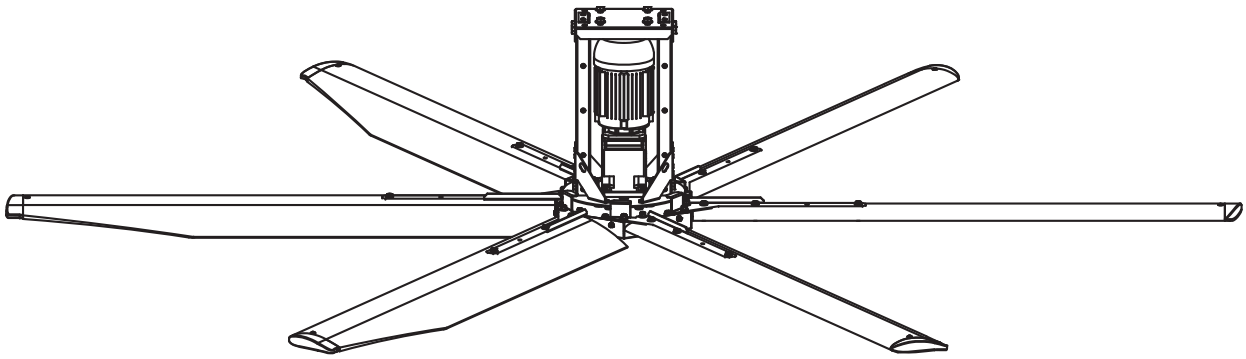
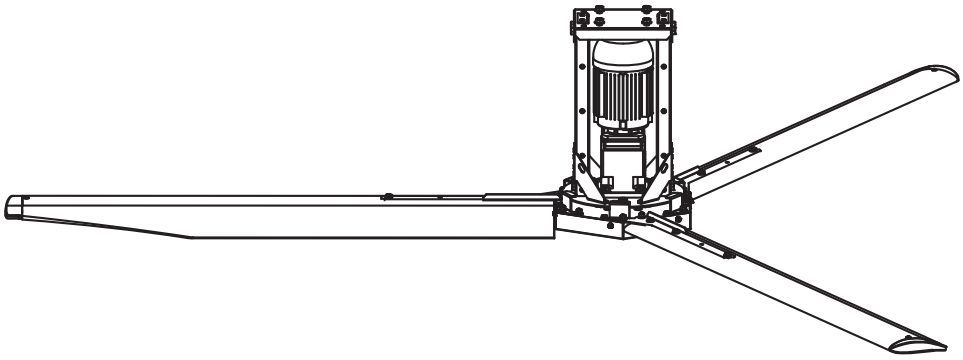
High Volume Low Speed (HVLS) Fan
HVLS and General Ventilation Fan Control Software
Installation, Operation, and Maintenance Manual





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.

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October 2021 Rev. 18

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WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 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.

NOTE: To receive warranty coverage, copy and print the "Start-Up Documentation" on page 80. Fill out the form, then fax the form to 1-919-516-8710 or call 1-866-784-6900 for email information within thirty (30) days of purchase.

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.

What this 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 80** 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: Call the Factory Service Department at 1-866-784-6900, or fax 1-919-554-9374. 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.

INSTALLATION

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, please call the service department at **1-866-784-6900** for warranty and technical support issues.

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.

Mechanical

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

Tools Required: Level, Basic wrench set, Basic socket set (up to 3/4”), Cable cutters, Lifting device or scaffolding, Ratchet or impact gun, Torque Wrench

Main Control Enclosure Installation

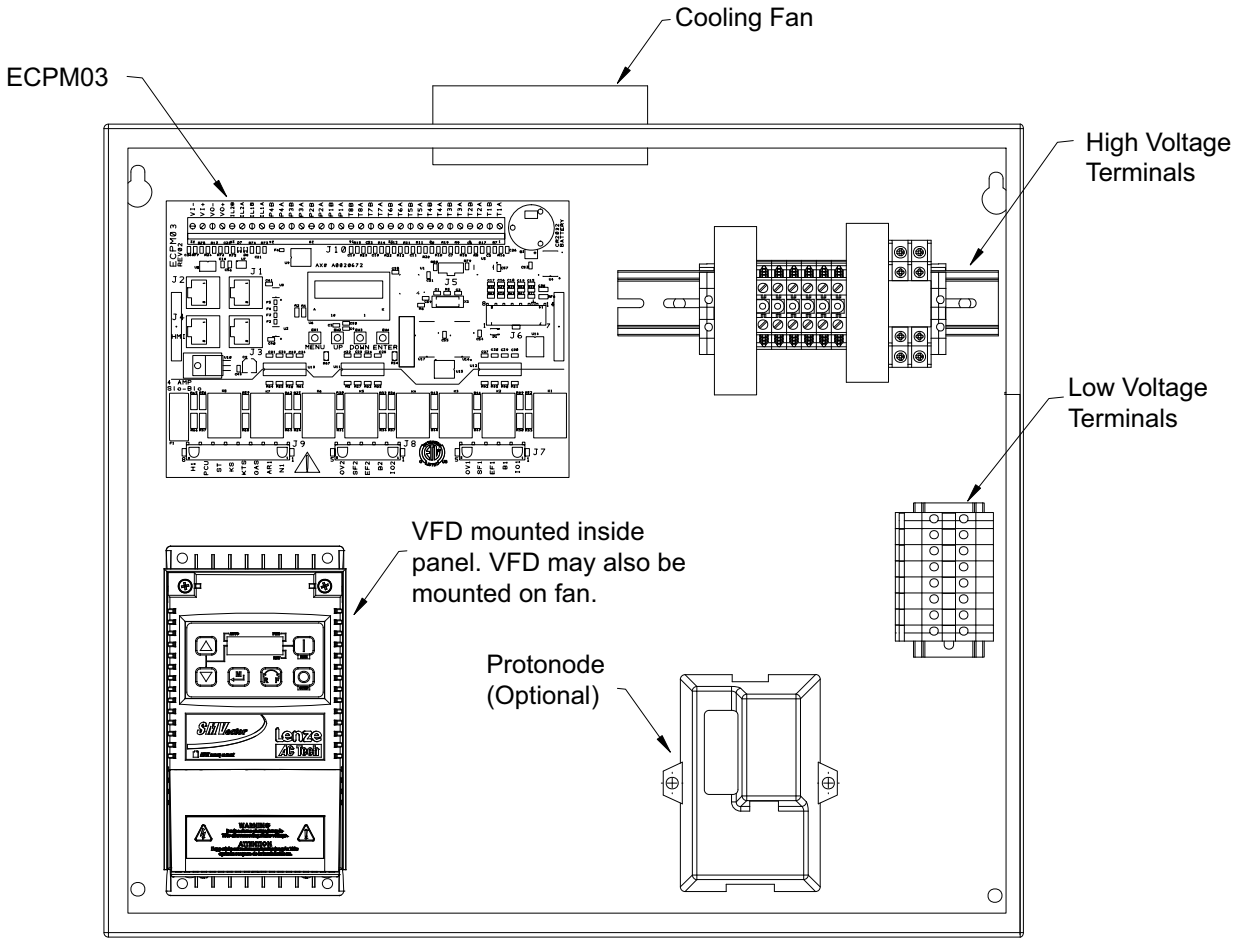
The control panel enclosure must be secured to a fixed wall near the fan. **Maintain adequate clearance from excessive heat sources, such as appliances or processing equipment, to prevent damage to the components**.

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.
- Refer to **Figure 1 on page 7** for typical control panel layout.

Figure 1 - Control Panel Layout



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
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

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 2**) 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.

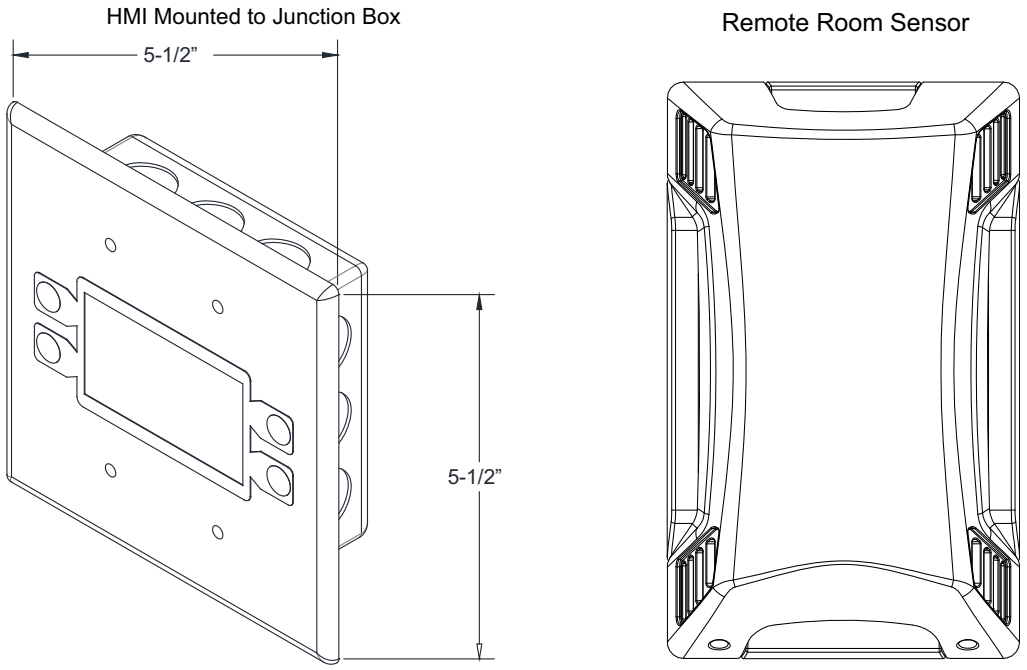
The HMI can also be configured to control the unit from a remote location manually. They can be configured not to use the internal temperature sensor. In this configuration, the sensor in the HMI is ignored in automatic operation. Multiple HMIs can be connected to one unit for temperature and R/H averaging.

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 2 - HMI and Remote Room Sensor



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

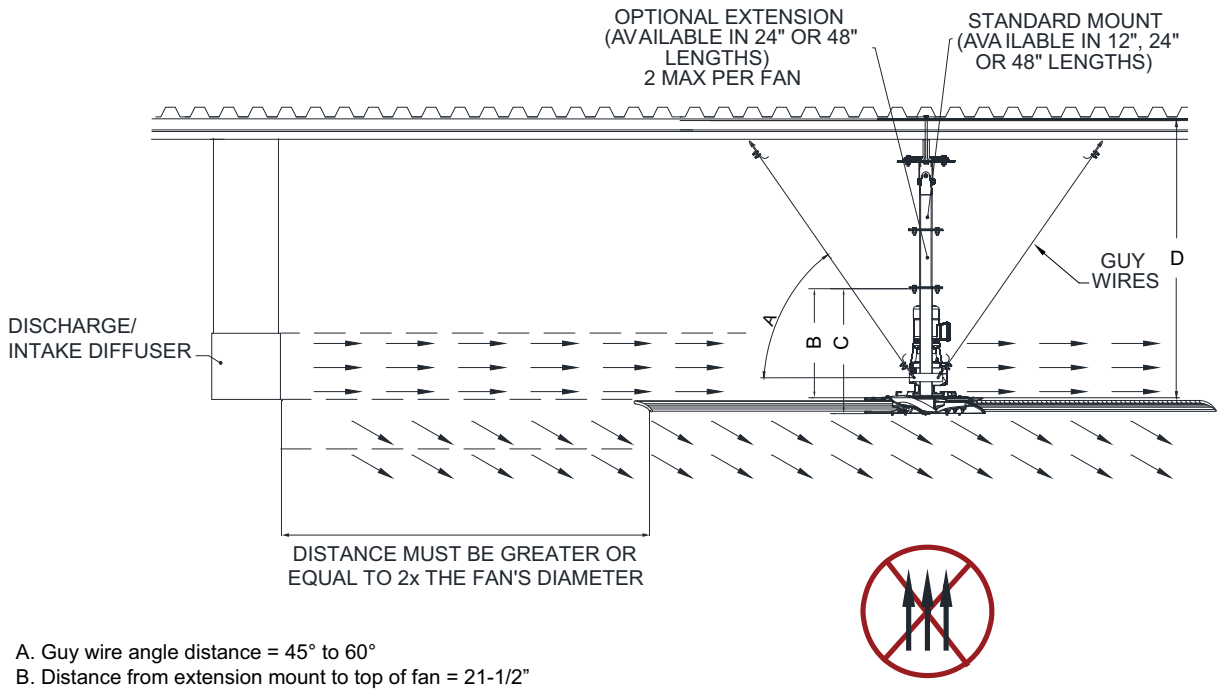
Table 2 - Blade Clearance

Fan Blade Diameter (Feet)	Clearance (Feet)
6	12
8	16
10	20
12	24
14	28
16	32
18	36
20	40
22	44
24	48

Fan Located Below HVAC Discharge or Intake

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

Figure 3 - Fan Located Below HVAC Details

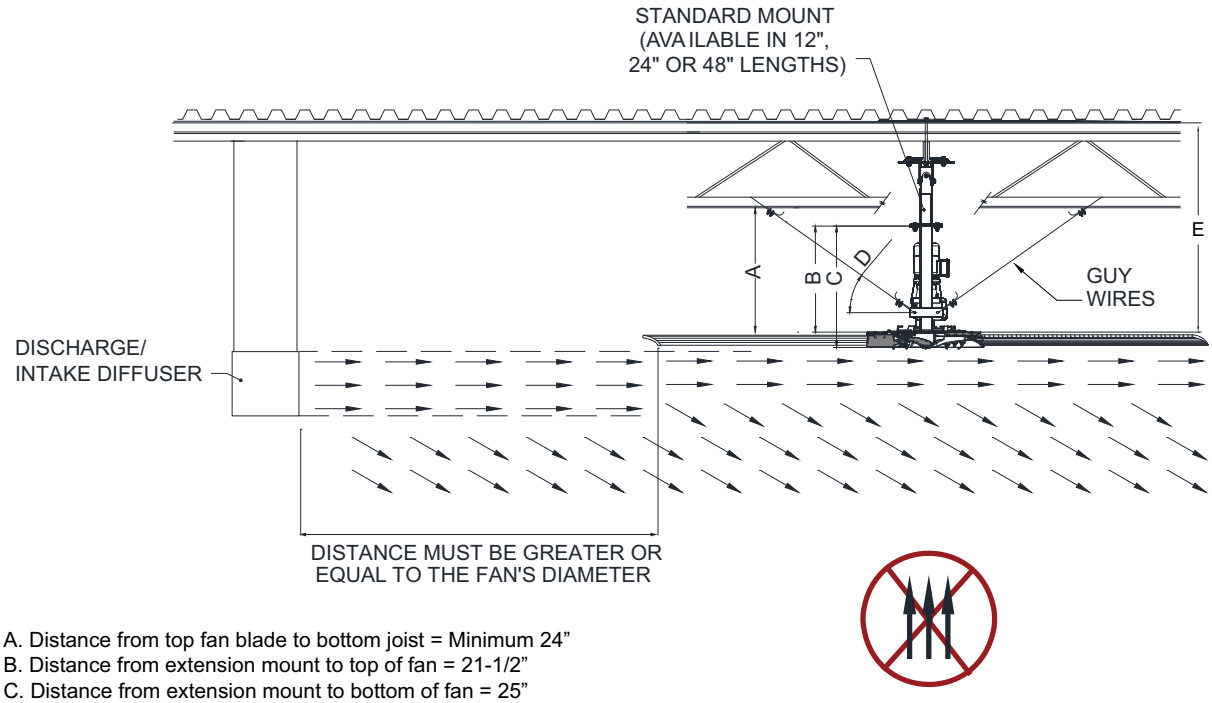


A. Guy wire angle distance = 45° to 60°
B. Distance from extension mount to top of fan = 21-1/2”
C. Distance from extension mount to bottom of fan = 25”
D. Distance from ceiling to fan = Minimum 60”

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 1/2 the fan's diameter**.

Figure 4 - Fan Located At or Above Discharge or Intake Details



A. Distance from top fan blade to bottom joist = Minimum 24"
B. Distance from extension mount to top of fan = 21-1/2"
C. Distance from extension mount to bottom of fan = 25"
D. Guy wire angle distance = 45° to 60°
E. Distance from ceiling to fan = Minimum 60"

Fan Located Near Lighting Sources

There are various lighting variables that may cause a strobing effect. **Figure 5** 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 5 - Clearances to Lighting Sources

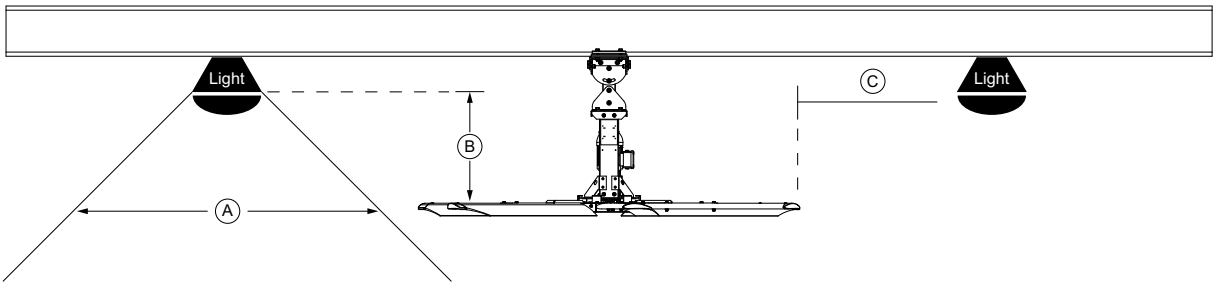
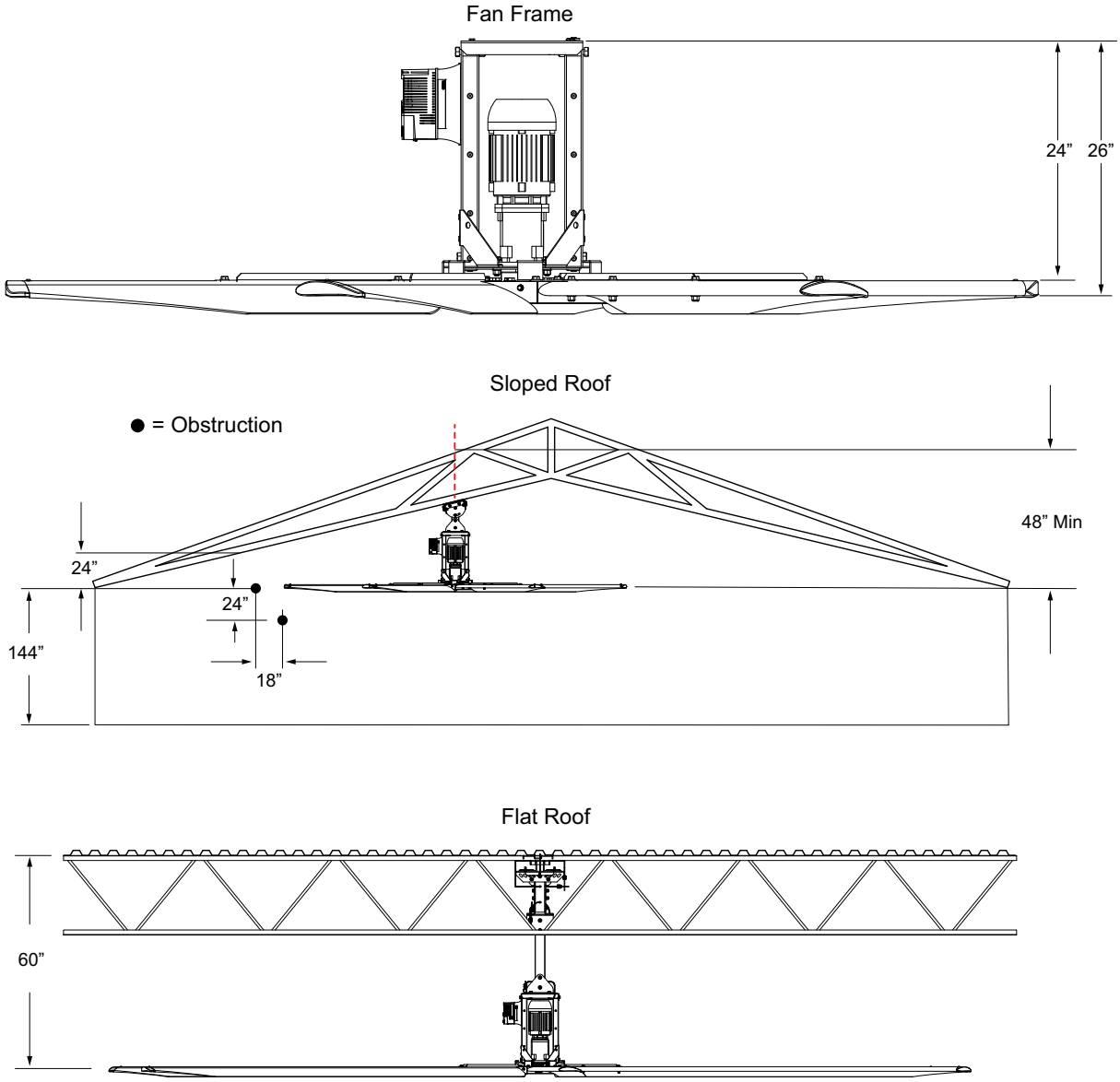


