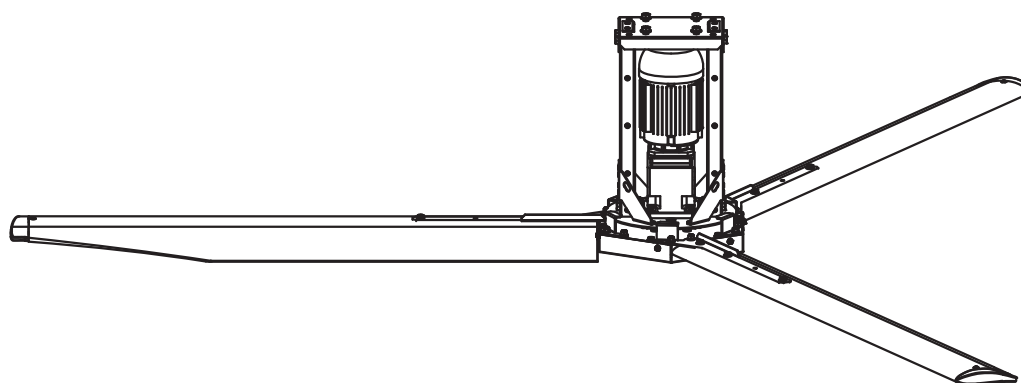
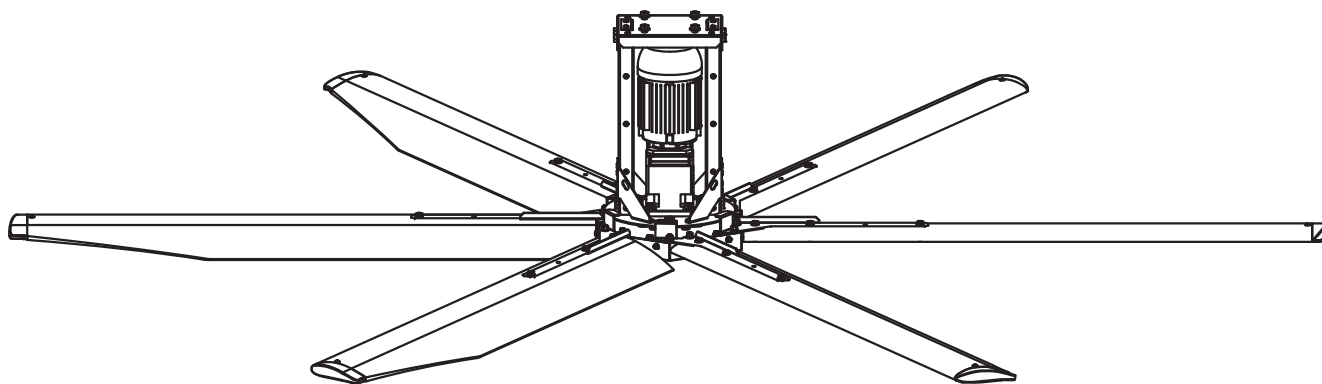


High Volume Low Speed (HVLS) Fan HVLS and General Ventilation Fan Control Software Installation, Operation, and Maintenance Manual



RECEIVING AND INSPECTION

Upon receiving the control package and/or fans, check for any interior and exterior damage, and if found, report it immediately to the carrier. Check that all accessory items are accounted for and free of damage.

WARNING!

Installation of this fan and control package 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 a serious risk of injury due to electric shock, contact with rotating equipment, and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. **ALWAYS** disconnect power prior to working on fans.

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	3	HVLS Control System Overview	59
HVLS Extended Warranty	3	Safety Faults (Level 3)	59
Warranty Conditions	4	System Overrides (Level 2)	59
MECHANICAL INSTALLATION	5	Optional Group Activation Modes (Level 1)	59
Hardware Torques	5	System Operation	60
HVLS Fan Clearance	6	Safety Features	60
Fan Located Near Lighting Sources	6	Emergency Input	60
Fan Located Below HVAC Discharge or Intake	7	Override Features	61
Fan Located At or Above HVAC Discharge or Intake	7	Temperature Alarms	61
Site Preparation - Fan	9	System Bypass	61
Caustic Environment Support System	9	Building Management System (BMS)	61
Fan Mounting Configurations	9	BMS Low Speed Input	61
I-Beam Mount	10	BMS High Speed Input	61
Concrete Beam Direct Mount	11	BMS Modulating Input	61
Concrete Multi-Beam Mount	12	Operational Modes	62
Wood Beam Direct Mount	13	Manual Mode	62
Wood Truss Mount	14	Schedule Mode	64
Open Web Steel Joist Mount(s)	15	Auto Mode	64
Direct Beam Mount	15	Input Mode	65
Installing Fan Between OWSJ	16	System Start-up Procedure	66
Mounting Between OWSJ	17	Powering Fans On for the First Time	66
OWSJ Bottom Mount Instructions	18	Start-up Procedure - Smart Control	66
OWSJ Top Mount Instructions	19	Switching Between Operational Modes	67
Purlin Mount	21	Manual Mode Startup	68
Mounting Hardware	23	Schedule Mode Startup	69
Installing Pivot Mount Assembly	23	Auto Mode Startup	70
Tube Assembly	24	Input Mode Startup	71
Leveling Pivot Assembly	25	BMS Only Startup	72
Hub Assembly	26	Network	73
Mounting Fan to Extension	27	BACnet	73
Guy Wire Installation	28	Device Instance, MAC Address, Baud Rate	74
Clamp Installation	28	Changing the IP Address	75
Blade Installation	30	LonWorks	76
6 Blade Fan Details	31	Direct Digital Control (DDC)	77
3 Blade Fan Details	32	TROUBLESHOOTING	82
ELECTRICAL INSTALLATION	33	VFD Fault List	83
Typical HVLS Fan and Smart Control Installation	34	HMI Fault List	84
Enclosure	34	MAINTENANCE	85
Site Preparation – Controls	34	General Maintenance	85
High Voltage Power Wiring	34	Every 3 Months	85
Low Voltage Control Wiring	35	6 Months After Startup	85
ECPM03 Board	36	Every 12 Months	86
Connector Descriptions	36	Maintenance Logging and Alerts	86
ELECTRICAL COMPONENTS	39	Start-Up Documentation	88
HMI and Remote Room Sensor Installation	39	Technical Support Information	88
Ceiling Mounted Temperature Sensors	40		
PWM 0-10V Board	40		
Wireless Mini Sensor Board (WMSB)	41		
WMSB Installation	42		
J-Box Installation	42		
Ambient Lighting Requirements	43		
Board Description	44		
Modes of Operation	45		
Variable Frequency Drive (VFD) Power Wiring	46		
VFD Wiring Connections	46		
Variable Frequency Drive (VFD) Installation	48		
VFD Input AC Power	49		
VFD Output Power	49		
VFD Programming	50		
ACTECH SMV VFD	51		
SYSTEM INFORMATION	52		
Human Machine Interface (HMI)	52		
Accessing Remote HMI Settings	52		
Menu System - Remote HMI Options	52		
Menu System - Remote HMI	53		
ECPM03 LCD	58		
General Overview	58		
Menu System - ECPM03 HMI	58		

WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 5-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, or Local codes and regulations.
3. The equipment is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 5-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.

HVLS Extended Warranty

Factory Authorized Representative Installation	
7-Year Warranty: Electrical and Mechanical components	Lifetime Warranty: Blades, Hub, and Frame

ATTENTION: If the fan is damaged during operation, the fan SHOULD NOT be operated until a factory authorized representative has inspected and approved the repair or replacement of parts.

The warranty does not cover, any defects or damage caused by:

- Objects that come in contact with the fan causing damage.
- Objects that become tangled with the fan (e.g., power cords, extension cords, air hoses, chains, etc.).
- Premises structural defects, structural movements or settlement.
- Parts and/or components damaged from neglect, accident, abuse, misuse, misapplication, or incorrect installation.
- Repair or alteration not authorized in writing by the MANUFACTURER.
- Failure to properly store the product before installation.
- Exposure to caustic chemicals, saltwater, acidic or corrosive elements, excessive humidity, or windy conditions.
- Improper testing, operation, maintenance, adjustment, or modification of any kind not authorized in writing by MANUFACTURER personnel.
- Use of the product under other than normal operating conditions or in a manner inconsistent with the product's label or instructions such as:
 - Controls and or any other external electronic controlling devices.
 - Exclusions listed in the standard or extended warranties.
 - Any products or components purchased prior to effective date of this warranty.
- Shipping and delivery of the product through the shipping carrier.

Warranty Conditions

This warranty is not valid:

- Unless the USER returns to the MANUFACTURER the “**Start-Up Documentation**” on page 88 within **thirty (30) days** of purchase.
- If the product’s serial numbers have been removed or are illegible.
- If any warranted items repaired or replaced pursuant to this warranty will be warranted for the remaining portion of the original warranty subject to all the terms thereof. The MANUFACTURER shall not be responsible for any charges for testing, checking, removal, or installation of warranted items unless authorized in writing by MANUFACTURING personnel.
- If failed to submit records at the time of performing recommended Maintenance Schedule, minimum every **18 months**.

Limitation of liability: The remedies of the USER set forth herein are exclusive and are the sole remedies for any failure of the MANUFACTURER to comply with its obligations hereunder. In no event shall the MANUFACTURER be liable in contract, in tort (including negligence or strict liability) or otherwise for damage to property or equipment other than the products, including loss of profits or revenue, loss of use of products, cost of capital, claims of customers of the USER or any special, indirect, incidental or consequential damages whatsoever. The total cumulative liability of the MANUFACTURER hereunder whether the claims are based in contract (including indemnity), in tort (including negligence or strict liability) or otherwise, shall not exceed the price of the product on which such liability is based. The MANUFACTURER shall not be responsible for failure to provide service or parts due to causes beyond the MANUFACTURER’S reasonable control.

User’s obligations: In order to receive the benefits of this warranty, the USER must use the product in a normal way, follow the product’s installation manual, and protect against further damage to the product if there is a covered defect. Submit records at the time of performing Recommended Maintenance Schedule, minimum every **18 months**.

Other limitations: The MANUFACTURER’S obligations under this warranty are expressly conditioned upon receipt by the MANUFACTURER of all payments due to it, including all applicable interest charges. During such time as the MANUFACTURER has not received payment of any amount due to it for the product, in accordance with the contract terms under which the product is sold, the MANUFACTURER shall have no obligation under this warranty. Also, during such time, the period of this warranty shall continue to run, and the expiration of this warranty shall not be extended upon payment of any overdue or unpaid amounts.

Costs not related to warranty: The USER shall be invoiced for and shall pay for all services not expressly provided for by the terms of the warranty, including without limitation, site calls involving an inspection that determines no corrective maintenance is required. Any costs for replacement equipment, installation, materials, freight charges, travel expenses, or labor of the MANUFACTURER’S representatives outside the terms of this warranty will be borne by the USER.

Obtain warranty service: The MANUFACTURER will not accept any products for return, credit, or exchange unless expressly authorized by the MANUFACTURER in writing and delivered to the MANUFACTURER’S factory service location with proper Return Authorization Number attached to the product. Refer to “**Technical Support Information**” on page 88 for more information.

MECHANICAL INSTALLATION

WARNING: TO REDUCE THE RISK OF PERSONAL INJURY, DO NOT BEND THE BLADE BRACKETS WHEN INSTALLING THE BRACKETS, BALANCING THE BLADES, OR CLEANING THE FAN.

DO NOT INSERT FOREIGN OBJECTS IN BETWEEN ROTATING FAN BLADES.

DO NOT LIFT CONTROL BY WIRING COMPONENTS. DO NOT LIFT FAN BY THE BLADES, MOTOR SHAFT OR BEARINGS. TORQUE ALL FASTENERS PER THIS MANUAL.

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, DO NOT USE REPLACEMENT PARTS THAT HAVE NOT BEEN RECOMMENDED BY THE MANUFACTURER.

It is imperative that this unit is installed and operated with the designed speed range and electrical supply in accordance with this manual and applicable codes. If there are any questions about any items, refer to support.captiveaire.com.

Tools Required:

- Level
- Cable Cutters
- Basic Wrench Set
- Ratchet or Impact Wrench
- Basic Socket Set (up to 3/4")
- Torque Wrench
- Lifting Device or Scaffolding

Hardware Torques

Table 1 - Torques

Thread Size	Torque
1/8" Clamp	3 Ft-lbs (36 in-lbs) / 4 Nm
3/16" Clamp	4.5 Ft-lbs (54 in-lbs) / 6 Nm
1/4" 316SS Clamp	10 Ft-lbs (120 in lbs) / 14 Nm
3/8" Grade 8 Min	30 Ft-lbs / 41 Nm
M10 Class 8.8 Min	38 Ft-lbs / 52 Nm
1/2" Grade 8 Min	75 Ft-lbs / 101 Nm
M14 Class 8.8 Min	105 Ft-lbs / 142 Nm
8, 12, 16 Torque Nut	190 Ft-lbs / 257 Nm
20, 24 Torque Nut	265 Ft-lbs / 359 Nm

HVLS Fan Clearance

NOTE: Make sure the fan is not installed above any objects that produce airflow toward fan blades.

Clearances (**Table 2**):

- 60" minimum top of fan blade to roof deck
- 24" minimum from fan blade to obstructions above or below
- 18" minimum from side of fan to any obstruction
- 144" minimum from floor to fan

Table 2 - Blade Clearance

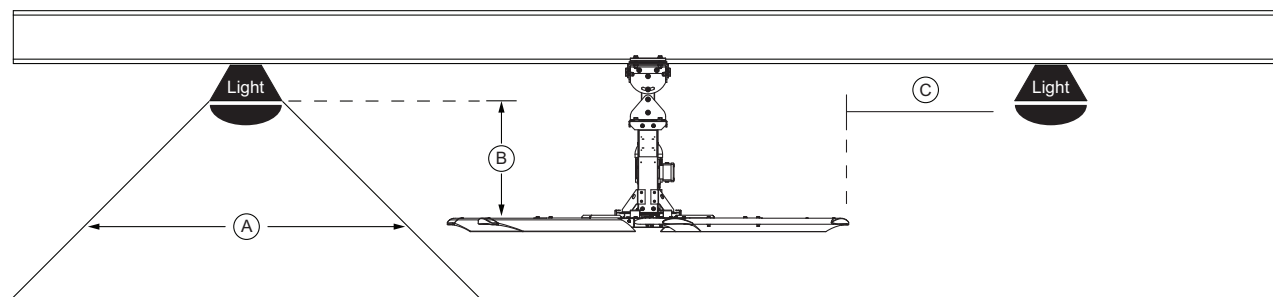
Fan Blade Diameter (Feet)	Clearance (Feet)
8	16
10	20
12	24
14	28
16	32
18	36
20	40
22	44
24	48

Fan Located Near Lighting Sources

There are various lighting variables that may cause a strobing effect. **Figure 1** illustrates lighting scenarios to consider when mounting an HVLS fan.

Lights mounted above an HVLS fan can create a strobing effect if the beam (A) passes through the blades. To minimize strobing effects, increase the vertical distance (B) between the light source and fan blades. Increasing the horizontal distance (C) between the blade tips and light source will also help to alleviate strobing effects.

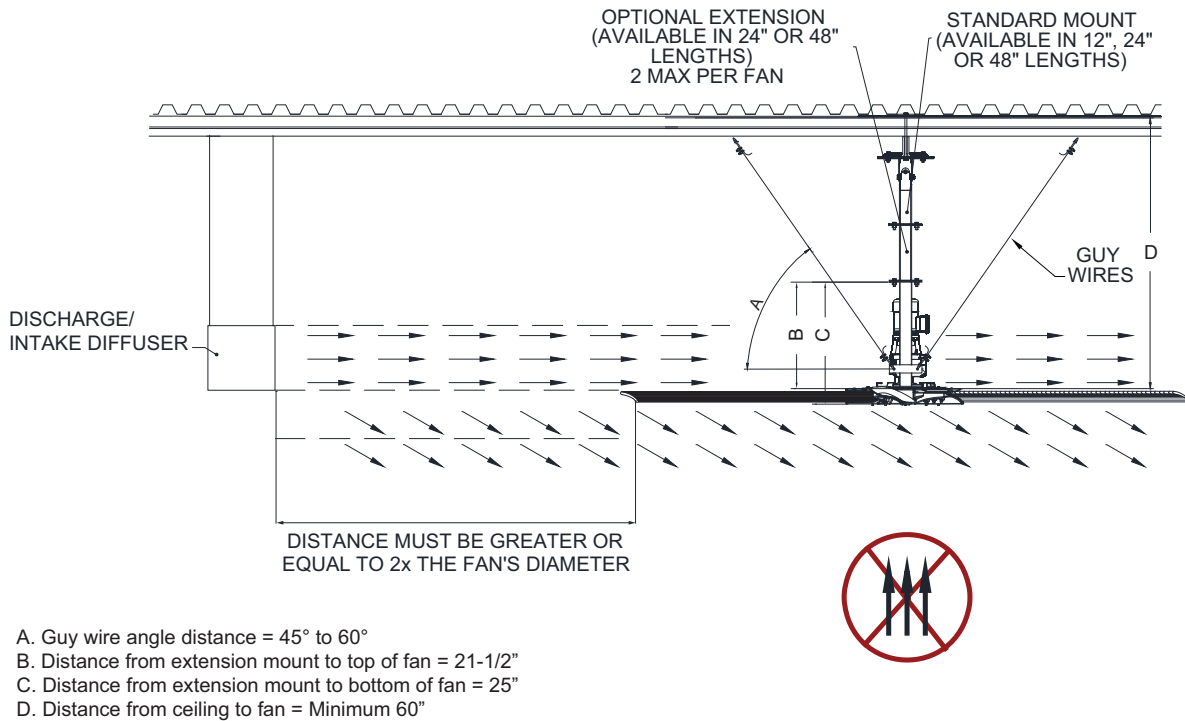
Figure 1 - Clearances to Lighting Sources



Fan Located Below HVAC Discharge or Intake

A fan that is mounted below a discharge/intake diffuser must be located greater or equal to twice the fan's diameter. **For down discharge, the distance must be greater or equal to 1/2 the fan's diameter.**

Figure 2 - Fan Located Below HVAC Details



Fan Located At or Above HVAC Discharge or Intake

A fan that is mounted at or above the discharge/intake diffuser must be located greater or equal to the fan's diameter. **For down discharge, the distance must be greater or equal to half the fan's diameter.**

Figure 3 - Fan Located At or Above Discharge or Intake Details

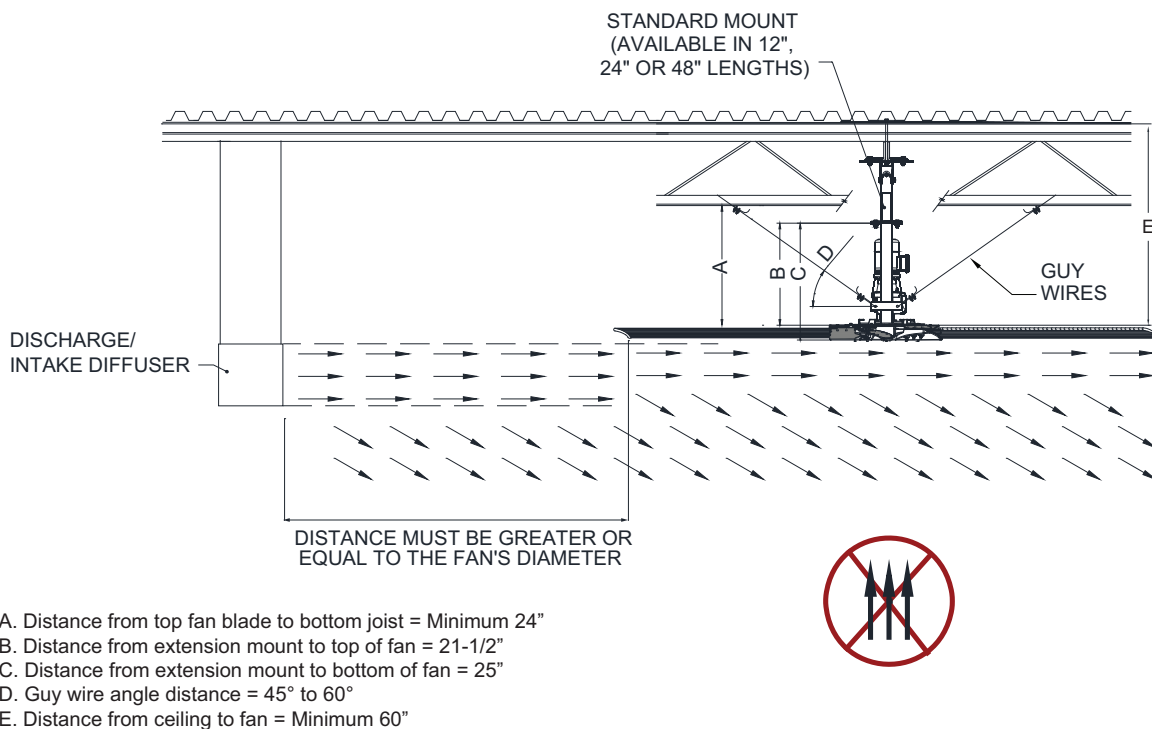
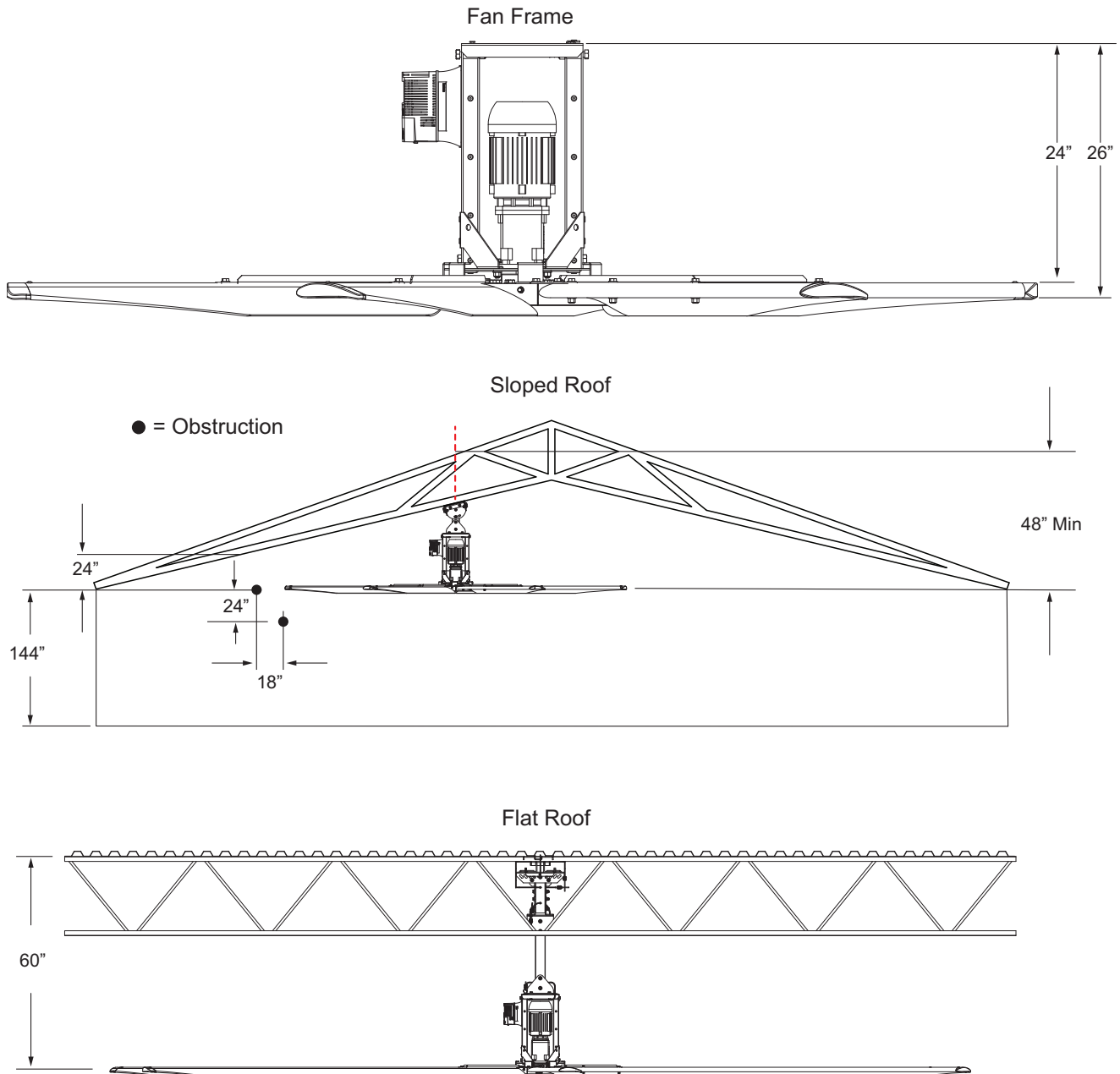


Figure 4 - Fan Clearance Details



HVLS fans installed in buildings equipped with sprinklers, including ESFR (Early Suppression, Fast Response) sprinklers, shall comply with the following:

- The maximum fan diameter shall be 24 ft (7.3 m).
- The HVLS fan shall be centered approximately between four adjacent sprinklers. The vertical clearance from the HVLS fan to sprinkler deflector shall be a minimum of 3 ft. (0.9 m).
- All HVLS fans shall be interlocked to shut down immediately upon receiving a water-flow signal from the alarm system in accordance with the requirements of NFPA 72.

NOTE: Contractor is responsible for verifying all site conditions to include field dimensions where applicable. If the contractor elects to make any changes without notification, the contractor is responsible for the changes. All drawings are to be used as general architectural intent unless otherwise stamped. See engineering drawings for structural design information. Contractor to ensure that all building departments and authorities are informed concerning the work, and all permits are obtained before beginning work.

Site Preparation - Fan

1. Provide clearance around installation site to safely rig and lift equipment into its final position. Supports and roof structure must adequately support fans. Refer to manufacturer's estimated weights.
2. Consider general service and installation space when locating fans.
3. Check drawings and layouts provided to locate where the fan is to be installed.
4. Check to see if you have all the tools required for the installation.
5. Verify that all fan components were received.
6. Ensure work area is safe and that all security policies and procedures for the facility are met.
7. Inspect the lift device or mobile platform.
8. Each person installing the fan must use a safety harness at all times. Other safety requirements may be required for installation.

Caustic Environment Support System

Caustic environments require corrosion-resistant support systems. If mounting in a caustic environment, fan installation requires **1/4" 316 stainless steel** support cables, cable clamps, turnbuckles, and thimbles. Guy wires and safety cables must be 1/4" 316 stainless steel. Clamps must be torqued to the appropriate setting. Refer to **"Hardware Torques" on page 5**.

Table 3 - Caustic Environment Support System

Description	Part Number
1/4" Guy Wire Cable - 316SS	HVLS8908T52GW
1/4" Safety Rope – 316SS	HVLS8908T52SR
1/4" Cable Clamp – 316SS	CABLECLAMP-CE
1/4" Cable Thimble – 316SS	3868T25
Round End Hook & Eye Turnbuckle – 316SS	30315T23

Fan Mounting Configurations

There are different mounting configurations for different types of ceiling structures. Refer to **page 10** through **page 30** for detailed component descriptions. Fans may be mounted directly to beams, hung from Open Web Steel Joists (OWSJ), Purlins, Wood Beams, or Concrete Beams.

AT ALL CONNECTIONS, SAFETY CABLES MUST BE USED FOR REDUNDANT SECURITY. 2 CLAMPS MUST BE USED ON EVERY SAFETY CABLE END. ALL HARDWARE MUST BE TORQUED APPROPRIATELY PER THIS MANUAL.

All fans require a standard mount in 12, 24, or 48-inch lengths. Up to 2 extensions can be used to lower the fan off the standard mount. Extensions are available in 24 or 48-inch lengths. Example installations are shown below and are representations which are subject to change without notice.

I-Beam Mount

Used to mount the fan directly under an I-Beam. The beam must be 3" to 10" wide and 1/4" to 1" thick. Use I-beam spacers when the beam thickness is greater than 5/8" up to 1" thick.

1. Install 1/2"-13x3" bolts with 1/2" washers through the I-beam clamp. Keep clamps as close to the beam as possible. Pivot mount should be centered along the width of the beam.
2. Place pivot extension assembly through bolts and secure with 1/2"-13 nylock nut and 1/2" washers.

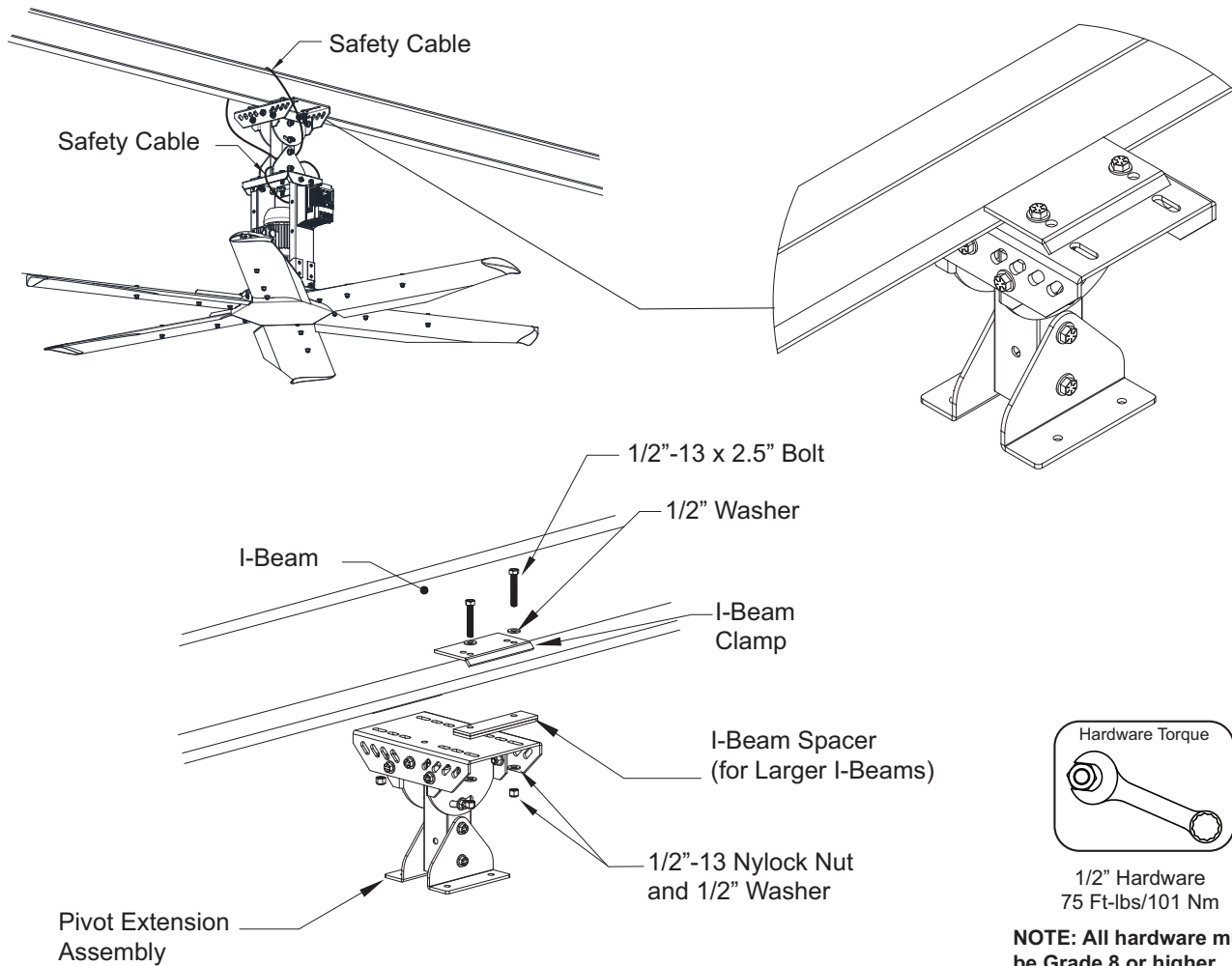
NOTE: Use the I-beam clamp spacer provided if the beam is too thick to install to the pivot extension assembly. Place the spacer between the I-beam clamp and pivot extension assembly.

