine if the motor is operating under safe load conditions.

Silicon Controlled Rectifier (SCR) Electrical Control

The electric coils on the heater are controlled using Silicon Controlled Rectifier (SCR) controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match heating demand of the system.

During modulation (proportional) control of the heater, an electric signal (0-10V DC) from a proportional sensor is transmitted to the stage controller. The sensor, which may be either a duct type for fresh make-up air or a room sensor thermostat for zone heating. The stage controller activates the modulating stage(s) of the electric heater. The heater is electronically controlled to provide 0 to 100% of its capacity to heat the space.

Depending on the space sensor demand, the heater is pulsed in different proportions of ON time and OFF time to match the heating demand. A modulation control can maintain an accurate room or discharge temperature without the typical variations of the ON/OFF method.

An example of proportional control would be when the heater element is operating at 10% of its capacity, 10% ON and 90% OFF.

Heaters that use more than one modulating stage use an ON/OFF control for supplemental stages.

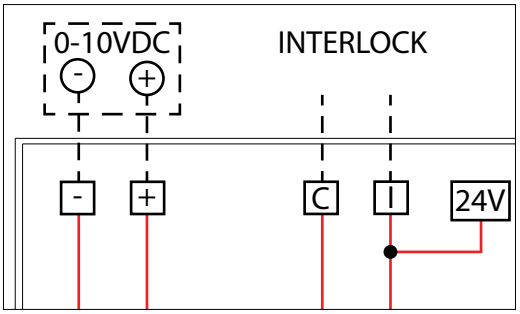
SCR Electrical Circuit Check

Components and electrical wiring will vary depending on heater model and insert. Refer to schematics provided with unit for appropriate electrical wiring checks.

- Verify the automatic and manual cutout switches are in their closed position.
- Verify electrical wiring and component connections are secure and tight.
- Check for air flow, and air flow switch operation. If the switch is not closed during operation, verify the tube is properly installed.
- Verify the control setting is set to 0-10V DC on the stage control board.
- Check for 0-10V DC between (-) to (+) connections.
- When there is a call for heat, verify there is 24V AC between interlock connection “I” and common connection “C”.
- When the unit is operating at 50% demand, the green LED should blink. If the light is not blinking, there may be an issue with the stage control board.
- Check for 24V AC at control fuse (labeled CF on heater schematics).
- Check SSR output terminals. There should be 0V DC when the demand is 0% and 24V DC when the demand is 100%. If the voltage readings are incorrect, there may be an issue with the stage control board.
- If the heater is equipped with multiple heating stages, verify operation of contacts. When the heating unit is at 100% demand, there should be 24V AC present at the corresponding contactor coil. The contacts should be closed.

If any components or wiring are found defective during these checks, repair or replace as required.

Figure 21 - Typical Heater Insert Wiring



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.
	Fan speed is too high	Reduce fan RPM.
Insufficient Heating	Blown fuse(s)	Inspect fuses. Replace if needed.
	Thermostat settings too low	Increase thermostat setting.
	Excessive Airflow	Reduce fan RPM.
	Insufficient coil power	Check incoming voltage and amperage with all coil stages on and compare to nameplate values.
No Heat	Blown fuse(s)	Inspect fuses. Replace if needed.
	Airflow switch not energized	Increase fan RPM (Sensing tube should be curved toward air flow)
	Hi-limit activation	Insufficient airflow. Increase fan RPM.
	Improper coil wiring	Inspect coil power wiring.

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.
		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.
		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.
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 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).
Electric Heat	The input for FSC proving is NOT energized.	Check the Electric Heat insert: Automatic/Manual Cutout Switches, or Airflow Proving Tube.
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.
Evap Water PS	Drain Closed - Water pressure is present. The board should not receive 120VAC. If 120VAC is not detected for 5 seconds, fault occurs.	Verify freeze protection kit is installed. Check freeze protection kit is operational.
	Drain Open - Water pressure not present. The board should receive 120VAC. If 120VAC is not detected for 15 seconds, fault occurs.	
Evap Float	Input signal from the evap float switch lost.	Check wiring. Repair broken or loose wiring connections.
		Clogged drain.
		Faulty float switch, replace switch.
DX Float	Input signal from the drain pan float switch lost.	Make sure the pan drain is clear and water is draining.
		Check wiring. Repair broken or loose wiring connections.
		Faulty float switch, replace the switch.