Figure 6 - Fan Clearance Details



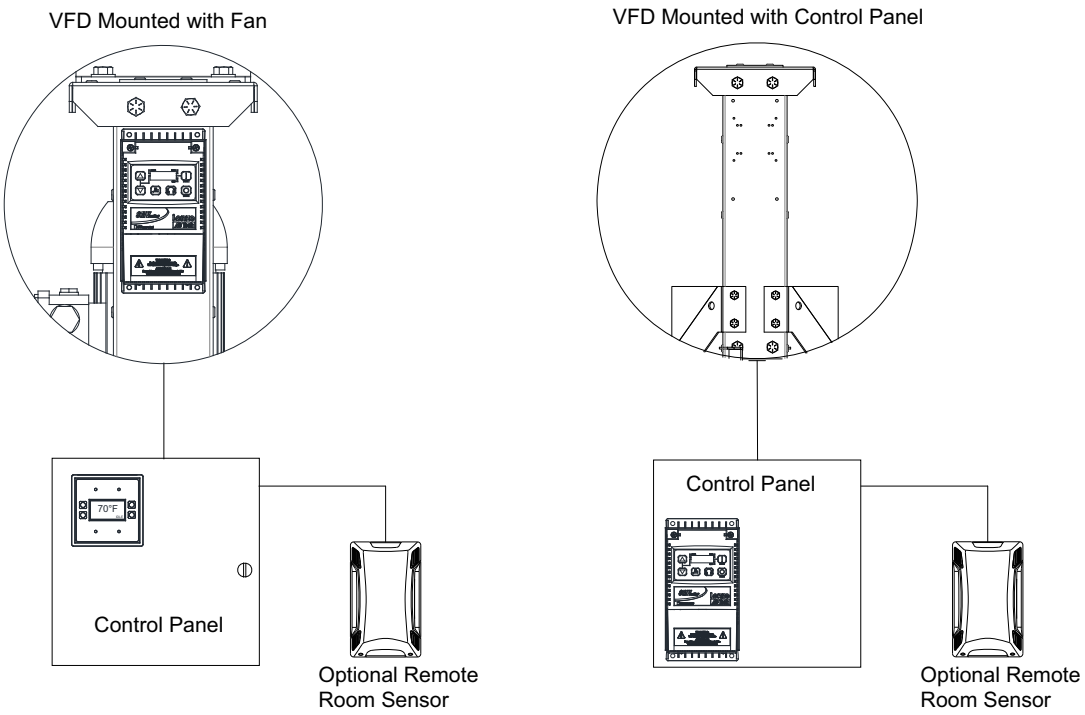
HVLS fans installed in buildings equipped with sprinklers, including ESFR (Early Suppression, Fast Response) sprinklers, shall comply with the following:

- 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.

Typical HVLS Fan and Smart Control Installation

Figure 7 - VFD and Smart Control Mounting Locations



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.

Fan Mounting Configurations

There are different mounting configurations for different types of ceiling structures. Refer to **page 13** through **page 33** 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.

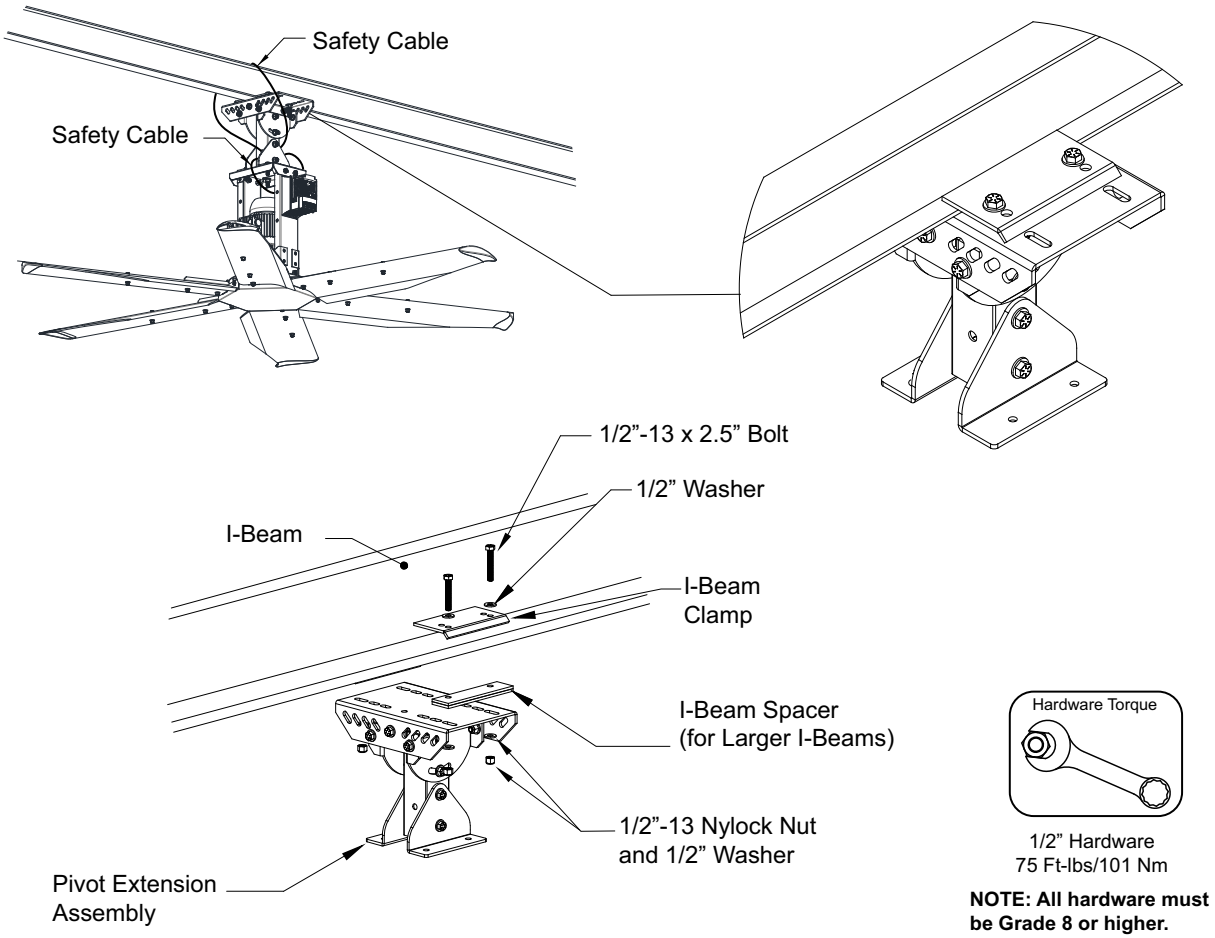
I-Beam Mount

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 26**.

Figure 8 - I-Beam Top Mount Details



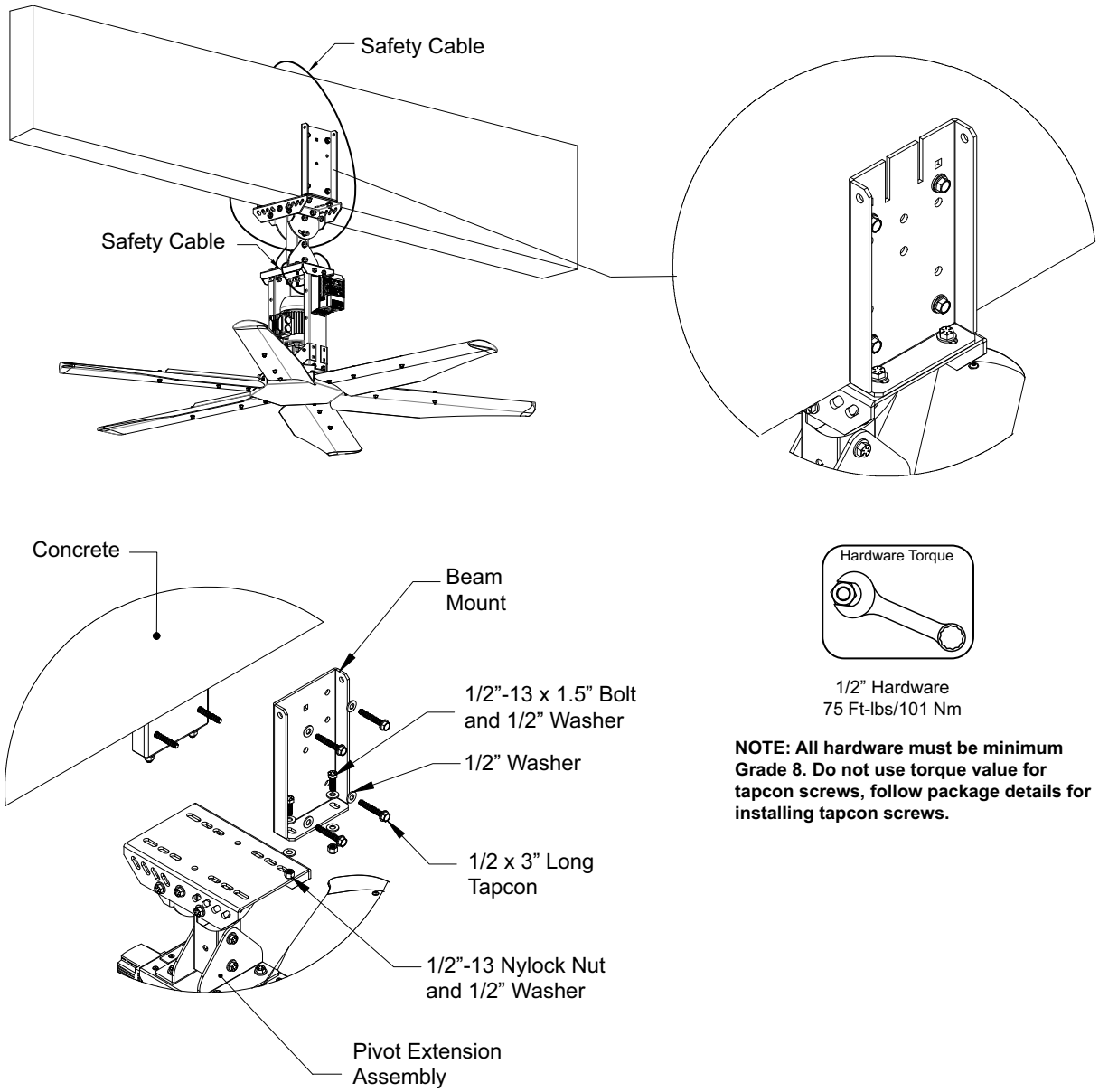
Concrete Beam Direct Mount

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 26**.

Figure 9 - Concrete Direct Mount Details



NOTE: All hardware must be minimum Grade 8. Do not use torque value for tapcon screws, follow package details for installing tapcon screws.

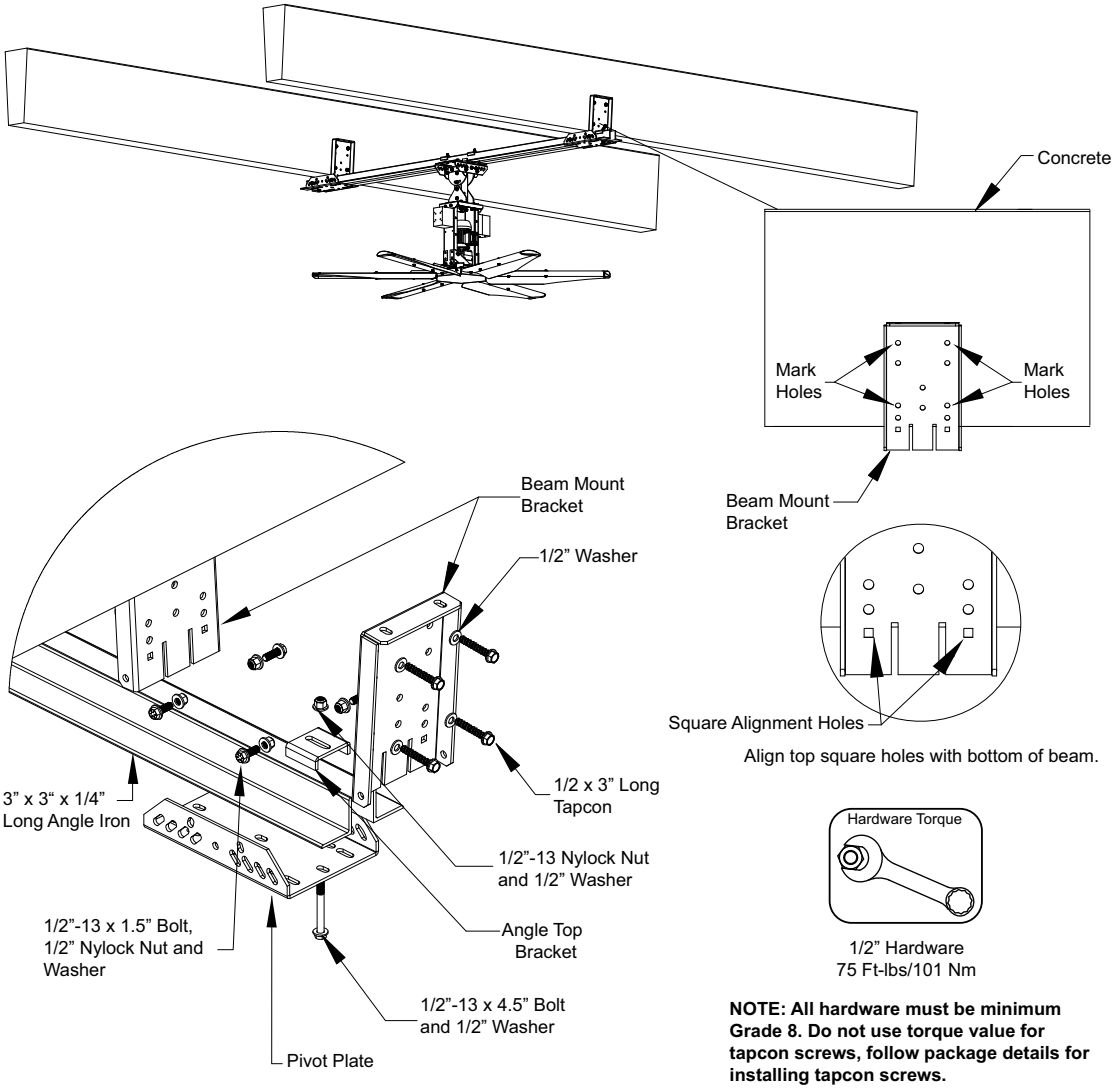
Concrete Multi-Beam Mount

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 26**.

Figure 10 - Multi-Mount Concrete Details



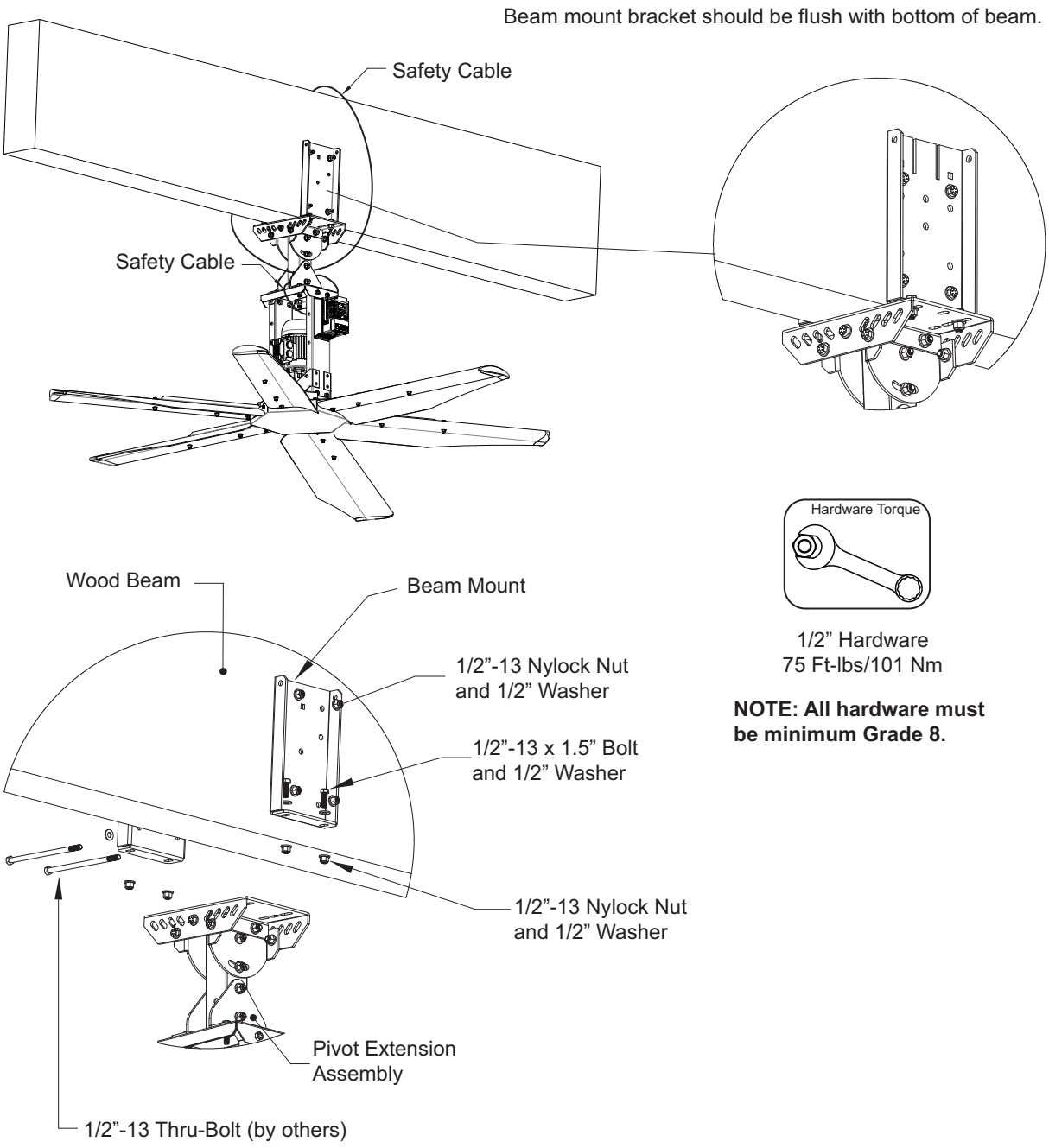
Wood Beam Direct Mount

Used to mount directly under single laminated wood beam. Beams should be 6”-10” 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 26**.