3. Torque hardware to 75 ft-lbs/101 Nm.

To install extension assembly, refer to "Installing Pivot Mount Assembly" on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 5 - I-Beam Top Mount Details



Concrete Beam Direct Mount

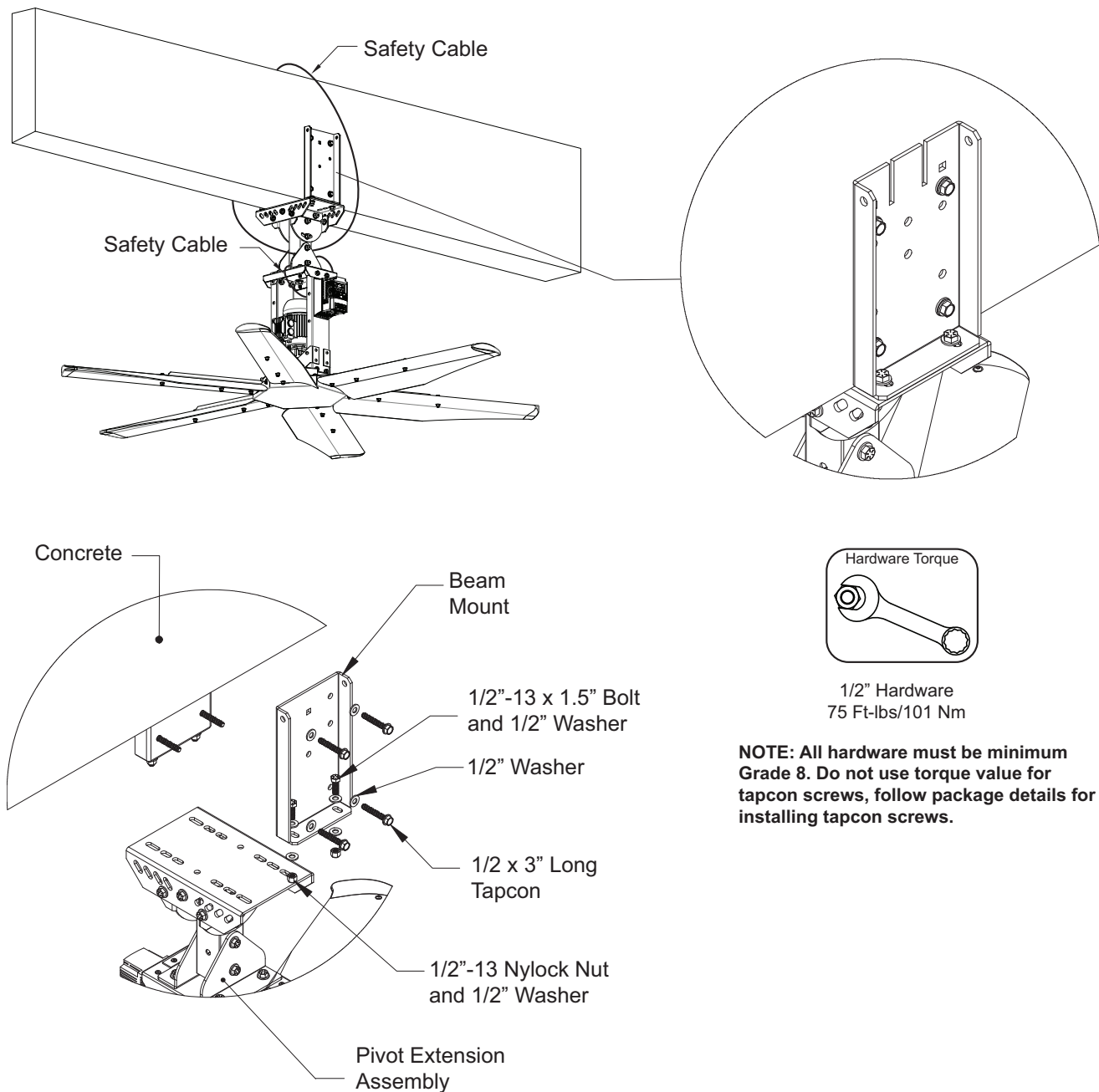
Used to mount the fan directly under a single concrete beam. Minimum thickness 6" / Maximum thickness 10".

1. Secure beam mount brackets to the concrete beam. Use four (4) 1/2" x 3" long tapcon screws with 1/2" washers to secure each bracket to the beam.
2. Install 1/2"-13 x 1.5" bolts with 1/2" washers through the bottom of the beam mount bracket.
3. Place pivot extension assembly through bolts and secure with 1/2"-13 nylock nuts and 1/2" washers.
4. Torque hardware to 75 ft-lbs/101 Nm.

To install extension assembly, refer to "Installing Pivot Mount Assembly" on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 6 - Concrete Direct Mount Details



Concrete Multi-Beam Mount

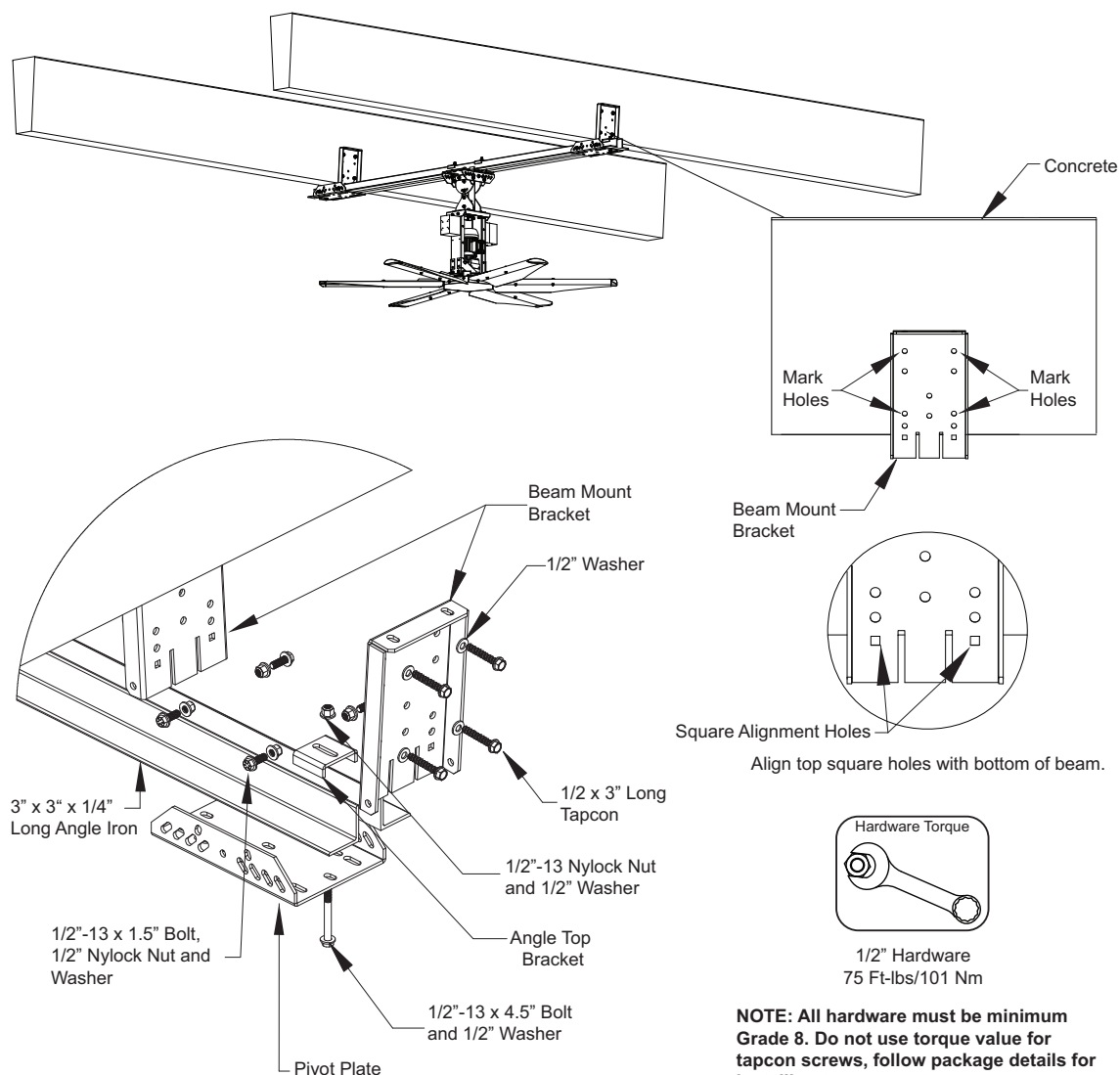
Used to mount fan between two concrete beams. Minimum thickness 6" / Maximum thickness 10".

1. Use the square alignment holes to keep the beam mount bracket flush with the beam. Mark the four mounting location holes.
2. Secure beam mount brackets to the concrete beam. Use four (4) 1/2" x 3" long tapcon screws with 1/2" washers on each bracket.
3. Install pivot plate to beam mount bracket. Insert 1/2"-13 x 1.5" bolts and 1/2" washers through the side of the pivot plate into the beam mount bracket. Secure with 1/2"-13 nylock nut and 1/2" washer.
4. Repeat securing the mounting brackets on the other side.
5. Slide the angle iron through the grooves in the beam mount bracket. This will align with the angle iron.
6. Install angle top bracket over the angle iron sections.
7. Insert 1/2"-13 x 4.5" bolts and 1/2" washer through one of the bottom holes located in the pivot plate. Secure with 1/2"-13 nylock nut and 1/2" washer.
8. Torque all hardware to 75 Ft-lbs/101 Nm.

To install extension assembly, refer to "Installing Pivot Mount Assembly" on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 7 - Multi-Mount Concrete Details



Wood Beam Direct Mount

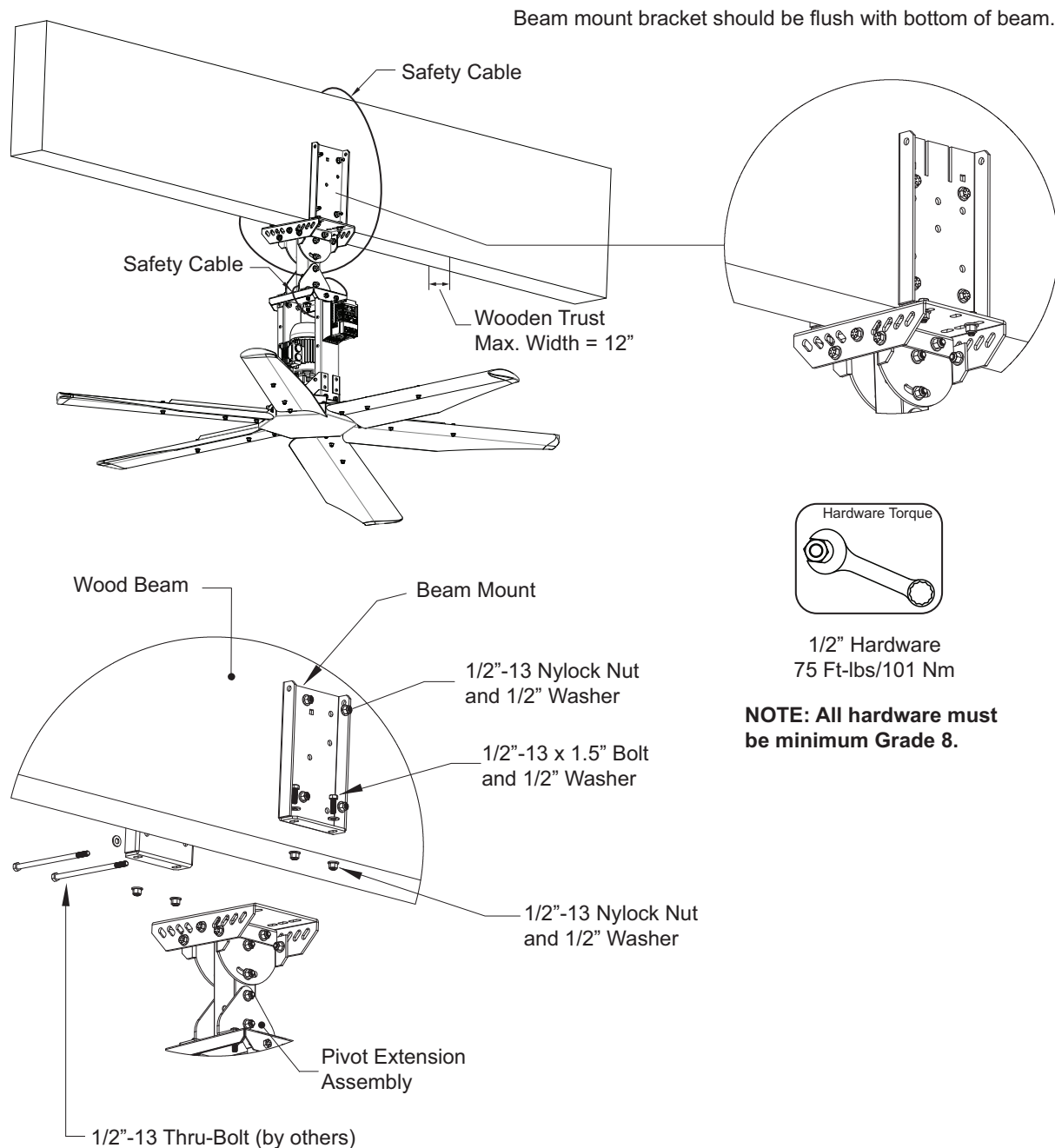
Used to mount directly under single laminated wood beam. Beams should be 6"-12" wide.

1. Secure beam mount brackets to the wood beam. Use four (4) 1/2"x13 thru-bolts (by others) with 1/2" washers. Secure with 1/2"-13 nylock nuts and 1/2" washers.
2. Install 1/2"-13x1.5" bolts with 1/2" washers through the bottom of the beam mount bracket.
3. Place pivot extension assembly through bolts and secure with 1/2"-13 nylock nuts and 1/2" washers.
4. Torque hardware to 75 ft-lbs/101 Nm.

To install extension assembly, refer to "Installing Pivot Mount Assembly" on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 8 - Wood Beam Direct Mount Details



Wood Truss Mount

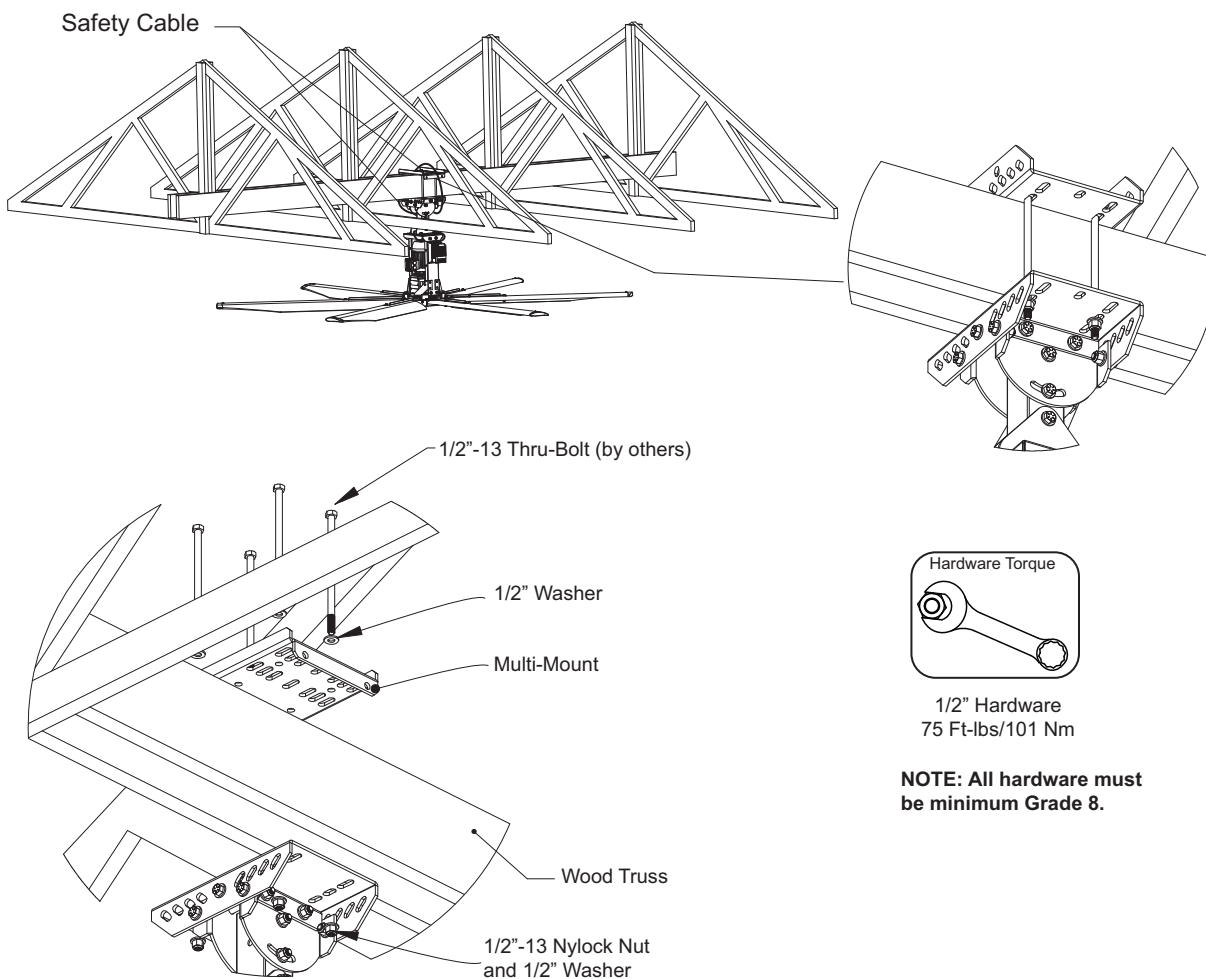
Used to mount fan to a wood truss structure.

1. Place four (4) 1/2"x13 thru-bolts (by others) with 1/2" washers through the multi-mount bracket.
2. Place pivot extension assembly through bolts and secure with 1/2"-13 nylock nuts and 1/2" washers.
3. Torque hardware to 75 ft-lbs/101 Nm.

To install extension assembly, refer to "Installing Pivot Mount Assembly" on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 9 - Wood Truss Mount Details



Open Web Steel Joist Mount(s)

Used to mount directly under a single OWSJ. There are different mounting configurations for installing the fan, depending on the installation location. You may directly mount the fan to the bottom of the OWSJ with kit HVLS-MOUNT-OWSJ-DM. You may install between the joists on the top or bottom of the OWSJ. If installing between joists, refer to “**Installing Fan Between OWSJ**” on page 16. All hardware must be minimum grade 8.

Direct Beam Mount

Used to mount the fan directly under an OWSJ. The beam must be 3” to 10” wide and 1/4” to 1” thick. Use I-beam spacers when the beam thickness is greater than 5/8” up to 1” thick.

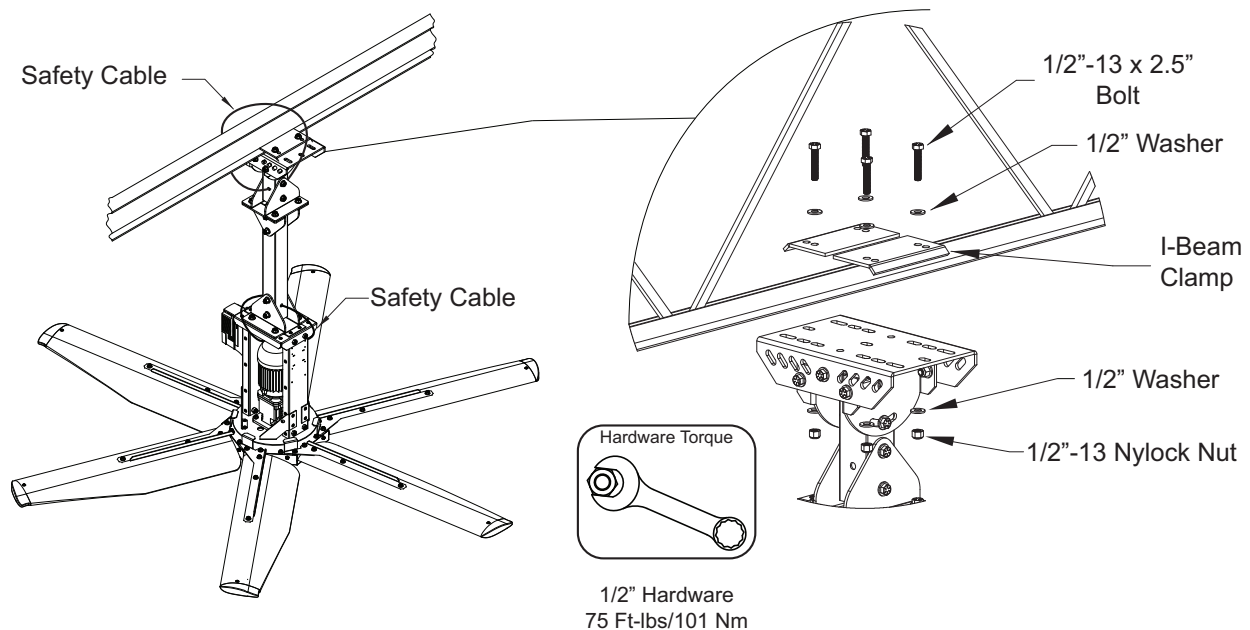
The direct mount uses two I-Beam clamps with the pivot extension assembly.

- Insert 1/2”-13 x 6” bolts with 1/2” washers through the I-Beam clamp.
- Place pivot extension assembly through bolts and secure with 1/2”-13 nylock nut and 1/2” washers.
- Torque hardware to 75 Ft-lbs/101 Nm.

To install extension assembly, refer to “**Installing Pivot Mount Assembly**” on page 23.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to “Caustic Environment Support System” on page 9.

Figure 10 - OWSJ Direct Beam Mount Details



NOTE: All hardware must be minimum Grade 8.

Installing Fan Between OWSJ

If installing the fan between OWSJ, the fan must be mounted to angle iron. Verify the distance between the joists. If the distance is 10 feet or less, use kit **HVLS-MOUNT-OWSJ-10**. If the distance is greater than 10 feet and less than 18 feet, use kit **HVLS-MOUNT-OWSJ-18**. The distance between the joists must not exceed a maximum distance of 18 feet.

The angle iron actual sizing is 11'-6" for 10-foot sections and 19'-6" for 18-foot sections. This allows for a minimum of 9" overhang past each joist. If the angle iron is cut down to fit the distance between the joists, the minimum 9" overhang on each joist must remain.

Keep the fan's weight distributed away from the joist. Install the fan at least 1/4 distance away from the edge of the mounts, refer to **Figure 12**.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 11 - Angle Iron Details

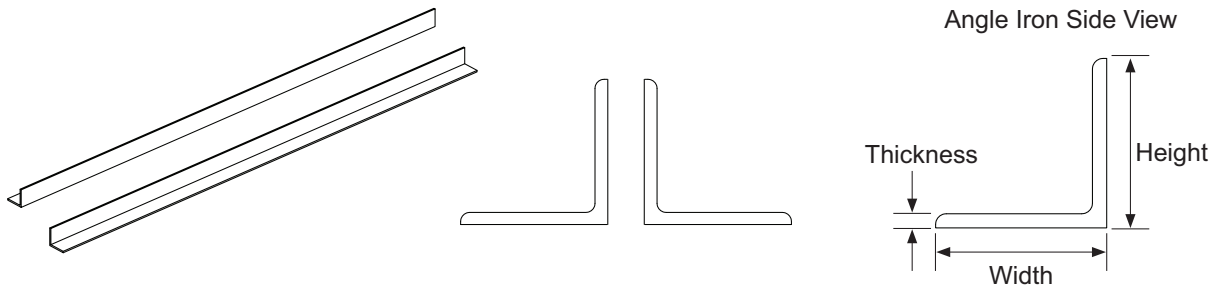
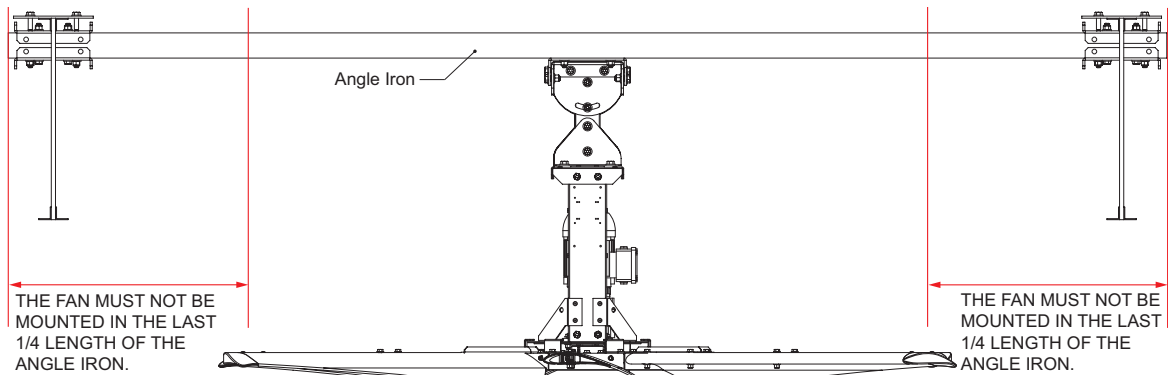
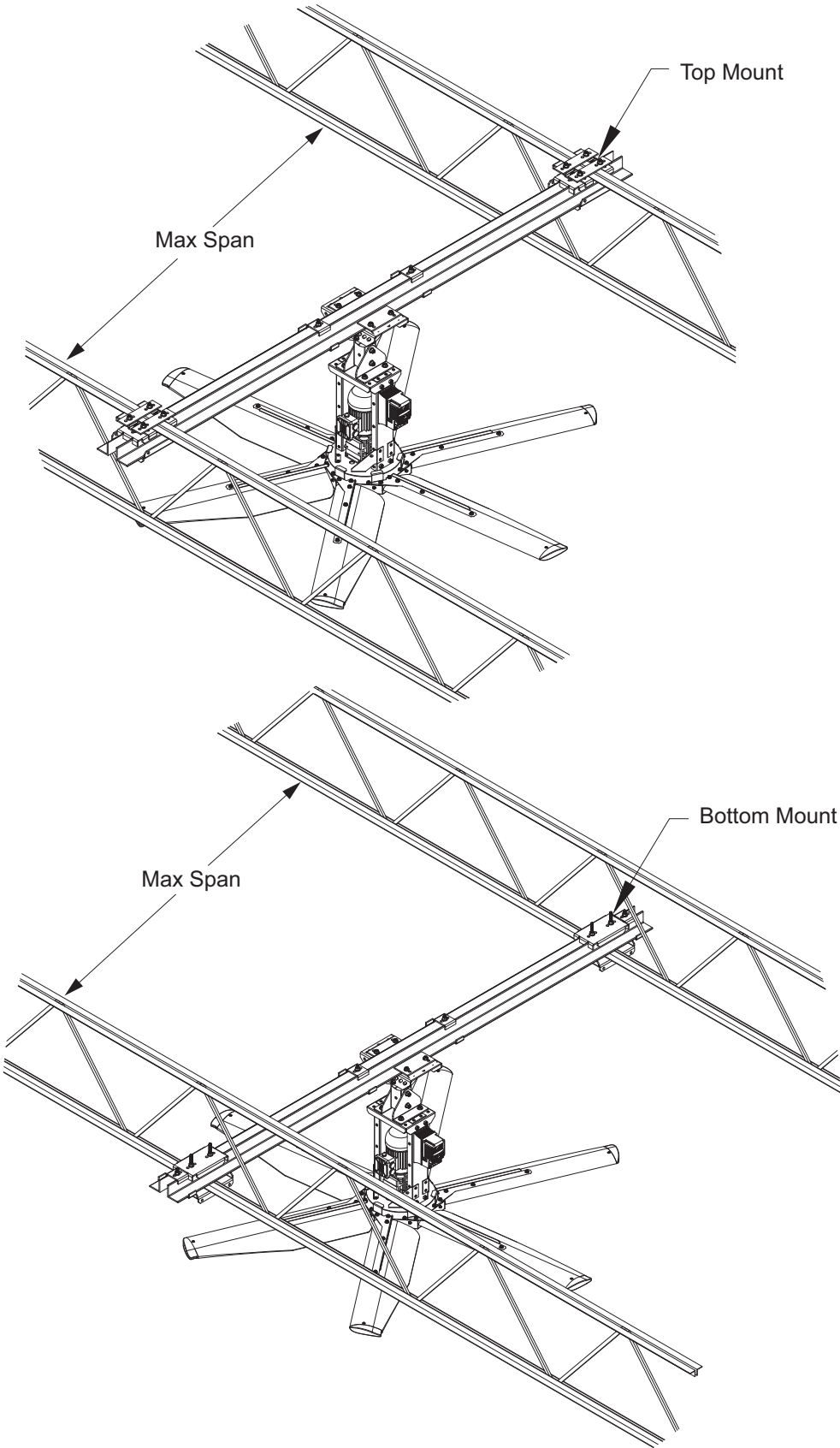


Figure 12 - OWSJ Mounting Location



Mounting Between OWSJ

Figure 13 - OWSJ Span Installations



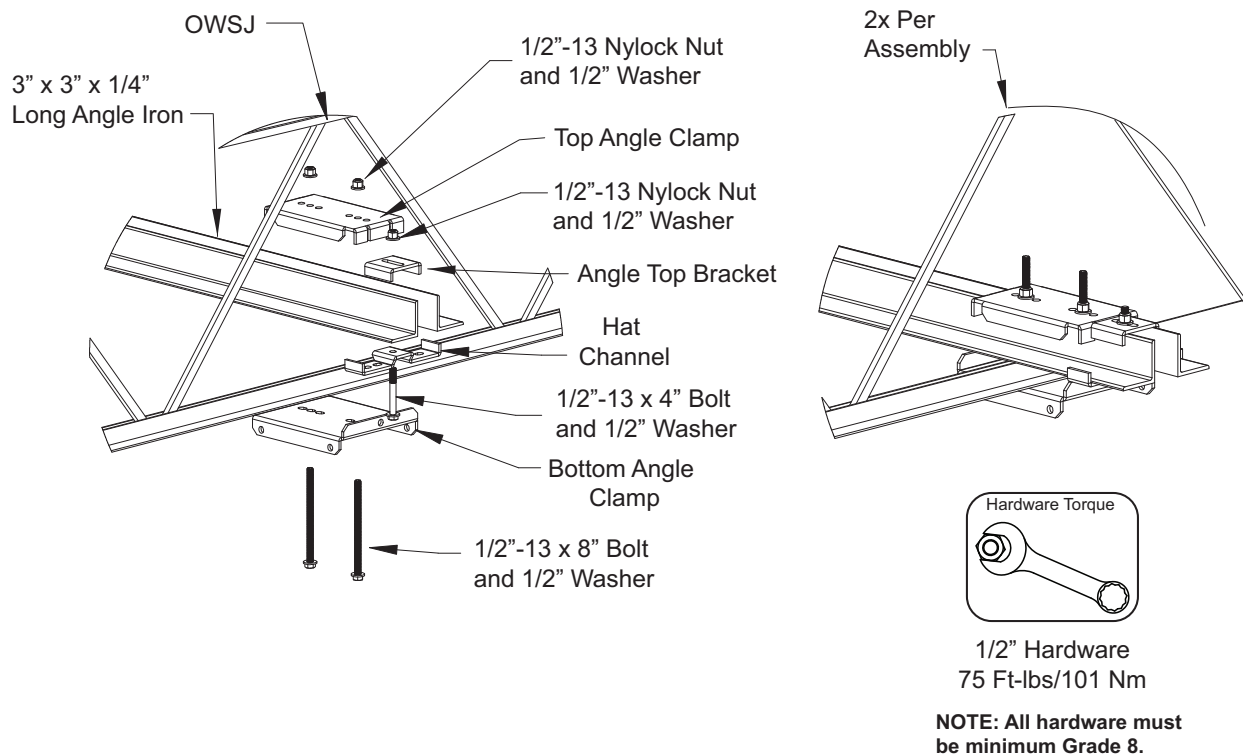
OWSJ Bottom Mount Instructions

Used to mount fan between bottom of two OWSJs.

1. Place both sections of angle iron where it will be mounted. Make sure each section is overhanging the joist.
2. Install the hat channel and angle top bracket to space the angle iron. Insert 1/2"-13 x 4" bolt and washer through the bottom center hole of the hat channel. Secure with 1/2"-13 nylock nut and washer.
3. Place the top angle clamp onto the angle iron. The grooves in the clamp will align with the angle iron.
4. Install the bottom angle clamp using 1/2"-13 x 8" bolts and washers. Secure with 1/2"-13 nylock nuts and washers.
5. Repeat securing the angle iron section to the other side.
6. Torque all hardware to 75 Ft-lbs/101 Nm.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 14 - OWSJ Bottom Mount Details



OWSJ Top Mount Instructions

Used to mount fan between top of two OWSJs.