Fault	Potential Cause	Corrective Action
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 is less than 0.05” w.c.	Kinked/blocked/damaged hose.
		Blockage in duct.
		Confirm proper CFM.
Clgd Fltr Mtnce	Input for clogged filters activated.	Clean or replace filters.
		Check clogged filter switch adjustment.
		Faulty switch, replace switch.
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.
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.
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

For i500 Series VFD Drive troubleshooting, refer to the i500 Operation Manual.

- Information on Status LEDs, refer to section 16.1 Status LEDs
- Information on Fault Ids, refer to section 16.6.2 Causes and Remedies
- Information on Parameters, refer to section 19.1 Parameter Attribute List

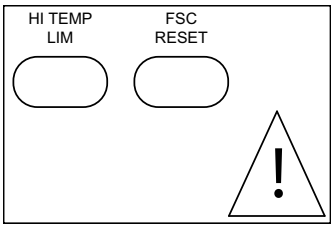
i500 Manual

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 22**. 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 22 - 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: ELECTRIC HEATERS HAVE TWO POWER INPUTS. DO NOT ATTEMPT MAINTENANCE ON THE HEATER UNTIL BOTH THE MOTOR AND COIL ELECTRICAL SUPPLY HAVE BEEN COMPLETELY DISCONNECTED.

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.
- Doors must be fully removed if technicians are entering the equipment for service.
- 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.**
- The electric coil should be kept free of dirt and foreign matter that may cause uneven air patterns. Hot spots on the coil can shorten the life of the coil.

2 Weeks After Start-up

- All fasteners should be checked for tightness when maintenance checks are performed before restarting unit.
- Inspect the electric coil. All elements should be in the proper location and clean. If an element is missing or broken, replace coil immediately.

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 when maintenance checks are performed before restarting unit.
- Inspect the unit assembly. Check all modules, curbs, and mounting equipment (rails/Uni-Strut).
- Inspect the electric coil. All elements should be in the proper location and clean. If an element is missing or broken, replace coil immediately.

Yearly

- Inspect bolts and screws. Secure and tighten as necessary.
- Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
- Inspect the unit assembly. Check all modules, curbs, and mounting equipment (rails/Uni-Strut).
- Inspect the electric coil. All elements should be in the proper location and clean. If an element is missing or broken, replace coil immediately.

Unit Filters

Table 7 - Filter Quantity Chart

Intake	16” x 20”	20” x 25”
Size 1 Standard Sloped	2	-
Size 2 Standard Sloped	-	2
Size 1 Modular Sloped	3	-
Size 2 Modular Sloped	-	3
Size 3 Modular Sloped	6	-
Size 4 Modular Sloped	10	-
Size 5 Modular Sloped	-	8
Size 1 V-Bank	-	3
Size 2 V-Bank	8	-
Size 3 V-Bank	-	8
Size 4 V-Bank	15	-
Size 5 V-Bank	-	12
Size 1 Inline	1	-
Size 2 Inline	-	1
Size 3 Inline	-	2

To order Filters, Scan the QR Code:

Notes

Start-Up and Maintenance Documentation

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

Job Information

Job Name	
Address	
City	
State	
Zip	
Phone Number	
Fax Number	
Contact	
Purchase Date	

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

Unit Information

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

Name Plate and Unit Information	
Model Number	
Serial Number	
Coil Voltage	
Coil Hertz	
Coil Phase	
Coil FLA	
Motor HP	
Motor Volts	
Motor Hertz	
Motor Phase	
Motor FLA	

Field Measured Information	
Coil Voltage	
Coil Amperage	
Motor Voltage	
Motor Amperage**	
RPM	
Thermostat Setpoint	
Temperature Control	Discharge:
	Space:

Airflow Direction	Correct	
	Incorrect	

**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.

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

CASLink

Technical Support

Parts Store