Figure 11 - Wood Beam Direct Mount Details



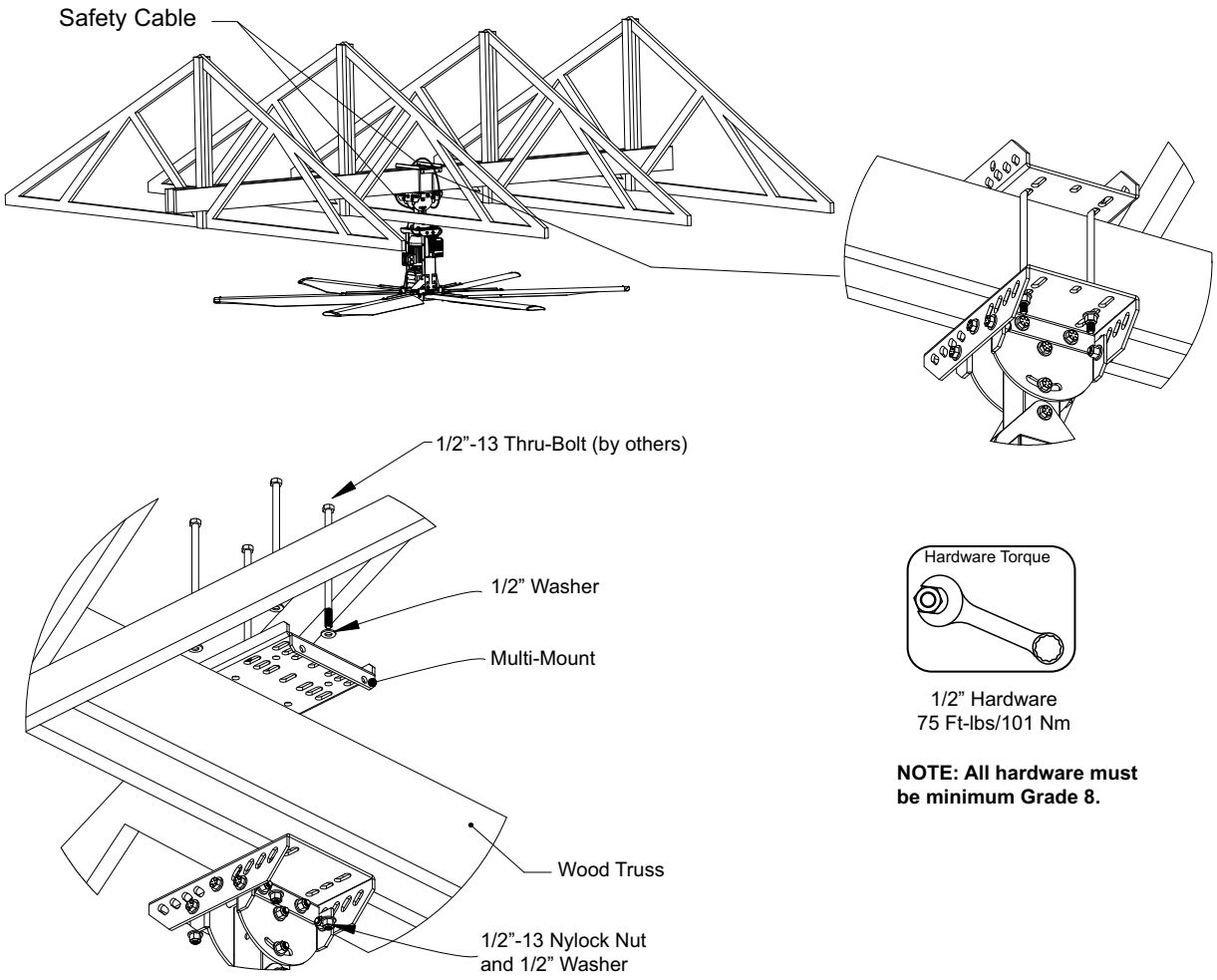
Wood Truss Mount

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 26**.

Figure 12 - 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 19**. All hardware must be minimum grade 8.

Direct Beam Mount

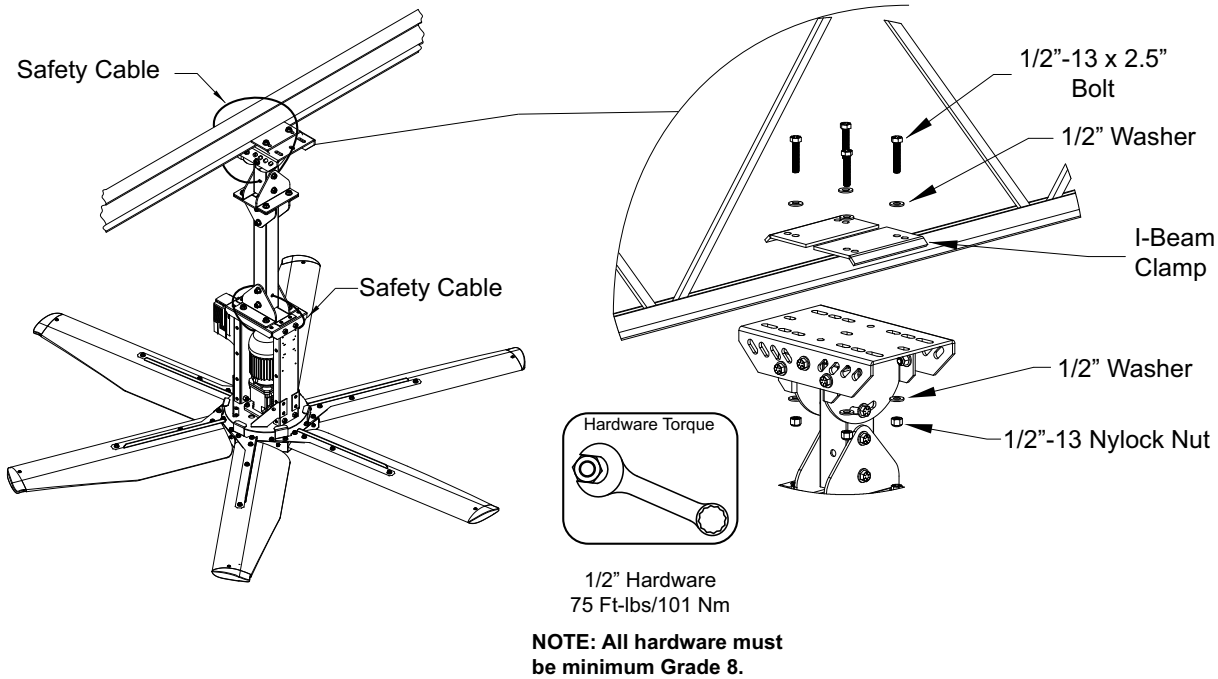
Used to mount the fan directly under an OWSJ. The beam must be 3" to 10" wide and 1/4" to 1" thick. Use I-beam spacers when the beam thickness is greater than 5/8" up to 1" thick.

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 26**.

Figure 13 - 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 15**.

Figure 14 - Angle Iron Details

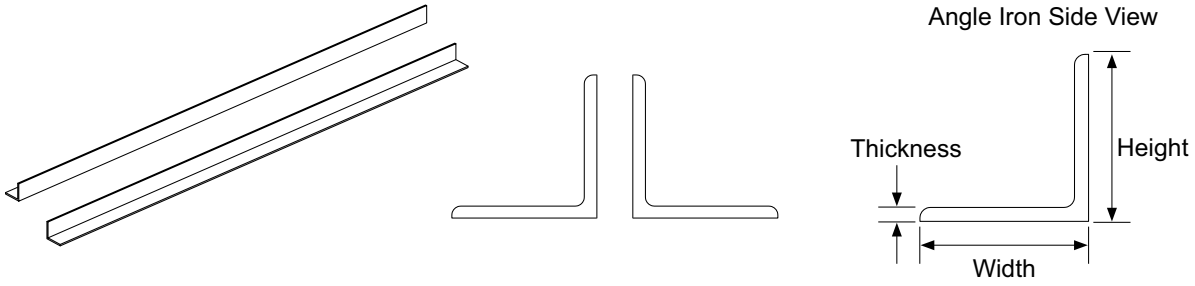
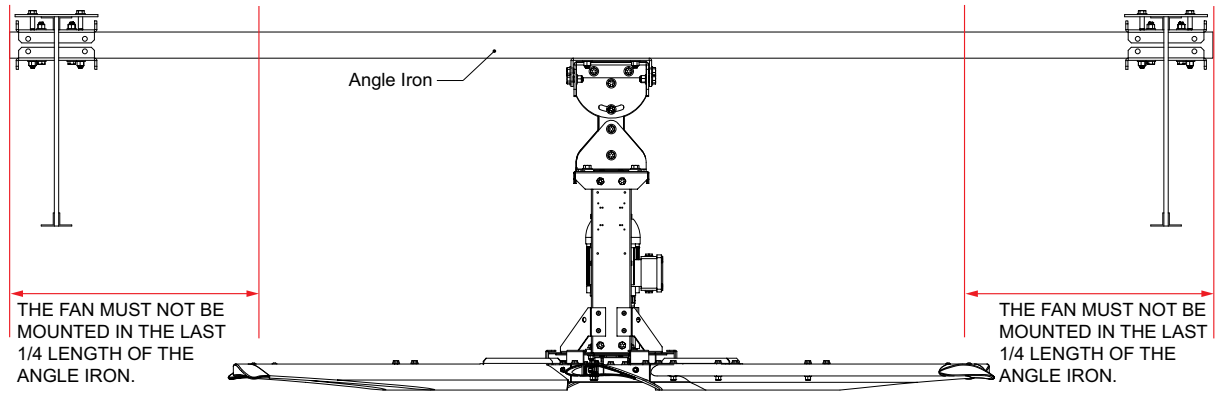
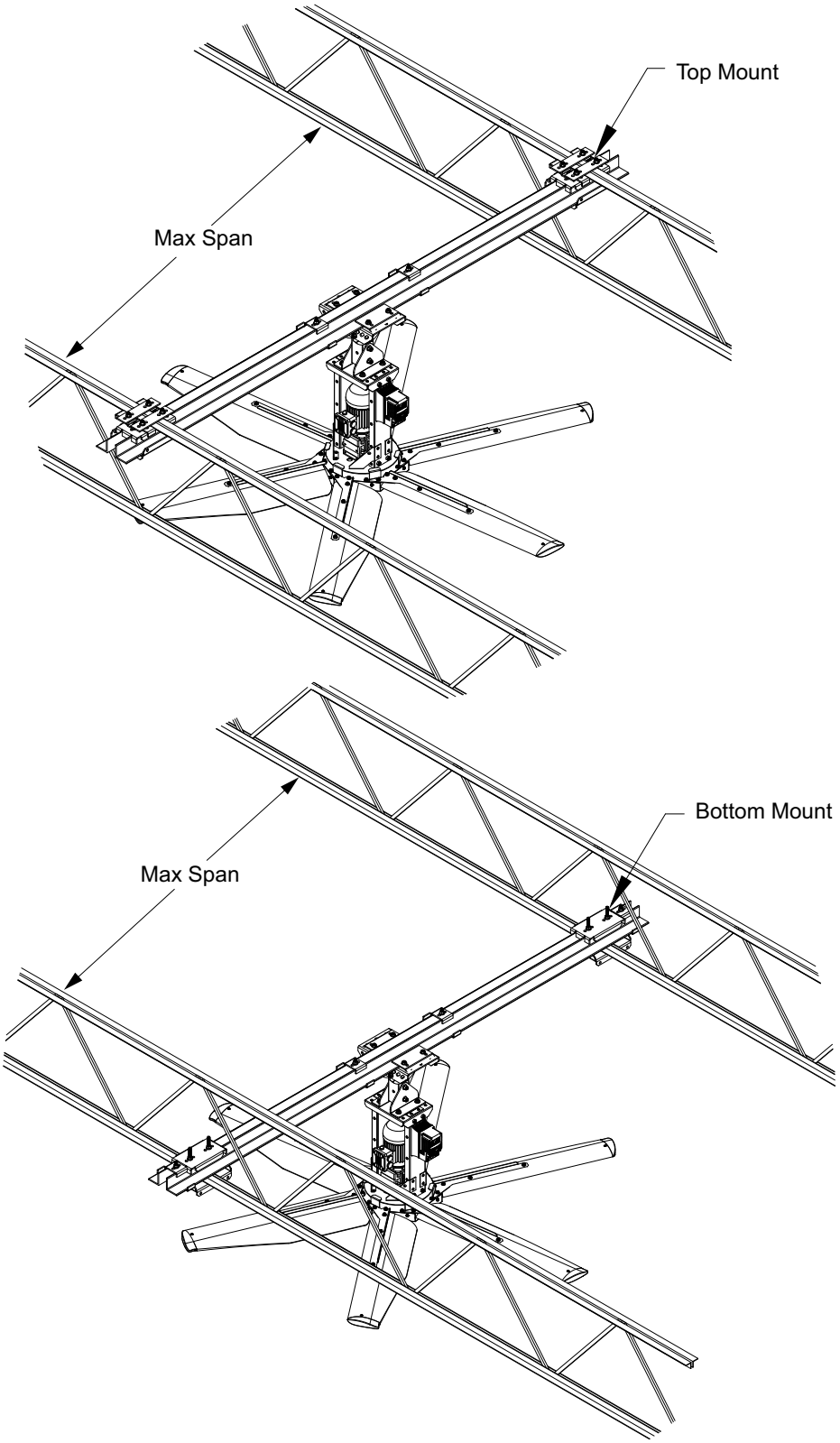


Figure 15 - OWSJ Mounting Location



Mounting Between OWSJ

Figure 16 - OWSJ Span Installations

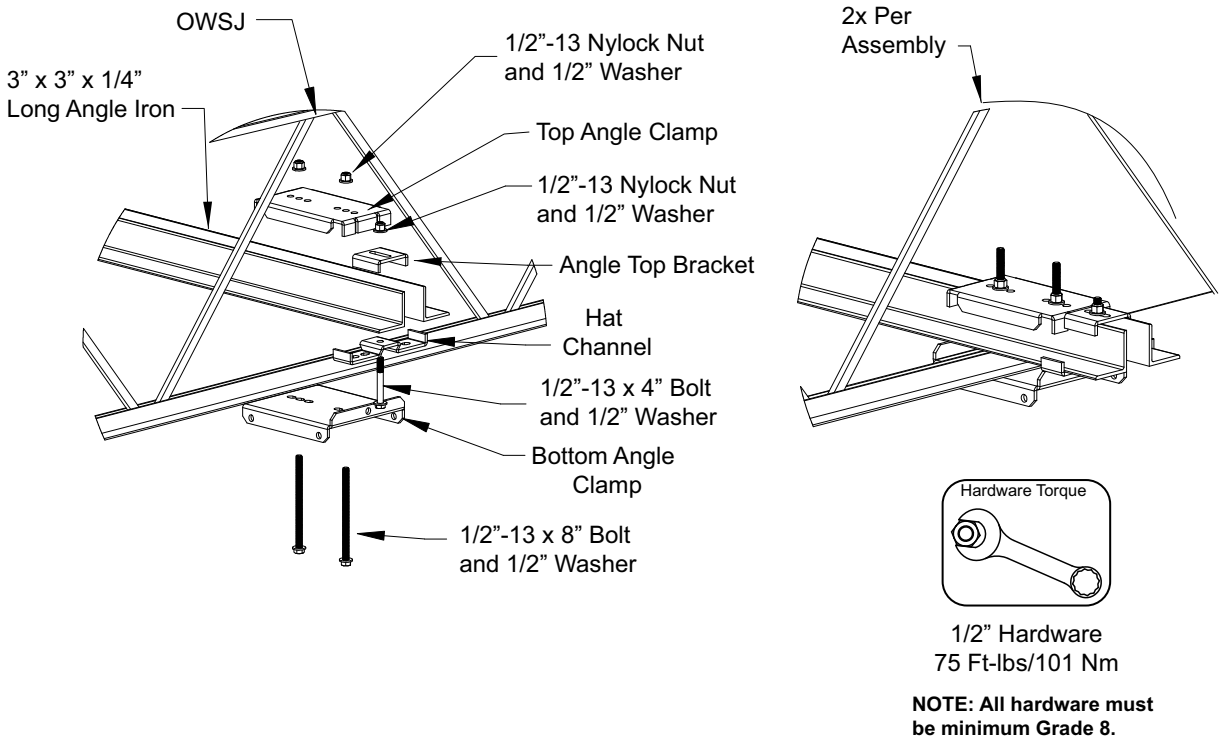


OWSJ Bottom Mount Instructions

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.

Figure 17 - OWSJ Bottom Mount Details



NOTE: All hardware must be minimum Grade 8.

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 19 Detail A on page 23**.
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.