1. Assemble one end of the top mount bracket and hat channel, refer to **Figure 16 Detail A on page 20**.
2. Insert 1/2"-13 x 8" bolts and washers through the top of the hat channel.
3. Center the bracket on the beam. Use the holes closest to the beam, this will secure the mount.
4. Align the hat channel to the top mount. Use 1/2"-13 x 1.5" bolts and washers. Secure with 1/2" nylock nuts and washers.
5. Slide the assembly on top of the joist.
6. Assemble the other end with 1/2"-13 x 1.5" bolts and washers. Secure with 1/2" nylock nuts and washers.
7. Place the top angle clamp through the 8" bolts. Install the bottom angle clamp. Loosely secure with 1/2" nylock nuts and washers.
8. Repeat securing the top mount bracket on the other side.
9. Slide the angle iron through the grooves in the clamp. This will align the angle iron with the hat channel.
10. Torque all hardware to 75 Ft-lbs/101 Nm.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 15 - OWSJ Top Mount Assembly Details

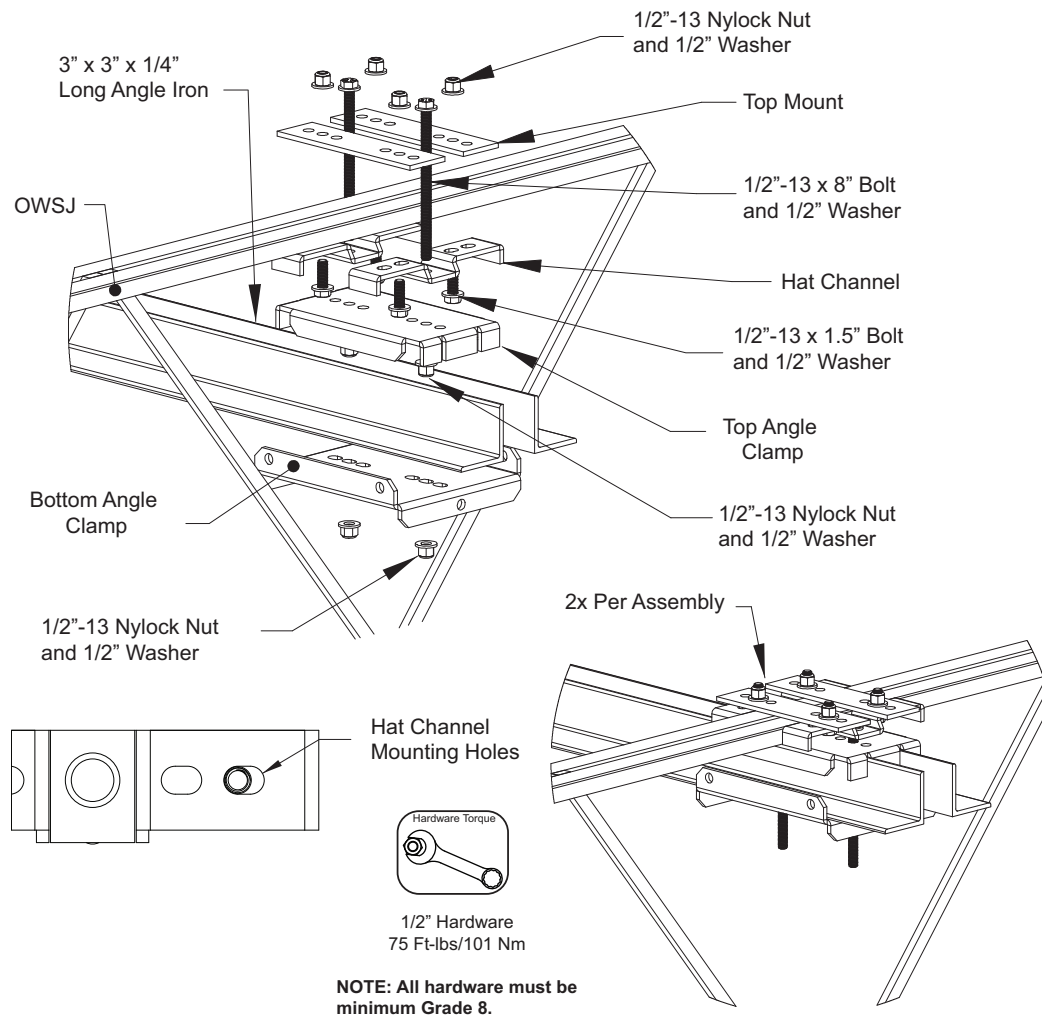
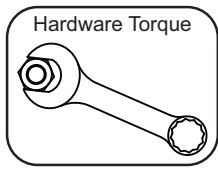


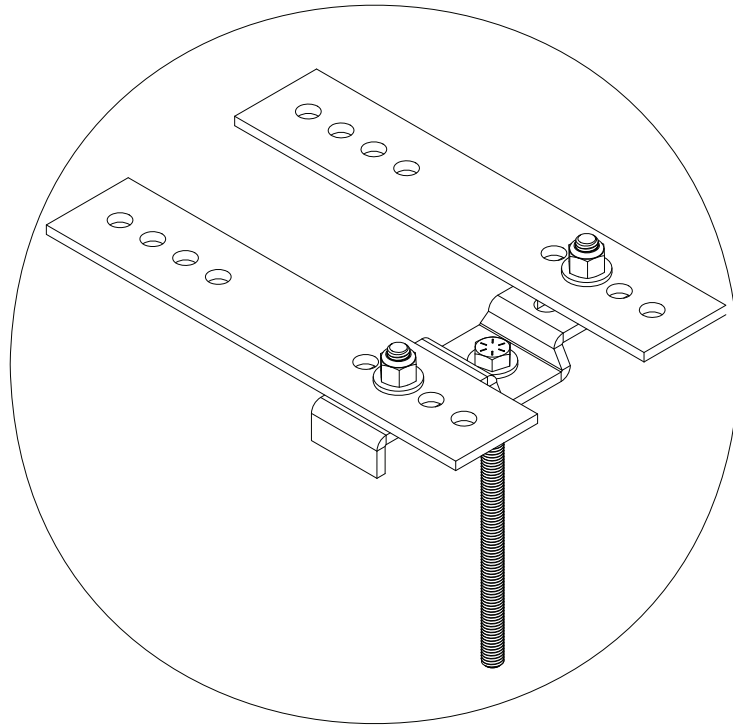
Figure 16 - OWSJ Top Mount Assembly Details



1/2" Hardware
75 Ft-lbs/101 Nm

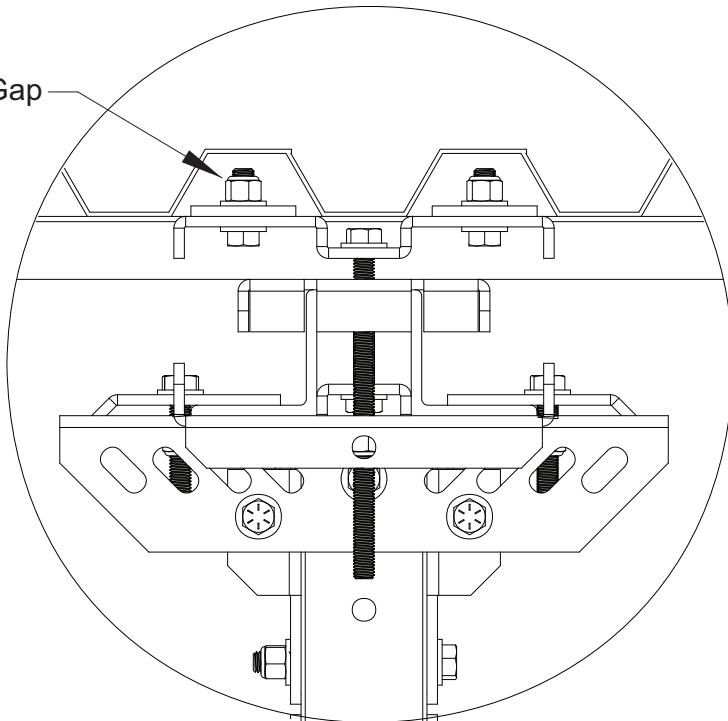
**NOTE: All hardware must
be minimum Grade 8.**

Detail A



Detail B

Bolts and Nuts Should
Mount Between Roof Gap



Purlin Mount

Used to mount fan under minimum (4) Purlin beams.

1. Use the beam mount bracket to mark drilling hole locations. After drilling out the holes, insert 1/2"-13 x 1.5" bolts and 1/2" washers through the bracket and purlin. Secure with 1/2"-13 nylock nut and 1/2" washer.
2. Install pivot plate to beam mount bracket. Insert 1/2"-13 x 1.5" bolts and 1/2" washers through the center holes of the pivot plate into the beam mount bracket. Secure with 1/2"-13 nylock nut and 1/2" washer.
3. Repeat securing the mounting brackets on the other side.
4. Slide the angle iron through the grooves in the beam mount bracket. This will align with the angle iron.
5. Install angle top bracket over the angle sections on the outside of each purlin beam.
6. Insert 1/2"-13 x 4.5" bolts and 1/2" washer through the bottom center hole located in the pivot plate. Secure with 1/2"-13 nylock nut and 1/2" washer.
7. Torque all hardware to 75 Ft-lbs/101 Nm.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 17 - Purlin Mount Assembly Details

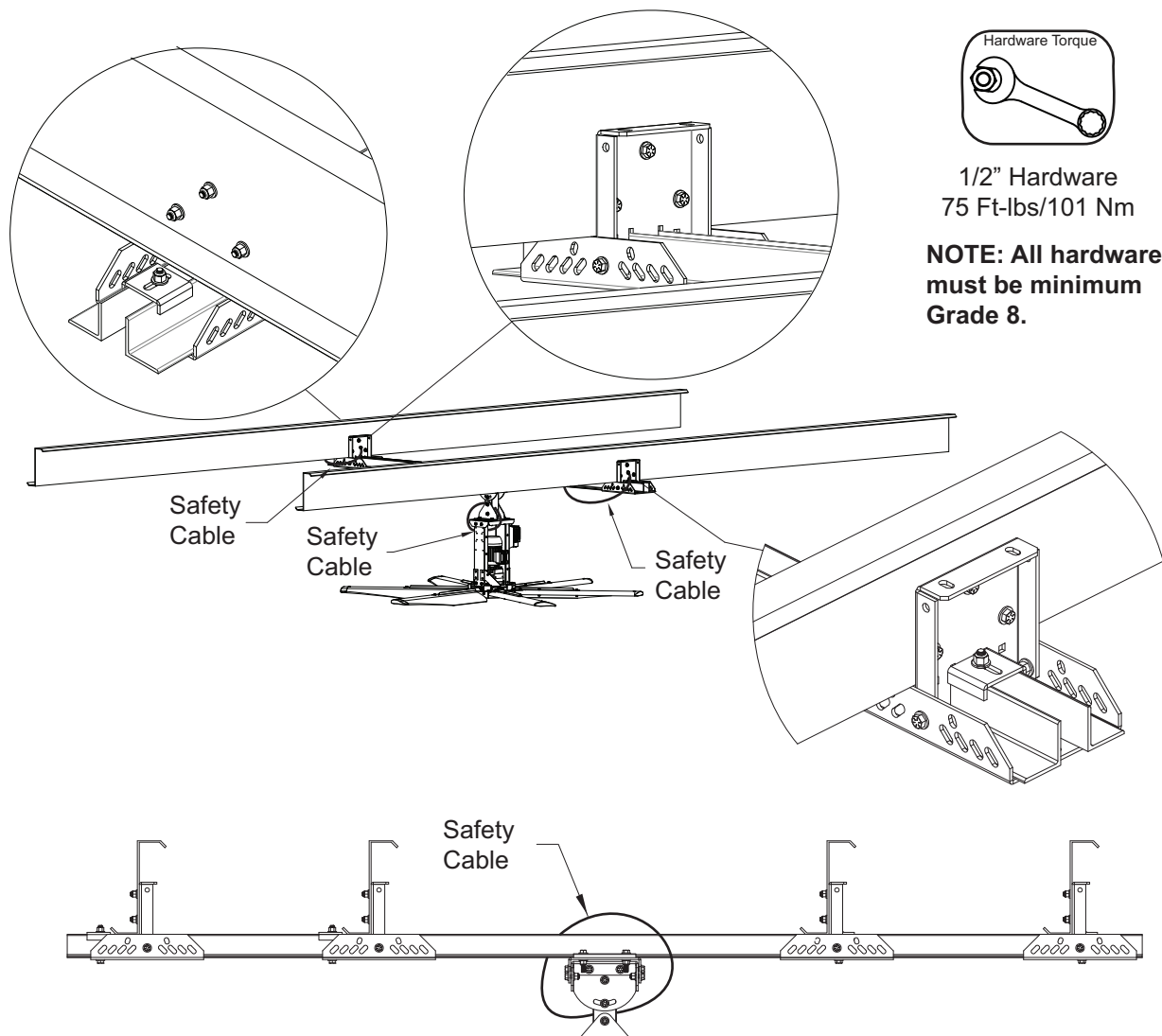
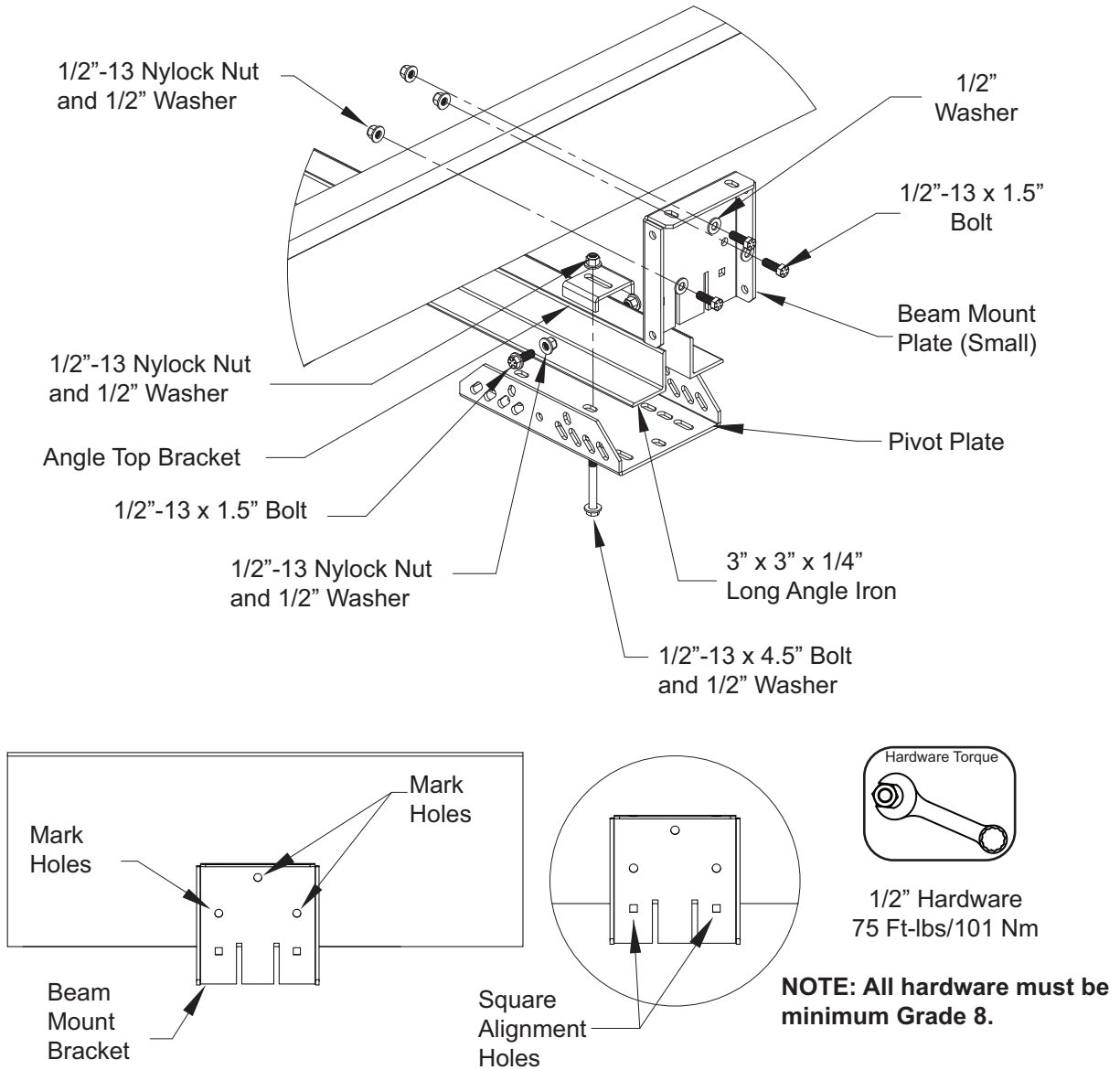


Figure 18 - Purlin Mount Assembly Details



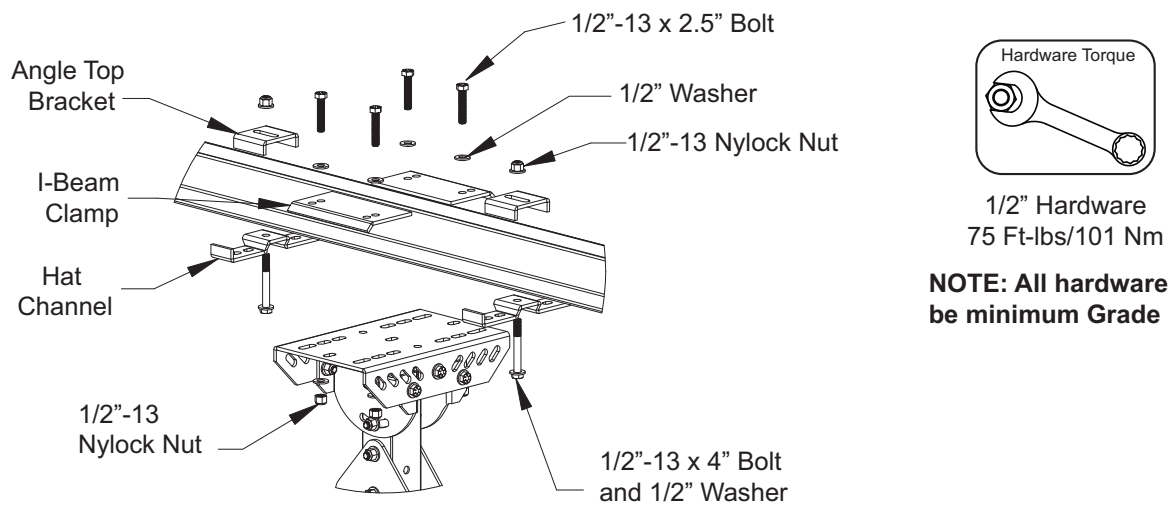
Mounting Hardware

Installing Pivot Mount Assembly

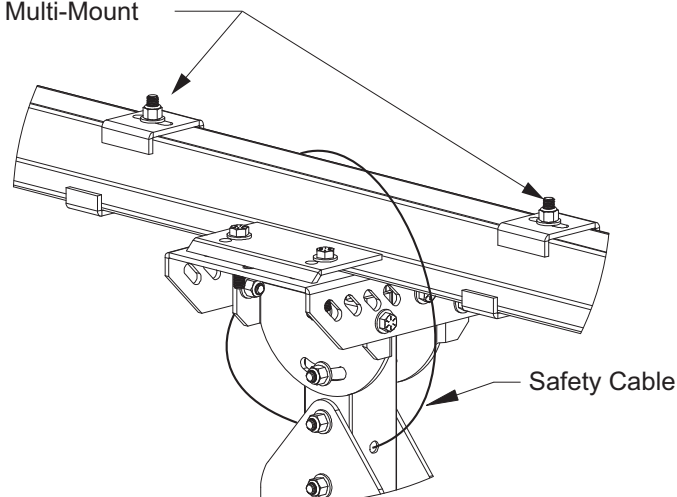
1. Locate where the fan will mount.
2. Install the angle top bracket and hat channel. Insert the 1/2"-13 x 4" bolt through the bottom of the hat channel. Secure with 1/2"-13 nylock nuts and washers.
3. Insert 1/2"-13 x 2.5" bolts with 1/2" washers through the I-Beam clamp.
4. Place pivot extension assembly through bolts and secure with 1/2"-13 nylock nut and 1/2" washers.
5. Torque hardware to 75 Ft-lbs/101 Nm.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

Figure 19 - Pivot Extension Assembly Details



Inner Spacer Brackets used on Top Mount OWSJ, Bottom Mount OWSJ, Multi-Mount Concrete Assemblies



Tube Assembly

Attention!

Every connection between components (mounts, extensions, fan frame) must include a Guy Wire (safety cable), as shown throughout this manual, with loops at both ends.

You may extend the length of the fan by using an extension assembly. There should be no more than 2 extensions used per fan. The following sizes are available:

Table 4 - Tube Assembly Sizes

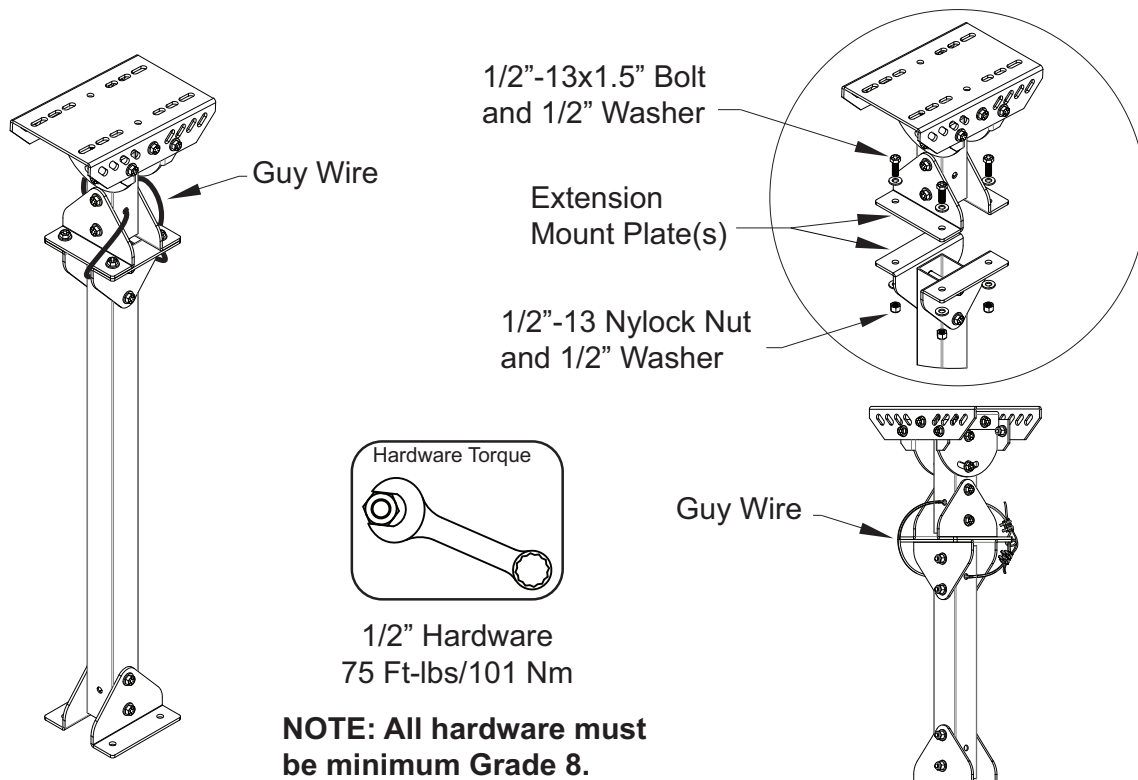
Description	Part Number
1' Square Tube Pivot Extension	HVLS1FTPVT
2' Square Tube Pivot Extension	HVLS2FTPVT
4' Square Tube Pivot Extension	HVLS4FTPVT
2' Square Tube Extension	HVLS2FTEX
4' Square Tube Extension	HVLS4FTEX
6' Square Tube Extension	HVLS6FTEX
8' Square Tube Extension	HVLS8FTEX

When mounting the pivot extension assembly to an extension mount, alternate the extension plates when assembling.

1. Install 1/2"-13 x 1.5" bolts with 1/2" washers through the extension plates.
2. Secure with 1/2"-13 nylock nut and 1/2" washers.
3. Torque hardware to 75 ft-lbs/101 Nm.
4. Secure together with a guy wire. Refer to "Guy Wire Installation" on page 28.

NOTE: If installing the system in a caustic environment, use the appropriate support system hardware. Refer to "Caustic Environment Support System" on page 9.

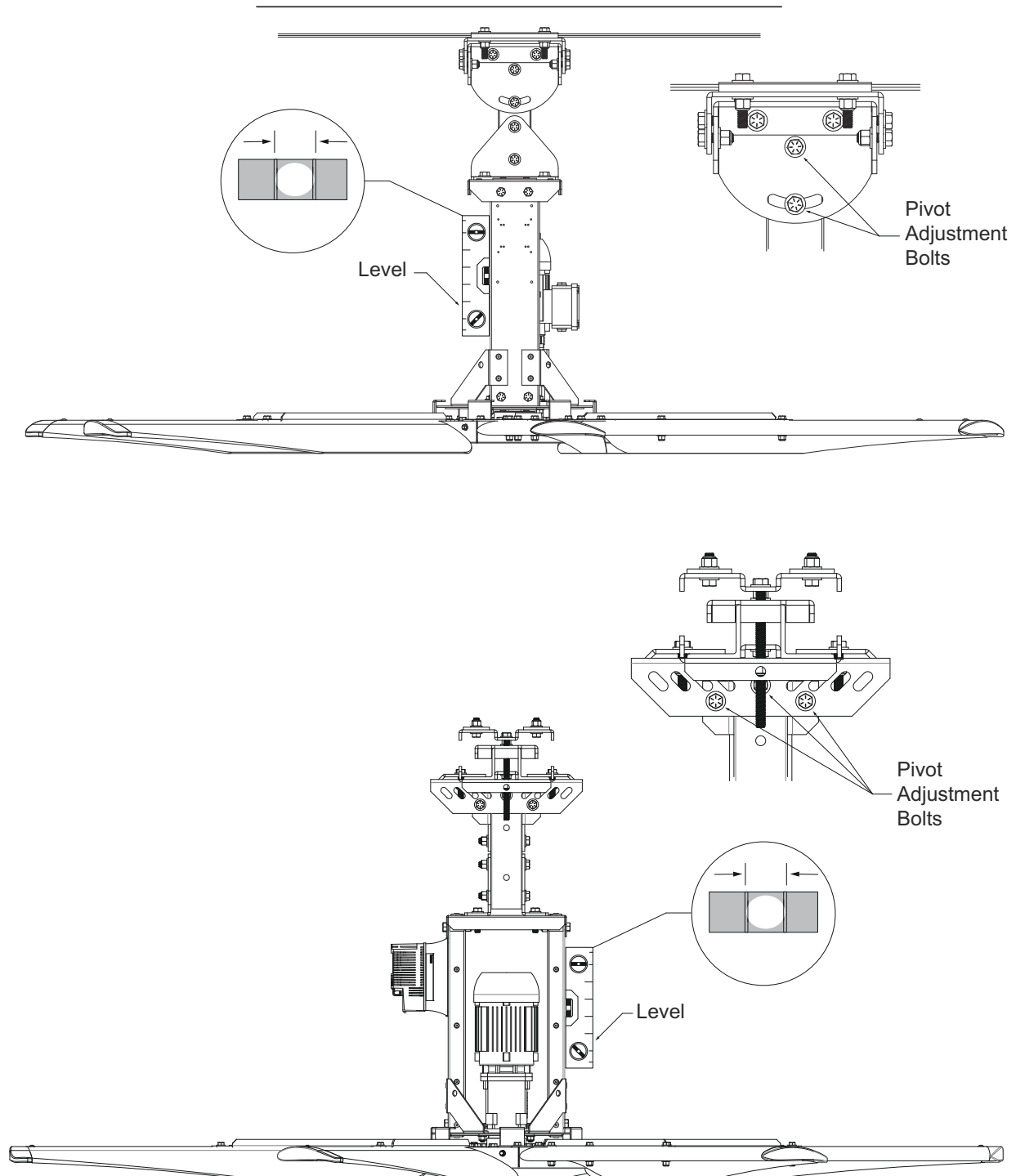
Figure 20 - Extensions Assembly Details



Leveling Pivot Assembly

After installing the fan, check the fan is level. Use the pivot adjustment bolts to level the fan. After the fan is level, tighten the pivot adjustment bolts. Install safety cables. Refer to **Figure 19** and **Figure 20**.

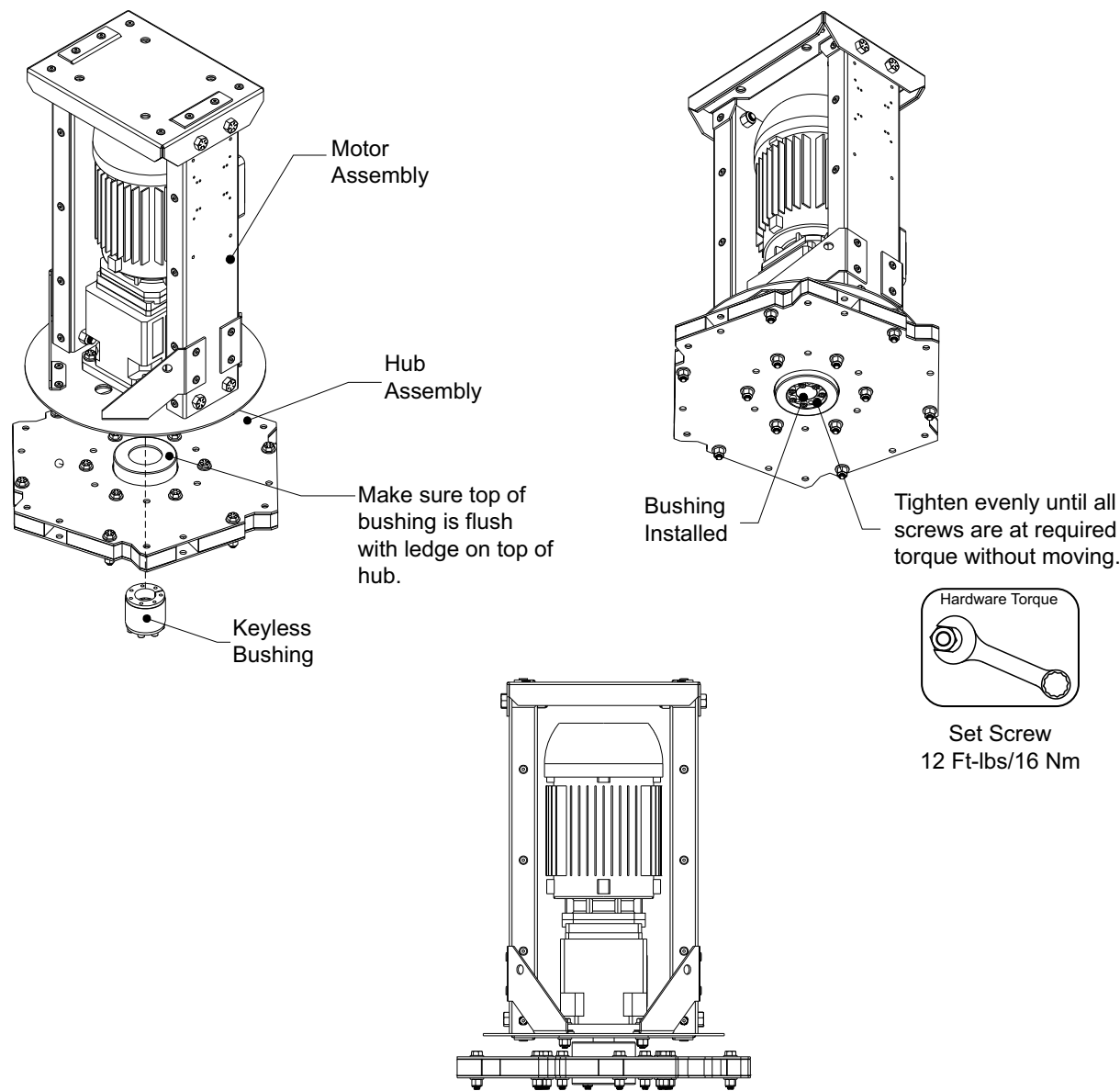
Figure 21 - Leveling Fan



Hub Assembly

NOTE: The hub assembly is pre-installed to the motor assembly from the factory. Figure 22 provides reference for maintenance when required.

Figure 22 - Hub Assembly Details

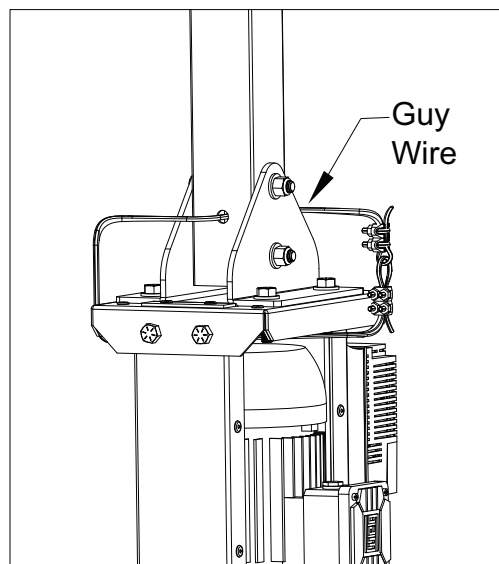
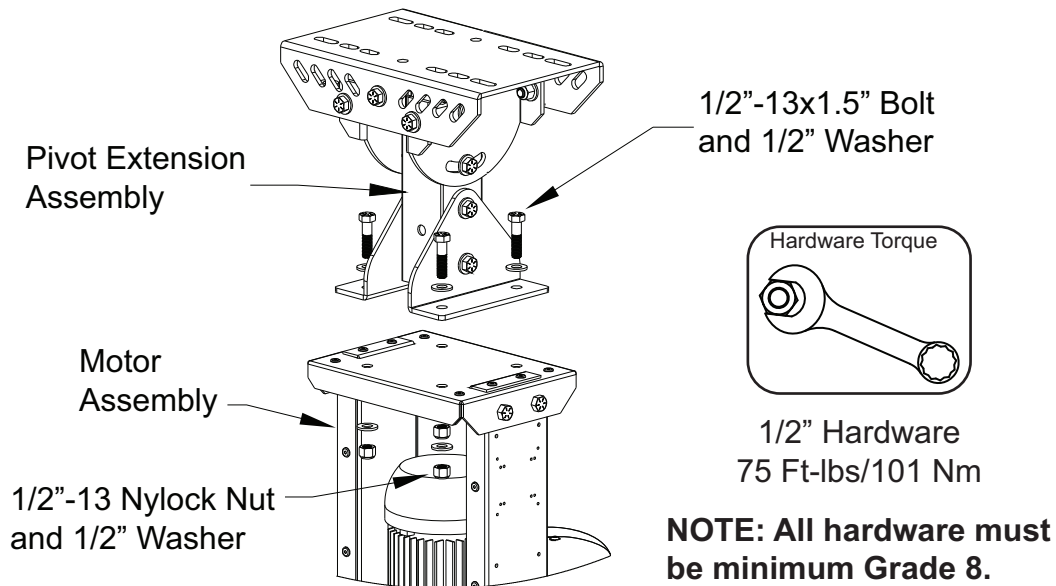


Mounting Fan to Extension

Attention!

Every connection between components (mounts, extensions, fan frame) must include a Guy Wire (safety cable), as shown throughout this manual, with loops at both ends.

Figure 23 - Motor Assembly Mounting Details



Guy Wire Installation

1. Determine mounting position on ceiling and establish the angle between 45°-60° for the cable.

NOTE: If installing into an I Beam, determine correct location on the beam to drill hole for the eye bolt. For example, if fan is 4 ft. down from ceiling, cables should be mounted approximately 4 ft away from fan. Install eye bolts with nuts and washers in the beams.

2. Measure the run of cable required and cut the cable approximately 2 ft longer.

NOTE: Longer runs or fans hanging lower than 10 ft. from where the guy wires mount will require an additional cable.

3. Secure the cable with 1 thimble and 2 cable clamps. Repeat using the other 3 pieces of guy wire cables, thimbles, and cable clamps. **Torque hardware appropriately.**
4. Guy wires should be snug, but not over-tight that the fan will become unlevel. The guy wires should also be approximately 90° apart from each other.
5. Check to see if the fan is level by placing a **level** vertically on the side of the fan frame. If adjustment is needed, slightly tighten the guy wires on the proper side. Check to make sure fan is level multiple times while adjusting the guy wires.

NOTE: Guy wire assemblies are required on all HVLS mounting configurations. If installing the system in a caustic environment, use the appropriate support system hardware. Refer to “Caustic Environment Support System” on page 9.

Clamp Installation

When placing cable clamps on the wire, it is imperative that the U-bolt side of the clip is placed on the short turn backside and the saddle goes on the long side (the “live” end). Two clamps must be used on every safety cable end.