Figure 18 - OWSJ Top Mount Assembly Details

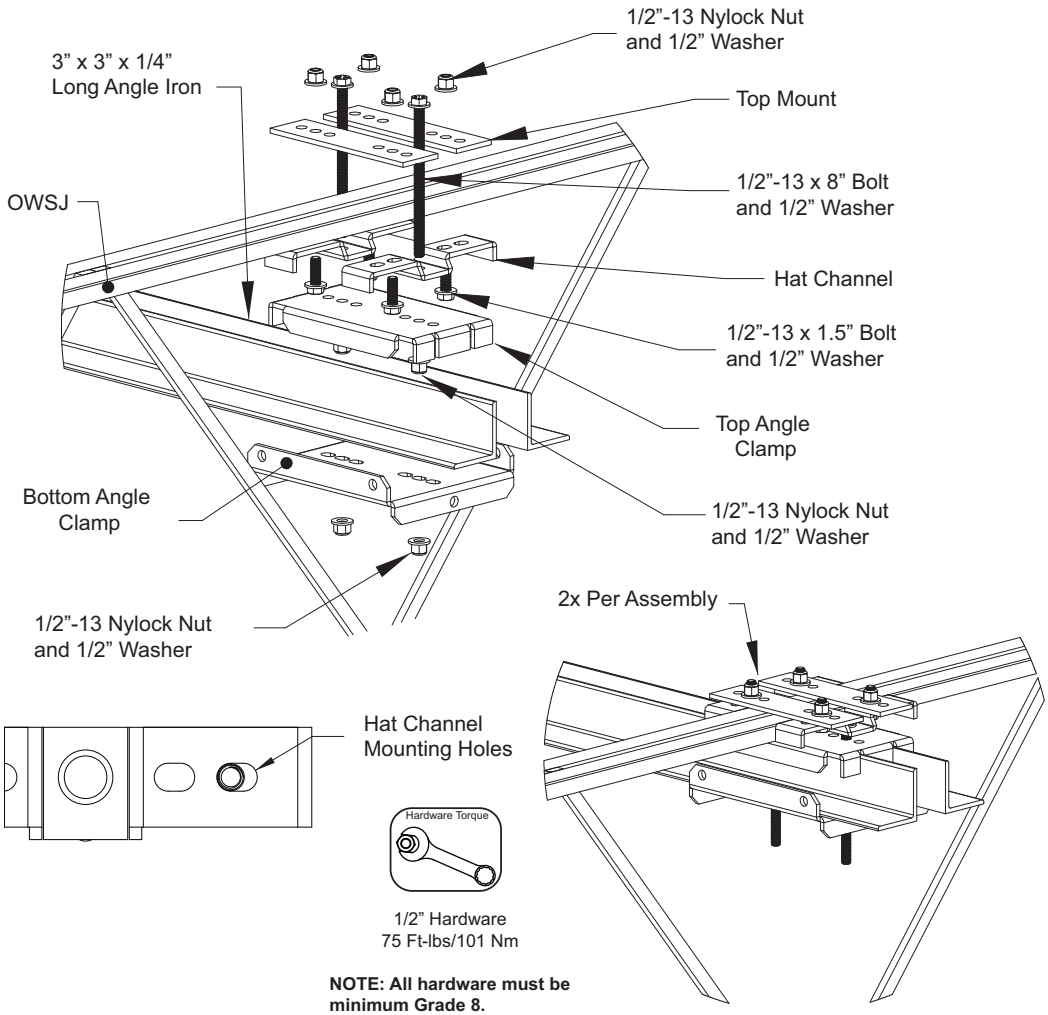
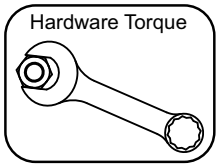


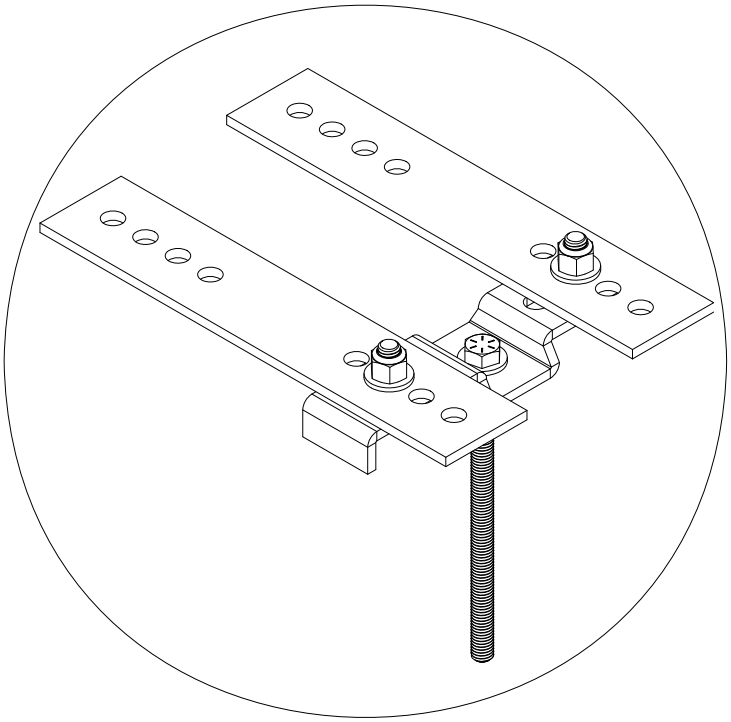
Figure 19 - OWSJ Top Mount Assembly Details



1/2” Hardware
75 Ft-lbs/101 Nm

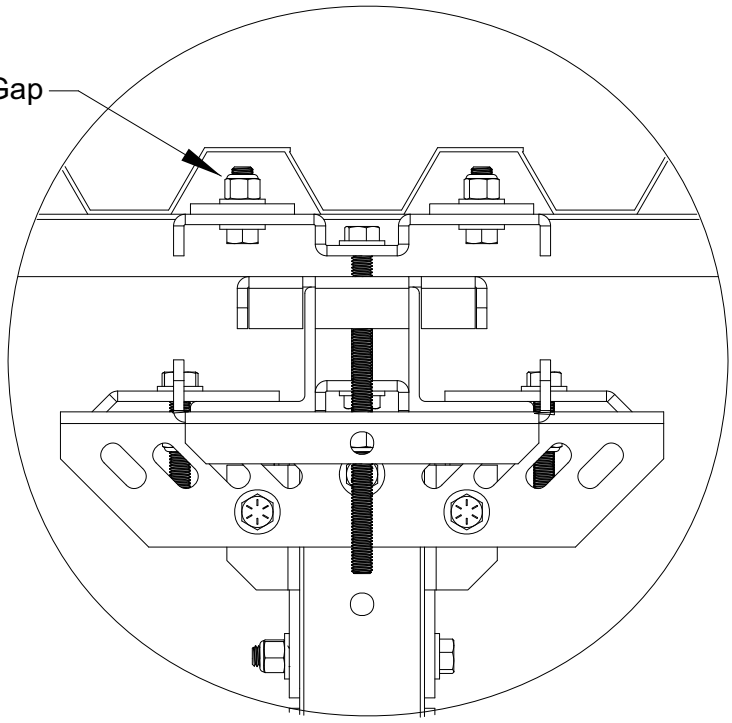
NOTE: All hardware must be minimum Grade 8.

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.

Figure 20 - Purlin Mount Assembly Details

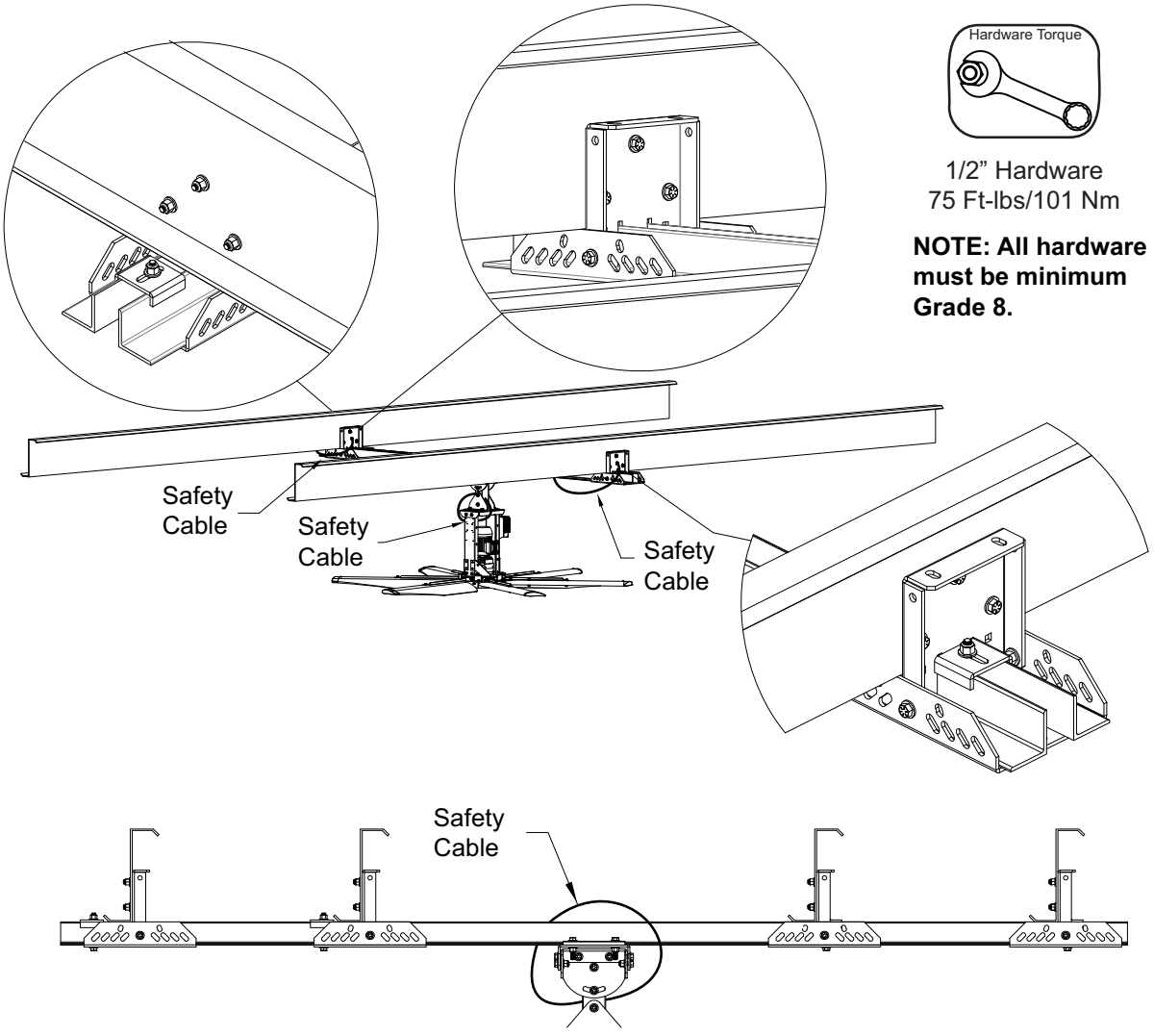
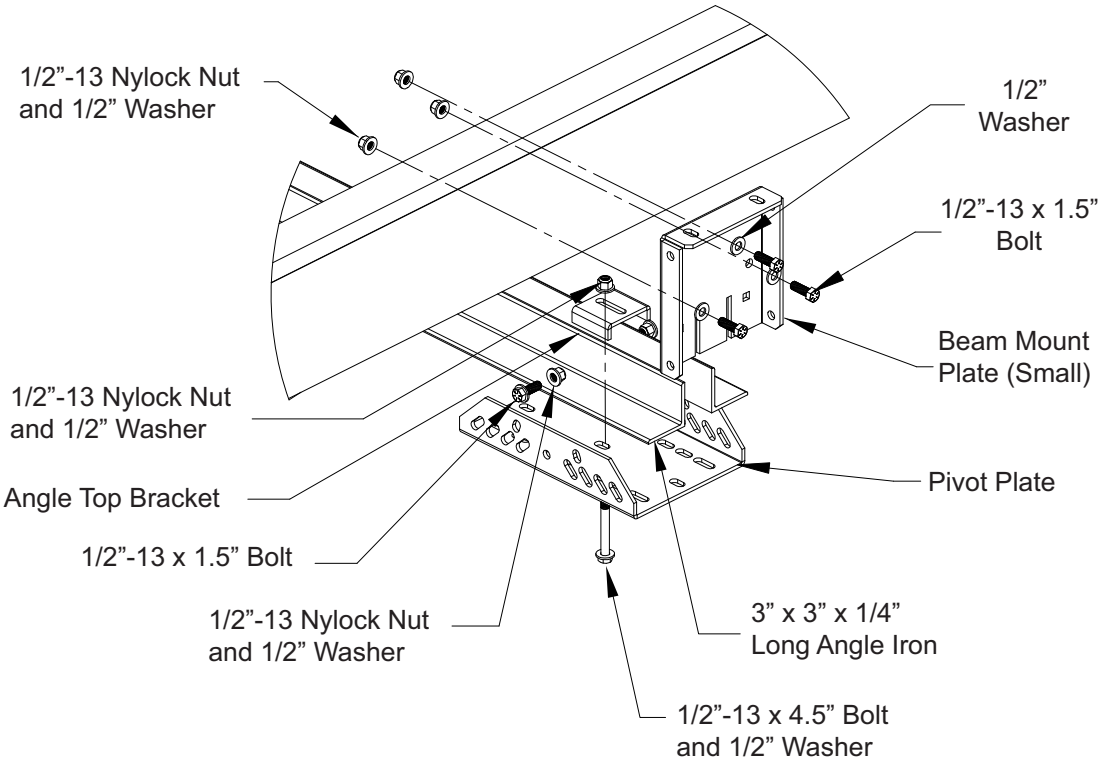
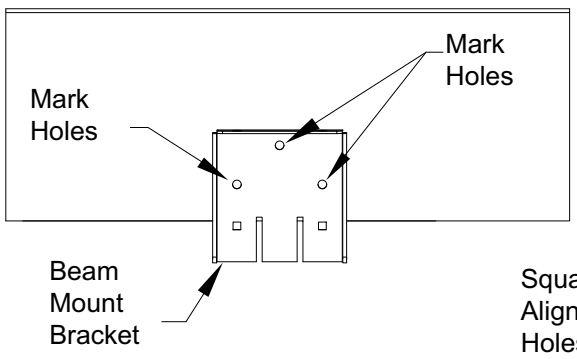
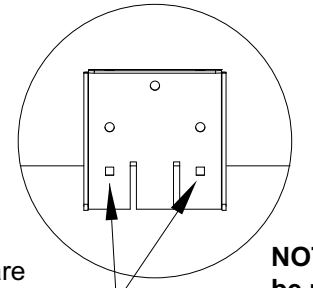
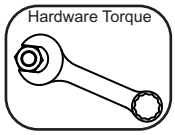


Figure 21 - Purlin Mount Assembly Details









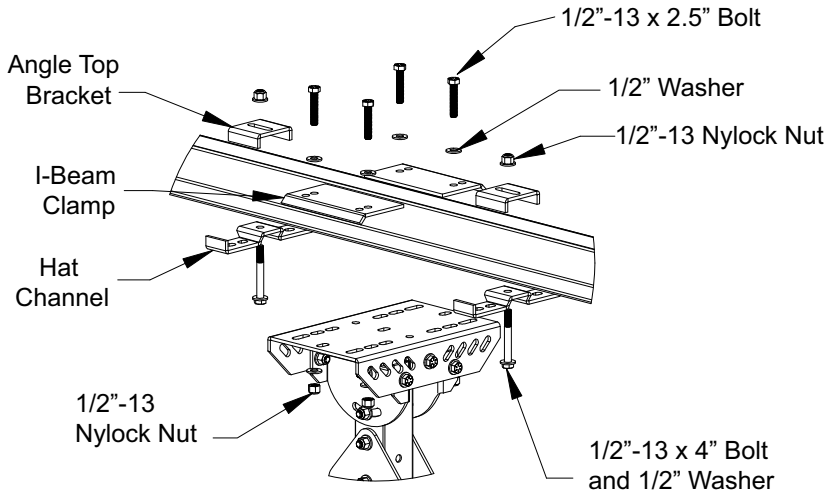
1/2” Hardware
75 Ft-lbs/101 Nm

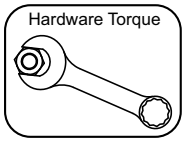
NOTE: All hardware must be minimum Grade 8.

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.

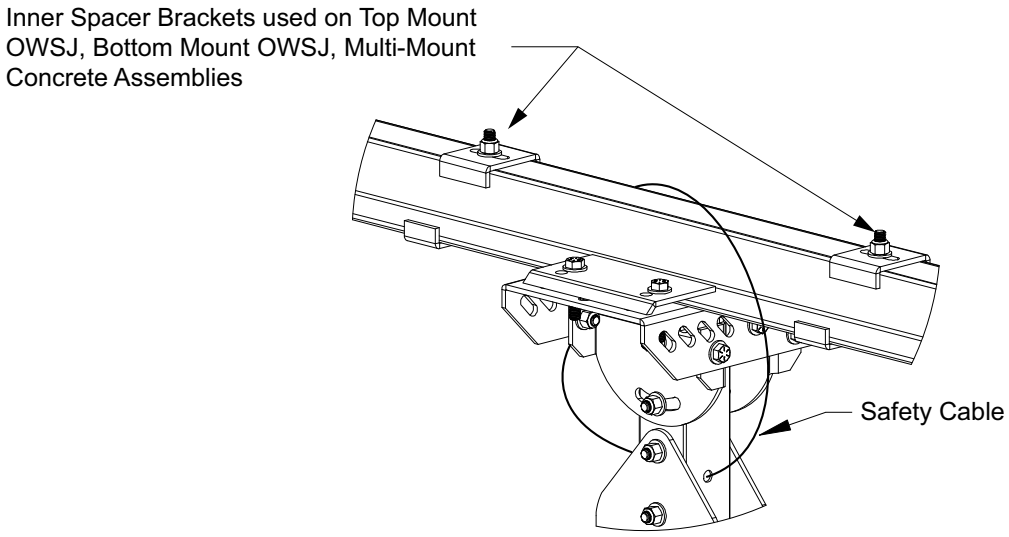
Figure 22 - Pivot Extension Assembly Details





1/2” Hardware
75 Ft-lbs/101 Nm

NOTE: All hardware must be minimum Grade 8.



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:

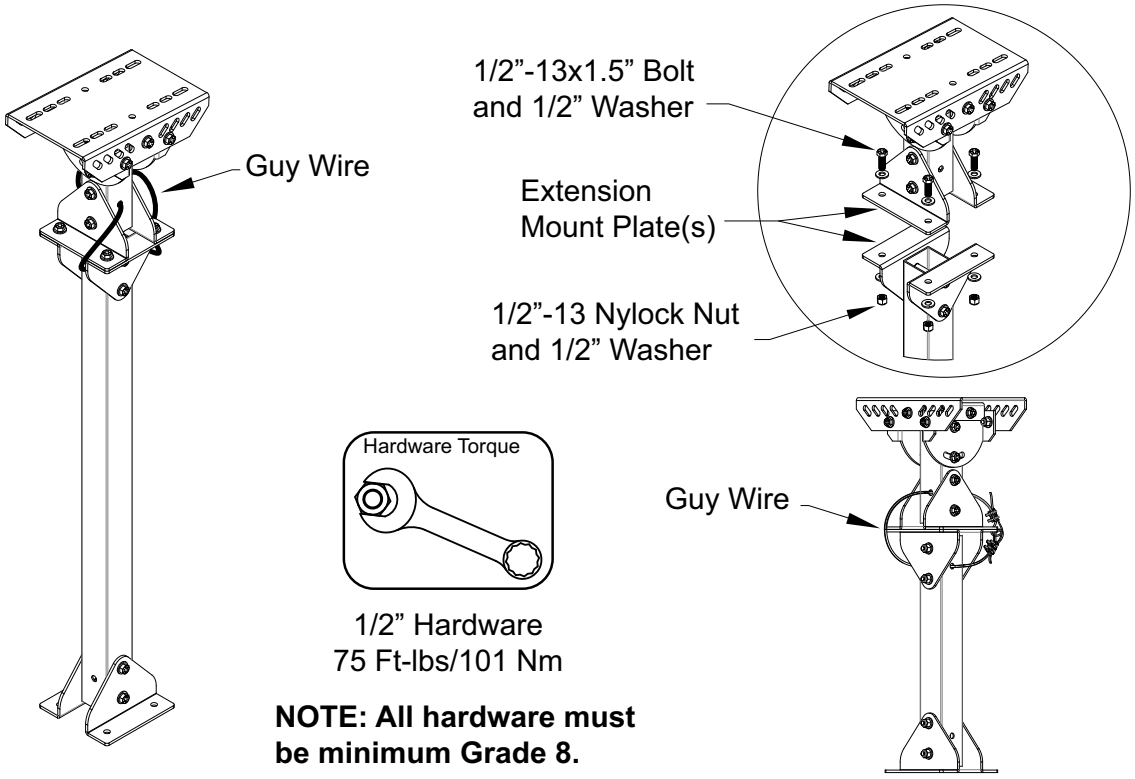
Table 3 - Tube Assembly Sizes

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” on page 31**.

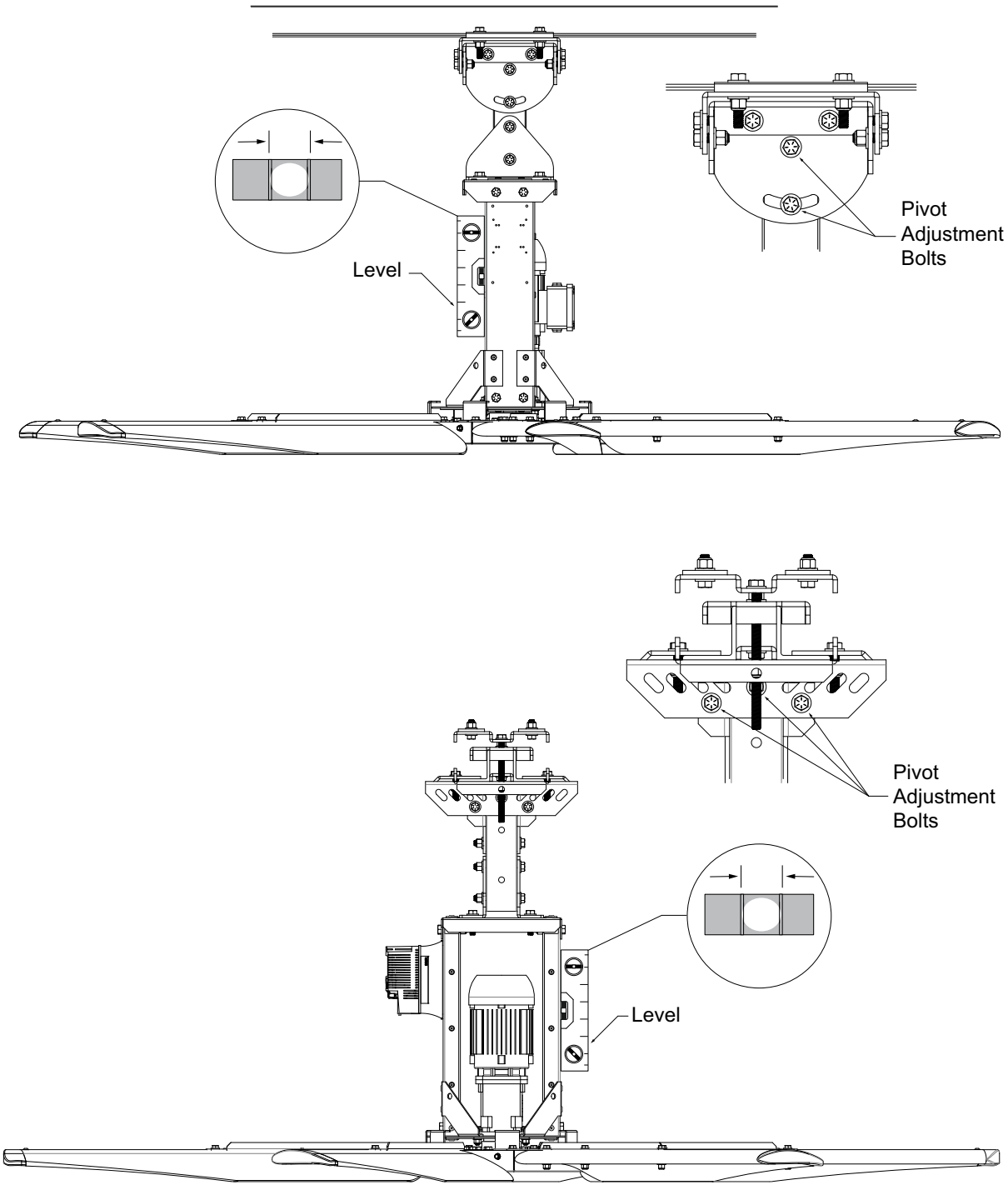
Figure 23 - Extensions Assembly Details



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 22** and **Figure 23**.

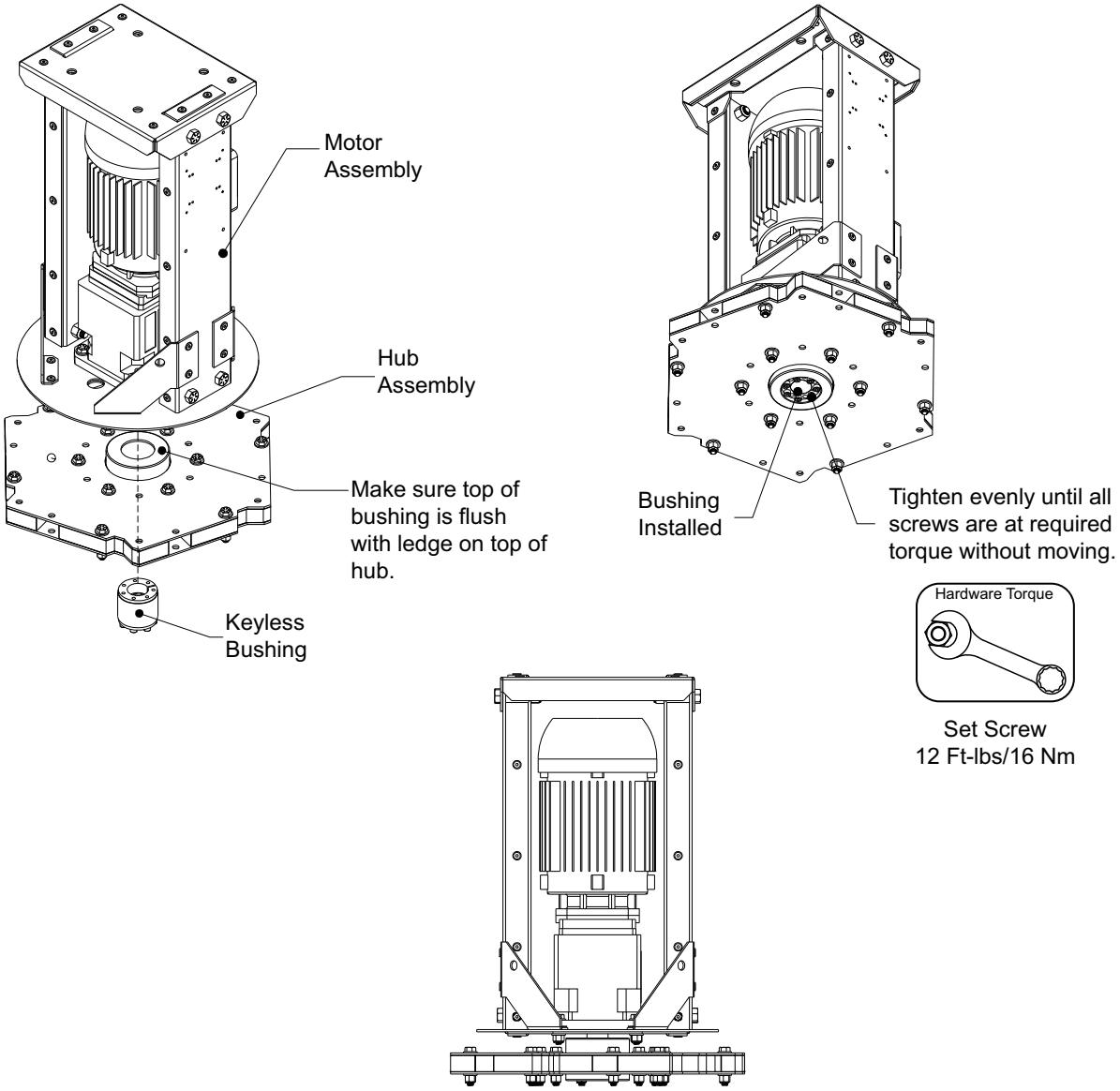
Figure 24 - Leveling Fan



Hub Assembly

NOTE: The hub assembly is pre-installed to the motor assembly from the factory. Figure 25 provides reference for maintenance when required.

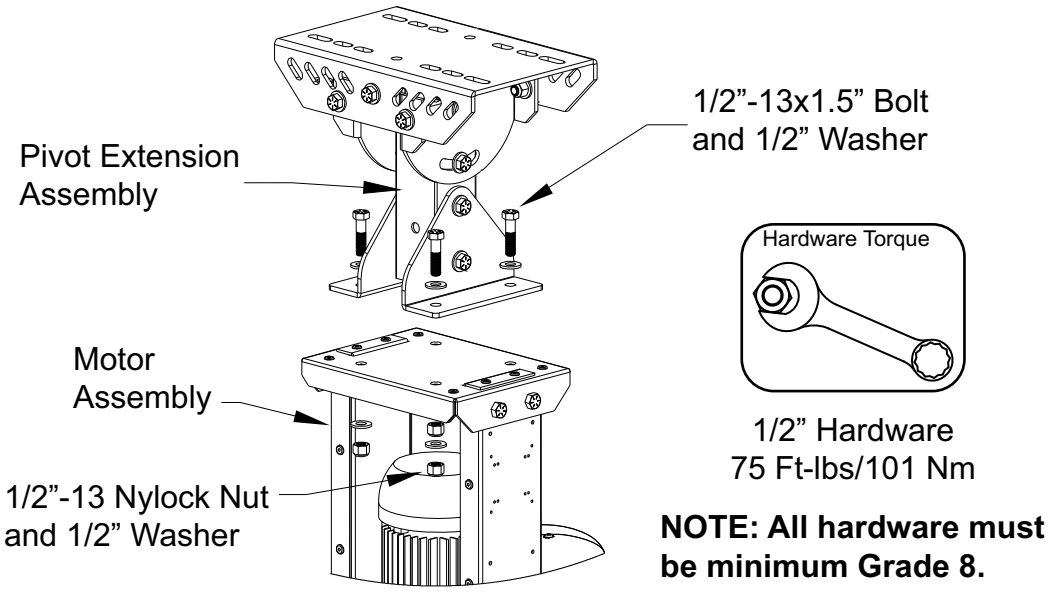
Figure 25 - Hub Assembly Details

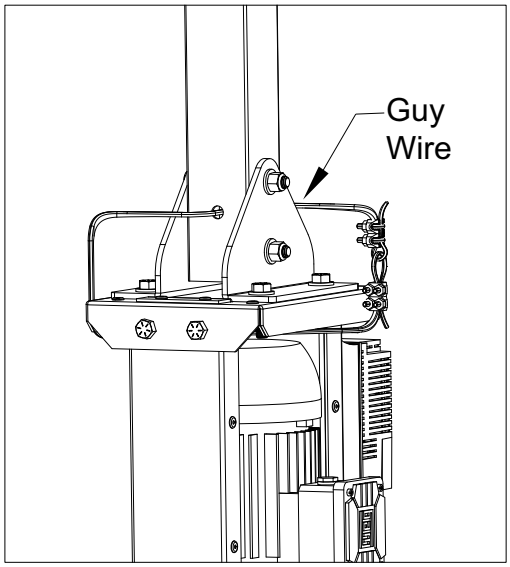


Mounting Fan to Extension

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 26 - Motor Assembly Mounting Details



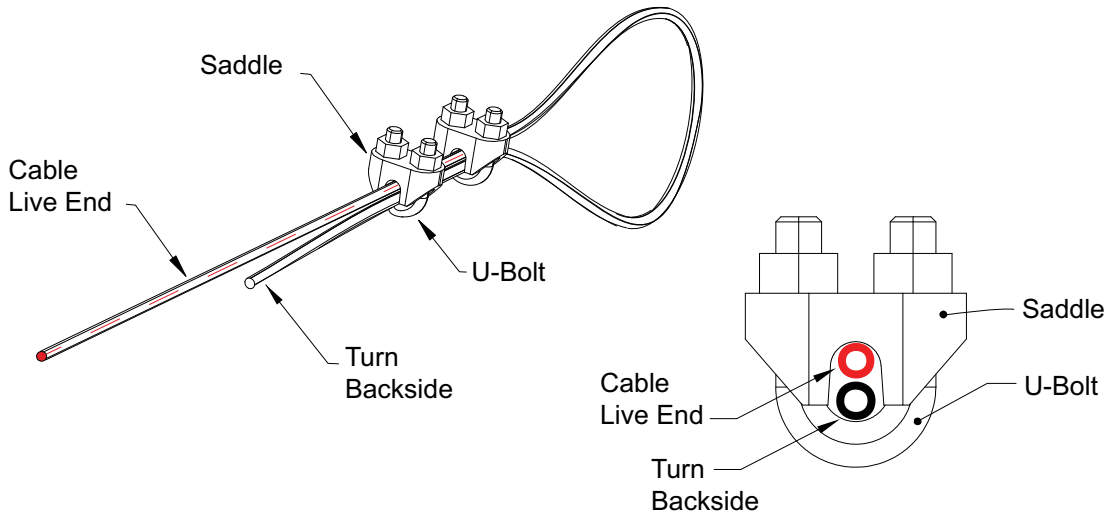


Guy Wire

Clamp Installation

When placing cable clamps on the wire, it is imperative that the U-bolt slide 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 27 - Clamp Installation Details



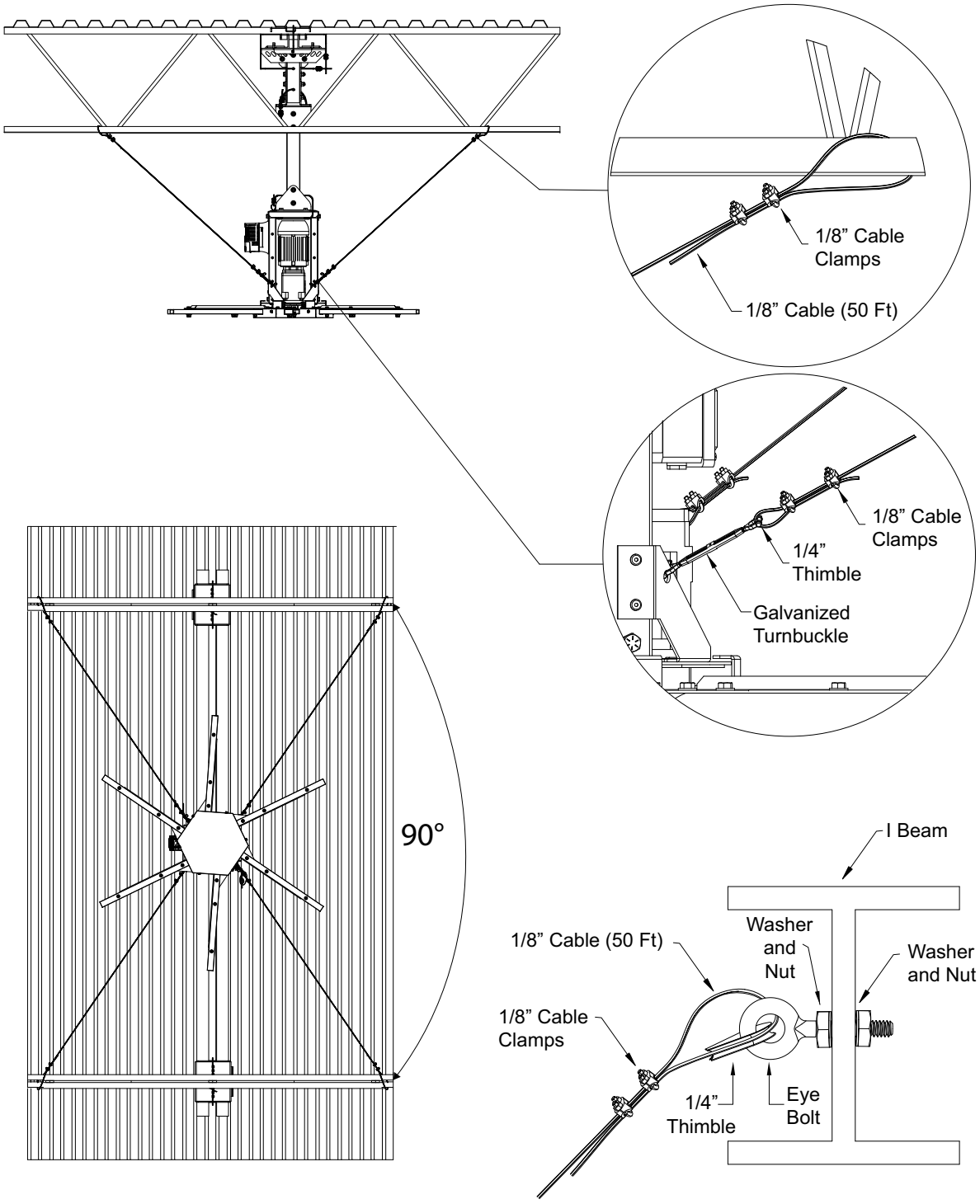
Guy Wire Installation

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 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 unleveled. 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.

Figure 28 - Guy Wire Installation Details

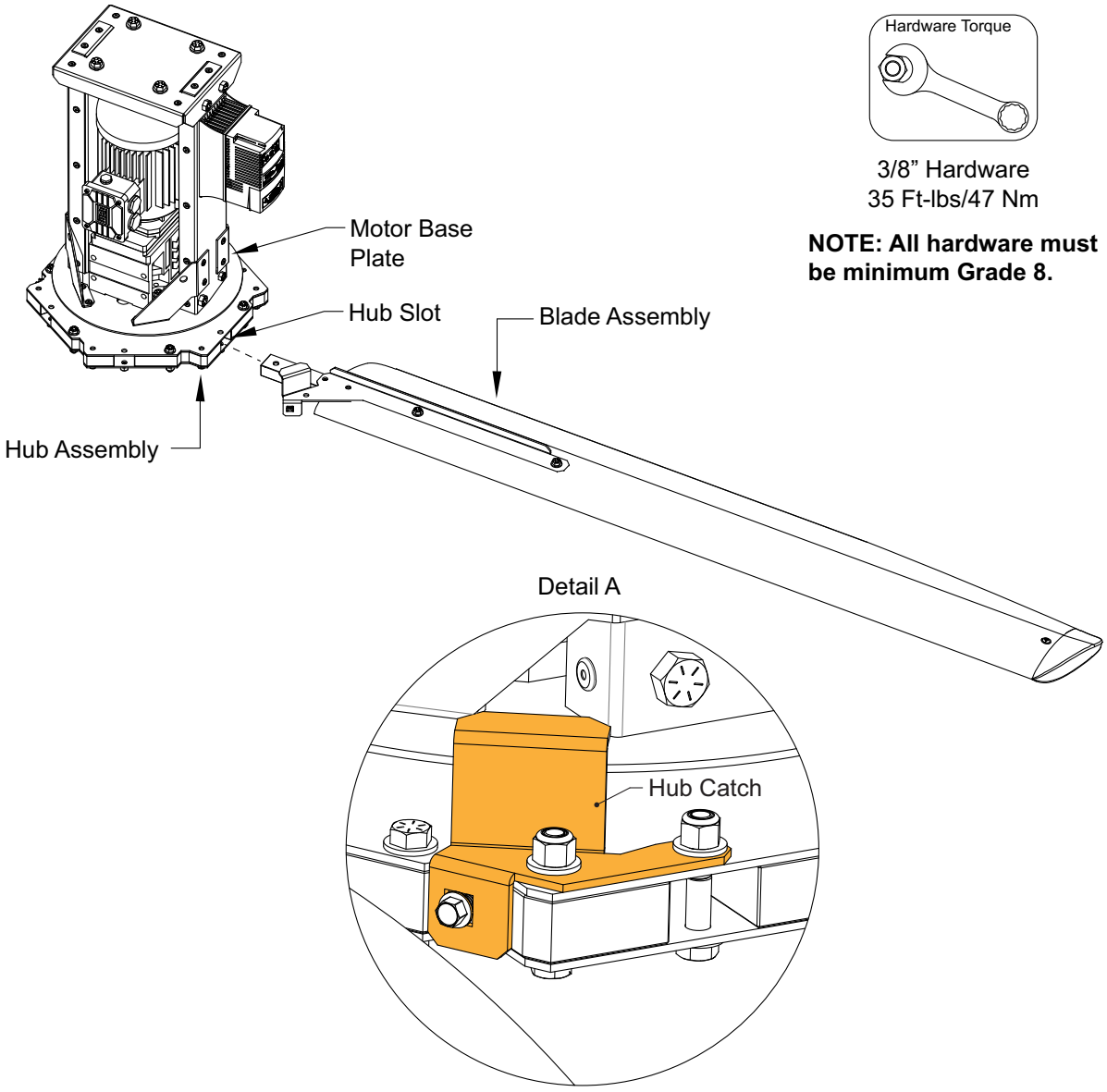


Blade Installation

NOTE: 3 blade fans will use a hub catch, Figure 29 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.