Figure 24 - Clamp Installation Details

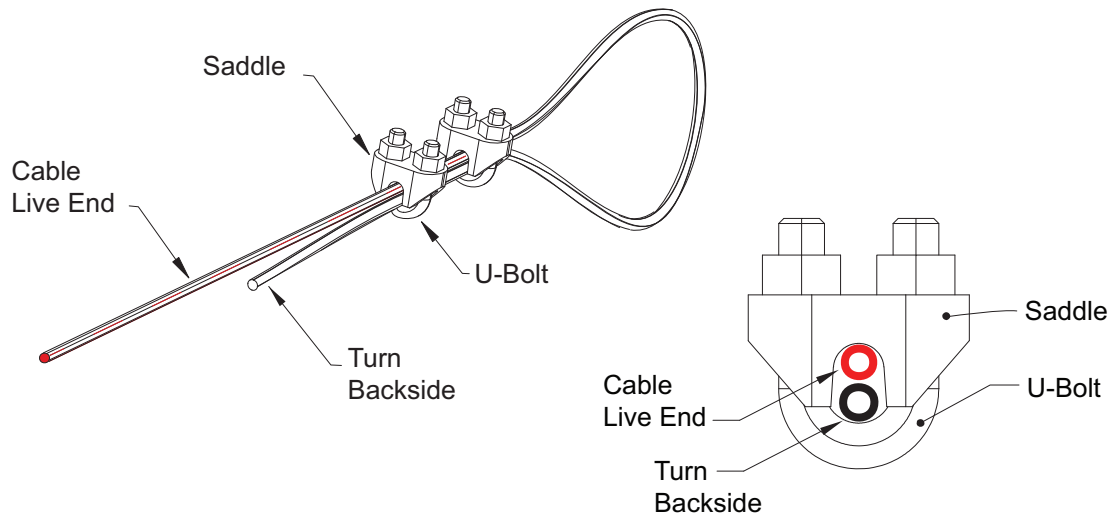
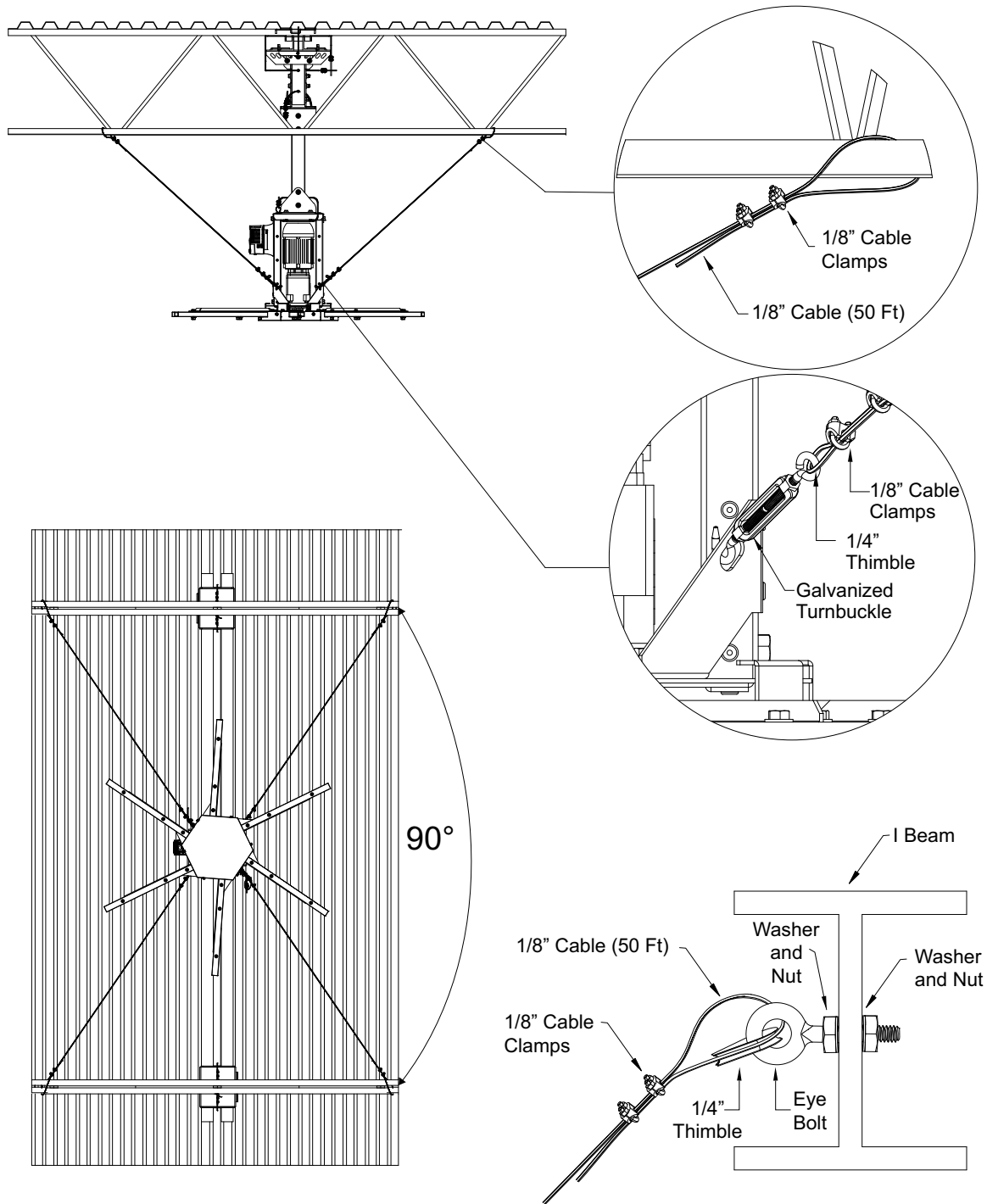


Figure 25 - Guy Wire Installation Details

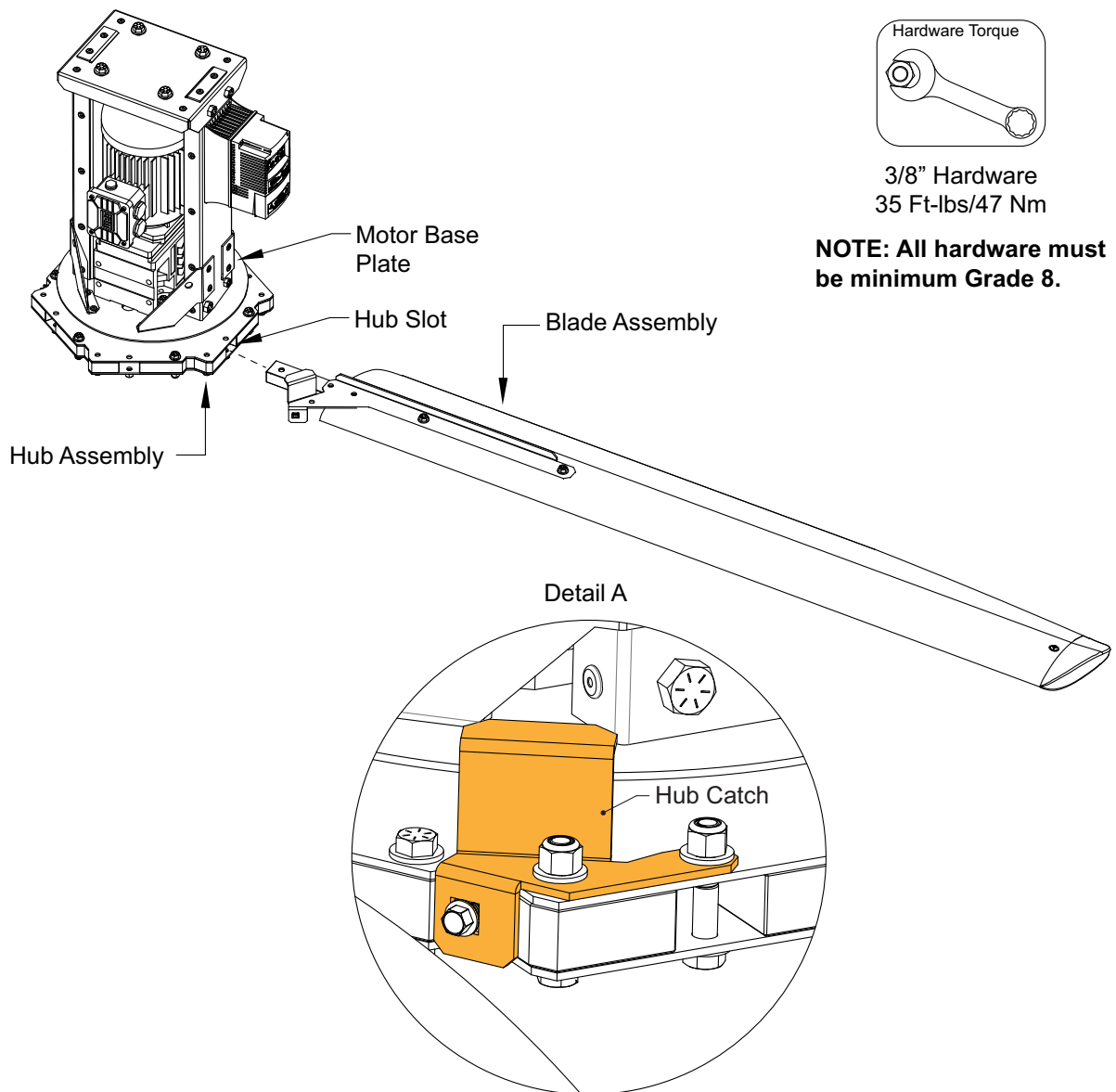


Blade Installation

NOTE: 3 blade fans will use a hub catch, Figure 26 Detail A, to close off open slots. The hub catch will be pre-installed from the factory. When installing blades, make sure to equally space the three blades to keep the fan balanced.

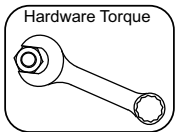
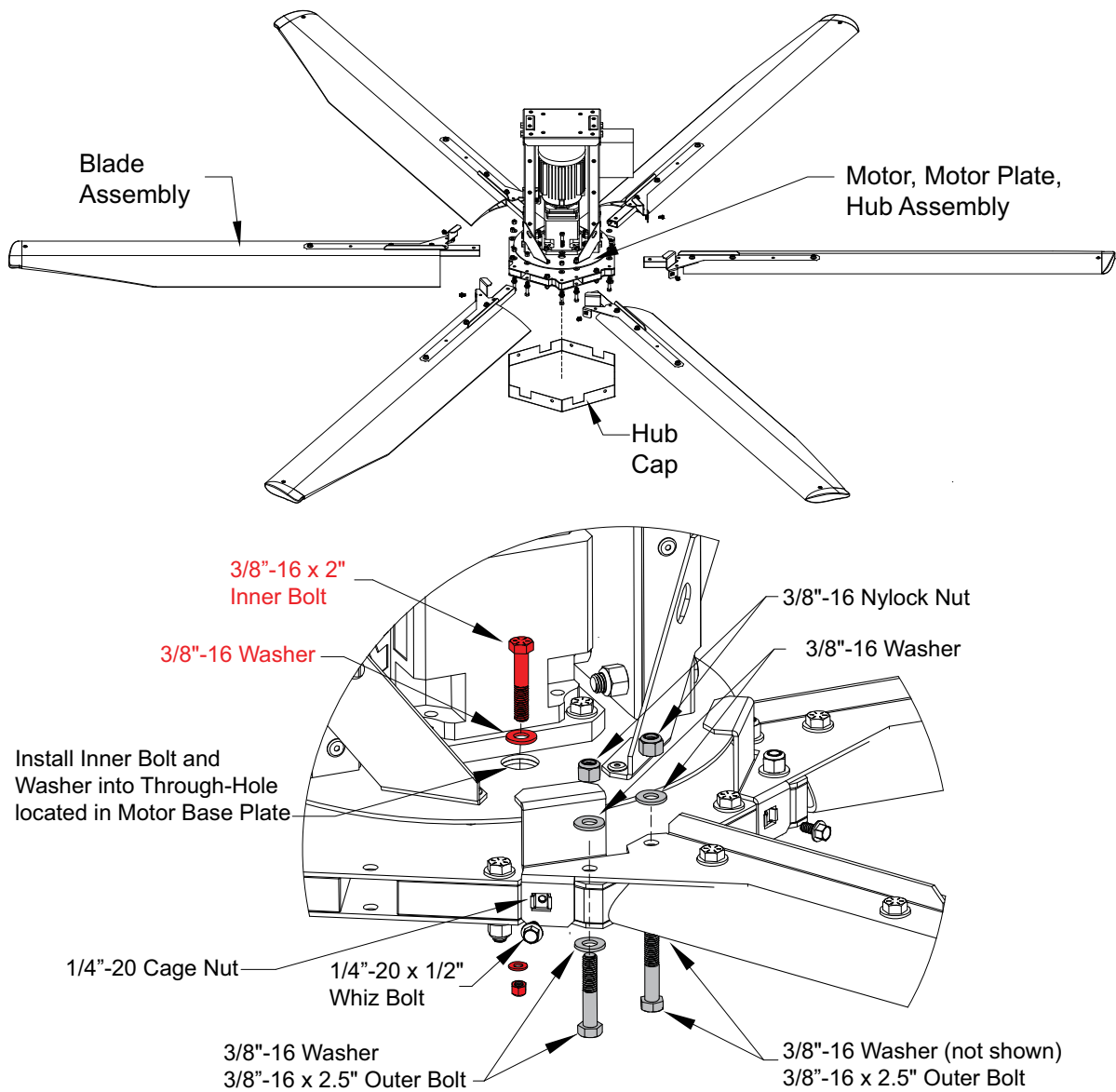
1. Insert blade assembly into the hub slot.
2. Install 3/8"-16 x 2" inner bolt and washer into through-hole, located in the top of the motor base plate. Secure with 3/8"-16 washer and nylock nut. Torque hardware to 35 Ft-lbs/47 Nm.
3. Install 3/8"-16 x 2.5" outer bolts and washers into top of blade assembly. Secure with 3/8"-16 washers and nylock nuts. Torque hardware to 35 Ft-lbs/47 Nm.
4. Once all the blades have been installed, insert the hub cap from below. Secure with 1/4"-20 whiz bolts. Hand tighten hardware. Refer to **Figure 27 on page 31** for 6 blade fan installation details. Refer to **Figure 28 on page 32** for 3 blade fan installation details.

Figure 26 - Blade Installation Details



6 Blade Fan Details

Figure 27 - 6 Blade Installation Details

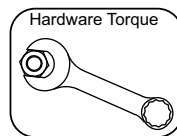
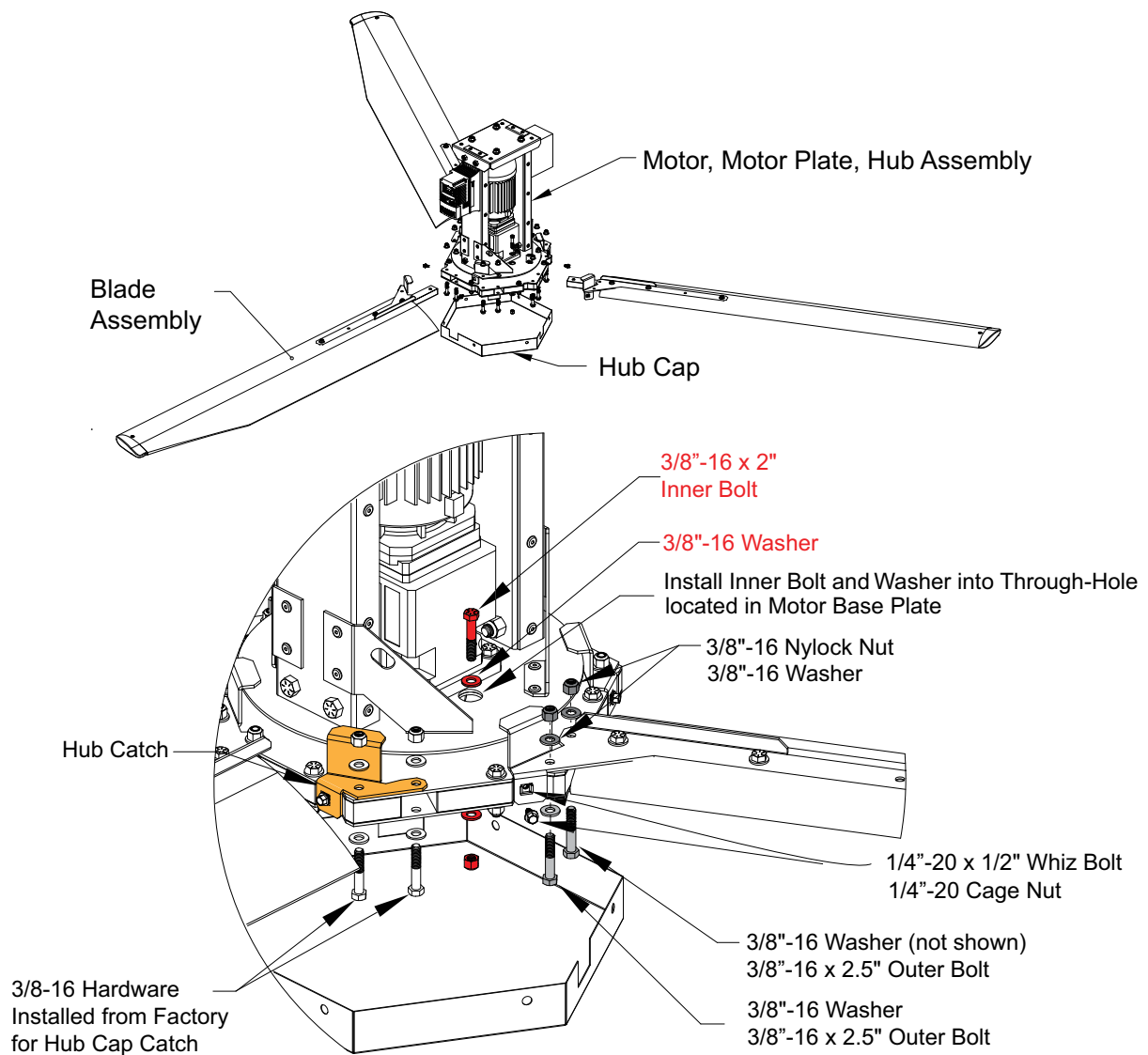


3/8" Hardware
35 Ft-lbs/47 Nm

NOTE: All hardware must be minimum Grade 8.

3 Blade Fan Details

Figure 28 - 3 Blade Installation Details



3/8" Hardware
35 Ft-lbs/47 Nm

NOTE: All hardware must be minimum Grade 8.

ELECTRICAL INSTALLATION

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 control, read and understand the entire section of this document. As-built wiring diagrams are furnished with each control by the factory and are attached either to the door of the unit or provided with a paperwork packet.

Electrical wiring and connections must be done in accordance with local ordinances and the National Electric Code, ANSI/NFPA 70. Verify the voltage and phase of the power supply, and the wire amperage capacity is in accordance with the unit nameplate.

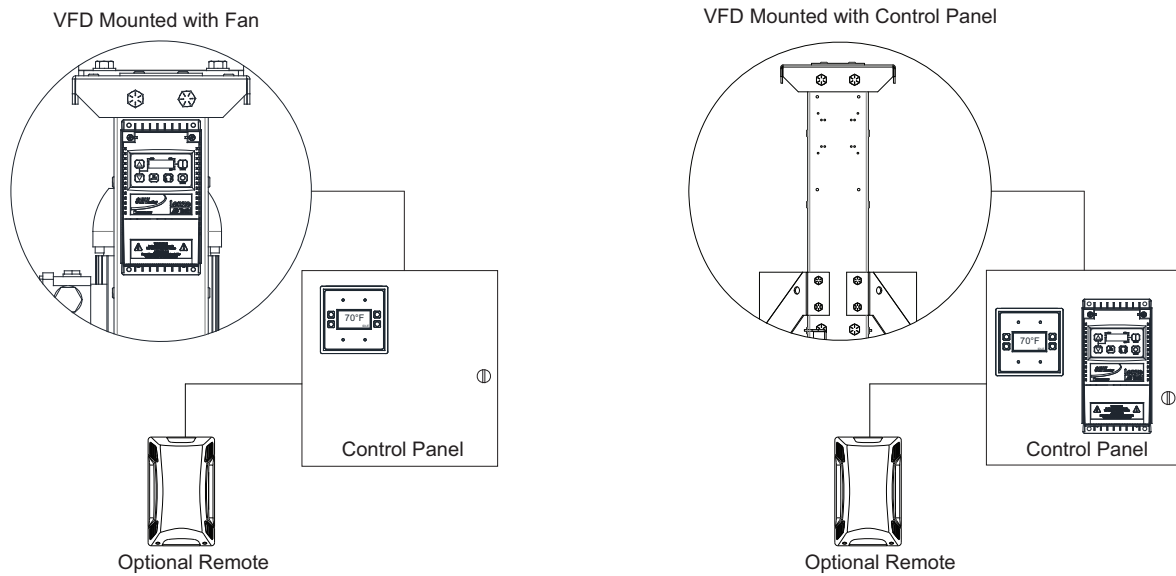
1. **Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up.**
2. Verify wiring to the fan or VFD (if fan mounted) is secured or clamped away from fan blades.
3. **A means of disconnecting power to the fan must be located within visual sight of the fan and outside of the perimeter of the blades. Ideally, this disconnect is located at ceiling level, a minimum of 3 feet outside the perimeter of the blades.**
4. Verify that the power source is compatible with the requirements of your equipment. The fan nameplate identifies the **proper phase and voltage** of the motor.
5. Before connecting the unit to the building's power source, verify that the power line wiring is de-energized.
6. Secure the power cable to prevent contact with sharp objects. Verify ground connection is secure.
7. Do not kink power cable and never allow the cable to encounter oil, grease, hot surfaces, or chemicals.
8. Before powering up the unit, make sure that the fan rotates freely. Make sure that the interior of the unit is free of loose debris or shipping materials.
9. Multi-strand thermostat wire must be used to wire the room temperature sensors back to the main panel.
10. If motors are spinning in the incorrect direction, switch any two wires on the output of the variable frequency drive. Alternatively, fan rotation can be changed in software, as described later in this manual.
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 fan must be replaced, it must be replaced with type THHN wire or equivalent.

Table 5 - 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

Typical HVLS Fan and Smart Control Installation

Figure 29 - VFD and Smart Control Mounting Locations



Enclosure

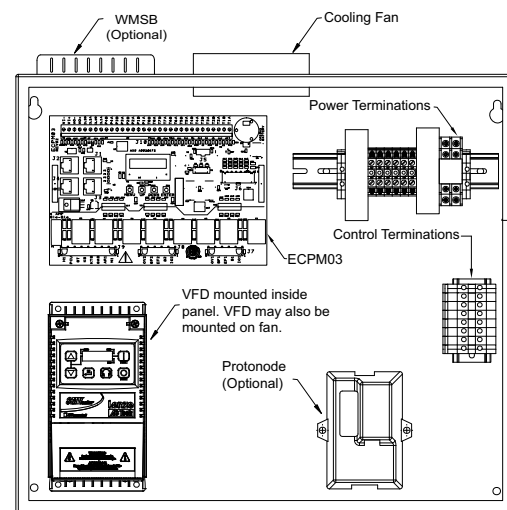
The control panel enclosure must be secured to a fixed wall near the fan. **Maintain adequate clearance from excessive heat sources, such as appliances or processing equipment, to prevent damage to the components.**

There are four pre-punched holes in the backside of the control enclosure. Use suitably sized mounting hardware to attach to the wall.

Site Preparation – Controls

- Provide clearance around installation site to safely install equipment into its final position. Supports must adequately support equipment. Refer to manufacturer's estimated weights.
- Consider general service and installation space when locating the control package and remote temperature control.
- Locate the control as close to space/fan that it will serve to reduce long, unnecessary wire runs.
- Install thermostats in locations that will produce a good representation of the air being moved by the fan in the space. Avoid thermostat installations in direct sunlight, near HVAC supplies, or abnormal temperature air streams.

Figure 30 - Control Panel Layout



High Voltage Power Wiring

- All high voltage power terminals are located to the upper right side of the panel as shown in **Figure 30**.
- All high voltage wiring shall be connected on the open side of the vertical terminal.
- The right side knockouts are only to be utilized for high voltage power connections.
- Variable frequency drives will have quick connectors for their line and load power. The load wiring must not share conduit with other motor load wiring. Each motor must have its own conduit, or the warranty is void.
- There are multiple electrical power sources required for this control panel. Refer to installation diagrams inside the panel for details.

Low Voltage Control Wiring

Low voltage wiring should be run through the left side knockouts on the panel. Do not route low voltage wiring in the same conduit as high voltage wiring. Low voltage wiring typically terminates directly on the control board or components.

NOTE: Maximum distance on any low voltage wire is 1000 feet. Use a Cat 5 cable tester to verify that the Cat 5 cable is functional. Testing the cable before installing will eliminate possible communication issues due to faulty Cat 5 cable or ends.

WARNING: LOW VOLTAGE CONTROL WIRING SHOULD NEVER BE RUN TOGETHER WITH HIGH VOLTAGE POWER WIRING.

1. **Temperature Sensors:** For all installations that include the thermostatically controlled option, temperature, or duct mounted sensors will need to be wired in the field. 2-wire 18 AWG plenum-rated thermistor cable must be used and is typically provided. The temperature sensor(s) should be wired to header connection J10 inputs designated as TxA and TxB. The “x” indicates the temperature input sensor number.
2. **Wireless Mini Sensor Board (WMSB):** For all installations, remote WMSB must be installed in a safe location. Locate the sensor(s) so that they are free from external heat sources that may affect the sensor readings. The solar cell requires 200 lumens per sq. foot or 20 foot candles. The location should be indicative of the average room temperature and relative humidity, and kept away from appliances. Refer to **“Ambient Lighting Requirements” on page 43.**
3. **HMI:** The HMI is connected to the ECPM03 board through a Cat 5 cable. The HMI has two RJ-45 connectors. The HMI connects to either port J4 or J5 (RJ-45) of the ECPM03 board. The other RJ-45 port of the HMI will typically be occupied by an RJ-45 end-of-line terminator. No more than 10 HMIs can be connected to the control package. To prevent overload of the on-board circuitry, no more than 4 HMIs shall be daisy-chained to each Modbus port on the ECPM03 control board (J3, J4, or J5).
4. **VDC Output:** VO+ and VO- output a 0-10V signal for controlling damper outputs for a vent group.
5. **Motor Control Pulse Width Modulation (PWM) Outputs:** Terminals PxA and PxB provide 24V DC signals suitable for driving Electrically Commutated Motors (ECM). PWM outputs should be wired with 18 AWG shielded twisted pair cable and should be wired directly to the connector on the ECM fan motor harness.
6. **Zone Activation Status Relay Outputs:** RO1 through RO6 of the header connection J6 are used to control **24V DC** relays. These outputs can be assigned to activate with any or multiple groups on the HVLS fan system.
7. **DDC (Direct Digital Control) Wiring:** For communications from a remote Building management system, low voltage communication wiring is required. This wiring will plug into a gateway that is mounted in the HVLS panel, which is connected by a Cat 5 cable to either J1 or J2 of the ECPM03 control board.
8. **Modbus Communication:** Refer to factory wiring schematics for proper connections of Modbus devices. The Modbus network may consist of the following:
 - HMIs
 - VFDs/MSCs
 - Bacnet Gateway
 - WMSBs
 - HVLS

NOTE: End Of Line (EOL) resistors are provided with the system to filter out noise in the Modbus network and must be used at the end of all HMI and VFD/MSCs runs.

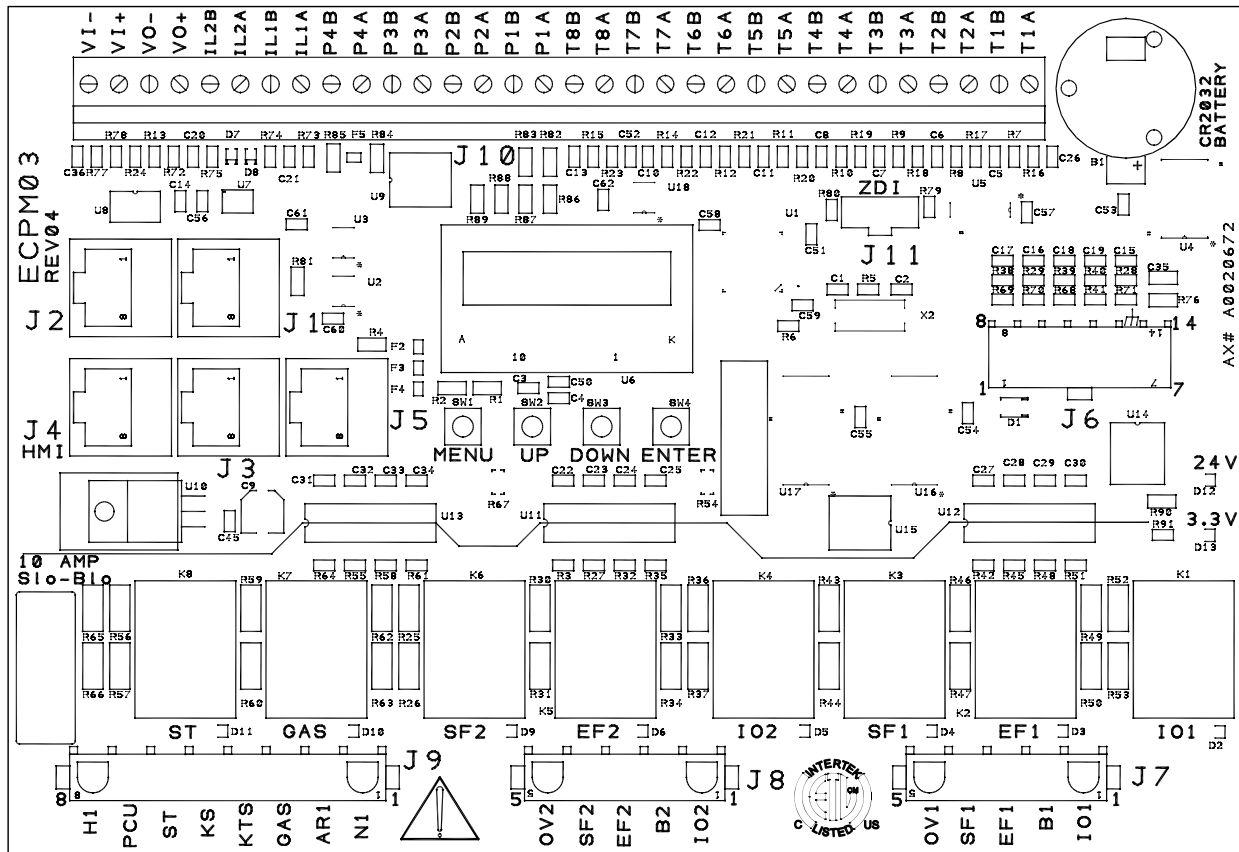
9. **Assignable 120V Outputs:** There are five **120V AC** outputs that are assignable to activate with any or multiple groups. If two speed is enabled, an output can be assigned to activate with either min or max speeds.
10. **Assignable Inputs:** There are five **120V AC** inputs that are assignable to activate fan groups in either inputs or manual modes. These inputs can be used to activate min or max speed if two speed is enabled.
11. **Emergency Shutdown Interlock:** Closing a dry contact across terminals IL2A and IL2B will deactivate all HVLS fans and sound an alarm. Emergency Shutdown will be displayed on all HMIs.

ECPM03 Board

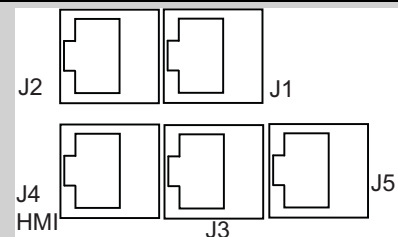
ECPM03 is the main control of the system. It receives all of the digital and analog inputs, and delivers all digital outputs for external devices.

NOTE: Not all pins or electrical features may be used with your electrical control package. Verify with factory wiring schematics and/or Factory Settings.

Connector Descriptions

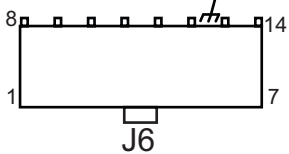
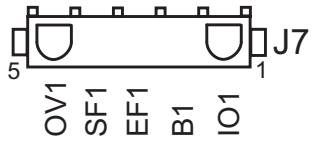
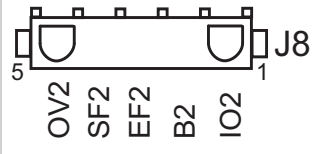


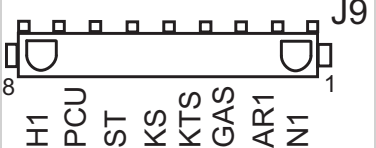
RJ45 Connectors

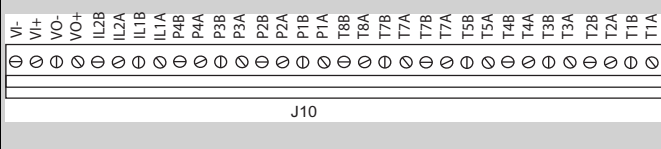


J1, J2 - Modbus master network connectors, feed through RJ45s, which conform to the Modbus pin-out for RS485 2 wire differential Modbus RTU standard. J1 and J2 are utilized for Comm Module and external BMS interface. No field wires should be connected to J1 or J2.

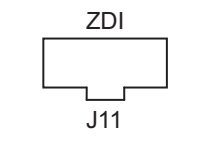
J3, J4, J5: Modbus slave network connectors feed through RJ45s, which conform to the Modbus pin-out for RS485 2 wire differential Modbus RTU standard. See <http://www.modbus.org>. Modbus communication is not configured for third party integration without additional components. All network, PCUA FM, HMI, VFDs, and MSCs report through J3, J4 and J5. The order of connection is irrelevant.

<p>Connector J6 contains factory only wiring for low voltage connections</p>	
<p>Pin 1 - 24VDC power input (positive side) to the board. Pin 2 - 24VDC open collector output for driving RO6 relay. (100mA max sourcing current) Pin 3 - 24VDC open collector output for driving RO5 relay. (100mA max sourcing current) Pin 4 - 24VDC open collector output for driving RO4 relay. (100mA max sourcing current) Pin 5 - 24VDC open collector output for driving RO3 relay. (100mA max sourcing current) Pin 6 - 24VDC open collector output for driving RO2 relay. (100mA max sourcing current) Pin 7 - 24VDC open collector output for driving RO1 relay. (100mA max sourcing current)</p>	<p>Pin 8 through Pin 12 - N/A Pin 13 - Chassis ground connection, this pin connects to the 24VDC ground through a paralleled 1000pf 2000V capacitor and a 100k Ohm 1/4W resistor. Pin 14 - 24VDC power input (negative side) to the board. Ground or common side of the low voltage circuitry.</p>
<p>Connector J7 contains 120V AC control connector for factory only wiring</p>	
<p>Pin 1 - (IO1) BMS High Speed Input. Pin 2 - (B1) 120VAC Input 1 Pin 3 - (EF1) 120VAC dedicated Vent output. Activates with any Vent type group.</p>	<p>Pin 4 - (SF1) 120VAC dedicated HVLS output. Activates with any HVLS type group. Pin 5 - (OV1) N/A</p>
<p>Connector J8 contains 120V AC control connector for factory wiring</p>	
<p>Pin 1 - (IO2) 120VAC Output 1 Pin 2 - (B2) 120VAC Input 2 Pin 3 - (EF2) 120VAC Output 2</p>	<p>Pin 4 - (SF2) 120VAC Output 3 Pin 5 - (OV2) N/A</p>

Connector J9 contains 120VAC control connector for factory only wiring	
Pin 1 - (N1) this is the neutral or return path for the detection of 120VAC by the input pins. It would be connected to the neutral side of the 120V AC supply. Pin 2 - (AR1) 120VAC Input 3 Pin 3 - (GAS) 120VAC Output 4 Pin 4 - (KTS) 120VAC Input 4	Pin 5 - (KS) N/A Pin 6 - (ST) 120VAC Output 5 Pin 7 - (PCU) 120VAC Input 5 Pin 8 - (H1) this is the 120V AC 50/60Hz input to the board, it feeds through an onboard 10 Amp Slow-Blow fuse and is used to source 120VAC to all the pins described as 120VAC outputs. The total current draw of all the 120VAC outputs must not exceed 10 Amps.

Connector J10 contains low voltage field wiring connections	
T1A/T1B - 10k Type B Thermistor Input 1 T2A/T2B - 10k Type B Thermistor Input 2 T3A/T3B - 10k Type B Thermistor Input 3 T4A/T4B - 10k Type B Thermistor Input 4 T5A/T5B - 10k Type B Thermistor Input 5 T6A/T6B - 10k Type B Thermistor Input 6 T7A/T7B - 10k Type B Thermistor Input 7 T8A/T8B - 10k Type B Thermistor Input 8 P1A - 24VDC source used for PWM Output 1* P1B - Open collector PWM output for PWM Output 1 P2A - 24VDC source used for PWM Output 2* P2B - Open collector PWM output for PWM Output 2	P3A - 24V DC source used for PWM Output 3* P3B - Open collector PWM output for PWM Output 3 P4A - 24VDC source used for PWM Output 4* P4B - Open collector PWM output for PWM Output 4 IL1A - BMS Low Speed Input 24VDC Source* IL1B - BMS Low Speed Input IL2A - Emergency Input 24VDC Source* IL2B - Emergency Input VO+ - 0-10VDC+ Modulating Output 5 VO- - 0-10VDC- Modulating Output 5 VI+ - 0-10VDC+ BMS Modulating Input VI- - 0-10VDC- BMS Modulating Input

(*) = A shared 24V DC source that is current limited through an onboard 200mA PTC Poly Fuse. Do not exceed current output rating.

Connector J11 factory programming only, Zilog ZDI micro-controller debug/programming interface	
Pin 1 - 3.3V DC Pin 2 - Reset Pin 3 - Gnd	Pin 4 - DBG input Pin 5 - Gnd Pin 6 - NC

ELECTRICAL COMPONENTS

HMI and Remote Room Sensor Installation

Do not install the room sensor on the ceiling.

Remote HMI faceplates, remote room sensors, and smart controls may be ordered and shipped separately. These components measure temperature and assist in controlling the unit. These components should be installed in a safe location, free of influence from external heat sources. Install sensors in areas indicative of the average room temperature, and away from heat-producing appliances. HMIs and remote room sensors (**Figure 31**) can be installed directly to industry-standard junction boxes, either surface mounted or recessed mounted. HMIs have a built-in temperature sensor, which is typically used to help control the automatic function of the unit.

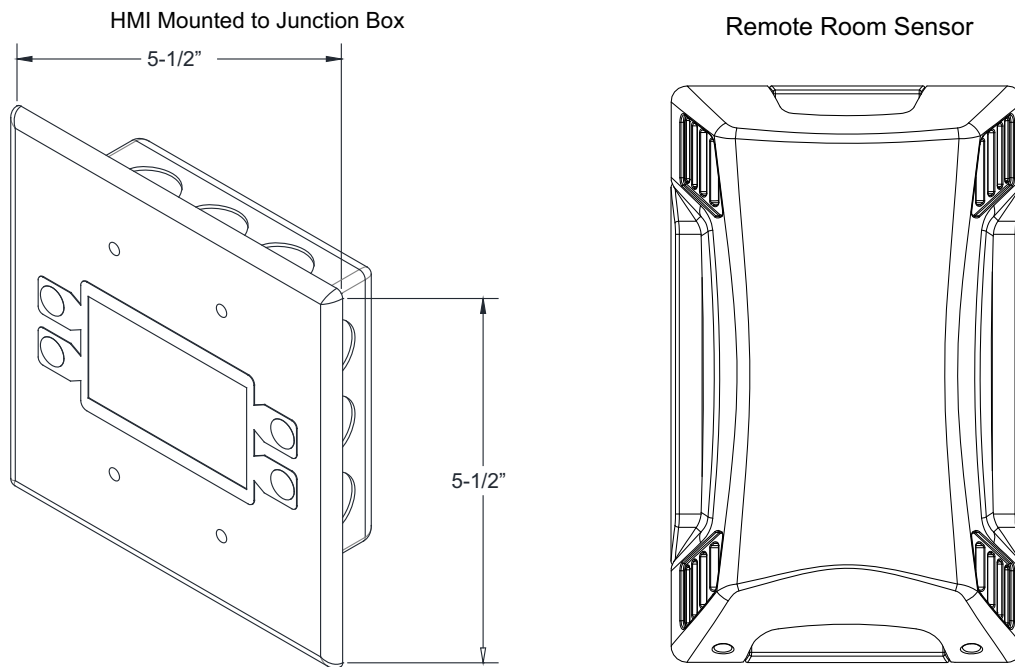
The HMI can also be configured to control the unit from a remote location manually. They can be configured not to use the internal temperature sensor. In this configuration, the sensor in the HMI is ignored in automatic operation. Multiple HMIs can be connected to one unit for temperature and R/H averaging.

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

The room temperature sensor is a 10K ohm thermistor. The sensor provides constant room temperature to the controller. It 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.

Figure 31 - HMI and Remote Room Sensor

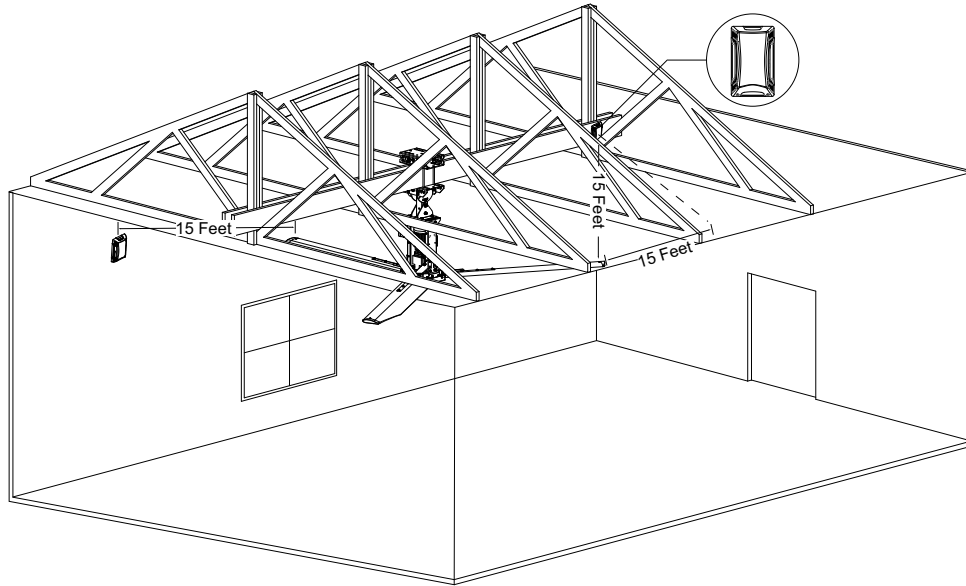


Ceiling Mounted Temperature Sensors

The Winter Differential parameter sets the maximum temperature differential for winter mode operation. When this is set above 0, the system requires a ceiling mounted temperature sensor. Sensor should be mounted as close to the ceiling as possible without touching the roof. The ceiling sensor should be installed in a neutral location, away from heat sources, supply diffusers, vents, and windows. The sensor should be at least 15 feet away from the nearest HVLS fan. Recommended locations to mount sensors are on the wall, truss, joist, or beam. Refer to **Figure 32**.

The ceiling mounted temperature sensor is a 10K ohm thermistor. The sensor provides constant room temperature to the controller. The sensor should be installed in a location that is not affected by any heat-producing or cooling appliances.

Figure 32 - Ceiling Mounted Temperature Sensor Details



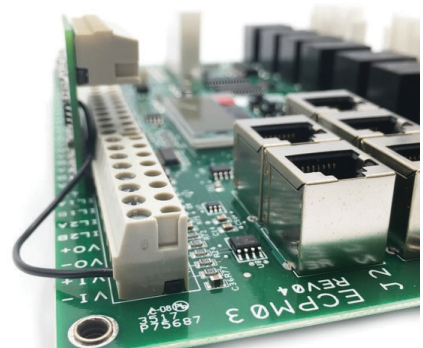
PWM 0-10V Board

The PWM0-10V is an accessory device used for controlling modulated dampers directly from the ECPM03 control board. When used in conjunction with Modbus control and the VO+ and VO- terminals of the ECPM03 control board, a maximum of fifteen fans can be controlled from a single HVLS control package.

The purpose of this board is to convert the PWM signals output from the ECPM03 control board to 0-10V control signals. Each output of this board operates independently of one another. Outputs must be configured in the Factory Settings menu and will modulate proportionally to the command speed of any VENT-type fan group that it is assigned to.

Utilization of this accessory with an HVLS control package requires several steps: installing the PWM0-10V board onto the J10 header pins P1A through P4B, landing the ground wire onto terminal VI-, setting the modulating output type in factory settings, and assigning the outputs to a VENT-type group.

Figure 33 - PWM 0-10V Board



Wireless Mini Sensor Board (WMSB)

The Wireless Mini Sensor Board (**Figure 34**) is used in conjunction with Electrical Control Packages (ECPs). The WMSB is designed to replace room temperature sensors that are installed in areas that are unable to obtain proper room temperature/relative humidity/barometric pressure readings. A significant benefit to using the WMSB is that it is wireless and can be installed in any location in a room to obtain proper connection to ensure the package receives room temperature/relative humidity/barometric pressure readings.

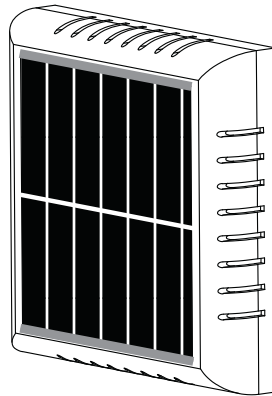
Before installing, find the best location where the sensor can obtain accurate readings for room temperature/relative humidity/barometric pressure. The sensor can communicate overall room temperature/relative humidity/barometric pressure readings to multiple control boards via Bluetooth connectivity.

The photovoltaic solar panel and rechargeable lithium-ion battery located behind the solar panel cover provides continual power and extended battery life to the sensor. The sensor's solar panel must be located in an area where there is bright light, without any impedance to lighting.

Installing the WMSB eliminates the need for a wired thermistor connection back to the ECP. This allows the sensor to be moved and installed anywhere in the space where it can obtain proper room temperature/relative humidity/barometric pressure readings.

NOTE: The battery for the sensor is not connected at the factory. This connection must be completed in the field prior to installing on the wall. Refer to Figure 39 on page 44 for connection locations.

Figure 34 - Wireless Mini Sensor Board



WMSB Installation

Install the sensor in an area where it can obtain accurate room temperature/relative humidity/barometric pressure, and the solar panel will receive sufficient bright light. Keep objects away from the solar panel so as not to impede any light required to keep the sensor's battery charged. Verify the sensor is within 10-15 feet of the electrical control package.

Avoid mounting the sensor in the following locations:

- Where the sensor will be in direct sunlight.
- Near heat emitting from appliances under the hood or warming stations.
- Near diffusers/PSP where the sensor may be influenced by cold or hot air streams.

Best mounting locations for the sensor:

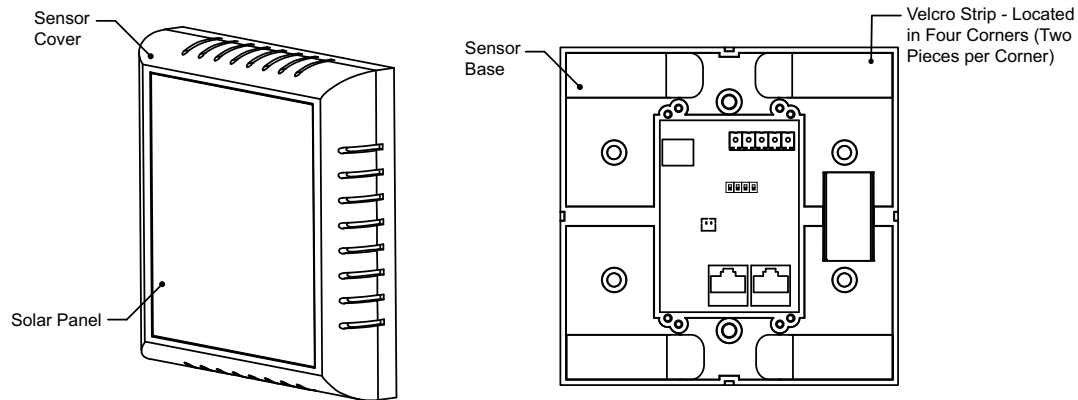
- On a wall near a return duct, if possible.
- A location that will provide an accurate representation of the average room temperature/relative humidity/barometric pressure.

The primary installation options are using provided wall adhesion strips or electrical J-boxes (single or double). Refer to **Figure 37 on page 43** for proper installation examples. Refer to **Figure 38 on page 43** for improper installations.

Wall Installation

When using the provided adhesion strips (**Figure 35**), located on the backside of the sensor base. Clean the wall from any debris, grease, or dirt. Find a suitable location for the sensor, and perform a mock fitment for installation. Remove the top and bottom adhesion strips to install sensor to the wall.

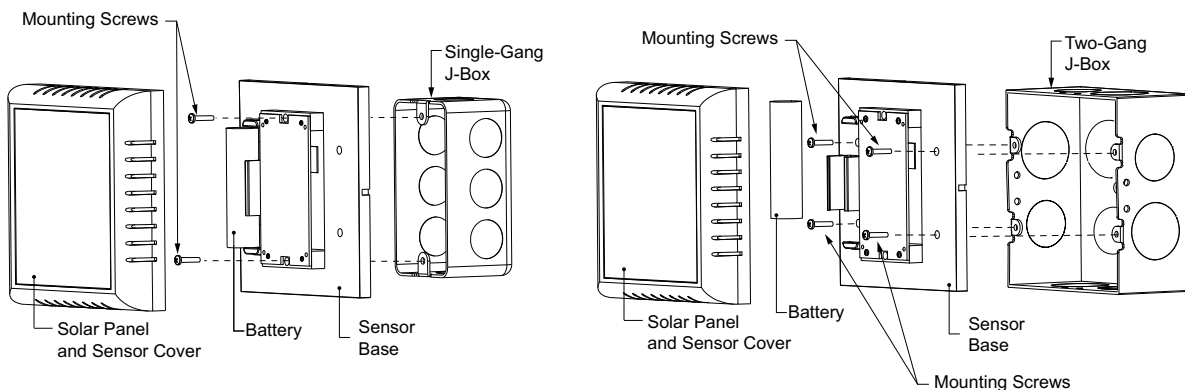
Figure 35 - Adhesion Strip Installation Details



J-Box Installation

When using J-boxes (**Figure 36**) to install into a wall, do not install the WMSB close to high-power (110V AC or higher) wiring or components. Locate the best area for sensor.

Figure 36 - J-Box Installation Details



Ambient Lighting Requirements

Lighting conditions for optimum operation of the solar cell is 200 lumens per sq. foot (lm/ft^2) or 20 foot candles (fc).

Figure 37 - Proper Installations

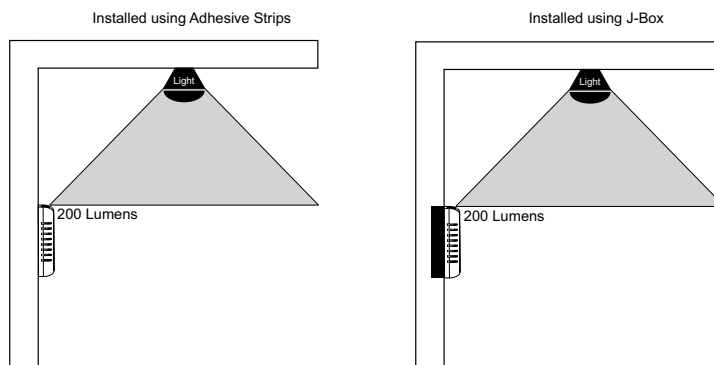
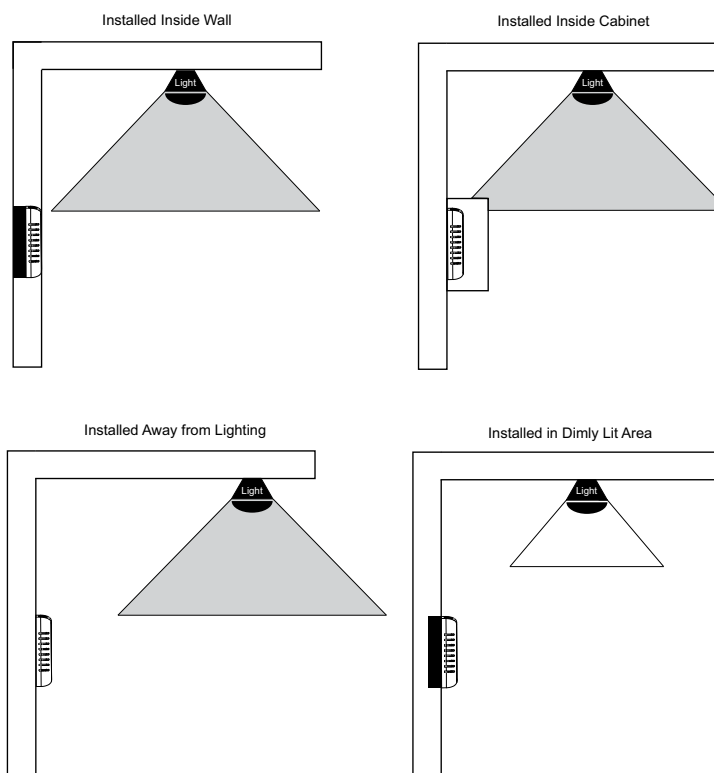


Figure 38 - Improper Installations



Board Description

Connectors J2 and J3 are the Modbus connections to connect the WMSB to other control boards.

Connector J4 is a 5-pin connector. This connector is divided into two sections. One side of the connector contains analog inputs (24V DC, 0-10V, and a common contact). The other side has temperature input connections (TH, and a common contact).

- 24V DC is the output to power the sensor.
- 0-10V is the input to connect third-party sensors.
- COM is the common (negative) for 24V DC and 0-10V connections.
- TH is the connection for additional thermistor(s) to be connected in the field.
- COM is the common (negative) contact connection.

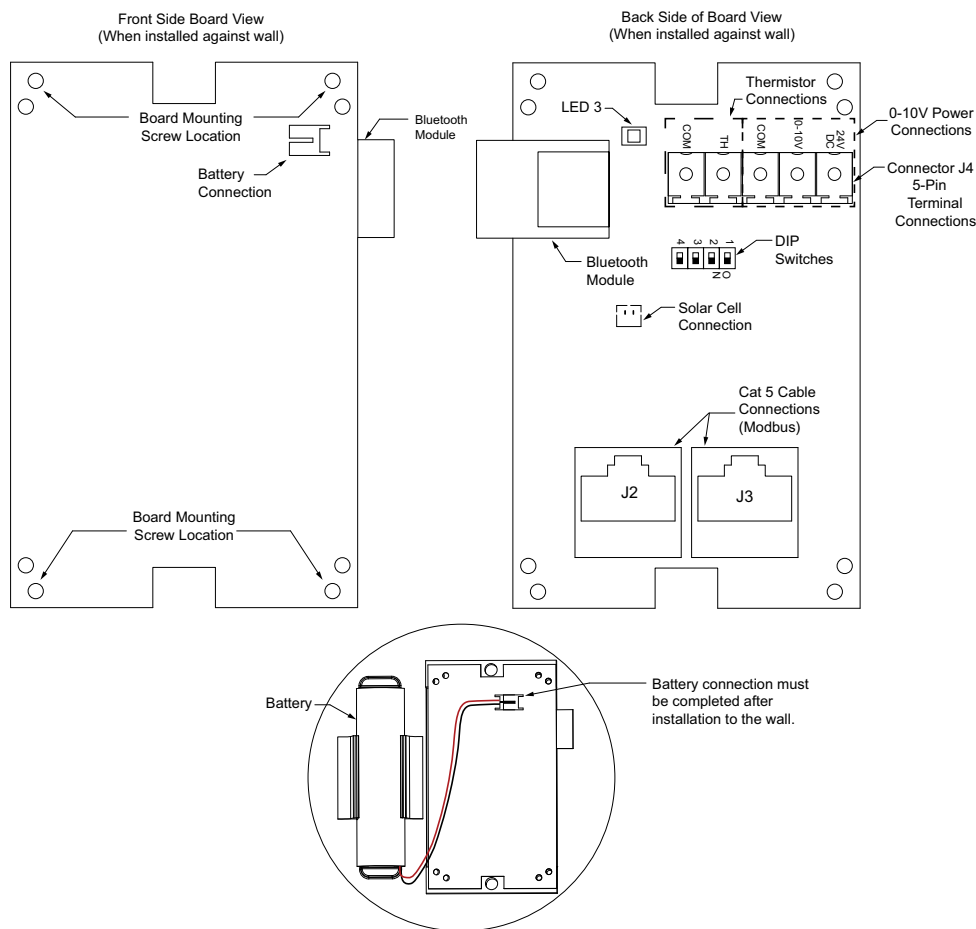
The P1 (solar cell) connection is located on the backside of the board.

The P2 (battery) connection is located on the front side of the board when installed against a wall. The battery must be connected to the board in the field.

The DIP switches are used to configure the board as a Base or Remote. No pairing is required between the base and the remote units. All configurations are based on the DIP switch settings. Refer to **“Modes of Operation” on page 45** for more information.

- 1111 is used for Base units.
- 0000 through 1110 is used to configure Remote units.

Figure 39 - WMSB Connections



Modes of Operation

There are two modes of operation the WMSB board contains. One is the Base Mode, and the other is the Remote. A max of 10 sensors can be used with the system. Each DIP Switch setting will denote a group, refer to **Figure 40**.

The WMSB Remote will send temperature, relative humidity, and barometric pressure readings to the WMSB Base every transmission rate duration. The WMSB Remote will record a temperature reading every "wake up time" duration. If the temperature reading is 2°F higher or lower than then last temperature reading, it will instantly send the new temperature, relative humidity, and barometric pressure readings to the WMSB Base.

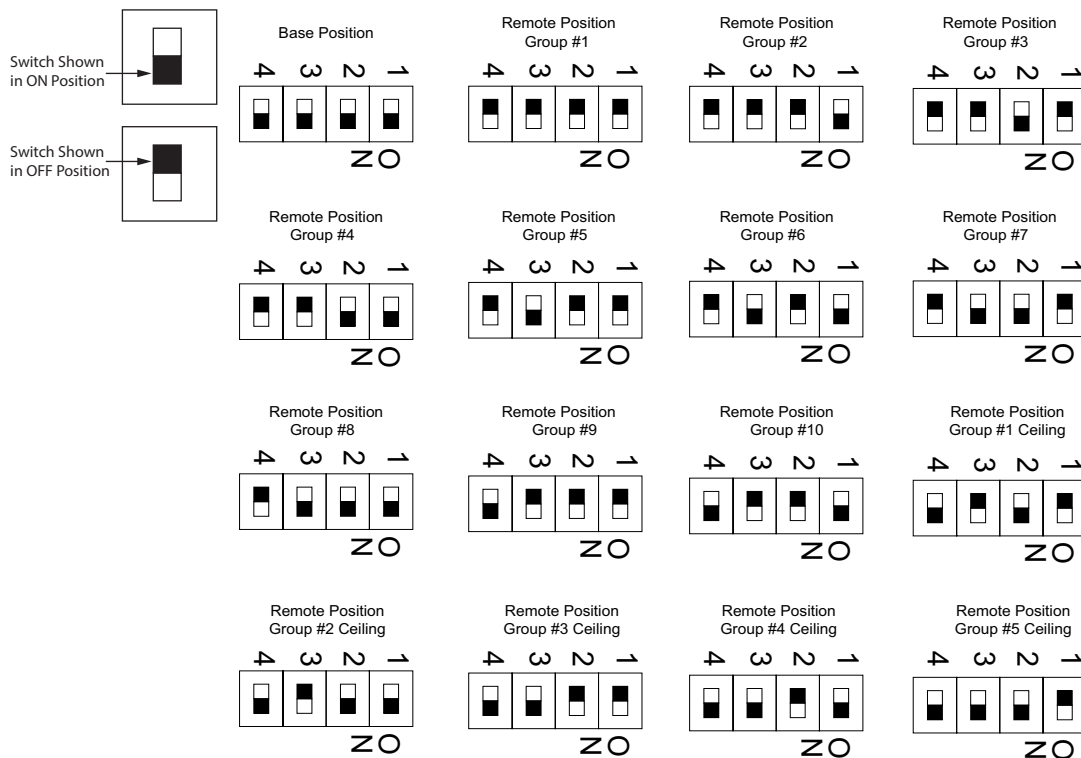
Base Mode - In base operation mode, the WMSB acts as a data collector and communicates to all the remote boards to collect the temperature and relative humidity (RH) readings. The base unit must be powered using 24V DC connections. It can utilize power over a Modbus (Cat 5) connection or hardwired 24V DC power line. The base module sensor should be connected to the Modbus master board using Cat 5.

Remote - In remote operation mode, the WMSB board acts as a data transmitter. It can transmit temperature and relative humidity (RH) information periodically to all base modules.

Figure 40 shows the difference in DIP switch settings. When all the switches are ON (black boxes), the sensor is set to Base. Any combination of switches other than all set to ON, the unit will be configured as Remote.

NOTE: When the rechargeable battery is connected to the sensor, LED 3 will light up for one second. This determines that the WMSB is working and ready to send data via Bluetooth connection.

Figure 40 - DIP Switch Settings



Variable Frequency Drive (VFD) Power Wiring

High voltage wiring consists of the main control panel power and wiring to and from each VFD when the VFD is panel mounted. If the VFD is remote mounted, VFD power does not need to go to the enclosure.

1. There are multiple electrical connections required for this control. 120V AC, 1 Phase, 15 Amp service should be wired to terminals H1 and N1 to power the controls. Input power to the variable frequency drives should be wired to the series of quick disconnect terminal blocks on the side of the enclosure. Drive input power should match the nameplate on the drive. Output power from the variable frequency drives is always 3 phase and should match the voltage requirements of the fan motors.
2. All high voltage wiring shall be terminated on the right side of the enclosure on terminal blocks located on the right-hand side.

VFD Wiring Connections

When connecting the motor to the VFD, use terminals U/T₁, V/T₂, W/T₃ for motor connections. For connecting building power:

- Use L1, L2, and L3 for building connections with 3-phase inputs
- Use only L1 and L2 for 240 volt single-phase inputs
- Use only L1 and N for 120 volt single-phase inputs

Reference **Figure 41** through **Figure 43** for common VFD wiring.

Figure 41 - VFD Wiring (3-Phase)

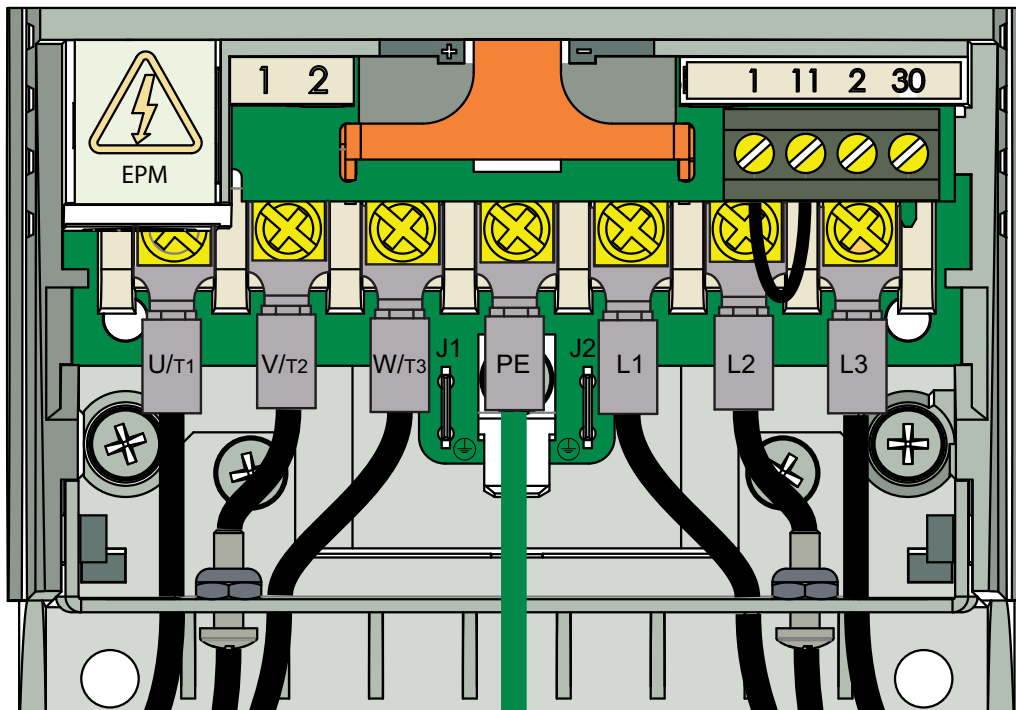


Figure 42 - VFD Wiring (240 Volt Single-Phase)

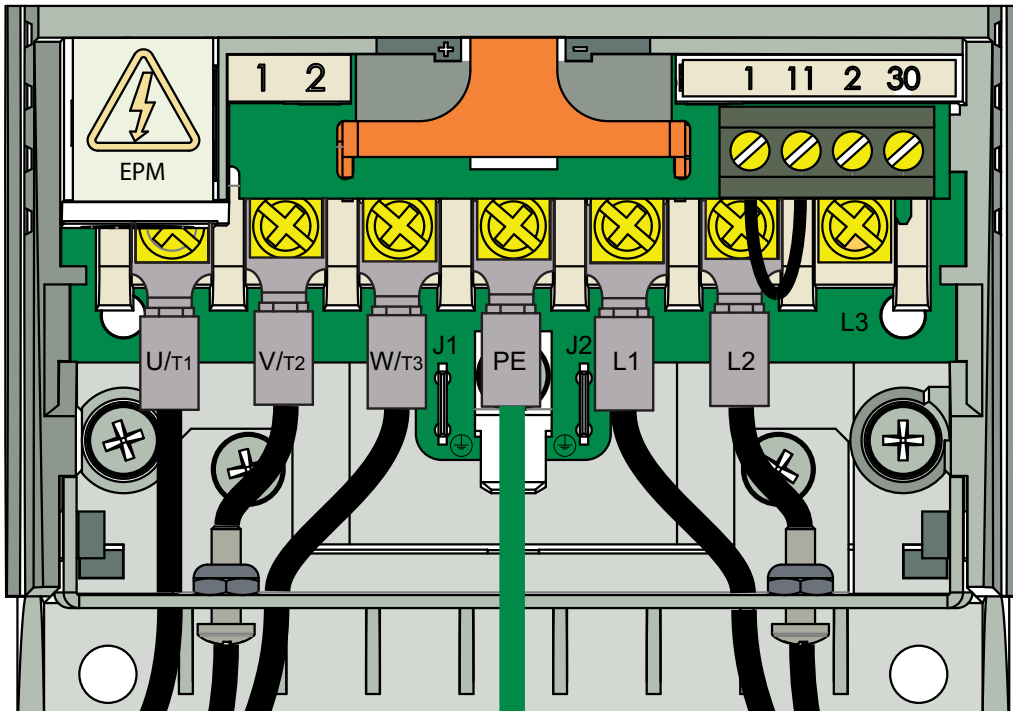
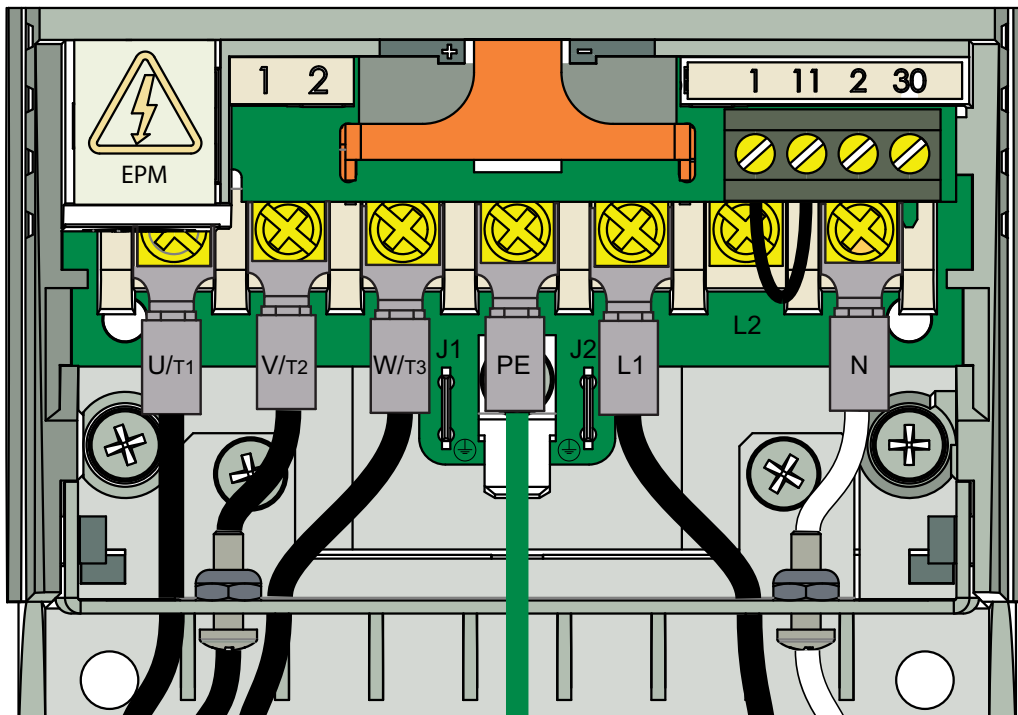


Figure 43 - VFD Wiring (120 Volt Single-Phase)



Variable Frequency Drive (VFD) Installation

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.