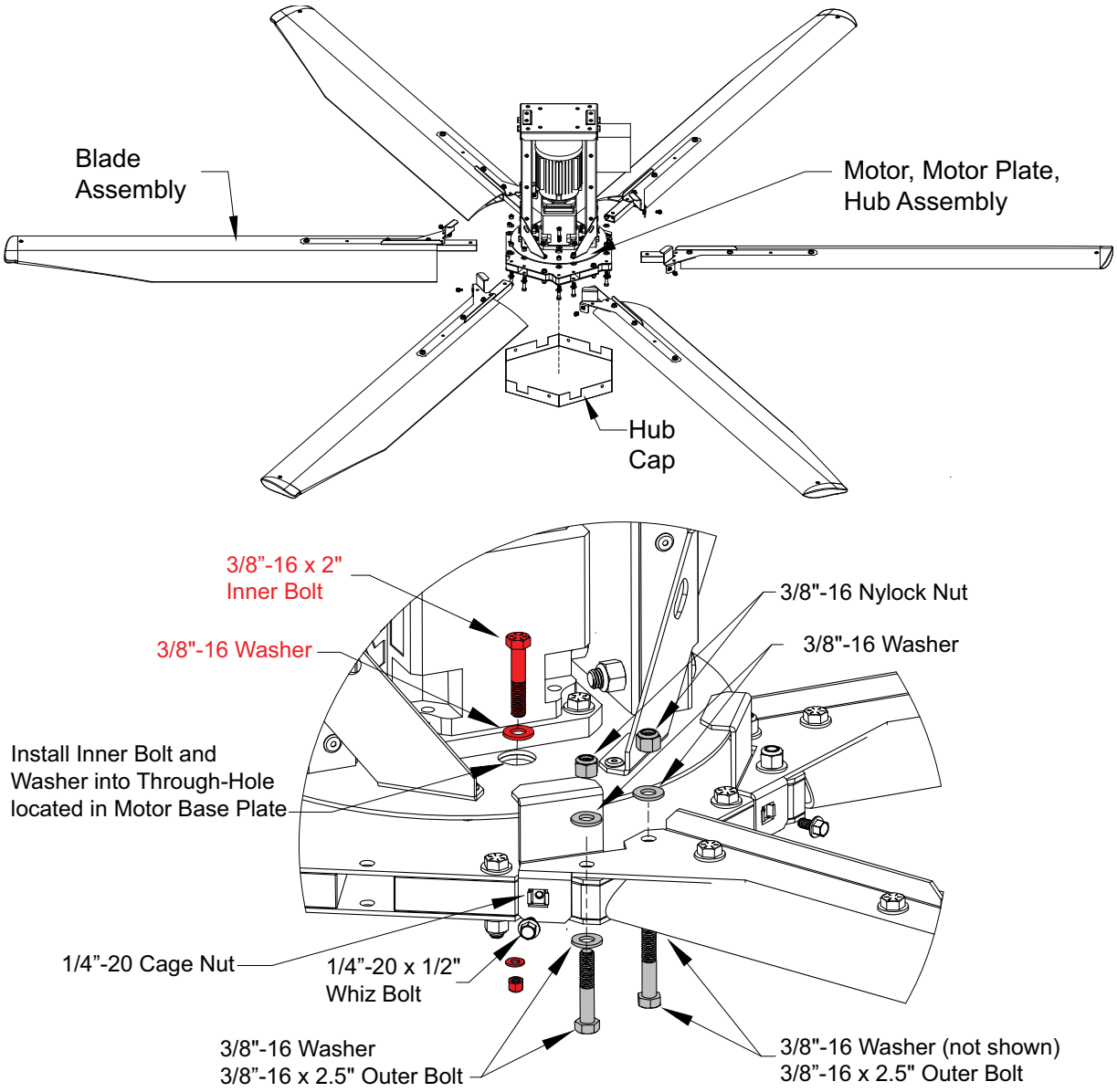
1. Insert blade assembly into the hub slot.
2. Install 3/8”-16 x 2” inner bolt and washer into through-hole, located in the top of the motor base plate. Secure with 3/8”-16 washer and nylock nut. Torque hardware to 35 Ft-lbs/47 Nm.
3. Install 3/8”-16 x 2.5” outer bolts and washers into top of blade assembly. 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 30 on page 34** for 6 blade fan installation details. Refer to **Figure 31 on page 35** for 3 blade fan installation details.

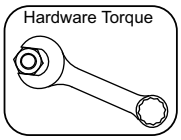
Figure 29 - Blade Installation Details



6 Blade Fan Details

Figure 30 - 6 Blade Installation Details



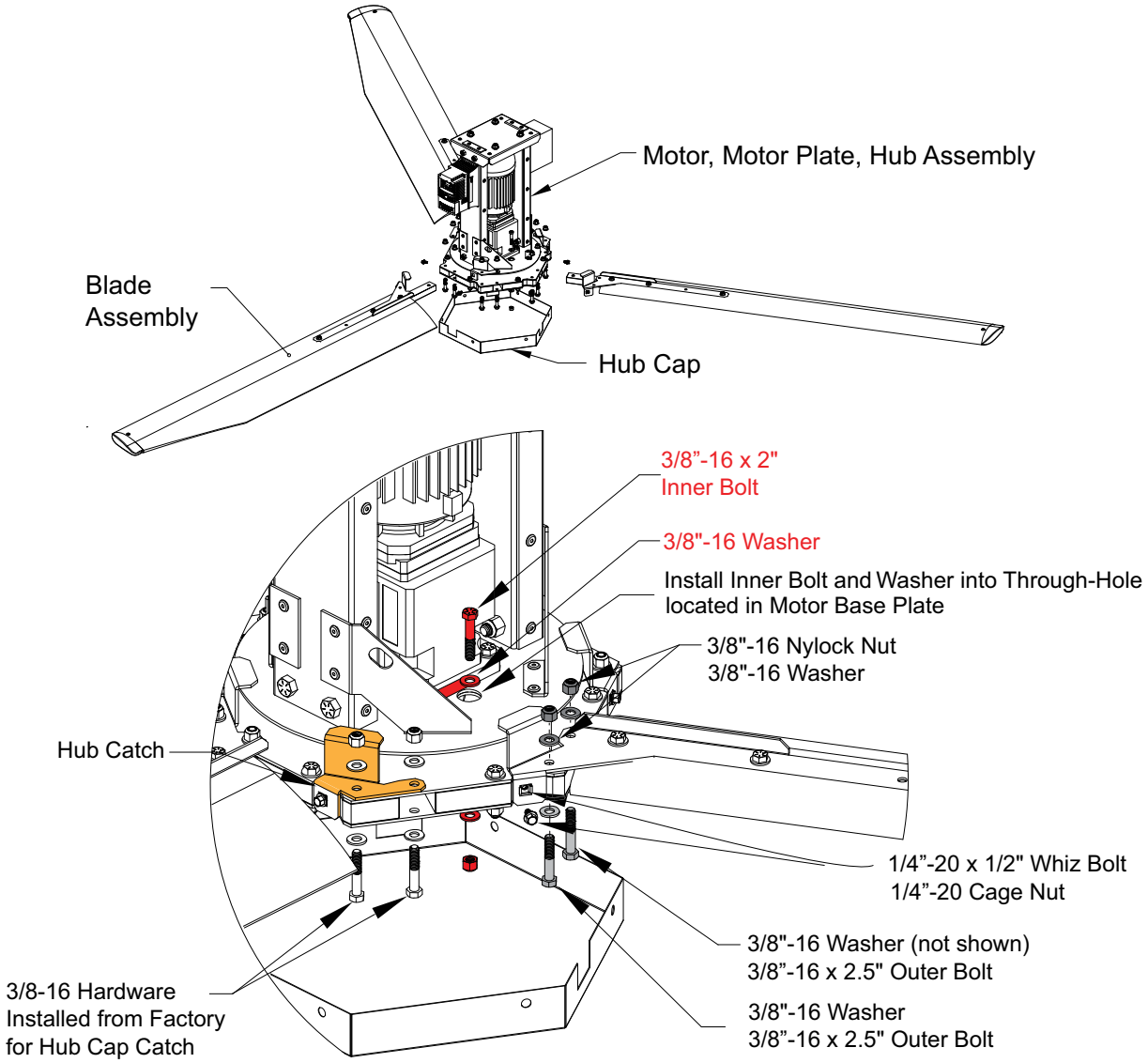


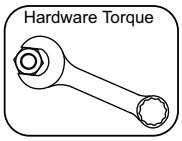
3/8” Hardware
35 Ft-lbs/47 Nm

NOTE: All hardware must be minimum Grade 8.

3 Blade Fan Details

Figure 31 - 3 Blade Installation Details





3/8” Hardware
35 Ft-lbs/47 Nm

NOTE: All hardware must be minimum Grade 8.

Electrical

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

Before connecting power to the 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.
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. If any of the original wire supplied with the fan must be replaced, it must be replaced with type THHN wire or equivalent.

Table 4 - Copper Wire Ampacity

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

High Voltage 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

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 32** through **Figure 34** for common VFD wiring.

Figure 32 - VFD Wiring (3-Phase)

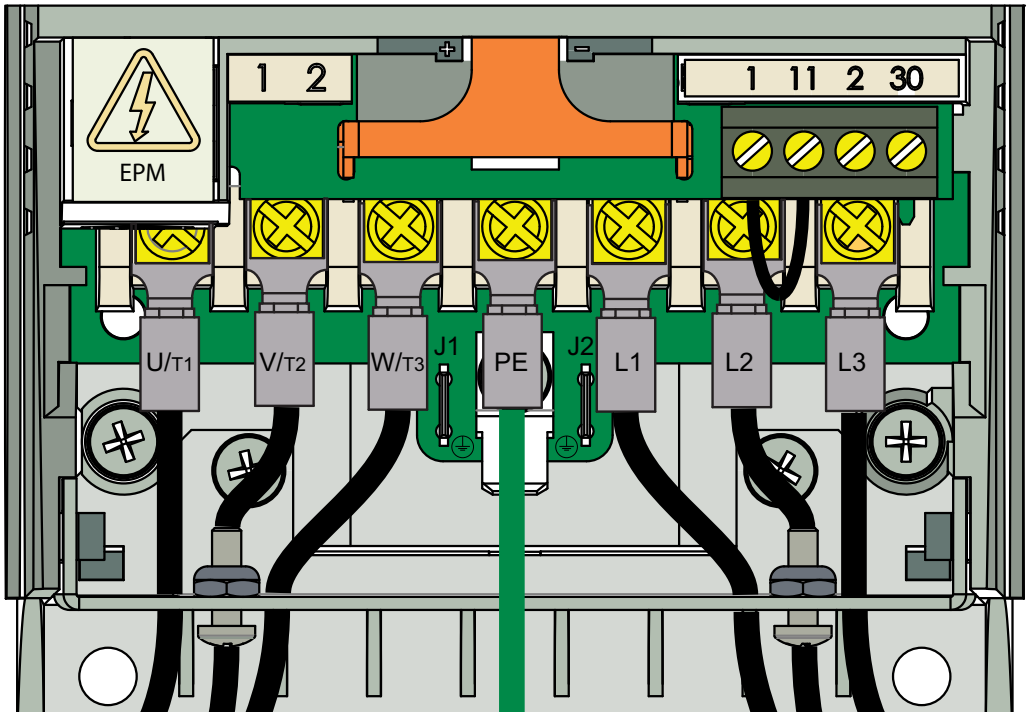


Figure 33 - VFD Wiring (240 Volt Single-Phase)

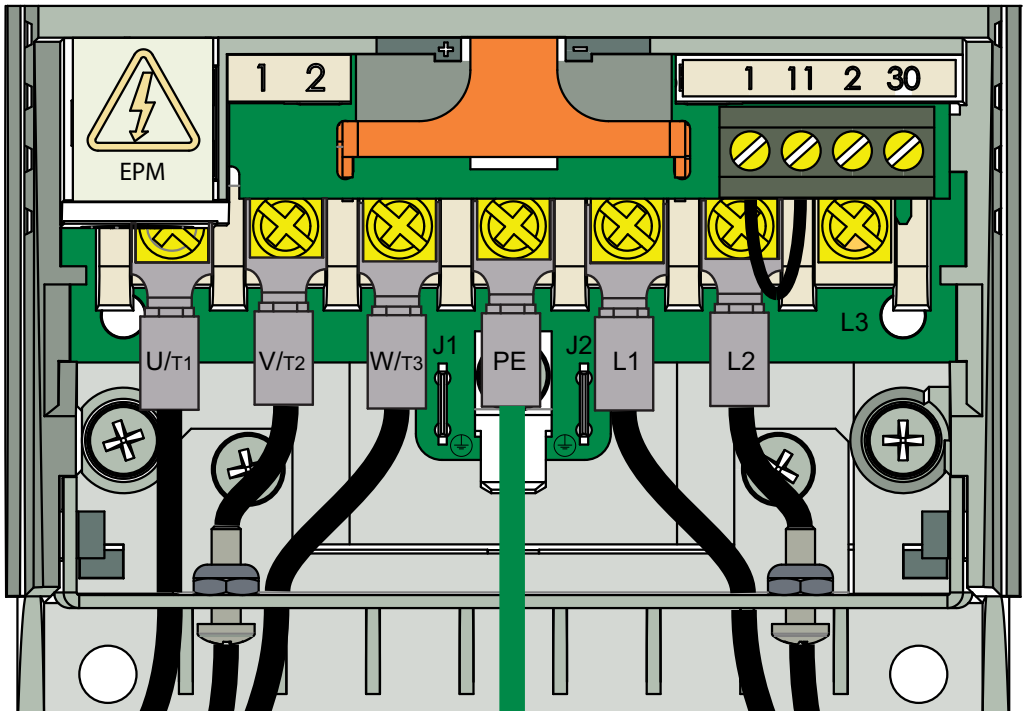
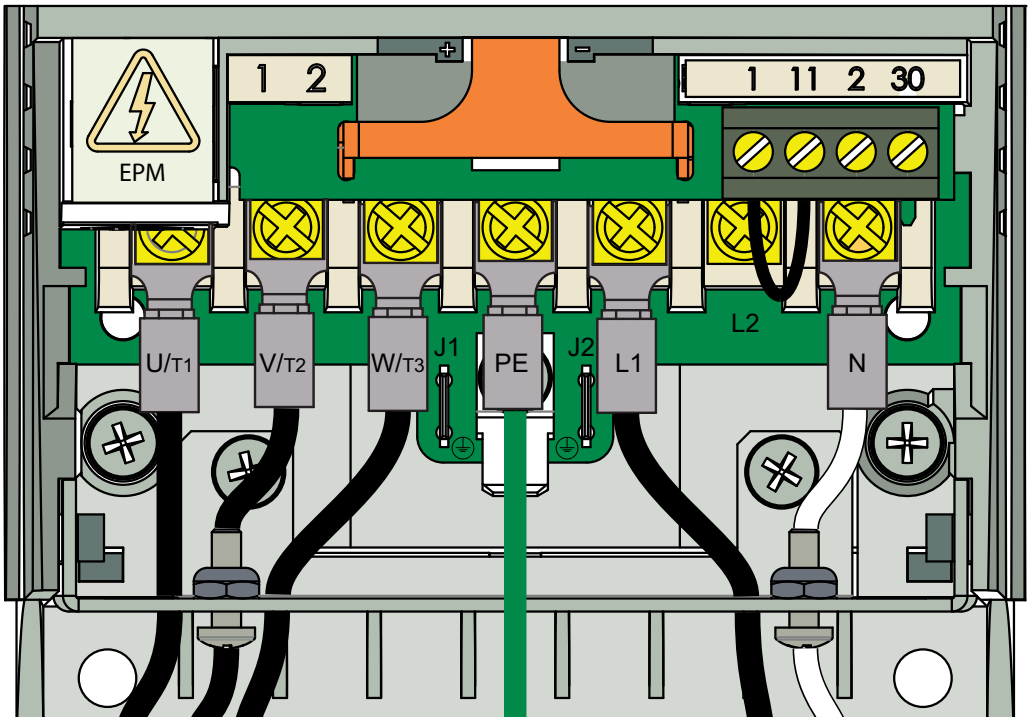


Figure 34 - VFD Wiring (120 Volt Single-Phase)



Variable Frequency Drive (VFD)

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

Consult the VFD manual and all documentation shipped with the unit for proper installation and wiring of the VFD. The VFD has been programmed by the factory with ordered specific parameters. Use **Table 5** as a guide during installation.

Table 5 - VFD Installation Check List

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

VFD Installation

Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage. Refer to **“ACTECH SMV VFD” on page 42**. 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.

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

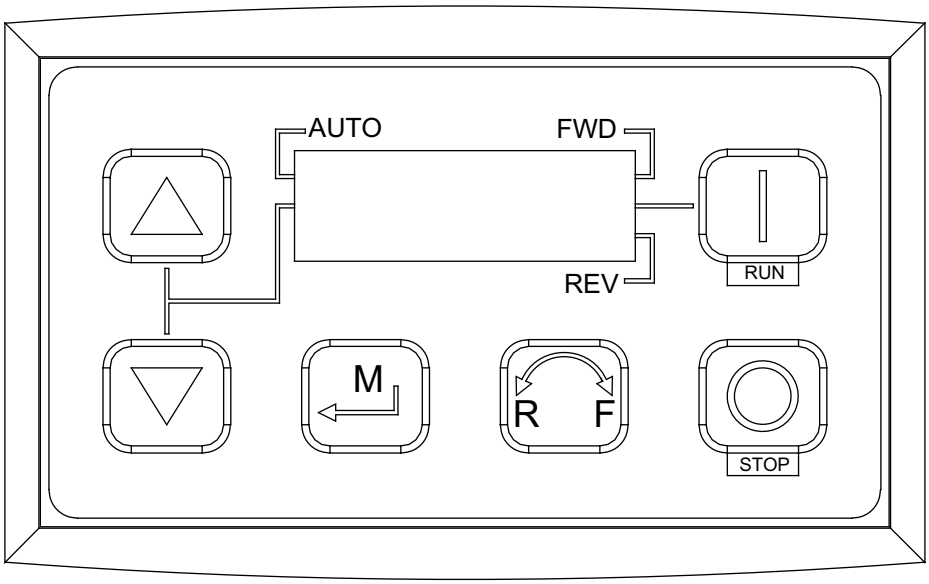
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (refer to **“ACTECH SMV VFD” on page 42**).