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 6** as a guide during installation.

Table 6 - VFD Installation Check List

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

VFD Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage. Refer to “**ACTECH SMV VFD**” on **page 51**. See installation schematic for exact breaker sizing.
- Every VFD should receive power from its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
- Input AC line wires should be routed in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed. **Do not combine input and output power cables in the same conduit.**
- The VFD should be grounded on the terminal marked PE. A separate insulated ground wire must be provided to each VFD from the electrical panel. This will reduce the noise being radiated in other equipment.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

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

VFD Output Power

- Motor wires from each VFD to its respective motor **MUST** be routed in a **separate steel** conduit away from control wiring and incoming AC power wiring. This is to avoid noise and crosstalk between drives. An insulated ground must be run from each VFD to its respective motor. Do not run different fan output power cables in the same conduit.
- VFD mounted in ECP: A load reactor should be used and sized accordingly when the distance between the VFD and motor is greater than specified below. The load reactor should be installed within 10 feet of the VFD output:
 - 208/230V** - Load reactor should be used when distance exceeds 250 feet.
 - 460/480V** - Load reactor should be used when distance exceeds 50 feet.
 - 575/600V** - Load reactor should be used when distance exceeds 25 feet.
- VFD mounted in fan: The load reactor should be sized accordingly when the VFD is mounted in the fan.
 - 208/230V** - Load reactor is optional but recommended for 15 HP and above motors.
 - 460/480V** - Load reactor is optional but recommended for 7.5 HP and above motors.
 - 575/600V** - Load reactors are required for all HP motors.
- If the distance between the VFD and the motor is extremely long, up to 1000 FT, a dV/dT filter should be used, and the VFD should be increased by 1 HP or to the next size VFD. The dV/dT filter should be sized accordingly and installed within 10 feet of the output of the VFD.
 - 208/230V** – dV/dT filter should be used when distance exceeds 400 feet.
 - 460/480V** – dV/dT filter should be used when distance exceeds 250 feet.
 - 575/600V** – dV/dT filter should be used when distance exceeds 150 feet.
- Do not install a contactor between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
- When a disconnect switch is installed between the drive and motor, the disconnect should only be operated when the drive is in a STOP state.

VFD Programming

Programming

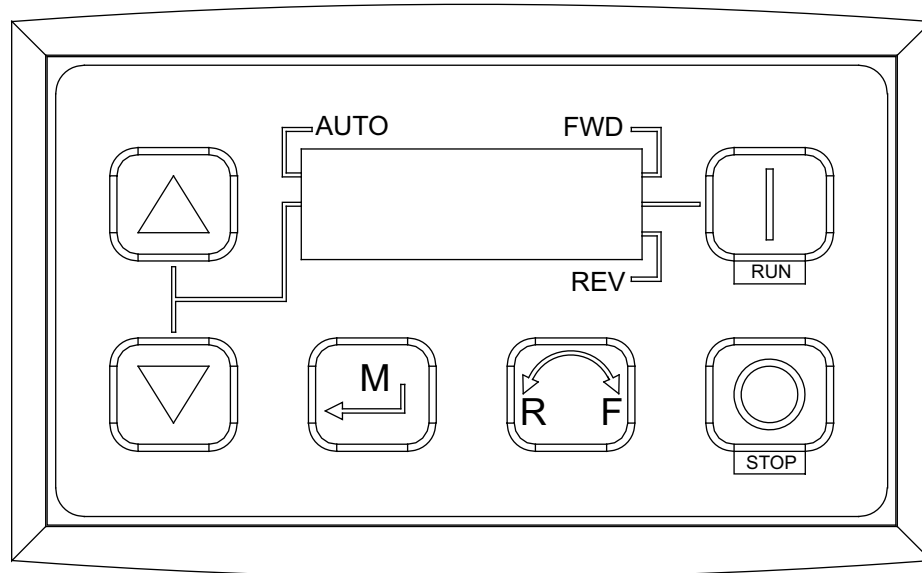
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (refer to “**ACTECH SMV VFD**” on page 51).

To enter the PROGRAM mode to access the parameters:

1. Use the buttons on the VFD screen (**Figure 44**) 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 44 - VFD Screen



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

ACTECH SMV VFD

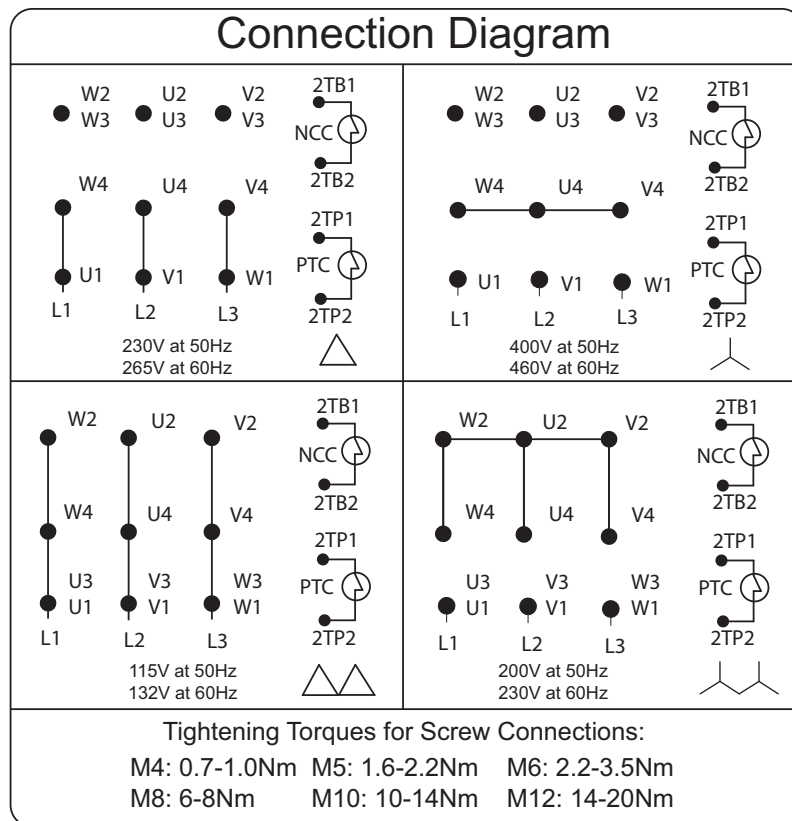
Table 7 - Cross Reference Table

HP	Part Number	Volts	1Ø Input	3Ø Input	Input Amps 1Ø 120V AC	Input Amps 1Ø 240V AC	Output Amps	Breaker 1Ø 120V AC	Breaker 1Ø 240V AC
1	ESV751N01SXB	120/240V	X	-	16.6	8.3	4.2	25	15
1.5	ESV112N01SXB	120/240V	X	-	20	10	6	30	20

HP	Part Number	Volts	1Ø Input	3Ø Input	Input Amps 1Ø	Input Amps 3Ø	Output Amps	Breaker 1Ø	Breaker 3Ø
1	ESV751N02YXB	240V	X	X	8.8	5	4.2	15	15
1.5	ESV112N02YXB	240V	X	X	12	6.9	6	20	15
2	ESV152N02YXB	240V	X	X	13.3	8.1	7	25	15
3	ESV222N02YXB	240V	X	X	17.1	10.8	9.6	30	20
1	ESV751N04TXB	480V	-	X	-	2.5	2.1	-	15
1.5	ESV112N04TXB	480V	-	X	-	3.6	3	-	15
2	ESV152N04TXB	480V	-	X	-	4.1	3.5	-	15
3	ESV222N04TXB	480V	-	X	-	5.4	4.8	-	15
1	ESV751N06TXB	600V	-	X	-	2	1.7	-	15
2	ESV152N06TXB	600V	-	X	-	3.2	2.7	-	15
3	ESV222N06TXB	600V	-	X	-	4.4	3.9	-	15

NOTE: To adjust the speed of 3 phase direct-drive motors, a variable frequency drive is required.

Figure 45 - Motor Wiring Diagrams



SYSTEM INFORMATION

Accessing parameters within the HVLS control system can be accomplished one of two ways: through one of the remote HMIs or through the HMI located on the ECPM03 control board. For menu specific information on remote HMIs, refer to “**Menu System - Remote HMI**” on page 53. For menu specific information on the LCD HMI mounted on the ECPM03 board, refer to “**ECPM03 LCD**” on page 58.

Human Machine Interface (HMI)

Through a remote HMI connected to the ECPM03 control board, both HMI Settings and System Operational Settings can be accessed.

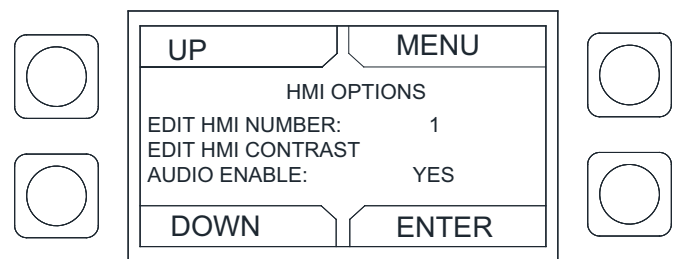
NOTE: Buttons change functions during certain operations and tests. Verify the functionality of buttons with the text and menu settings.

Accessing Remote HMI Settings

To access the HMI parameters of a specific remote HMI, press the bottom two buttons located to the left and right of the screen and hold for one second. Once the HMI Configuration menu has appeared, either the HMI Number or screen contrast can be adjusted. Save settings when exiting the menu, failing to do so will discard all changes and revert to the previous state.

NOTE: Each HMI connected to the main control board must have a unique number assigned to it. Duplicating or skipping consecutive numbers will generate a Modbus fault that must be corrected before operating the system.

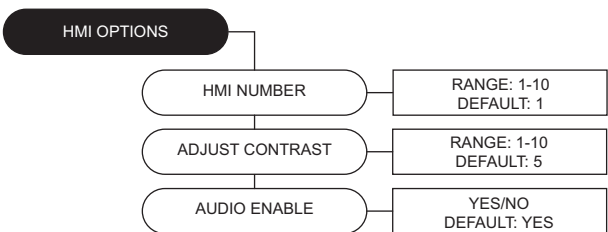
Figure 46 - HMI Number and Contrast



Menu System - Remote HMI Options

HMI Options

- **HMI Number** - Set the HMI number in the series. When an HMI is set to #1, this will be the main HMI. Do not duplicate HMI numbers on the same ECP.
- **Adjust 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.
- **Audio Enable** - When enabled, any button presses will be muted. Alarms will still sound.



Menu System - Remote HMI

There are three separate menus associated with the operation of the HVLS control package that can be accessed through a remote HMI connected to the main control board: User Settings, Factory Settings, and Service Settings.

To access any one of these three menus, press and hold the top two buttons located to the left and right of a remote HMI screen for one second. The Factory and Service Settings menus require passwords for entry. Only Factory Trained Personnel should adjust parameters/settings.

Following is a detailed list of all configurable parameters and monitoring points on the HMI.

User Settings

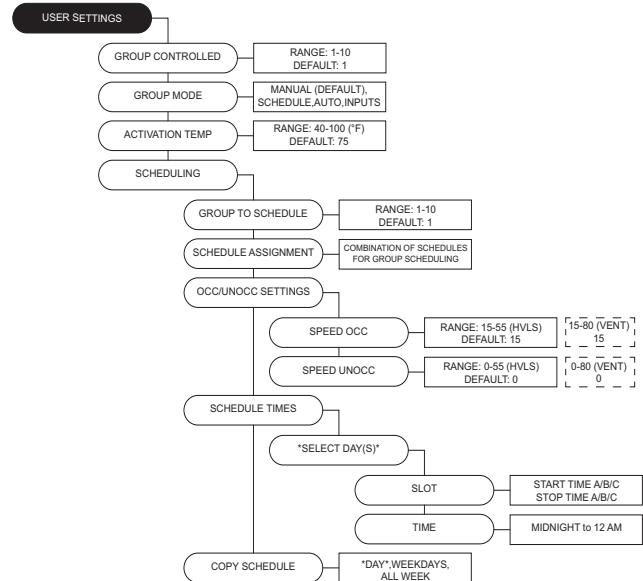
Group Controlled - Assigns current HMI to another group. Alterations will not affect default factory settings. The group controlled number selection will hold after a power cycle, but will revert to the default assignment after a factory reset.

Group Mode - Defines mode of operation from the selection in the "Group Controlled" setting. All fans in the selected group will follow the mode change.

Activation Temp - Temperature setting will activate a group.

Scheduling

- **Group to Schedule** - Any changes to the group number selected will affect all related scheduled settings.
- **Schedule Assignment** - Select a schedule for the group indicated in "Group To Schedule."
- **Occ/Unocc Settings** - # of HVLS/Vent fan(s) must be set to 1 under Factory Settings.
 - **Speed Occ/Unocc** - Fan speed settings for Occ/Unocc time periods.
- **Schedule Times** - User may set schedules per day.
 - **Slot** - User may select Start and Stop schedules based on "Schedule Assignment."
 - **Time** - User may set schedule start/stop times.
- **Copy Schedule** - Copy a schedule between days.



Factory Settings

of HVLS Fans - Total number of HVLS fans.

of Vent Fans - Total number of Vent fans.

of Mod Outputs - Amount of ECM/Damper outputs.

of Groups - Total number of groups assigned to the ECP. Up to 10 HVLS groups can be assigned. Up to 5 Vent groups can be assigned.

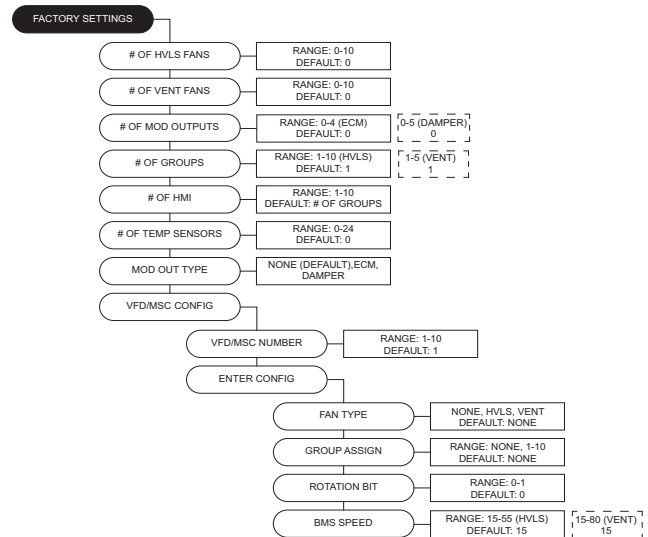
of HMI - Number of remote HMIs connected to the ECP. One HMI must be assigned per group, or a fault will generate.

of Temp Sensors - Up to 8 sensors may be connected to the ECPM03 board, additional sensors may be wired by adding ECPM03EX board(s).

Mod Out Type - Setting for wired modulating outputs from the ECPM03 board. Cannot mix output types.

VFD/MSC Config

- **VFD/MSC Number** - The selected number is the VFD/ MSC that will be modified in the "Enter Config" menu.
- **Enter Config**
 - **Fan Type** - Selection for fan type of the VFD.
 - **Group Assign** - Assigns the VFD/ MSC to a group. HVLS and Vent type fans cannot be assigned to the same group. Configurations hold after a power cycle.
 - **Rotation Bit** - Reverses default direction of fan if motor phasing is set incorrectly.
 - **BMS Speed** - The frequency at which the respective VFD will operate when a BMS LOW SPEED input signal is received on terminal IL1B of the ECPM03 board.



Group Config

- **Group Number** - Select the group number to be modified.
- **Enter Config**
 - **Two Speed** - Enables two speed operation for the group when in either Manual ([page 62](#)) or Input ([page 65](#)) modes. Fans will operate between Min/Max speeds.
 - **Min Speed/Max Speed** - The minimum/maximum speed for the set fan group.
 - **Winter SPD Min/Max** - Minimum and maximum setpoint(s) for winter mode operation.
 - **Winter Diff** - The maximum temperature differential for winter mode operation. When set equal to 0, a ceiling temperature sensor is not required.
 - **Winter Act Temp** - Winter mode activation temperature setpoint. When the group average temperature falls below this setpoint, winter mode becomes active.
 - **Modulation Band** - Temperature range for modulation of a group.
 - **Hyst Temp** - The hysteresis temperature value for deactivation of a group.
 - **Low Temp Alarm** - Any sensor linked to a fan group detects a room temperature equal to or less than the Low Temperature Alarm, that sensor will cause all fans in that fan group to stop.
 - **High Temp Alarm** - Any sensor linked to a fan group detects a room temperature equal to or higher than the High Temperature Alarm, that sensor will cause all fans in that fan group to stop.
 - **Min Cycle Time** - The minimum cycle timer in the system to help prevent frequent fan cycling when operating in Auto Mode.
 - **Timer Mode** - If "Time to Auto" is selected for a fan group, the group will switch from Manual Mode to Auto Mode when the timer expires. If "Time to Off" is selected, fans will run for the defined time period and then turn off.
 - **Act Stat Relay** - Selected relay output will activate when the respective fan group is ON.
 - **Vac Out Assign** - ECPM03 board can activate with any or multiple groups. Refer to [Table 8](#).
 - **Vac Out Number** - The number selected is the output that will be modified by "With Fans On" or "Max Speed" settings.
 - **With Fans On** - Selecting this option will activate the respective output any time the assigned fan group is on. Outputs will function in all operational modes.
 - **Max Speed** - This option will activate the respective output only when the assigned fan group is operating in Max Speed from a button press or a Max Speed input. Outputs assigned to activate with "Max Speed" will only activate when a group is operating in Manual or Input Mode.
 - **Vac In Assign** - The number selected is the input that will be modified by "Min Speed" and "Max Speed."
 - **Vac In Number** - The number selected is the input that will be modified by "With Fans On" or "Max Speed" settings.
 - **Min Speed/Max Speed** - The defined input will run the group at the "Min Speed" or "Max Speed" when operating in either Manual or Input Mode.

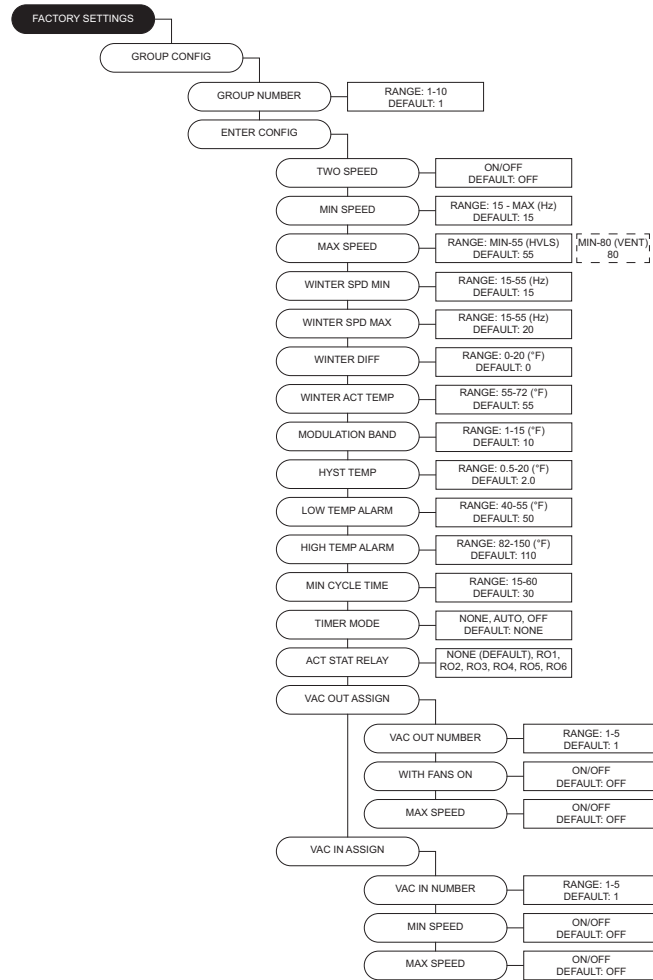


Table 8 - 120V AC Assignable Outputs

Terminal Name	Terminal Number	VAC OUT #
IO2	J8-1	Output 1
EF2	J8-3	Output 2
SF2	J8-3	Output 3
GAS	J9-3	Output 4
ST	J9-6	Output 5

Table 9 - Assignable Inputs for Fan Groups

Terminal Name	Terminal Number	VAC IN #
B1	J7-2	Input 1
B2	J8-2	Input 2
AR1	J9-2	Input 3
KTS	J9-4	Input 4
PCU	J9-7	Input 5

HMI Config

- **HMI Number** - The HMI number selected will be modified by this setting.
- **Enter Config**
 - **Group Assign** - The number selected will modify the selected HMI's options under "On/Off Board Sensor."
 - **On Board Sensor** - Enables On Board Sensor (built into the HMI).
 - **On Board Assignment** - Active when On Board Sensor is enabled.
 - **Group Number** - Select group number for sensor to be assigned.
 - **Assign To Group** - Assign sensor to a group.
 - **Off Board Sensor** - Enables Off Board Sensor (third-party).
 - **Off Board Assignment** - Active when Off Board Sensor is enabled.
 - **Group Number** - Select group number for sensor to be assigned.
 - **Assign To Group** - Assign sensor to group.

Temp Sensor Config

- **Sensor Number** - Select the sensor number that will be modified within the menu structure.
- **Group Assignment**
 - **Group Number** - Select group number for sensor to be assigned.
 - **Assign to Group** - Assign sensor to the selected group.
 - **Ceiling Assign** - Fan's ceiling assignment.

Mod Output Config

- **Mod Output #** - Select the modulating output # to assign.
- **Group Assign** - Assigns output to the selected group.
- **Damper Volts** - Damper voltage setting.
- **ECM Speed Min** - Minimum speed setting for EC operated motors.
- **ECM Speed Max** - Maximum speed setting for EC operated motors.

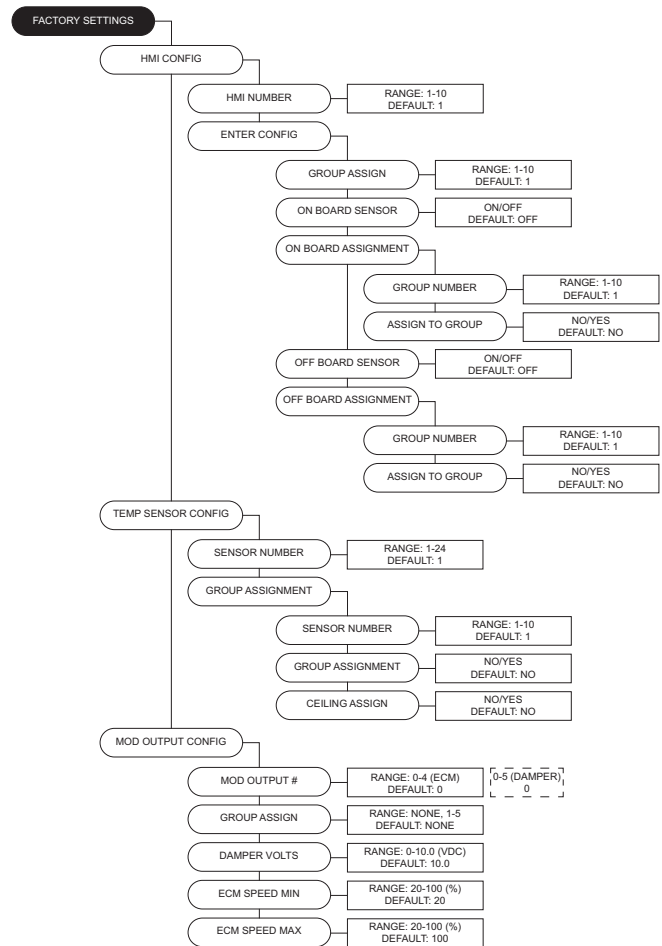
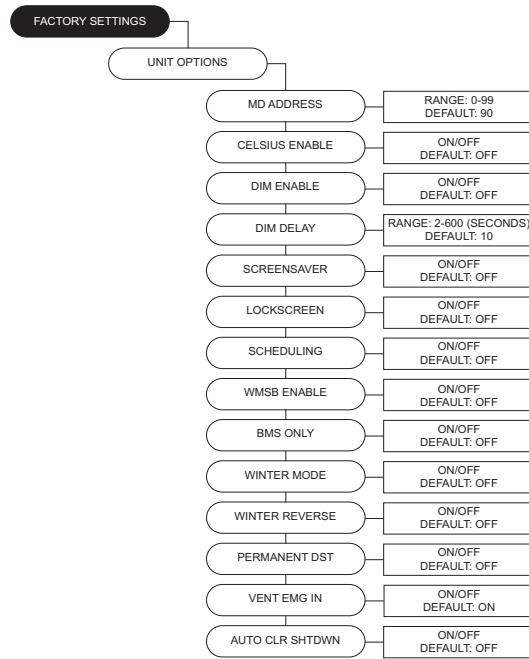


Table 10 - HVLS BMS Only Mode

Terminal Name	Terminal Number	BMS Function
IL1B	J10-26	Low Speed Input
IO1	J7-1	Max Speed Input
VI+	J10-29	Modulating Input

Unit Options

- **MB Address** - Modbus address of the ECPM03 board.
- **Celsius Enable** - Enables temperature reading to °C.
- **Dim Enable** - When enabled, all HMI back lights will turn OFF after the specified time has elapsed from the last button press.
- **Dim Delay** - The amount of time that must elapse before the HMI screen back lights are turned OFF.
- **Screensaver** - When enabled, if no buttons are pressed for “X” time or greater, the HMI membrane temperature will display.
- **Lock Screen** - Password (9999) entry required after screensaver becomes active.
- **Scheduling** - Enables scheduling.
- **WMSB Enable** - Enables communication with a WMSB-Base on the MODBUS network of the ECPM03.
- **BMS Only** - When enabled, all other operational modes (MANUAL / AUTO / SCHED / INPUT) will become disabled from the user settings menu. All fans will respond only to signals received on the inputs listed in **Table 10**. Refer to “**Building Management System (BMS)**” on **page 61** for more information.
- **Winter Mode** - Winter speed and temperature settings become available in HVLS “Group Config” when enabled: Winter Spd Min, Winter Spd Max, Winter Diff, and Winter Act Temp. Fan speed is modulated between Winter Min/Max speeds based on the difference of temperature between ceiling and floor temperature inputs to the control board. If the Winter Diff setting is set equal to zero, a fan group will operate at its respective Winter Spd Min when the temperature falls below the Winter Spd Max.
- **Winter Reverse** - All HVLS fans will operate in reverse when “Winter Mode” becomes active.
- **Permanent DST** - Time will not adjust as per daylight savings scheme when this setting is turned ON.
- **Vent Emg In** - Enabling this setting will activate vent fans to operate at their max speed values. When an emergency input signal is received. Refer to “**Emergency Input**” on **page 60** for more information.
- **Auto Clr Shtdwn** - Enabling this setting will remove the requirement to press “CLEAR” on the HMI during an emergency condition. The system will exit the emergency condition as soon as the dry contact is opened.



Service Settings

Test Fans

- **All Fans** - All fans connected to the ECP will run when this setting is turned ON.
- **VFD/MSC**
 - **VFD/MSC Number** - The selected output number will run when the override is set to ON and the service menu changes are saved.
 - **Override** - Activates the VFD/MSC output for testing.
- **Modulating Outputs**
 - **Modulating Out #** - The selected output number will run when the override is set to ON and the service menu changes are saved.
 - **Override** - Activates the modulating output for testing.
- **Groups**
 - **Group Number** - The selected group will run when the override value is set to ON and the service menu changes are saved.
 - **Override** - Activates the selected group for testing.

Diagnostics

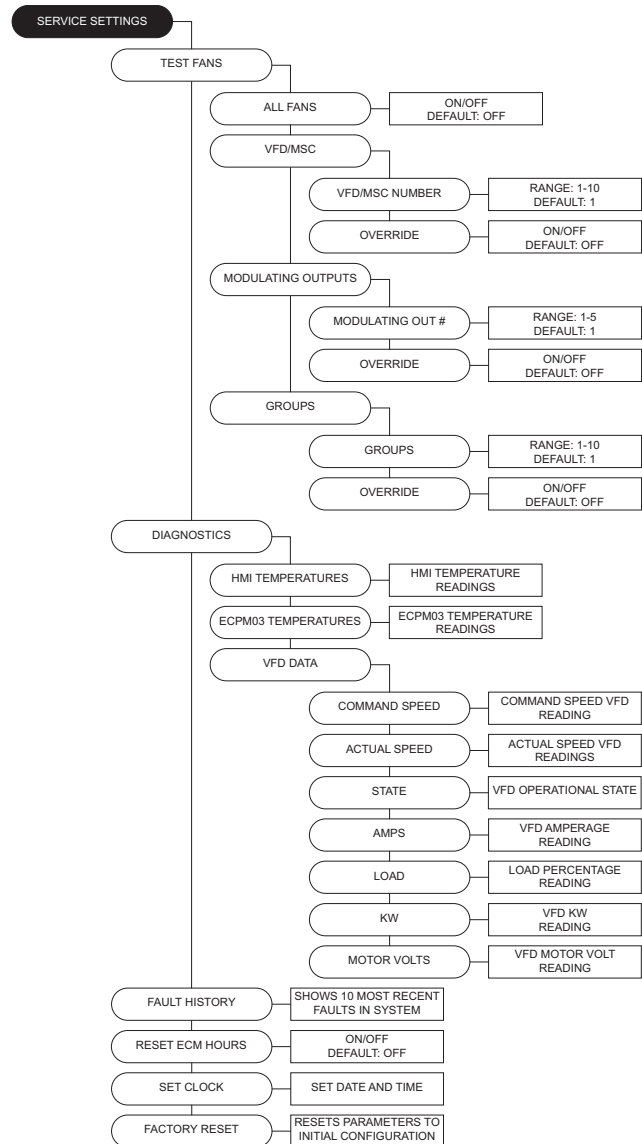
- **HMI Temperatures** - Displays HMI Temperature readings.
- **HMI Membrane All** - Displays temperatures for all HMI membrane sensors used for group temperature calculations. Membrane sensors are located on the HMI and are not replaceable.
- **Membrane #1** - Primary membrane sensor for temperature calculation.
- **Membrane #2** - Secondary membrane sensor used for backup calculations. If Membrane #1 sensor fails, Membrane #2 will override Membrane #1.
- **ECPM03 Temperatures**
 - **Temp Sensor** - Wired thermistor inputs to the ECPM03 board.
- **Ex1 Temperatures** - Displays temperatures sensor data for wired input sensor numbers 9-16.
- **Ex2 Temperatures** - Displays temperatures sensor data for wired input sensor numbers 17-24.
- **VFD Data**
 - **Command Speed** - Displays output speed from ECP.
 - **Actual Speed** - Displays actual motor speed.
 - **State** - Displays VFD drive status.
 - **Amps** - Displays amperage output.
 - **Load** - Displays the drive's power output over the total output rating of the VFD.
 - **KW** - Displays power output.
 - **Motor Volts** - Displays output voltage.

Fault History - 10 most recent faults are stored for troubleshooting purposes.

Reset ECM Hours - Resets logged hours of EC motors controlled from the ECPM03 board.

Set Clock - This menu will let the user set the clock on the ECPM03.

Factory Reset - Activating a factory reset will reset all parameters to the values loaded during the initial configuration of the control board.



ECPM03 LCD

General Overview

The ECPM03 control board is equipped with an LCD HMI (**Figure 47**) that can be used for accessing limited parameters and service features. The four buttons located below the screen are used for navigating the menu structure.

First press the **MENU** button to enter the menu system. The **UP** and **DOWN** button are used for navigating through the current directory. The **ENTER** button will confirm selection/changes. Press the **MENU** button to escape back through the menu structure.

Menu System - ECPM03 HMI

Faults

- **View Faults** - Displays logged faults.
- **Clear Faults** - Clears all faults that are logged in the system.

Fan Monitoring

- **Command Speed** - Displays output speed from ECP.
- **VFD/MSC Act Spd** - Displays actual motor speed.
- **Amps** - Displays current (amps) output.
- **KW** - Displays power output.
- **Load** - Displays the motor's load percentage
- **Volts** - Displays output voltage.
- **VFD Temp** - Displays VFD temperature.
- **VFD Run Time** - Logged VFD run time.
- **ECM Run Time** - Logged ECM run time.

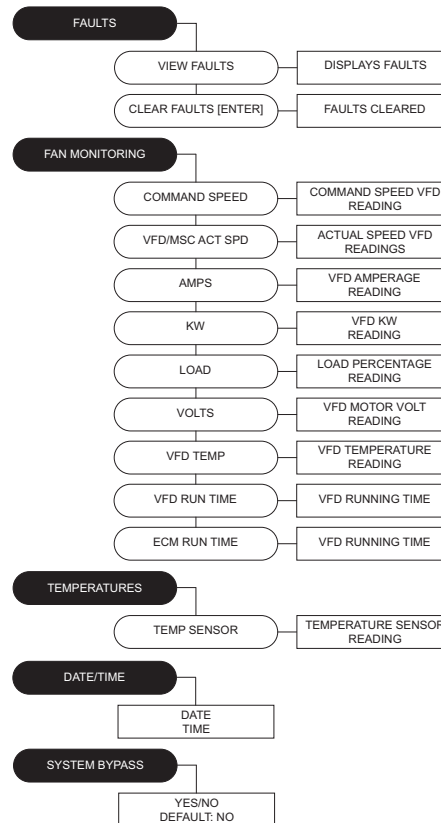
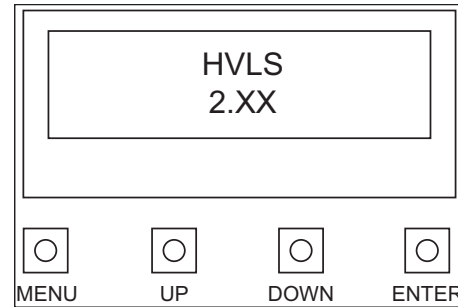
Temperatures

- **Temp Sensor** - Wired thermistor input sensors to the ECPM03 board.