To enter the PROGRAM mode to access the parameters:

1. Use the buttons on the VFD screen (**Figure 35**) 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 35 - VFD Screen



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

ACTECH SMV VFD

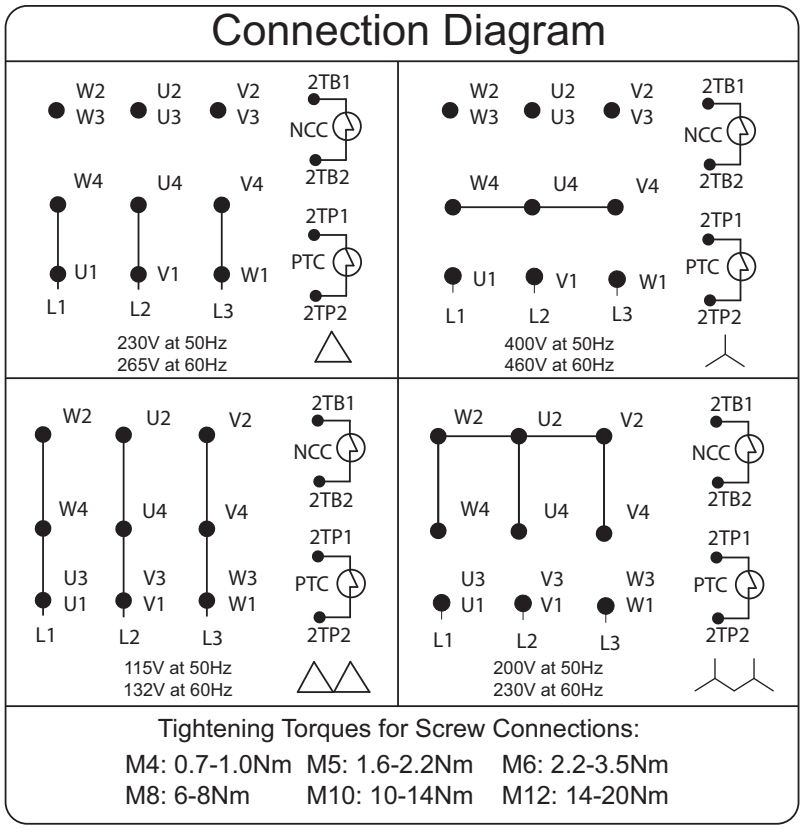
Table 6 - Cross Reference Table

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 36 - Motor Wiring Diagrams



Low Voltage Wiring

Low voltage field wiring consists of Room Temperature sensors, 24VDC input/outputs, or Modbus communication over Cat 5 cables for displays and remote equipment. Low voltage wiring must be run on the left-hand side of the enclosure and directly terminated on the terminals located on the ECPM03 board.

NOTE: Maximum distance on any low voltage wire is 1000 feet.

NOTE: Use a Cat 5 cable tester to verify that the Cat 5 cable is good. Testing the cable before installing will eliminate possible communication issues due to faulty Cat 5 cable or ends.

WARNING: Low Voltage Wires Should Never Be Run Together With High Voltage Wires.

1. **Room temperature sensor(s)**: 1 or more room temperature sensors may be used to sense room temperature or average room temperature. Room temperature sensors must be installed in a safe location, free of influence from external heat sources. It should be indicative of the average room temperature and located away from heat-producing appliances, HVAC supply, or direct sunlight. 2-wire 18 AWG thermistor cable must be used. The room temperature sensor shall be wired according to the installation wiring schematic, terminals "**T1A**" and "**T1B**" for example.
2. **LCD faceplate (HMI)** is connected to the ECPM03 board through a **Cat 5** cable. The faceplate has two RJ-45 connectors connected together for Modbus. The HMI connects to port J4 or J5 (RJ-45) of the ECPM03 board. The other RJ-45 port of the HMI faceplate will typically be occupied by a RJ-45 end-of-line terminator (Part # EOL120A) or can be used as a connection point for another HMI faceplate.
3. **End-of-line terminators** (Part # EOL120A): Two end-of-line terminators are included in each panel. They are typically plugged in at the factory on J3 and either on port J4 or in the back of the first HMI faceplate. If another faceplate or other equipment should connect to a port occupied by an end-of-line terminator, the resistor shall be removed and placed on the faceplate or equipment that became connected at the end of the Modbus network. A **third end-of-line terminator** will be included with the package if the panel is ordered with 2 or more HMI faceplates. The extra end-of-line terminators will be mounted on the last HMI if it is connected directly to ECPM03 terminal J5. Otherwise, if the HMIs are daisy-chained, the third-end-line terminator should be mounted on J5.
4. **Modbus Communication:** If other pieces of equipment such as an extra VFD are connected to this panel, a Cat 5 cable will also be used to run the Modbus communication between these devices. The cable would be plugged in port J3 of the ECPM03 board. The end-of-line terminators should then be relocated from J3 to the device being added on. **Multiple VFDs on one control must be wired in series using Cat 5 cable. VFDs may be panel mounted or mounted directly onto fans. An end-of-line resistor must be installed at the last VFD to complete the Modbus network.**
5. **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 then connects to J1 on the ECPM03 board via Cat 5 connection.

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 **OFF** or before connecting the fan to power, 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 over amp and fail. Reducing speeds below the minimum operating speed can cause motors to overheat and fail.

There are multiple ways to control fans. All methods require VFDs for 3 phase motor speed controls. Two methods for doing this are; Smart Controls with Control logic to control the VFDs.

Smart Control Functionality

Summary of Fan Control

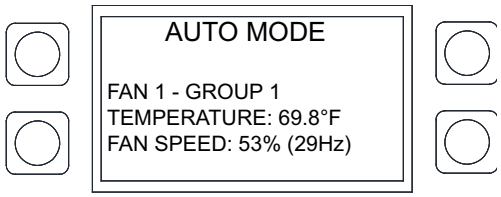
The purpose of the Smart Control System is to offer intelligent control of Sensible Cooling or Destratification fans. Smart Controls offer the ability for the fans to operate **AUTOMATICALLY** based on room temperature and minimum cycle timers, **MANUALLY** based on user input and basic scheduling timers, by a hard wired **BUILDING MANAGEMENT SYSTEM** or through a **DDC (Direct Digital Control)** system. Fans can be controlled individually or assigned to groups to allow one-button control of multiple fans. All fans assigned to a group will follow that command. Also, multiple HMIs can be used to control a single fan or multiple fans. This allows multiple HMIs to be installed in larger buildings or manager's offices to control the operation of fans.

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 32 remote temperature sensors can be wired into the system. They can be assigned to one or more fan groups. In total, up to 42 sensors can be assigned to 1 or more groups (10 from HMIs, 32 from remote sensors).

Automatic Mode

In Automatic 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. This mode is designed to maximize building comfort and to save energy.

Figure 37 - Auto Mode Display



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 or 25°C.
2. The fans will start at low speed (15 Hz 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 or 3°C and is adjustable. In the default case, at 80°F or 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 or 0.5°C. In the default case, below 74°F or 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 38 - Fan Cycle

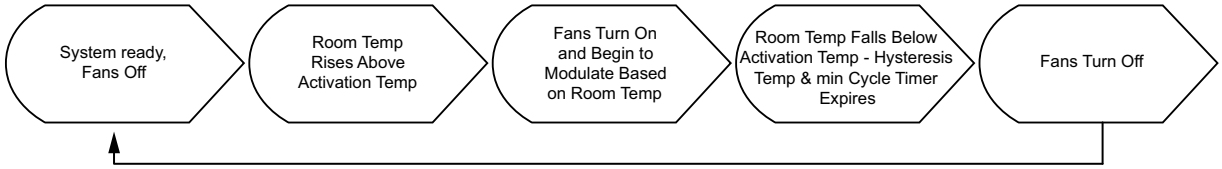


Table 7 - Automatic Mode Operation Summary

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

Configurable Item	Range/Limit
Min Speed	15 Hz to Max
Max Speed	Min Speed to 55 Hz (HVLS)/80 Hz (Vent)
Activation Temperature	40-100°F (5.5-38°C)
Modulation Band	1-15°F (0.5-7°C)
Hysteresis Temperature	0.5-20°F (0.5-11°C)
Min Cycle Timer	1-60 Minutes
Temperature Units	°F/°C

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 Alarms.

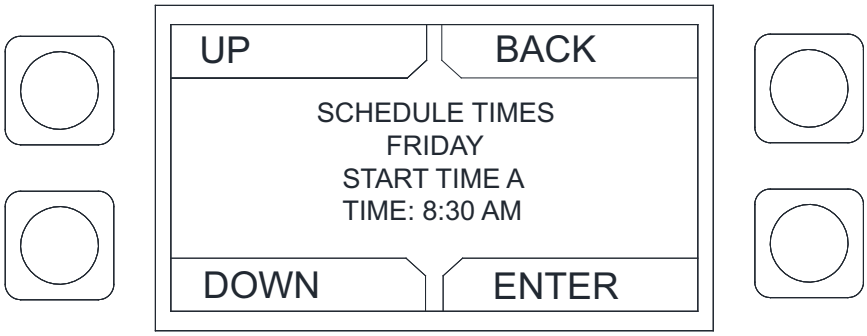
Scheduling

ECPM03 board (*CONFIGURATION* > *SCHEDULING* > *ENABLE*). When scheduling is active and a fan group is in auto mode, fan speed will be controlled according to temperature and the group will run only during the occupied time periods to which it has been assigned.

OPERATING INFO > *SCHEDULING*> *SET SCHEDULE TIMES* defines two occupied time periods per day (Period A and Period B), for the seven days of the week. Time Period “A” must come before Period B and cannot overlap with Period “B.”

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

Figure 39 - Scheduling Display



Manual Mode

In MANUAL mode, the operator can choose to start, stop, speed up, slow down, or reverse. Reverse for HVLS only the direction of fans from an HMI (Human Machine Interface). Fan faults and operating information can be viewed from any HMI as well. The chart below shows all controllable items, monitoring points, and configurable items in manual mode. Also available in Manual Mode are timing functions. Time to AUTO will automatically switch the control from Manual to Auto Mode after the timer expires. TIME TO OFF will automatically turn the Fans OFF after the timer expires. When the timer is set to “NONE,” the timer is completely disabled. The timers are reset if the fan is turned from OFF to ON.

Figure 40 - Manual Mode HVLS Display

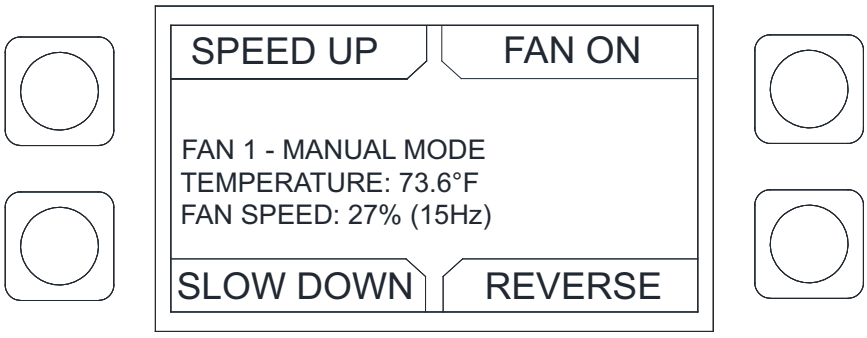


Table 8 - Manual Mode Operation Summary

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
Min Speed	15 Hz to Max
Max Speed	Min Speed to 55 Hz (HVLS)/80 Hz (Vent)
Timer Mode	Auto/Off/None
Timer Setting	1 to 18 Hours
Temperature Units	°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.

Start-up Procedure

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

Start-up Procedure - Fans

1. Check all electrical connections are secure and tight.
2. Inspect the blades and air-stream for obstructions.
3. Compare the supplied **voltage** with the fan's nameplate voltage. If this does not match, correct the problem.
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. Start the fan up by turning the external disconnect/control to the **ON** position. Shut it **OFF** immediately to **check rotation of the fan**. Normal direction should be counter-clockwise as viewed from below the fan. For 3-phase motors, any two power leads can be interchanged to reverse motor direction. Some control packages allow for fan rotation reversal.
6. When the fan is started up, observe the operation and check for any unusual noises.
7. Switch the external disconnect back to the **ON** position.
8. Measure and record the **voltage** and **amperage** to the motor and compare with the motor nameplate to determine if the motor is operating under safe load condition.

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 is no alarm message 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. The HMI has 3 main modes: AUTO mode, Manual Mode, and Building Management Mode. 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.

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

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.

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

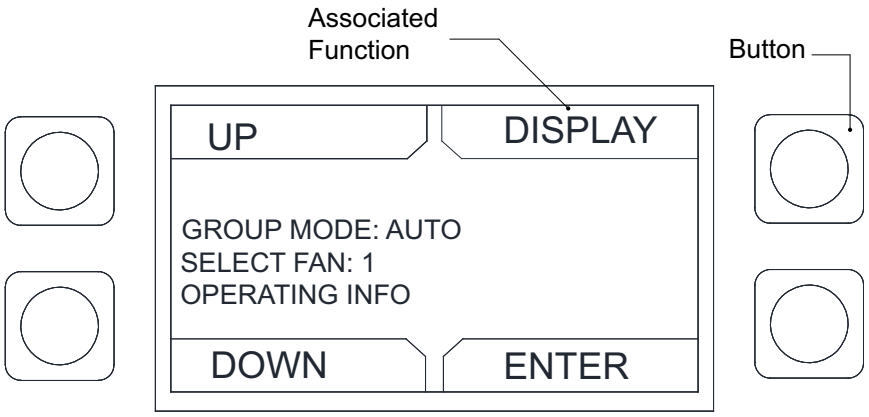
When a fault occurs, an audible alarm is triggered and a message is displayed on the HMI(s). The Audible Alarm can be silenced by pushing the **Mute** button that appears on the screen.

At any point in time, the control can be changed from Manual to Auto mode and vice versa. This is achieved by simultaneously pressing both top buttons and holding them for 1 second. When this occurs, the screen will look similar to the image to the right.

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 41 - 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. This will activate every fan in the fan group. Multiple fans may be assigned to 1 fan group. By pressing the FANS ON button, all fans in that group will startup. Fan Group assignment will be discussed later in this manual.
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 % 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 in several different ways. First, the amperage can be measured directly with an amperage meter. Second, the amperage can be read off of each VFD using parameter P508 on the VFD itself. Lastly, the HMI can display the amperage, as well as other operating information. This is done by:
    - Holding the top two buttons and entering the Main Configuration Screen.
    - Use the UP and DOWN buttons to highlight the SELECT FAN line. Press ENTER
    - Use the UP and DOWN buttons to select the desired fan and then press SEL. FAN.
    - Once back into the Main Configuration Screen, Select OPERATING INFO and press ENTER.
    - This will show all of the current operating info for the selected fan, including real-time POWER, CURRENT, SPEED, MOTOR VOLTAGE, % LOAD, RUN TIME, and VFD TEMPERATURE.
    - Once the high-speed data is recorded for each fan, press the BACK button to return to the Main Configuration Screen.
    - Another fan can be selected at this point or the DISPLAY button can be pressed to go back into the Operating Screen.
    - To turn the fans off, press the highlighted FANS OFF button at any time.

Table 9 - 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.

Automatic Mode Startup

During Automatic 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 AUTOMATIC 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 10** to record all initial startup data. Keep data for troubleshooting when necessary.

Table 10 - 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										
Minimum Frequency										
Rotation Correct										
Number of Fans in Group										
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.

HMI Configuration

General Overview

The HMI allows the user to change between Manual Mode and Auto Mode as well as view Operating Information regarding fans, Fan Group Assignments, HMI sensor group assignments, External sensor assignments, sensor temperatures, and Fault History.

At any point in time, the user can access the HMI configuration screen. This is achieved by simultaneously pressing both top buttons and holding them for 1 second. When this occurs, the screen will look similar to the image to the right. To exit this screen, simply press the DISPLAY button.

Also, during initial HMI configuration, each HMI must have a unique Modbus address or HMI number. To assign this, simultaneously press both bottom buttons and hold them for 1 second. When this occurs, the user will be able to assign an HMI number to the HMI. Once the HMI number is assigned, press the SAVE button to exit the screen.

When a fault occurs in the system, 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.

The HMI menu system is illustrated on **page 54** and allows full access to every configurable parameter in the HMI. The parameters are factory configured to the specific application. Parameters may need to be modified to fine-tune automatic operation or to add an HMI or fan to a system after the original setup.

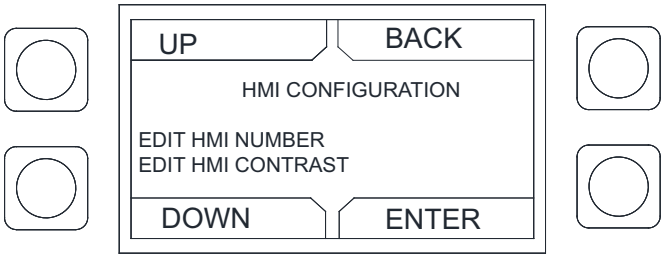
Editing HMI Number and Contrast

To set the HMI number or to adjust the screen contrast, press the bottom two buttons simultaneously on the HMI faceplate. Use the UP and Down buttons to select the parameter that will be adjusted. Press Enter to select the highlighted parameter.

Setting the HMI number configures the Modbus address for that HMI.

The user may adjust the contrast setting from 0 to 10. Setting the contrast to 0 is the lowest setting available, 10 is the highest contrast setting available. The factory default contrast setting is 5.

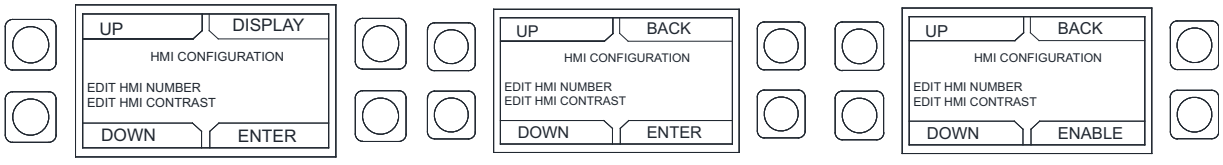
Figure 42 - HMI Number and Contrast



Input Simulation

Input simulation allows the user to test the fans *(Configuration > Advanced Options > Input Simulation).* This will allow the user to enable the 0-10V signal test. You may adjust the voltage signal range from low (0V) to high (10V).

Figure 43 - Input Simulation



HMI Configuration Details

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

Group Mode: This menu defines mode of operation of the fan group. If any fan in a group is changed from one mode to another, all fans in that group will follow the mode change.

Select Fan: This menu defines the fan information that will be displayed in the running data menu. It also selects the fan to modify modes. Reminder, if a selected fan is part of a fan group that has other fans in it and the mode of operation is changed, all other fans in that group will follow the mode change.

Operating Information: Operating information shows current information about the selected fan, all component assignments, fault history, and active sensor readings.