Date/Time - Provides access to date/time (view only), and time zone (view/change). Use the remote HMI to change date/time settings.

System Bypass - Yes/No option to run all fans connected to the ECP at their defined BMS speed.

Figure 47 - ECPM03 Configuration Screen



HVLS Control System Overview

There are three levels of importance for the features contained in the HVLS control system: Safety Faults (level 3), System Overrides (level 2), and Optional Group Activation Modes (level 1). The greater the level, the higher the precedence that control has over the other features within the HVLS control system.

Safety Faults (Level 3)

Level 3 safety faults of the Smart Fan Controls are the Reverse Safety timer, Emergency Shutdown Interlock, High Temperature Alarm, and Low Temperature Alarm.

These features are broken into two sub-categories:

- System-wide
 - Reverse Safety Timer
 - Emergency Shutdown Interlock
- Group-centric
 - High Temperature Alarm
 - Low Temperature Alarm

Under certain conditions, system-wide safety faults will prevent the entire system from operating. Group-centric safety faults monitor setpoints relative to each group on the Smart Fan Control system and will prevent the respective groups from operating when the predefined limits are exceeded. Groups will remain inactive until all fault conditions are inactive.

System Overrides (Level 2)

Level 2 system overrides include the Fan Override, System Bypass, Building Management System (BMS) control, and Direct Digital Control (DDC). These features bypass all of the optional level 1 control methods listed below. Any level 3 safety faults will prevent the system from operating, as stated in the section above.

Optional Group Activation Modes (Level 1)

The four activation methods for group control are: Manual, Schedule-based, Automatic (Auto), and activation by Input. These are the lowest level of control on the system and will be overwritten by any of the Level 2 or 3 features listed above.

System Operation

Before starting up or operating the fan or control panel, check all fasteners and wires for tightness. In particular, check the blade hardware and all safety cables. With power to the fan(s) **OFF**, turn the fan blades by hand to be sure it is not striking any obstacles. Re-position if necessary.

The VFDs (Variable Frequency Drives) included in this system have been factory programmed at **55Hz** (HVLS) / **80Hz** (General Ventilation Fans) for high speed and **15Hz** for low speed. For HVLS fans, the speed cannot go above **55Hz**. This results in a **73%** reduction in airflow when operating at low speed. The VFDs are used to adjust the speed of 3 phase motors, and frequency is directly proportional to airflow. Exceeding the max VFD speed can cause motors to draw excessive current and fail. Reducing speeds below the minimum operating speed can cause motors to overheat and fail.

Up to 10 total fans can be controlled with one control system. Fans can be arranged in groups where fan operation is identical. There can also be a maximum of 10 HMIs assigned to a system. This allows for flexibility on where the fans are controlled and how they are controlled. Each HMI has a built-in temperature sensor for room sensing. In addition to this, up to 34 remote temperature sensors can be wired into the system. They can be assigned to one or more fan groups. In total, up to 44 sensors can be assigned to 1 or more groups (10 from HMIs, 34 from remote sensors).

Safety Features

The reverse safety timer is a feature integrated into software that prevents the accidental damage to drive components under the following conditions:

- In the event of complete power loss to the control package.
- When any reverse commands have been initiated.
- If at any time a factory settings change has been made.

All fan controls will remain inactive for 90 seconds after the save command has been received. When a group either receives a reverse command during automatic or manual control, the respective group will be issued a stop command, wait 90 seconds, then resume control in the reverse direction.

Emergency Input

Emergency Inputs is a means of control provided for overriding fans in an emergency fire condition. Closing a dry contact across terminals IL2A and IL2B on the ECPM03 control board will cause:

- all HMIs to display EMERGENCY INPUT ACTIVE
- all HMIs to sound an alarm
- all HVLS fans to stop
- Vent fans to run at their respective groups MAX SPEED value if the VENT EMG SD option is set equal to ON, OR the fans will turn off if the VENT EMG SD option is set to OFF.

Pressing the MUTE button on an HMI will silence the alarm. If AUTO CLR SHTDWN is set to ON, the user only needs to open the dry contact between IL2A and IL2B in order for the system to exit the emergency condition. If AUTO CLR SHTDWN is set to off (default setting), the user must also press the CLEAR button on any HMI tied to the system.

Pressing the CLEAR button on a single HMI will push the entire control package out of the emergency condition. All HVLS and vent fans will return to the control mode that they were previously set to prior to the Emergency Input.

Emergency Input is the highest priority command. It supersedes all other modes, including, System Bypass, BMS Only Mode, Auto Mode, and Manual Mode. Priorities are:

- Emergency Input (Highest Priority)
- System Bypass
- Service Menu Fan Override
- Building Management System (BMS) Mode
- Direct Digital Control (DDC) Mode
- Manual/Inputs/Auto/Temperature Modes (Lowest Priority)

Override Features

Temperature Alarms

For the protection of the equipment, there are two temperature alarms associated with every group on the HVLS package, “High Temp Alarm” and “Low Temp Alarm”. When any temperature inputs read by the high and low temperature alarms that has been assigned to a group is out of range of the alarm value, all fans associated to that group will stop, display the respective alarm name on all HMIs, and the HMI will have an audible sound. Fans will resume the previous operational mode of control once environmental conditions have fallen within the high and low temperature alarms. Temperature inputs read by High and Low Temperature Alarms:

- HMI Membrane Sensors
- HMI Wired Thermistor Inputs
- ECPM03 Wired Thermistor Inputs
- ECPM03 EX1 and EX2 Wired Thermistor Inputs
- WMSB Group Average Temperature Inputs

System Bypass

In the event that a remote HMI is not accessible or has become damaged, the user can initiate fan control from the small HMI located on the ECPM03 control board.

Building Management System (BMS)

There are three inputs available for controlling BMS operation: IL1B (24V DC, BMS Low Speed Input), IO1 (120V AC, BMS Max Speed Input), and VI+ (BMS Modulating Input). The IL1B and IO1 inputs will force the fans to different speeds, these are used to drive all fans on a package to their respective BMS and high speed values. Input VI+ is used to modulate all fans between their respective BMS and maximum speed values. Input IO1 takes precedence over both IL1B and VI+ inputs.

BMS Low Speed Input

Interlocks IL1A and IL1B are located on J10 header pins of the ECPM03 board. Closing a dry contact between these two terminals will turn all fans connected to the ECPM03 on and run them at their respective BMS speed. The BMS speed is defined for each group on the ECPM03 board. Once the contacts open between IL1A and IL1B, all groups will resume back to their previous mode of operation.

BMS High Speed Input

Input IO1 is located on connector J7 of the ECPM03 board. This input is used for controlling the high voltage BMS speed. All fans connected to the ECPM03 board will go to their respective maximum speed values when input IO1 receives 120V AC signal.

BMS Modulating Input

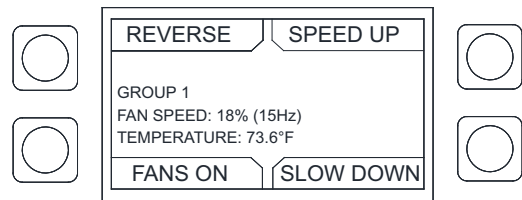
Input VI+ located on J10 header pins of the ECPM03 is used for modulating fans between their respective BMS and high speed values. Fans will only modulate if the low voltage BMS interlock is closed, and a 0-10V signal is present on input VI+.

Operational Modes

Manual Mode

There are several Manual Mode options, all with the basic means of controlling a fan group based on button presses from a remote HMI. Based on factory configurations, group settings of the HVLS control package, manual mode can exist with external inputs and with a two speed functionality enabled.

Figure 48 - Manual Mode HVLS Display



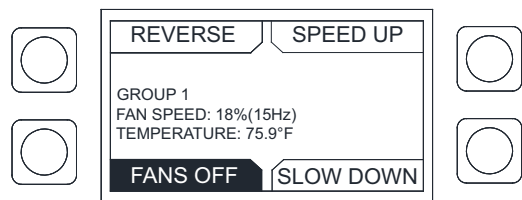
Manual Mode - Basic

NOTE: Due to the variations of functionality associated with the lower left button for all remote HMIs, it will be referred to as the “Fan Button” in the remainder of this text.

The most basic form of manual mode does not have either TWO SPEED or VAC Inputs options enabled in the factory settings menu. Refer to **page 54** for more information. The remote HMI buttons starting with the upper left moving clockwise are: REVERSE, SPEED UP, SLOW DOWN, and the FAN Button.

- REVERSE: Reverses the direction of all HVLS fans associated with the fan group. When this command is used, the fans will receive a stop command and pause for 90 seconds prior to starting in the reverse direction. This button is not available for any VENT type fan groups.
- SPEED UP: Increases the FAN SPEED (**Figure 49**) in 1Hz intervals.
- SLOW DOWN: Decreases the FAN SPEED in 1Hz intervals.
- FAN Button: Toggles between FANS ON / FANS OFF. FANS ON will force the fans to operate at the FAN SPEED displayed on the remote HMI screen.

Figure 49 - Manual Mode with 2 Speed Option OFF



Manual Mode - VAC Inputs

Any of the five VAC Inputs listed in **Table 9 on page 54** are configurable to provide an external means of activation for the fans to go to either the factory configured MIN or MAX fan speeds. All functionality of the Fan Button takes precedence over VAC Inputs. Fans can be forced off by cycling the fan button to the FANS OFF position.

Manual Mode - TWO SPEED Enabled

With the TWO SPEED option enabled, the functionality is identical to the Basic functionality explained above, with the exception of the Fan Button.

Fan Button: Toggles between FANS ON / MAX SPEED / FANS OFF. MAX SPEED will force the fan group to operate at the factory configured MAX SPEED associated with the fan group.

Table 11 - Manual Mode Operation Summary

Controllable Item	Range
Fan Status	On/Off
Fan Speed	Min to Max Frequency
Fan Direction (HVLS Only)	Forward or Reverse

Monitoring Points	Units
Power	Kw
Current	Amps
Speed	Hz
Motor Voltage	Volts
% Load	%
Run Time	Hours
VFD Temp	°F/°C

Configurable Item	Range/Limit
Two Speed	On/Off
Min Speed	15 Hz to Max
Max Speed	Min Speed to 55 Hz (HVLS)/80 Hz (Vent)
Timer Mode	Auto/Off/None
Timer Hr/Min	1 to 18 Hours
Vac Out Assign	1-5
Act Stat Relay	RO1-6
Vac In Assign	1-5
Vac In	1-5
Vac Out	1-5
Temperature Unit	°F/°C

NOTE: All fans assigned to a group will follow the commands from the HMI. They will all start together, stop together, and run forward or reverse together. They will also have the same minimum and maximum speeds and temperature limits. If independent control is needed for specific fans, that fan should be in a group by itself.

Schedule Mode

ECPM03 board (*CONFIGURATION > SCHEDULING > ENABLE*). When a group is set to schedule mode, it will toggle between the Speed Occ/Unocc settings found in the HMI *USER SETTINGS > SCHEDULING* (page 53).

USER SETTINGS > SCHEDULING > SCHEDULE TIMES defines three occupied time periods per day (Period A, Period B, and Period C), for the seven days of the week. Scheduled times must be sequential and cannot overlap with one another.

After the occupied time periods have been set, the fan groups can be individually assigned to run during these time periods in *USER SETTINGS > SCHEDULING > SCHEDULE ASSIGNMENT*. The occupied/unoccupied status will display on the main AUTO mode screen.

Auto Mode

In Auto Mode, the system is designed to automatically energize fans as the room temperature rises, modulate them based on increasing or decreasing room temperature and shut the fans down once the room temperature falls below set-point. If schedules have been assigned to a group, fan will only activate during occupied periods. This mode is designed to maximize building comfort and to save energy. Refer to **page 56**.

1. All fans assigned to a fan group will turn on once the room temperature rises above the ACTIVATION TEMPERATURE. The default activation temperature is 75°F (25°C).
2. The fans will start at low speed (15Hz or 27% minimum). The low speed for each fan group is configurable.
3. As the temperature rises in the building, the fan speed will increase until the temperature reaches the end of the MODULATION BAND. The modulation band default is 5°F (3°C) and is adjustable. In the default case, at 80°F (28°C) [activation temp + modulation band], the fan will be at its maximum speed [55 Hz (HVLS) / 80 Hz (Vent) or 100%]. The maximum speed for each fan group is configurable.
4. As the temperature decreases, the speed will decrease until the temperature falls back down to the activation temperature. At this point, the fans will be back at minimum speed.
5. As the temperature decreases below the activation temperature, the fans will continue to operate at their minimum speed until the temperature falls below the HYSTERESIS temperature. The hysteresis temperature default is 1°F (0.5°C). In the default case, below 74°F (24.5°C) [activation temp - hysteresis temp], the fan will stop and will stay off until the temperature rises back above the activation temperature.
6. There is also a MINIMUM cycle timer in the system to help prevent frequent fan cycling. The default setting is 30 minutes. Once the fans start, the fans will run for at least this amount of time before turning back off.

Figure 50 - Scheduling Display

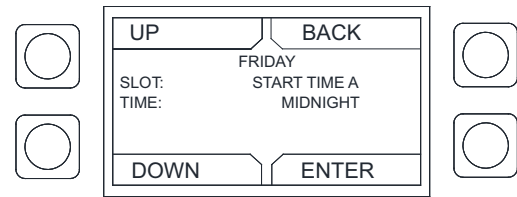


Figure 51 - Auto Mode Display

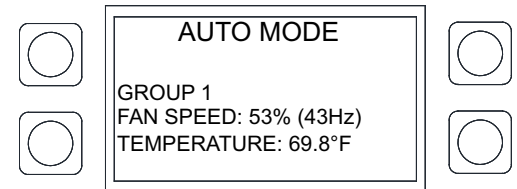


Figure 52 - Fan Cycle

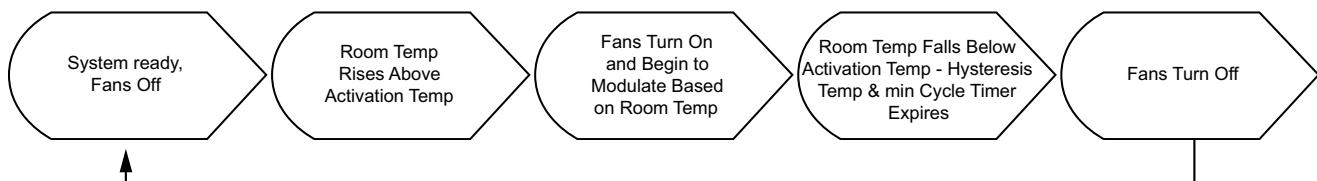


Table 12 - Auto Mode Operation Summary

Monitoring Points	Units	Configurable Item	Range/Limit
Power	Kw	Min Speed	15 Hz to Max
Current	Amps	Max Speed	Min Speed to 55 Hz (HVLS)/80 Hz (Vent)
Speed	Hz	Activation Temperature	40-100°F (5.5-38°C)
Motor Voltage	Volts	Modulation Band	1-15°F (0.5-7°C)
% Load	%	Hysteresis Temperature	0.5-20°F (0.5-11°C)
Run Time	Hours	Min Cycle Timer	15-60 Minutes
VFD Temp	°F/°C	Temperature Units	°F/°C
		Scheduling	On/Off

NOTE: All fans assigned to a group will follow the average temperatures defined for that group. They will also follow the min and max VFD speeds assigned to that group. The Activation Temperature, Modulation Band, and Hysteresis Timers are dependent on the Low and High Alarm Temperature Limits. Sometimes the adjustment range is limited to prevent overlap with the High and Low Temperature Alarms.

Input Mode

In Input Mode, the system is designed to use any of the five inputs to activate either the min or max speeds of a group. A single input can be used to activate more than one group. Inputs are activated by supplying a 120V AC signal sourced from H1 of the control package. Refer to **Table 9 on page 54**.

NOTE: All fans assigned to the same group will operate simultaneously based on the same: input command(s), minimum speed, maximum speed, and temperature limits. For scenarios that require independent control of a fan or multiple fans, the fan(s) should be assigned to an independent group.

System Start-up Procedure

Tools Required: AC Voltage Meter, Standard Hand Tools, Amperage Meter

Powering Fans On for the First Time

1. Check all electrical connections are secure and tight.
2. Inspect the blades and air-stream for obstructions. Remove any obstructions before proceeding.
3. Verify supply voltages to the motor, VFD, and control package nameplates. If the supplied voltage(s) do not match, correct the conditions before proceeding.
4. Discard any loose tags or covers attached to the unit. If the yellow sticker is attached to the unit, it can remain in place.
5. Provide power to the control system and fans by turning the external disconnect(s) to the ON position.
6. Wait 90-seconds for the reverse safety timer to expire.
7. Use the #1 remote HMI to test each fan. Go to *SERVICE SETTINGS > TEST FANS*. Check for proper rotational direction. Correct any directions before proceeding.

NOTE: The Rotation Bit (page 53) can be used to correct the rotation of any fan that is rotating in the incorrect direction.

8. Initiate a service test for each individual fan. Record the supplied voltage and current (amperage). Compare these values with the motor nameplate to determine if the motor is operating under safe load conditions.

Table 13 - Initial Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
Maximum Frequency										
Amperage at Maximum Speed										
Minimum Frequency										
Rotation Correct										
Group Number										

Start-up Procedure - Smart Control

Once all required connections have been completed as indicated on the installation schematic, start-up can begin.

Apply power to the panel. The ECPM03 board and the HMI will power up and illuminate. If that is not the case, check all power connections. Verify that there are no alarm messages displayed on any HMI screen. If there are alarms present, you can press the MUTE button to silence the alarm and then work to resolve them. Main modes of operation are: Manual Mode, Schedule Mode, Auto Mode, and Input Mode. If an HVLS package is configured with the BMS Only (**page 55**) unit option, Manual, Schedule, Auto, and Input modes will become inoperable and the system will only activate fans based on the inputs outlined in Building Management System (**page 61**).

The HMI has 4 buttons; the function is displayed adjacent to them on the screen. These functions will change depending on the status of the panel. If no text is adjacent to the button, it does not have a function.

Typically, the control operates in AUTO mode. In this mode, individual buttons are locked out and fans operate based on the room temperature.

NOTE: The term “button” will be used to refer to either the actual button or the function associated with it.

In MANUAL mode, there are typically four functions shown. The 2 right buttons control the speed of the fan (SPEED UP and SLOW DOWN). The upper left button controls the fan direction. The bottom left button turns the fan on and off.

NOTE: The bottom left button will change functionality when a group has the two-speed option enabled.

The status of those elements is shown by the shading used inside the box associated with the function. An empty box around the FAN function means that the FANS are turned OFF. A dark box around the FAN function means that the FANS are turned ON. For HVLS, this also applies to the FORWARD/REVERSE button. The text on the HMI shows the action that the button will produce.

When a fault occurs, an audible alarm is triggered and a message is displayed on the HMI(s). The audible alarm can be silenced by pushing the **Mute** button that appears on the screen.

Switching Between Operational Modes

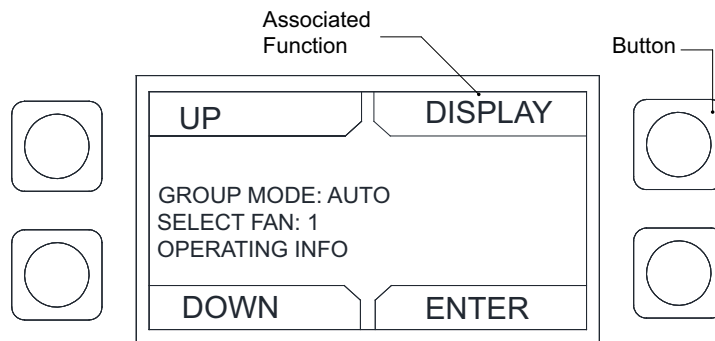
At any point a fan group can be switched between the available operational modes through the User Settings menu. This is achieved by simultaneously pressing both top buttons and holding them for 1 second. When this occurs, the screen will look similar to **Figure 53**.

NOTE: Schedule, Auto, and Input modes are dependent on factory configuration settings and may not be available.

To change operating modes:

1. Press and hold the top 2 buttons for 1 second. This will bring up the configuration screen.
2. The mode should be highlighted. If the mode is not highlighted, use the up and down buttons to navigate to mode until it is highlighted.
3. Once the mode is highlighted, press the ENTER button.
4. Use the UP and DOWN buttons to select the desired mode. For initial start-up, select MANUAL mode. Once the desired mode is selected, press ENTER.
5. This will bring back the main Configuration Screen. If the desired mode is correct, press the DISPLAY button to go into that mode of operation.

Figure 53 - Configuration Screen



Manual Mode Startup

The suggestion to use MANUAL mode at startup is for checking min and max fan speed operation and other operating conditions. **It is extremely important not to operate the fans below 15 Hz for proper motor cooling or above a frequency that will cause the motor to over amp. The high-speed frequency has been factory programmed at 55 Hz (HVLS) / 80 Hz (Vent) to prevent this from happening.**

Once in MANUAL mode, to start the fans:

1. Press the FANS ON button. All fans assigned to the group will start running. Record the direction of each fan and use the "Rotation Bit" parameter (**page 53**) for correcting any fans that are not rotating in the correct direction.
2. Press the SPEED UP button, or hold it down. This will increase the speed of the fans in that group. When this button is pressed, the display will show the desired fan speed in a percentage (%) of maximum speed. It will also show the desired maximum fan frequency. Increase the fan speed to 100%. The fans will begin to increase in speed. They have a slow ramp speed to avoid damage to the fan gearbox.
3. Once the fans are operating at their maximum speed, verify and record the amp draw for each fan. This can be done by these methods:
 - Using a clamp on ammeter, by reading P508 on a VFD.
 - By entering the diagnostics menu on any remote HMI. Refer to **page 57** for more information.

Table 14 - Manual Mode Fan Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
Maximum Frequency										
Amperage at Maximum Speed										
Minimum Frequency										
Rotation Correct										
Group Number										

Note: All fans assigned to a group will follow the commands from the HMI. They will all start together, stop together, and for HVLS to run forward or reverse together. They will also have the same minimum and maximum speeds and temperature limits. If independent control is needed for specific fans, that fan should be in a group by itself.

Schedule Mode Startup

During Schedule Mode Startup, it is important to verify the following: Min temp alarm, Max temp alarm, Min fan speed, Max fan speed, and the scheduled occupied periods for each day of the week.

Once in Schedule Mode, to start the fans:

1. Verify that all scheduled start and stop times (found in the user settings menu) match the requirements of the application.
2. Place the group being tested in Auto Mode.
3. If the home screen status reads "OCCUPIED", the fan group should run at its respective occupied speed. If the status displayed is "UNOCCUPIED," the fans will run at the unoccupied fan speed. Unoccupied fan speed is defaulted to 0.
4. If the fans are operating per the schedule, the test is complete. If the fans are not operating per the schedule, verify all schedule related parameters are set correctly for the application.

Use **Table 15** to record all initial startup data. Keep data for troubleshooting when necessary.

Table 15 - Schedule Mode Fan Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
Maximum Frequency										
Minimum Frequency										
Group Number										
HMI Sensors										
Remote Temp Sensors										
Activation Temperature										
Modulation Band										
Hysteresis Temperature										
Minimum Cycle Time										
High Temp Alarm										
Low Temp Alarm										

NOTE: All fans assigned to a group will follow the same temp settings and speeds. They will all start together, stop together, and modulate together. They will also have the same minimum and maximum speeds and temperature limits. If independent control is needed for specific fans, that fan should be in a group by itself.

Auto Mode Startup

During Auto Mode Startup, it is important to verify min and max fan speed operation, group settings, and all temperature settings. All temperature sensors (HMI sensors and remote hard wired sensors) assigned to a group will average together. The averaged sensed temperature will be the temperature used for fan activation and modulation. Individual temperature sensors will be used for high and low-temperature limits and alarms.

Once in AUTO mode, to start the fans:

1. Apply heat to the sensors assigned to a fan group, so the resulting temperature goes above the defined activation temperature.
2. Fans should turn on and begin to modulate based on the activation temperature and the modulation band.
3. Fans should reach their maximum speed at a temperature of (activation + modulation band).
4. Cool the sensors down so that the resulting temperature is below the activation minus hysteresis temperature. The fans should stop once the temperature is cool enough, and the min cycle time has expired.

If any sensor is disconnected or has failed, the control will produce a fault stating such. Also, if there is a sensor assigned to a group and it is not connected correctly, a warning will be displayed. If a low temp or high temp limit is reached by any individual sensor, all fans in that fan group will stop operation.

Use **Table 16** to record all initial startup data. Keep data for troubleshooting when necessary.

Table 16 - Auto Mode Fan Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
Min Speed										
Max Speed										
Fan Rotation Correct?										
Group Number										
HMI Sensor in Group										
Wired HMI Sensor in Group										
Remote Sensor in Group										
Winter Speed Min										
Winter Speed Max										
Winter Diff										
Winter Act Temp										
Modulation Band										
Activation Temp										
Hyst Temp										
Low Temp Alarm										
High Temp Alarm										
Min Cycle Time										

NOTE: All fans assigned to a group will follow the same temp settings and speeds. They will all start together, stop together, and modulate together. They will also have the same minimum and maximum speeds and temperature limits. If independent control is needed for specific fans, that fan should be in a group by itself.

Input Mode Startup

NOTE: Before operating fans in Input Mode, verify the min and max fan speeds in manual mode. Refer to “Manual Mode Startup” on page 68.

Input mode is a means of operating fans automatically from an external switching source. Any input listed in **Table 9 on page 54** can be used to activate either the MIN or MAX speed of a fan group. Consult the provided factory and field wiring schematics for the proper installation.

Once in Input Mode, to start the fans:

1. Wire external dry contact into inputs as indicated on the field wiring schematics provided with the control package.
2. Force each input and verify that the correct fan group runs at the correct MIN or MAX speed value.

NOTE: If inputs fail to activate fan groups, please contact your nearest Service Region for troubleshooting and repair.

Temperature readings are monitored but not utilized for activating fans when operating in input mode. If any temperature reading exceeds the min or max temperature setting, the fan group will sound an alarm and deactivate fans until the temperature of all assigned sensors have fallen within the min and max temperature settings.

Table 17 - Schedule Mode Fan Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
VAC Input(s)										
VAC Output(s)										
Min Speed										
Max Speed										
High Temp Alarm										
Low Temp Alarm										

NOTE: All fans assigned to a group will activate based on the same input(s). They will all start together, stop together. They will also have the same minimum and maximum speeds and temperature limits. If independent control is needed for specific fans, that fan should be in a group by itself.

BMS Only Startup

When the “BMS Only” option is enabled from the factory (**page 55**), the user settings menu will be disabled. The system will only respond to the inputs outlined in “**Building Management System (BMS)**” on **page 61**.

Consult with the field wiring schematics and follow these steps for starting a control package that has the BMS Only option enabled.

1. First complete all steps outlined in the “**System Start-up Procedure**” on **page 66**.
2. Lock-out all power sources to the control panel and fans.
3. Consult with the field wiring schematics provided with the unit and wire the applicable BMS Inputs to the system.
4. Verify that all connections are correct and then re-apply power to the system.
5. Apply a BMS Low Speed Input and:
 - Document if the direction of each fan is correct in **Table 18**.
 - Verify that each fan is running at the intended BMS speed by viewing the “Actual Speed” value in the Service Diagnostics menu (**page 57**).
 - Document the value of each fan speed in **Table 18**.
6. Apply a BMS High Speed Input and document the speed from the Service Diagnostics menu for each fan in **Table 18**.
7. Remove all BMS Inputs from the system.
8. For each fan that was rotating in the incorrect direction, change the state of the Rotation Bit found in the VFD/ MSC Config directory of the Factory Settings menu (**page 53**) and save the Factory Settings.
9. Wait 90 seconds for the reverse safety time to expire.
10. The system is now ready for service.

Table 18 - BMS Only Startup Checklist

	Fan 1	Fan 2	Fan 3	Fan 4	Fan 5	Fan 6	Fan 7	Fan 8	Fan 9	Fan 10
Fan Rotation Correct?										
BMS Low Speed Input (Hz)										
BMS Low Speed Input (Hz)										

NOTE: If the system is equipped with a BMS Modulating Input, both the BMS Low Speed and BMS Modulating inputs must be applied for the system to work as intended. Refer to “**Building Management System (BMS)**” on **page 61**. If the system is not operating as intended, please contact your nearest Service representative.

Network

NOTE: The board will reboot when altering certain factory settings.

Communication Module (Optional)

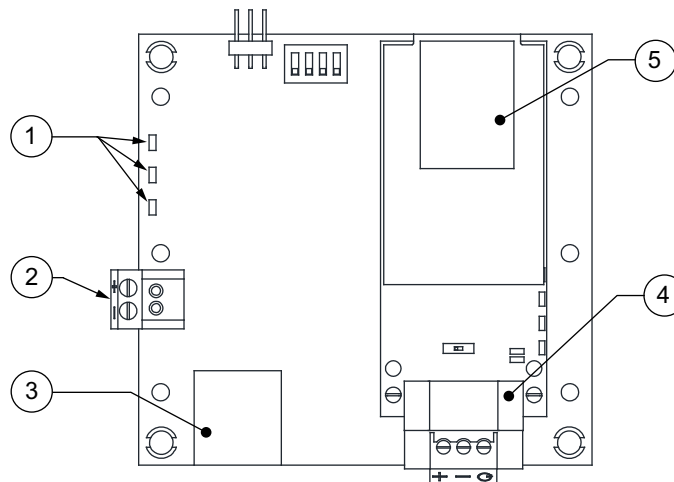
The Communication Module, PN: **SCADA**, is included in all CASlink equipped panels. It obtains operational data from various connected components. This communication wiring is either RS-485 shielded twisted pair wiring or RJ45 Cat 5 Ethernet wiring.

BACnet

BACnet IP or BACnet MS/TP (**Figure 54**) compatibility can be implemented with this package through a Processor, which is a BTL listed embedded Gateway configured to give a Building Management System access to monitor and/or control a list of BACnet objects. The Processor is mounted and factory pre-wired inside the Electrical Control Panel (ECP). Field connections to the Building Management System (BMS) are shown on wiring schematics.

The Processor is preconfigured at the factory to use the field protocol of the Building Management System in the specific jobsite. BACnet objects can only be accessed through the specified port and protocol.

Figure 54 - BACnet



- | | |
|---------------------------|--|
| 1. Status LEDs | 3. Cat 5 Cable to MUA Board. |
| • Green - Data Out | 4. Field RS485 Connection for BACnet MS/TP |
| • Yellow - Data In | 5. Field Ethernet Connection for BACnet IP |
| • Red - Power On | |
| 2. Power Supply 24V AC/DC | |

Device Instance, MAC Address, Baud Rate

Some applications may require that the Protoceptor have a specific Device Instance, the default device instance is 50,000. To change the Device Instance, you must access the Web Configurator by connecting a computer to the Ethernet port of the Protoceptor. The computer used must be assigned a static IP address of 192.168.1.xxx and a subnet mask of 255.255.255.0.

To access the Web Configurator, type the IP address of the Protoceptor in the URL of any web browser. The default IP address of the Protoceptor is 192.168.1.24. Once the landing page has loaded, if required, log in using “admin” for the username and password. If the default “admin” password does not work, the gateway should have a printed password on the module’s Ethernet port.

Go to the main configuration page, select “Configure” from the left-hand menu. Select “Profile Configuration,” the following window shown in **Figure 55** should appear.

The MAC address and Baud Rate, used by BACnet MTSP, are editable. The MAC address default is 127, and the Baud Rate default is 38400.

If any changes are made, **click on the submit button for each individual change**. Each individual change will require the system to restart.

Figure 55 - Configuration Parameters Page

Configuration Parameters		
Parameter Name	Parameter Description	Value
bac_device_id	BACnet Device Instance This sets the BACnet device instance. (1 - 4194303)	<input type="text" value="50177"/> <input type="button" value="Submit"/>
bac_mac_addr	BACnet MSTP Mac Address This sets the BACnet MSTP MAC address. (1 - 127)	<input type="text" value="7"/> <input type="button" value="Submit"/>
bac_baud_rate	BACnet MSTP Baud Rate This sets the BACnet MSTP baud rate. (9600/19200/38400/76800)	<input type="text" value="38400"/> <input type="button" value="Submit"/>
bac_max_master	BACnet MSTP Max Master This sets the BACnet MSTP max master. (1 - 27)	<input type="text" value="127"/> <input type="button" value="Submit"/>

Changing the IP Address

Some BACnet IP applications may require changing the IP address of the Processor. To change the IP address, go to the internal server by typing the default IP address of the Processor, 192.168.1.24, in the URL field of any web browser. The computer used must have a static IP address of 192.168.1.xxx. The window shown in **Figure 56** appears. Click on the “Diagnostics and Debugging” button on the lower right corner.

Click on “Setup” from the left-hand side menu and select “Network Settings.” The window shown in **Figure 56** will appear. You can now modify the IP address to whatever is required in the application. Once the IP address has been modified, click on “Update IP Settings.”

Figure 56 - Network Settings Page

SMC sierra monitor

Navigation

- Y CN0861 CaptiveAire v1.00a
 - About
 - Y Setup
 - File Transfer
 - Network Settings**
 - Passwords
 - > View
 - User Messages

Network Settings

IP Settings

Note

Updated settings only take effect after a System Restart. If the IP Address is changed you will need to direct your browser to the new IP Address after the System Restart.

N1 IP Address	<input type="text" value="192.168.1.24"/>
N1 Netmask	<input type="text" value="255.255.255.0"/>
N1 DHCP Client State	<input type="text" value="DISABLED"/>
N1 DHCP Server State	<input type="text" value="DISABLED"/>
Default Gateway	<input type="text" value="192.168.1.1"/>
Domain Name Server1	<input type="text" value="0.0.0.0"/>
Domain Name Server2	<input type="text" value="0.0.0.0"/>

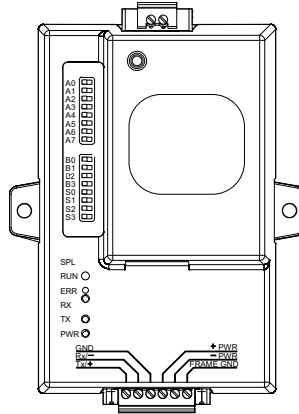
MAC Address

N1 MAC Address: 00:50:4E:10:07:27

LonWorks

LonWorks compatibility (**Figure 57**) can be implemented on control packages through the ProtoNode, a LonMark certified external Gateway configured to give a Building Management System access to monitor and/or control a list of Network Variables. The ProtoNode is mounted and factory pre-wired inside the Electrical Control Panel. Refer to schematics connections to the Building Management System are shown.

Figure 57 - LonWorks



Commissioning on a LonWorks Network

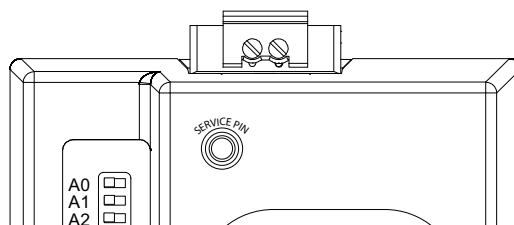
During the commissioning process by the LonWorks administrator (using a LonWorks Network Management Tool), the user will be prompted to hit the Service Pin in the ProtoNode. This pin is located in the front face, and it can be pressed by inserting a small screwdriver and tilting it towards the LonWorks Port. Refer to **Figure 58** for location of the “Service Pin.”

If an XIF file is required, it can be obtained by following these steps:

1. Set your computer's static IP address to 192.168.1.xxx with a subnet mask of 255.255.255.0.
2. Run a Cat 5 connection from the ProtoNode's Ethernet port to your computer.
3. On any web browser's URL field, type 192.168.1.24/fserver.xif.

The web browser should automatically download the fserver.xif file or let you save it on your computer. Save it as fserver.xif.

Figure 58 - LonWorks Service Pin



**NOTE: Insert small screwdriver.
Tilt toward LonWorks Port to
activate service pin.**

Direct Digital Control (DDC)

When the DDC Mode Menu is set to ENABLED, all fan start and stop commands are issued over a network to the controller. The list of points that can be controlled and monitored are shown below, along with their network name and ID. When the control is configured for DDC and Auto mode, the DDC system allows the HVLS control to automatically control the fans based on its temperature sensors.

BACnet			LON SNVT		Function	Description
Object Name	Object ID	Data Type	Name	Type		
TempSensor1	1	Analog Input	nvoTempSens1	SNVT_count_f	Monitor	Room Temperature with 1 decimal precision
TempSensor2	2		nvoTempSens2			
TempSensor3	3		nvoTempSens3			
TempSensor4	4		nvoTempSens4			
TempSensor5	5		nvoTempSens5			
TempSensor6	6		nvoTempSens6			
TempSensor7	7		nvoTempSens7			
TempSensor8	8		nvoTempSens8			
EXPTemp1	9	Analog Input	nvoEXPTemp1	SNVT_count_f	Monitor	Room Temperature from Expansion Board with 1 decimal precision
EXPTemp2	10		nvoEXPTemp2			
EXPTemp3	11		nvoEXPTemp3			
EXPTemp4	12		nvoEXPTemp4			
EXPTemp5	13		nvoEXPTemp5			
EXPTemp6	14		nvoEXPTemp6			
EXPTemp7	15		nvoEXPTemp7			
EXPTemp8	16		nvoEXPTemp8			
EXPTemp9	17		nvoEXPTemp9			
EXPTemp10	18		nvoEXPTemp10			
EXPTemp11	19		nvoEXPTemp11			
EXPTemp12	20		nvoEXPTemp12			
EXPTemp13	21		nvoEXPTemp13			
EXPTemp14	22		nvoEXPTemp14			
EXPTemp15	23		nvoEXPTemp15			
EXPTemp16	24		nvoEXPTemp16			
HMITemp1	25	Analog Input	nvoHMITemp1	SNVT_count_f	Monitor	HMI Temperature with 1 decimal precision
HMIWiredTemp1	26		nvoHMIWiredTemp1			
HMITemp2	27		nvoHMITemp2			
HMIWiredTemp2	28		nvoHMIWiredTemp2			
HMITemp3	29		nvoHMITemp3			
HMIWiredTemp3	30		nvoHMIWiredTemp3			
HMITemp4	31		nvoHMITemp4			
HMIWiredTemp4	32		nvoHMIWiredTemp4			
HMITemp5	33		nvoHMITemp5			
HMIWiredTemp5	34		nvoHMIWiredTemp5			
HMITemp6	35		nvoHMITemp6			
HMIWiredTemp6	36		nvoHMIWiredTemp6			
HMITemp7	37		nvoHMITemp7			
HMIWiredTemp7	38		nvoHMIWiredTemp7			
HMITemp8	39		nvoHMITemp8			
HMIWiredTemp8	40		nvoHMIWiredTemp8			
HMITemp9	41		nvoHMITemp9			
HMIWiredTemp9	42		nvoHMIWiredTemp9			
HMITemp10	43		nvoHMITemp10			
HMIWiredTemp10	44		nvoHMIWiredTemp10			
FrequencyF1	45	Analog Input	nvoFreqF1	SNVT_count_f	Monitor	VFD Frequency with 1 decimal precision (Hz)
FrequencyF2	46		nvoFreqF2			
FrequencyF3	47		nvoFreqF3			
FrequencyF4	48		nvoFreqF4			
FrequencyF5	49		nvoFreqF5			
FrequencyF6	50		nvoFreqF6			
FrequencyF7	51		nvoFreqF7			
FrequencyF8	52		nvoFreqF8			
FrequencyF9	53		nvoFreqF9			
FrequencyF10	54		nvoFreqF10			

BACnet			LON SNVT		Function	Description
Object Name	Object ID	Data Type	Name	Type		
StateVFD1	55	Analog Input	nvoStateVFD1	SNVT_count_f	Monitor	1 = Off by Temperature, 2 = Off by High Temperature Alarm, 3 = Off by Low Temperature Alarm, 4 = Off by Emergency Shut-down, 5 = Off by Manual Mode Timer Expire, 6 = On by Temperature, 7 = On by HMI Command (Button Press), 8 = On by System Bypass, 9 = On by BMS 1, 10 = On by BMS 2, 11 = Off by HMI Command (Button Press)
StateVFD2	56		nvoStateVFD2			
StateVFD3	57		nvoStateVFD3			
StateVFD4	58		nvoStateVFD4			
StateVFD5	59		nvoStateVFD5			
StateVFD6	60		nvoStateVFD6			
StateVFD7	61		nvoStateVFD7			
StateVFD8	62		nvoStateVFD8			
StateVFD9	63		nvoStateVFD9			
StateVFD10	64		nvoStateVFD10			
AmperageF1	65	Analog Input	nvoAmpsF1	SNVT_count_f	Monitor	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF2	66		nvoAmpsF2			
AmperageF3	67		nvoAmpsF3			
AmperageF4	68		nvoAmpsF4			
AmperageF5	69		nvoAmpsF5			
AmperageF6	70		nvoAmpsF6			
AmperageF7	71		nvoAmpsF7			
AmperageF8	72		nvoAmpsF8			
AmperageF9	73		nvoAmpsF9			
AmperageF10	74		nvoAmpsF10			
PowerF1	75	Analog Input	nvoPowerF1	SNVT_count	Monitor	VFD (Fan) Power with 2 decimal precision (KW)
PowerF2	76		nvoPowerF2			
PowerF3	77		nvoPowerF3			
PowerF4	78		nvoPowerF4			
PowerF5	79		nvoPowerF5			
PowerF6	80		nvoPowerF6			
PowerF7	81		nvoPowerF7			
PowerF8	82		nvoPowerF8			
PowerF9	83		nvoPowerF9			
PowerF10	84		nvoPowerF10			
VFDFaultF1	85	Analog Input	nvoVDFFaultF1	SNVT_count	Monitor	Reference VFD Manual Fault Codes
VFDFaultF2	86		nvoVDFFaultF2			
VFDFaultF3	87		nvoVDFFaultF3			
VFDFaultF4	88		nvoVDFFaultF4			
VFDFaultF5	89		nvoVDFFaultF5			
VFDFaultF6	90		nvoVDFFaultF6			
VFDFaultF7	91		nvoVDFFaultF7			
VFDFaultF8	92		nvoVDFFaultF8			
VFDFaultF9	93		nvoVDFFaultF9			
VFDFaultF10	94		nvoVDFFaultF10			
VFDLoadF1	95	Analog Input	nvoVFDLoadF1	SNVT_count_f	Monitor	Motor Load as a percentage of VFD Output Current (%)
VFDLoadF2	96		nvoVFDLoadF2			
VFDLoadF3	97		nvoVFDLoadF3			
VFDLoadF4	98		nvoVFDLoadF4			
VFDLoadF5	99		nvoVFDLoadF5			
VFDLoadF6	100		nvoVFDLoadF6			
VFDLoadF7	101		nvoVFDLoadF7			
VFDLoadF8	102		nvoVFDLoadF8			
VFDLoadF9	103		nvoVFDLoadF9			
VFDLoadF10	104		nvoVFDLoadF10			
VFDTempF1	105	Analog Input	nvoVFDTempF1	SNVT_count_f	Monitor	VFD Heat sink Temperature (degrees C)
VFDTempF2	106		nvoVFDTempF2			
VFDTempF3	107		nvoVFDTempF3			
VFDTempF4	108		nvoVFDTempF4			
VFDTempF5	109		nvoVFDTempF5			
VFDTempF6	110		nvoVFDTempF6			
VFDTempF7	111		nvoVFDTempF7			
VFDTempF8	112		nvoVFDTempF8			
VFDTempF9	113		nvoVFDTempF9			
VFDTempF10	114		nvoVFDTempF10			

BACnet			LON SNVT		Function	Description
Object Name	Object ID	Data Type	Name	Type		
VFDVoltageF1	115	Analog Input	nvoVFDVoltsF1	SNVT_count	Monitor	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF2	116		nvoVFDVoltsF2			
VFDVoltageF3	117		nvoVFDVoltsF3			
VFDVoltageF4	118		nvoVFDVoltsF4			
VFDVoltageF5	119		nvoVFDVoltsF5			
VFDVoltageF6	120		nvoVFDVoltsF6			
VFDVoltageF7	121		nvoVFDVoltsF7			
VFDVoltageF8	122		nvoVFDVoltsF8			
VFDVoltageF9	123		nvoVFDVoltsF9			
VFDVoltageF10	124		nvoVFDVoltsF10			
ModulationG1	125	Analog Input	nvoModulationG1	SNVT_count	Monitor	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121 Range: 1-15°F Default: 5°F
ModulationG2	126		nvoModulationG2			
ModulationG3	127		nvoModulationG3			
ModulationG4	128		nvoModulationG4			
ModulationG5	129		nvoModulationG5			
ModulationG6	130		nvoModulationG6			
ModulationG7	131		nvoModulationG7			
ModulationG8	132		nvoModulationG8			
ModulationG9	133		nvoModulationG9			
ModulationG10	134		nvoModulationG10			
MinG1	135	Analog Input	nvoMinG1	SNVT_count	Monitor	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335 Range: Min to Max Default: 15 Hz
MinG2	136		nvoMinG2			
MinG3	137		nvoMinG3			
MinG4	138		nvoMinG4			
MinG5	139		nvoMinG5			
MinG6	140		nvoMinG6			
MinG7	141		nvoMinG7			
MinG8	142		nvoMinG8			
MinG9	143		nvoMinG9			
MinG10	144		nvoMinG10			
MaxG1	145	Analog Input	nvoMaxG1	SNVT_count	Monitor	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455 Range: Min to Max Default: 55 Hz (HVLS) Default: 80 Hz (Vent)
MaxG2	146		nvoMaxG2			
MaxG3	147		nvoMaxG3			
MaxG4	148		nvoMaxG4			
MaxG5	149		nvoMaxG5			
MaxG6	150		nvoMaxG6			
MaxG7	151		nvoMaxG7			
MaxG8	152		nvoMaxG8			
MaxG9	153		nvoMaxG9			
MaxG10	154		nvoMaxG10			
ActivationTempG1	155	Analog Input	nvoActTempG1	SNVT_count	Monitor	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725 Range: 40-100°F Default: 75°F
ActivationTempG2	156		nvoActTempG2			
ActivationTempG3	157		nvoActTempG3			
ActivationTempG4	158		nvoActTempG4			
ActivationTempG5	159		nvoActTempG5			
ActivationTempG6	160		nvoActTempG6			
ActivationTempG7	161		nvoActTempG7			
ActivationTempG8	162		nvoActTempG8			
ActivationTempG9	163		nvoActTempG9			
ActivationTempG10	164		nvoActTempG10			
VFDMSCFaults1	165	Analog Input	nvoVFDMSCFaul1	SNVT_count	Monitor	VFD Faults
VFDMSCFaults2	166		nvoVFDMSCFaul2			
VFDMSCFaults3	167		nvoVFDMSCFaul3			
VFDMSCFaults4	168		nvoVFDMSCFaul4			
VFDMSCFaults5	169		nvoVFDMSCFaul5			
VFDMSCFaults6	170		nvoVFDMSCFaul6			
VFDMSCFaults7	171		nvoVFDMSCFaul7			
VFDMSCFaults8	172		nvoVFDMSCFaul8			
VFDMSCFaults9	173		nvoVFDMSCFaul9			
VFDMSCFaults10	174		nvoVFDMSCFaul10			
EmergencyShutdownG1	175	Binary Input	nvoEmergShutG1	SNVT_count	Monitor	0 = No Emergency Shutdown, 1 = Hard Wired Emergency Shutdown
EmergencyShutdownG2	176		nvoEmergShutG2			
EmergencyShutdownG3	177		nvoEmergShutG3			
EmergencyShutdownG4	178		nvoEmergShutG4			
EmergencyShutdownG5	179		nvoEmergShutG5			
EmergencyShutdownG6	180		nvoEmergShutG6			
EmergencyShutdownG7	181		nvoEmergShutG7			
EmergencyShutdownG8	182		nvoEmergShutG8			
EmergencyShutdownG9	183		nvoEmergShutG9			
EmergencyShutdownG10	184		nvoEmergShutG10			

BACnet			LON SNVT		Function	Description
Object Name	Object ID	Data Type	Name	Type		
OccupiedG1	185	Binary Input	nvoOccupiedG1	SNVT_count	Monitor	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG2	186		nvoOccupiedG2			
OccupiedG3	187		nvoOccupiedG3			
OccupiedG4	188		nvoOccupiedG4			
OccupiedG5	189		nvoOccupiedG5			
OccupiedG6	190		nvoOccupiedG6			
OccupiedG7	191		nvoOccupiedG7			
OccupiedG8	192		nvoOccupiedG8			
OccupiedG9	193		nvoOccupiedG9			
OccupiedG10	194		nvoOccupiedG10			
ModbusFault	195	Analog Input	nvoModbusFault	SNVT_count	Monitor	Modbus Faults
BrokenStatG1	196	Binary Input	nvoBrokenStat1	SNVT_count	Monitor	0 = No Fault 1 = Broken Sensor
BrokenStatG2	197		nvoBrokenStat2			
BrokenStatG3	198		nvoBrokenStat3			
BrokenStatG4	199		nvoBrokenStat4			
BrokenStatG5	200		nvoBrokenStat5			
BrokenStatG6	201		nvoBrokenStat6			
BrokenStatG7	202		nvoBrokenStat7			
BrokenStatG8	203		nvoBrokenStat8			
BrokenStatG9	204		nvoBrokenStat9			
BrokenStatG10	205		nvoBrokenStat10			
MissingStatG1	206	Binary Input	nvoMsgStat1	SNVT_count	Monitor	0 = No Fault 1 = Missing Sensor
MissingStatG2	207		nvoMsgStat2			
MissingStatG3	208		nvoMsgStat3			
MissingStatG4	209		nvoMsgStat4			
MissingStatG5	210		nvoMsgStat5			
MissingStatG6	211		nvoMsgStat6			
MissingStatG7	212		nvoMsgStat7			
MissingStatG8	213		nvoMsgStat8			
MissingStatG9	214		nvoMsgStat9			
MissingStatG10	215		nvoMsgStat10			
BoardFuseBlown	216	Binary Input	nvoFuseBlown	SNVT_count		0 = No Fault 1 = Fuse Blown
TemperatureSensorNotAssigned	217	Binary Input	nvoTempSensorNA	SNVT_count		0 = No Fault 1 = Temperature Sensor Not Assigned
LowTempAlarmFaultG1	218	Binary Input	nvoLowTempG1	SNVT_count	Monitor	0 = No Fault 1 = Low Temperature Fault for Group 1 through 10
LowTempAlarmFaultG2	219		nvoLowTempG2			
LowTempAlarmFaultG3	220		nvoLowTempG3			
LowTempAlarmFaultG4	221		nvoLowTempG4			
LowTempAlarmFaultG5	222		nvoLowTempG5			
LowTempAlarmFaultG6	223		nvoLowTempG6			
LowTempAlarmFaultG7	224		nvoLowTempG7			
LowTempAlarmFaultG8	225		nvoLowTempG8			
LowTempAlarmFaultG9	226		nvoLowTempG9			
LowTempAlarmFaultG10	227		nvoLowTempG10			
HighTempAlarmFaultG1	228	Binary Input	nvoHighTempG1	SNVT_count	Monitor	0 = No Fault 1 = High Temperature Fault for Group 1 through 10
HighTempAlarmFaultG2	229		nvoHighTempG2			
HighTempAlarmFaultG3	230		nvoHighTempG3			
HighTempAlarmFaultG4	231		nvoHighTempG4			
HighTempAlarmFaultG5	232		nvoHighTempG5			
HighTempAlarmFaultG6	233		nvoHighTempG6			
HighTempAlarmFaultG7	234		nvoHighTempG7			
HighTempAlarmFaultG8	235		nvoHighTempG8			
HighTempAlarmFaultG9	236		nvoHighTempG9			
HighTempAlarmFaultG10	237		nvoHighTempG10			
MembraneStatFaultG1	238	Binary Input	nvoMemStatG1	SNVT_count	Monitor	0 = No Fault 1 = Membrane Stat Fault for Group 1 through 10
MembraneStatFaultG2	239		nvoMemStatG2			
MembraneStatFaultG3	240		nvoMemStatG3			
MembraneStatFaultG4	241		nvoMemStatG4			
MembraneStatFaultG5	242		nvoMemStatG5			
MembraneStatFaultG6	243		nvoMemStatG6			
MembraneStatFaultG7	244		nvoMemStatG7			
MembraneStatFaultG8	245		nvoMemStatG8			
MembraneStatFaultG9	246		nvoMemStatG9			
MembraneStatFaultG10	247		nvoMemStatG10			

BACnet			LON SNVT		Function	Description
Object Name	Object ID	Data Type	Name	Type		
WiredStatFaultG1	248	Binary Input	nvoWiredStatG1	SNVT_count	Monitor	0 = No Fault 1 = HMI Wired Stat Fault for Group 1 through 10
WiredStatFaultG2	249		nvoWiredStatG2			
WiredStatFaultG3	250		nvoWiredStatG3			
WiredStatFaultG4	251		nvoWiredStatG4			
WiredStatFaultG5	252		nvoWiredStatG5			
WiredStatFaultG6	253		nvoWiredStatG6			
WiredStatFaultG7	254		nvoWiredStatG7			
WiredStatFaultG8	255		nvoWiredStatG8			
WiredStatFaultG9	256		nvoWiredStatG9			
WiredStatFaultG10	257		nvoWiredStatG10			
SensorRequiredFaultG1	258	Binary Input	nvoSensorReqG1	SNVT_count		0 = No Fault 1 = Sensor Required for Group 1 through 10
SensorRequiredFaultG2	259		nvoSensorReqG2			
SensorRequiredFaultG3	260		nvoSensorReqG3			
SensorRequiredFaultG4	261		nvoSensorReqG4			
SensorRequiredFaultG5	262		nvoSensorReqG5			
SensorRequiredFaultG6	263		nvoSensorReqG6			
SensorRequiredFaultG7	264		nvoSensorReqG7			
SensorRequiredFaultG8	265		nvoSensorReqG8			
SensorRequiredFaultG9	266		nvoSensorReqG9			
SensorRequiredFaultG10	267		nvoSensorReqG10			
SpeedF1	268	Analog Variable	nvoSpeedOccG1/nviSpeedOccG1	SNVT_count		Group 1 fan speed when Occupied in Hz
SpeedF2	269		nvoSpeedOccG2/nviSpeedOccG2			
SpeedF3	270		nvoSpeedOccG3/nviSpeedOccG3			
SpeedF4	271		nvoSpeedOccG4/nviSpeedOccG4			
SpeedF5	272		nvoSpeedOccG5/nviSpeedOccG5			
SpeedF6	273		nvoSpeedOccG6/nviSpeedOccG6			
SpeedF7	274		nvoSpeedOccG7/nviSpeedOccG7			
SpeedF8	275		nvoSpeedOccG8/nviSpeedOccG8			
SpeedF9	276		nvoSpeedOccG9/nviSpeedOccG9			
SpeedF10	277		nvoSpeedOccG10/nviSpeedOccG10			
DirectionF1	278	Analog Variable	nvoDirectionF1/nviDirectionF1	SNVT_count		Fan Direction 0 = Forward 1 = Reverse Range: 0 or 1 Default: 0
DirectionF2	279		nvoDirectionF2/nviDirectionF2			
DirectionF3	280		nvoDirectionF3/nviDirectionF3			
DirectionF4	281		nvoDirectionF4/nviDirectionF4			
DirectionF5	282		nvoDirectionF5/nviDirectionF5			
DirectionF6	283		nvoDirectionF6/nviDirectionF6			
DirectionF7	284		nvoDirectionF7/nviDirectionF7			
DirectionF8	285		nvoDirectionF8/nviDirectionF8			
DirectionF9	286		nvoDirectionF9/nviDirectionF9			
DirectionF10	287		nvoDirectionF10/nviDirectionF10			
ModeG1	288	Binary Value	nvoModeG1/nviModeG1	SNVT_count	Control	Fan Group Mode 0 = DDC Auto 1=DDC Manual Range: 0 or 1 Default: 0
ModeG2	289		nvoModeG2/nviModeG2			
ModeG3	290		nvoModeG3/nviModeG3			
ModeG4	291		nvoModeG4/nviModeG4			
ModeG5	292		nvoModeG5/nviModeG5			
ModeG6	293		nvoModeG6/nviModeG6			
ModeG7	294		nvoModeG7/nviModeG7			
ModeG8	295		nvoModeG8/nviModeG8			
ModeG9	296		nvoModeG9/nviModeG9			
ModeG10	297		nvoModeG10/nviModeG10			
ButtonG1	298	Binary Value	nvoButtonG1/nviButtonG1	SNVT_count	Control	Fan Group State 1 = ON 0 = OFF in DDC Manual Mode Range: 0 or 1 Default: 0
ButtonG2	299		nvoButtonG2/nviButtonG2			
ButtonG3	300		nvoButtonG3/nviButtonG3			
ButtonG4	301		nvoButtonG4/nviButtonG4			
ButtonG5	302		nvoButtonG5/nviButtonG5			
ButtonG6	303		nvoButtonG6/nviButtonG6			
ButtonG7	304		nvoButtonG7/nviButtonG7			
ButtonG8	305		nvoButtonG8/nviButtonG8			
ButtonG9	306		nvoButtonG9/nviButtonG9			
ButtonG10	307		nvoButtonG10/nviButtonG10			

TROUBLESHOOTING

The following table lists causes and corrective actions for possible problems with the fan units. Review this list prior to consulting manufacturer. The following table lists causes and corrective actions for possible problems with the fan units. Review this list prior to consulting manufacturer.

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.
	VFD Overloaded	Check amps. Reset VFD.
Motor Overloaded	Incorrect fan rotation	Verify that the fan is rotating in the direction shown on rotation label.
	Incorrect wiring to motor	Inspect motor wiring. Verify connections with wiring diagram located on fan motor.
	Overload in VFD set too low	Set overload to motor FLA value.
Poor Airflow	Incorrect wiring to motor	Inspect motor wiring. Verify connections with wiring diagram located on fan motor.
	Poor airflow conditions	There should be a straight clear path for air under the fan.
	Fan speed too low	Increase fan RPM. Do not overload motor.
	Clearance above fan blade	Refer to "HVLS Fan Clearance" on page 6.
Excessive Vibration and Noise	Damaged or unbalanced blade	Replace blade.
	Gears need replacement	Replace gear box motor assembly.
	Fan speed is too high	Reduce fan RPM.
Room Temperature is too Warm and Fans Do Not Cool	Fan Activation Temperature Set Too High	Reduce the fan activation temperature.
	Fan running incorrect direction	Fan Should Spin Counter-Clockwise when looking up from floor in cooling mode.
	Equipment or Storage Items blocking airstream	Clear equipment or storage items from under fan.
Fans Spinning Wrong Direction	3 phase Motor output wired backward	Change 2 of the 3 phase wires on the output of the VFD feeding the motor, or change in software.

VFD Fault List

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	Internal Fault 1
19	Internal Fault 2
20	Internal Fault 3
21	Internal Fault 4
22	Internal Fault 5
23	Internal Fault 6
24	Internal Fault 7
25	Internal Fault 8
26	Internal Fault 9
27	Internal Fault 10
28	Remote Keypad Lost
29	Assertion Level Fault
30	Internal Fault 11
31	Internal Fault 12
32	Internal Fault 13
33	Internal Fault 14
34	Comm. Module Failure
35	Network Fault 0
36	Network Fault 1
37	Network Fault 2
38	Network Fault 3
39	Network Fault 4
40	Network Fault 5
41	Network Fault 6
42	Network Fault 7
43	Network Fault 8
44	Network Fault 9

Refer to VFD manufacturer manual for further details.

HMI Fault List

Fault Message on HMI	Potential Cause	Corrective Action
High Temp Alarm Sensor #	Room Temperature exceeded the High Temperature Limit Fault for a Fan Group. Fans in that Group shut down.	Verify why the temperature is so high and either correct the high-temperature situation or raise the high-temperature permissible limit.
Low Temp Alarm Sensor #	Room Temperature dropped below the Low Temperature Limit Fault for a Fan Group. Fans in that Group shut down.	Verify why the temperature is so low and either correct the low-temperature situation or decrease the low-temperature permissible limit.
Over Amp Fault Fan #	Fan speed is too high	Reduce fan RPM.
	Motor wired incorrectly	Check motor wiring to wiring diagram located on fan motor.
	Overload in VFD set too low	Set overload to motor FLA value.
Modbus Fault HMI #	HMI not connected or assigned incorrectly	Install HMI or change HMI address using bottom 2 buttons on HMI.
Modbus Fault Fan #	VFD not connected or assigned incorrectly	Install VFD or change VFD address using P410 and P403 on VFD.
Modbus Fault Expansion Board	Expansion board not connected or powered properly	When more than 8 external sensors are used, an expansion board is required to be installed, powered, and configured.
Modbus Fault VFD/MS #	VFD or MSC not connected or powered properly	Check Modbus connections.
		Verify Modbus address is correct on VFD or MSC.
Sensor Fault Sensor # Missing Sensor	Temperature sensor x is not wired to the ECPM03 board.	Verify proper wiring to terminals TxA and TxB on the board and wiring to the sensor.
Sensor Fault Sensor # Broken Sensor	Temperature sensor x is not reading temperature correctly or is shorted.	Verify proper wiring to terminals TxA and TxB on the board and wiring to the sensor. If wiring is correct, replace sensor with a 10K ohm thermistor.
Sensor Fault Sensor # Missing Board	Temp sensor connected to expansion board and expansion board becomes disconnected	Re-connect expansion board.
Fuse F1 Blown	Fuse F1 is blown or missing	Verify there is no short-circuits, and the load is below 10 amps.
		Replace ECPM03 fuse.
Emergency Shutdown	External Device has closed terminals IL2A to IL2B	Make sure there is no danger of fire and that contact is opened back up. Press the CLEAR button.
System Bypass	System Bypass turned on. All fans running at BMS speed.	Fix reason why System Bypass was enabled and turn system bypass off on ECPM03 menu.

MAINTENANCE

For General Ventilation Fan Maintenance, refer to Exhaust Fan Operation, Installation, and Maintenance Manual.

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

Please record any maintenance or service performed on this equipment in the documentation section located at the end of this manual.

WARNING: DO NOT ATTEMPT MAINTENANCE ON THIS FAN OR CONTROL UNTIL THE ELECTRICAL SUPPLY HAS BEEN COMPLETELY DISCONNECTED, LOCKED OUT AND TAGGED OUT.

General Maintenance

1. Control enclosure should be kept clean and free from any grease or dirt build-up.
2. All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.
3. Control enclosure door panel should be securely closed after maintenance to prevent tampering or electrical shock.
4. Real-Time Clock (RTC) battery should be replaced every 10 Years. Use CR2032 or equivalent.
5. Fan blades path should be kept clean and free from any obstruction.
6. Maintenance schedule is based on running 5,000 hours per year and is a guideline to ensure safe and continuous operation of the fan(s). In case of extreme operating (e.g., high humidity, aggressive environment, or large temperature variations), shorter intervals between service are recommended. Occasionally oil and dust may accumulate causing imbalance. If the fan is installed in a corrosive or dirty atmosphere, periodically inspect and clean the blades, inlet, and other moving parts to ensure smooth and safe operation.

Every 3 Months

Enclosure Cooling Fan Filter Maintenance

1. Remove outer black plastic housing of the enclosure fan to gain access to the fan filter. The cover is held in place by frictional clips, simply pry on it to remove.
2. Inspect the fan filter for grease/debris. If the filter is dirty, clean or replace. Replacement fan filter part number: MC32658 (pack of 5).

WARNING: IF THE COOLING FAN FILTER CLEANING IS NOT PERFORMED, GREASE/DEBRIS BUILDUP MAY OCCUR RESULTING IN VFD/ELECTRONICS FAILURE DUE TO OVERHEATING. VFD WARRANTY MAY BE DENIED IF FILTER INSPECTION IS NOT PERFORMED ON A QUARTERLY BASIS AND LOGGED ON THE MAINTENANCE RECORD.

6 Months After Startup

1. Check for hot spots on motor, wiring, and controls and re-tighten all loose electrical connections. Gear motors are built for this specific application and are designed for use with variable frequency drives.
2. Re-tighten all loose electrical connections.
3. Ensure blades are intact, level, and clean as required. Blades are made from coated aluminum for corrosion protection and ease of cleaning.
4. Physically check all guy wires and safety cables, re-tighten clamps if required.
5. Check all nuts, bolts, clamps to ensure they are not missing, loose, or damaged. Repair or replace if necessary.

Every 12 Months

1. Check for hot spots on motor, wiring, and controls and re-tighten all loose electrical connections.
2. Re-tighten all loose electrical connections.
3. Ensure blades are intact, level and clean as required.
4. Physically check all guy wires and safety cables, re-tighten clamps if required.
5. Check all nuts, bolts, clamps to ensure they are not missing, loose, or damaged. Repair or replace if necessary.

Maintenance Logging and Alerts

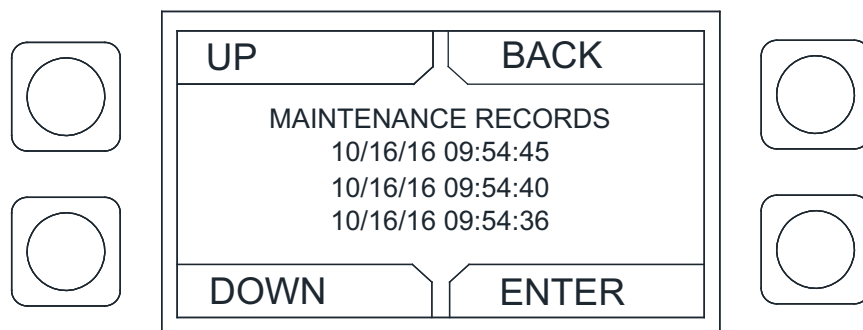
The HVLS control system stores maintenance events in its on-board memory. These maintenance events can either be manually entered or can be logged out of the maintenance alerts that will appear on the screen at the proper time intervals. Maintenance alerts and logged maintenance events are also made available to a DDC system.

To manually log a maintenance event, go to *OPERATING INFO > MAINTENANCE LOG > LOG MAINTENANCE EVENT* > Scroll to select event and press *LOG/EXIT*. The following maintenance items are available to be logged: *CHECK PANEL FILTERS, CHECK BOLTS/CABLES, AND CHANGE CLOCK BATTERY*.

Maintenance alerts will appear on the HMI at the maintenance intervals listed in the General Maintenance section above. When a maintenance alert appears, two options are available on the screen. The first option is *HIDE*. This will hide or “snooze” the alert for 6 hours, allowing continued operation of the system until the reminder reappears. The second option is *RESOLVE*, which will change to a screen where the maintenance notification can be either saved to the on-board maintenance log by pressing *LOG/EXIT* or ignored by pressing *IGNORE*.

The logged maintenance events can be viewed on the HMI by going to *OPERATING INFO > MAINTENANCE LOG > MAINTENANCE HISTORY* > *Select* on the desired date.

Figure 59 - Maintenance Screen



Maintenance Documentation

[illegible]

Start-Up Documentation

START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED AND WITH THE HEAT ON. WARRANTY WILL BE VOIDED WITHOUT COMPLETION OF THIS FORM.

Job Information

Job Name		Size of Fan(s)	
Address		Service Company	
City		Address	
State		City	
Zip		State	
Phone Number		Zip	
Fax Number		Phone Number	
Contact		Fax Number	
Purchase Date		Contact	
Quantity of Fan(s)		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	
Input Voltage	
Input Frequency	
Input Phase	
Input FLA	
Input HP	
Field Measure Information	
Motor Voltage	
Motor Amperage*	
RPM	

*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



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