- **Running Data**: Shows information about the selected fan. This can be useful for monitoring or troubleshooting a fan.
  - Fan Power (KW) shows how much energy the selected fan is consuming.
  - Fan Current (Amps) shows the amperage that the selected fan is using.
  - Fan Speed (Hz) shows the VFD output frequency to the selected fan.
  - Motor Voltage (Volts) shows the output VFD voltage to the selected fan motor.
  - VFD Load (%) shows what % of the output VFD power is being utilized by the selected fan.
  - Total Runtime (Hours) shows the total number of hours of runtime of the selected fan.
  - VFD Temperature (°F or °C) shows the selected fan VFD heat sink temperature.
- **Sensor Assignments**: Shows the fan group that all external sensors on the system are linked to.
- **Fan Assignments**: Shows the fan group that all fans on the system are linked to.
- **HMI Sensor Assignments**: Shows the fan group that all HMI sensors on the system are linked to.
- **Fault History**: Shows the most recent faults in the system for troubleshooting.
- **External Sensor Readings**: Shows the temperature input for all external sensors on the system.
- **HMI Sensor Readings**: Shows the temperature input for all HMI sensors on the system.
- **Maintenance Log/Maintenance History (HVLS only)**: Allows the user to view all logged maintenance events.
- **Maintenance Log/Log Maintenance Event (HVLS only)**: Allows the user to log individual maintenance events performed on the fan or fan controls.
- **Scheduling/Assign Occupancy**: Fan groups can be assigned to occupied Period A and/or Period B for each day of the week.
- **Scheduling/Set Schedule Times**: The beginning and end of occupied Period A and Period B can be set for each day of the week.

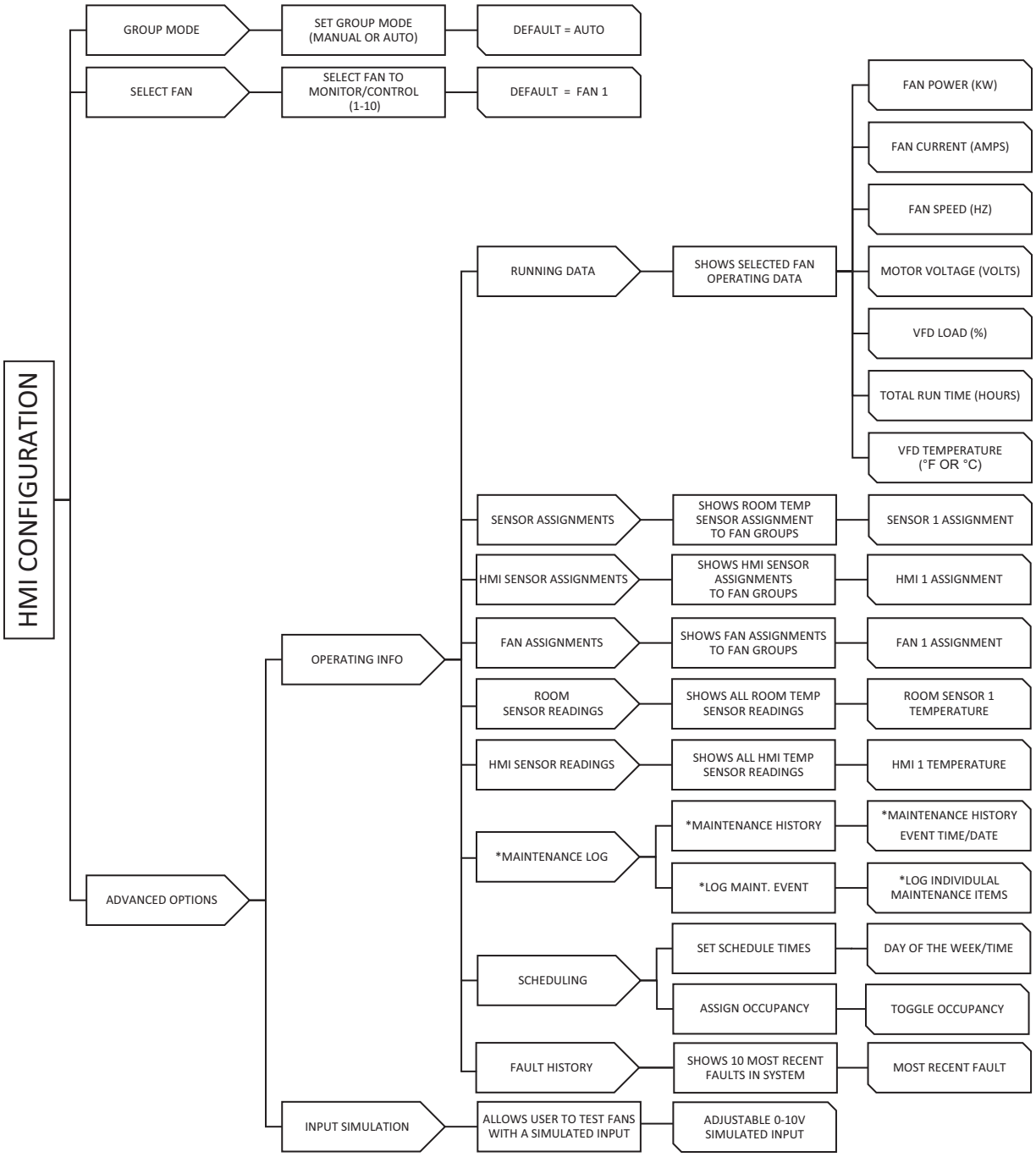
HMI Menu System Overview

This chart shows the menu system of the HMI. Press the two top buttons of the HMI to enter this menu system.

NOTE: Each HMI must have its own unique number or address. Failure to set this up correctly will result in a Modbus communication error in the system. Press the two bottom buttons of the HMI to access the HMI address or number.

HMI Menu Tree

NOTE: Parameters marked with an (*) are not applicable to general ventilation fans.



ECPM03 Configuration

General Overview

The ECPM03 board allows the user to configure functionality of the system through the setup menus on its LCD as shown to the right. Below the ECPM03 LCD are 4 buttons for navigation: MENU, UP, DOWN, ENTER.

The MENU button typically takes you up one level in the menu tree while the ENTER button takes you down one level. UP and DOWN navigate through the same level of the menu tree and also allow the user to change the value of a parameter.

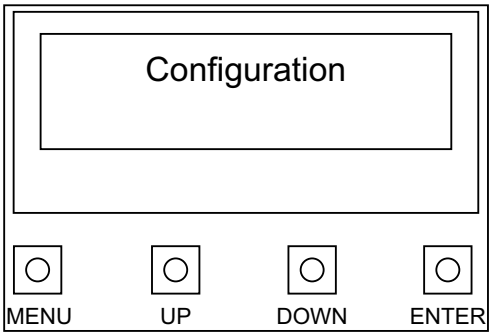
After changing some parameters in the configuration menus, the user needs to press MENU multiple times until the screen displays the message “Saved. Press any Key to Reboot.” As indicated, the processor will reboot after any key is pressed. This allows the board to correctly process the parameters changed.

Access the Configuration menu:

1. Starting from the Main menu, which shows HVLS and the software revision, press the MENU button. Screen displays “Configuration.” Press the ENTER button. Screen displays “Enter Pass Code.”
2. **Use passcode 1111 to access the Configuration menu**.
3. Use the Up button to change the first 0 to 1 and then press the ENTER button. Use the Up button to change the second 0 to 1 and then press the ENTER button. Repeat this for the third and fourth 0.
4. If “Wrong Pass Code Enter Again” is displayed, press the ENTER button to try again.
5. Once the correct passcode is entered in, access to change operating parameters is granted.

The menu system allows full access to every configurable parameter in the control system. The parameters are factory configured to the specific application. Parameters may need to be modified to fine-tune automatic operation or to add a sensor, HMI, or fan to a system after the original setup. After changing the desired parameters, press MENU multiple times to get back to the main menu and one more time to reboot the processor after seeing “Saved. Press any Key to Reboot.”

Figure 44 - ECPM03 Configuration Screen



Product Mode

The Product Mode menu allows the user to set the fan configuration between HVLS or General Ventilation Fan software settings. Software settings vary between HVLS and General Ventilation Fans. Always verify that the software system is set for the correct fan. Refer to the menu system is illustrated on **page 59**.

ECPM03 Menu System Overview

NOTE: The activation temp, high temp alarm, and low temp alarm are programmed not to overlap each other. Ranges shown will be limited by activation temperature, modulation bands, and hysteresis settings.

ECPM03 Configuration Details

Following is a detailed list of all configurable parameters in the system.

Number of Fans: This menu defines the **total** number of fans controlled by a single fan control system. It also corresponds directly to the number of VFDs controlled by one ECPM03 circuit board. This includes all fans in all groups.

Number of Groups: This menu defines the **total** number of fan groups controlled by a single fan control system. A fan group can consist of 1 fan or up to 10 fans.

Number of HMIs: This menu defines the **total** number of HMI faceplates connected to a single control system. Each HMI has an internal sensor that can be used to sense room temperature. Any fan or fan group can be controlled from any or all HMIs.

BMS Fan Settings: This menu allows specific speed set-points for all fans when operating in the low voltage BMS mode. When a dry contact closes ECPM03 terminal IL1A to IL1B, all fans will go to their defined BMS speed. The BMS mode speeds are limited by the VFD minimum and maximum speeds defined under GROUP Settings. **Note: The high voltage BMS interlock, H1 to IO1, will override the low voltage BMS interlock. The high voltage interlock will set fans to their maximum VFD speed**.

Fans: This menu allows Fans to be assigned to Fan Groups. All fans assigned to a fan group will function identically. They will start, stop, increase speed, and decrease speed altogether. The BMS interlock will override fan group operation and set fans to the BMS Fan Setting individual speeds.

Number of External Temperature Sensors: This menu defines the **total** number of External 10k Thermistor Temperature sensors connected to a single control system. Each external temperature sensor can be used to sense room temperature or average room temperature in a group. Any temperature sensor can be assigned to one or all fan groups.

Assign External Temperature Sensors: This menu allows External Temperature Sensors to be assigned to Fan Groups. Sensors can be assigned to 1 fan group or all fan groups. Each sensor that is assigned to a fan group is averaged with other sensors assigned to that same fan group. The average temperature is used for all activation and modulation of fans.

Assign HMI Temperature Sensors: This menu allows HMI Temperature Sensors to be assigned to Fan Groups. Sensors can be assigned to 1 fan group or all fan groups. Each sensor that is assigned to a fan group is averaged with other sensors assigned to that same fan group. The average temperature is used for all activation and modulation of fans.

Timer Settings: Timer settings can be applied to individual fan groups. There are three timer modes; (1) No Timer, (2) Time to Automatic Mode, and (3) Time to Off. When No Timer is selected, this option is disabled. When Time to Automatic Mode is selected for a fan group, the fan group will switch from a Manual mode of operation to an Automatic Mode of operation after the timer expires. When Time to Off Mode is selected for a fan group, the fan group will switch from a Manual mode of operation to Off after the timer expires.

Group Settings: These settings define the action of all fans linked to a specific group. All fans linked to the same group will start, modulate and stop together.

- **Activation Temperature**: The temperature at which fans will automatically turn on when the fan group is set to AUTO mode. When the room temperature rises above the activation temperature, all VFDs in the group will activate.
- **Modulation Band**: Once the fan group activates by the Activation Temperature, fans will modulate from low to high speed within the modulation band. Low speed occurs when the room temperature is equal to the Activation Temperature. High speed occurs when the room temperature is equal to Activation Temperature + Modulation Band. Fan speed is linear along the modulation band.
- **Hysteresis**: As the room temperature decreases below the activation temperature set-point, the fans will continue to operate at their minimum speed until the temperature falls below the HYSTERESIS temperature. Fans will run on low speed until the room temperature falls below (activation temp – hysteresis temp). The fans will stop and will stay off until the temperature rises back above the activation temperature.
- **Minimum Cycle Time**: The MINIMUM cycle timer is in the system to help prevent frequent fan cycling. Once the fans start, the fans will run for at least this amount of time before turning back off. Once fans automatically activate, the room temperature must fall below Activation Temperature - Hysteresis band and run for the minimum cycle time to automatically shut off.
- **Maximum VFD Frequency**: The Maximum VFD Frequency is the maximum speed the fans will operate in Manual, Auto, and BMS modes. It defines the upper limit speed for fans to protect fan motors from experiencing an over-amperage situation.
- **Minimum VFD Frequency**: The Minimum VFD Frequency is the minimum speed the fans will operate in Manual, Auto, and BMS modes. It defines the lower limit speed for fans to protect fan motors from experiencing an overheating situation.
- **High-Temperature Alarm**: The High Temperature Alarm is the Room Temperature that will cause fans to shut down in an emergency. If any sensor linked to a fan group sees a temperature equal to or higher than the High Temperature Alarm, that sensor will cause all fans in that fan group to stop.
- **Low-Temperature Alarm**: The Low Temperature Alarm is the Room Temperature that will cause fans to shut down in an emergency. If any sensor linked to a fan group sees a temperature equal to or less than the Low Temperature Alarm, that sensor will cause all fans in that fan group to stop.
- **Reverse Temp (HVLS only)**: If the temperature falls below this value, the fan will run in reverse at the ‘Rev. VFD Freq’.
- **Rev. Hysteresis (HVLS only)**: If the temperature goes above reverse temp + hysteresis, then the fan will no longer operate in reverse mode as long as the min cycle time has expired.
- **Rev. VFD Freq. (HVLS only)**: This is the speed at which the fan will run when activated in reverse mode.

Temperature Unit Select: Use this menu to change the units of temperature from degrees F to degrees C. This changes all activation, hysteresis, modulation band, high temp limit and low temp limit ranges, and default values. Also, all monitored temperature units are changed. When this setting is changed, all temperatures are reset to default settings and configuration of all temperatures must be manually reset.

Fan Direction: The direction of rotation of three-phase fans can be switched by this parameter. Changing from Forward to reverse will change the default rotation of each individual fan. This will help align all fans to the proper rotation orientation for use with the HMI. It also allows fan rotation change without re-wiring the output of the Variable Frequency Drives.

Set HMI Dimming: The back-light on the HMI LCD display can be configured to automatically dim. With this option off, the HMI stays illuminated all of the time. With this option on, the HMI back-light will automatically dim after a configurable time after the last button press. The HMI will illuminate automatically when any button is pressed.

Set Dim Delay Time: When the HMI is configured to dim automatically, this parameter sets the amount of time that the HMI back-light will stay on after the last button press.

System Bypass: The system bypass mode allows some limited control of fans in the event of an HMI failure or disconnect. Turning system bypass to ON will force all fans to their predefined BMS speed until system bypass is turned back off. The system bypass will override the BMS, Auto, or Manual mode operation.

Set Modbus Address: The Set Modbus Address value allows the user to set a specific network address for the controller. This makes it possible for multiple controllers to be recognized on a single network.

Product Mode: Allows the user to set the software between HVLS or General Ventilation Fan configurations.

DDC Mode: The DDC Mode menu allows the controller to receive commands from a Direct Digital Network such as BACNET, Lonworks, or CASlink. These specific commands are outlined in the DDC section of this manual. Examples of remote commands are controlling the on/off state of the fan and monitoring fan operating conditions. When DDC is enabled, control of the fans from the HMI is disabled.

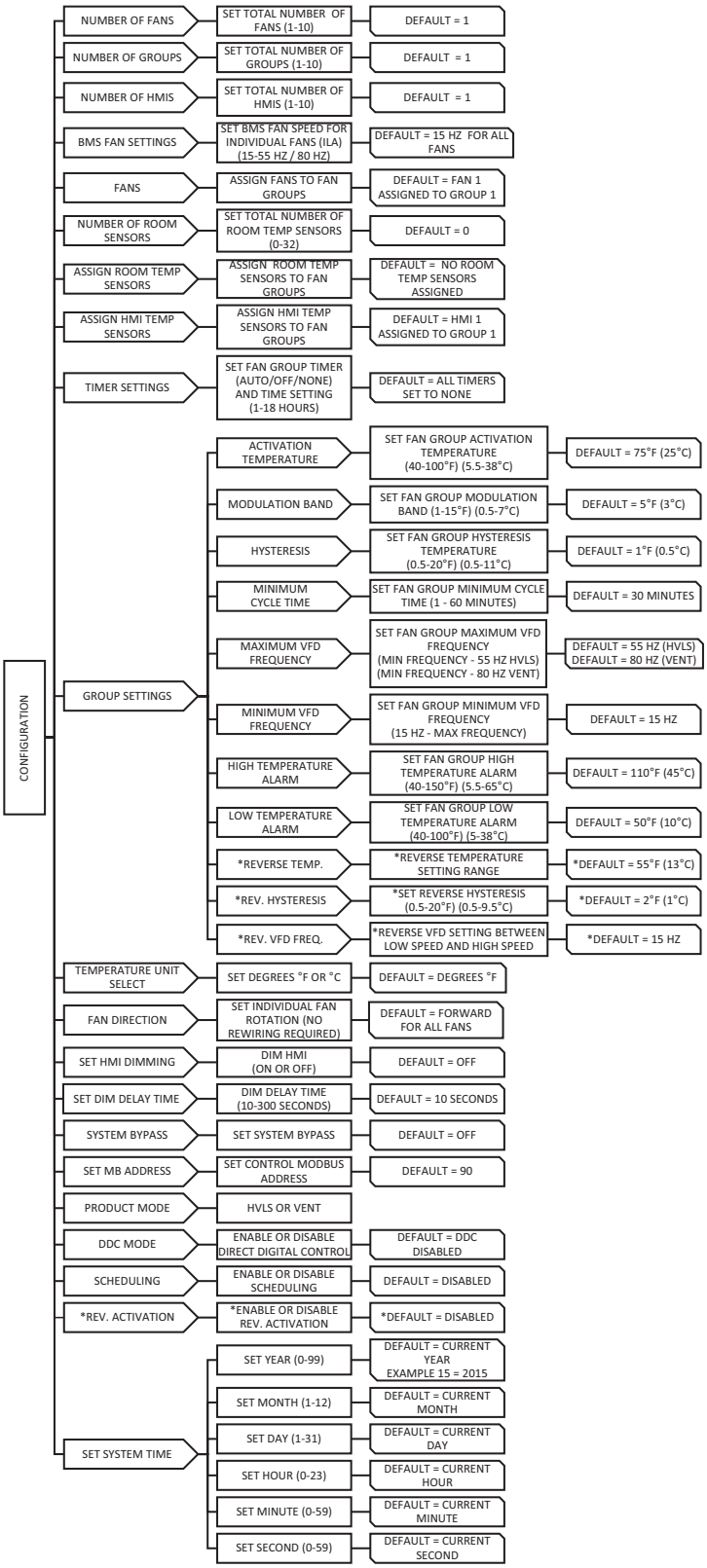
Scheduling: Scheduling allows for fan groups to follow a 7-Day occupied and unoccupied schedule. Each day can have up to 2 occupied times. If scheduling is enabled, the scheduling menus become available on the HMI. Scheduling works in AUTO mode only, and fans will operate based on temperature only during scheduled times.

Rev. Activation (HVLS only): Allows the fan to automatically run in reverse when the temperature is below the set reverse activation temperature range. The fan will not shut off until the temperature rises above the set range (reverse temperature + reverse hysteresis).

Set System Time: Allows the user to set the current system date and time. Year, Month, Day, Hour, Minute, and Seconds can be configured.

ECPM03 Menu Tree

NOTE: Parameters marked with an (*) are not applicable to general ventilation fans.

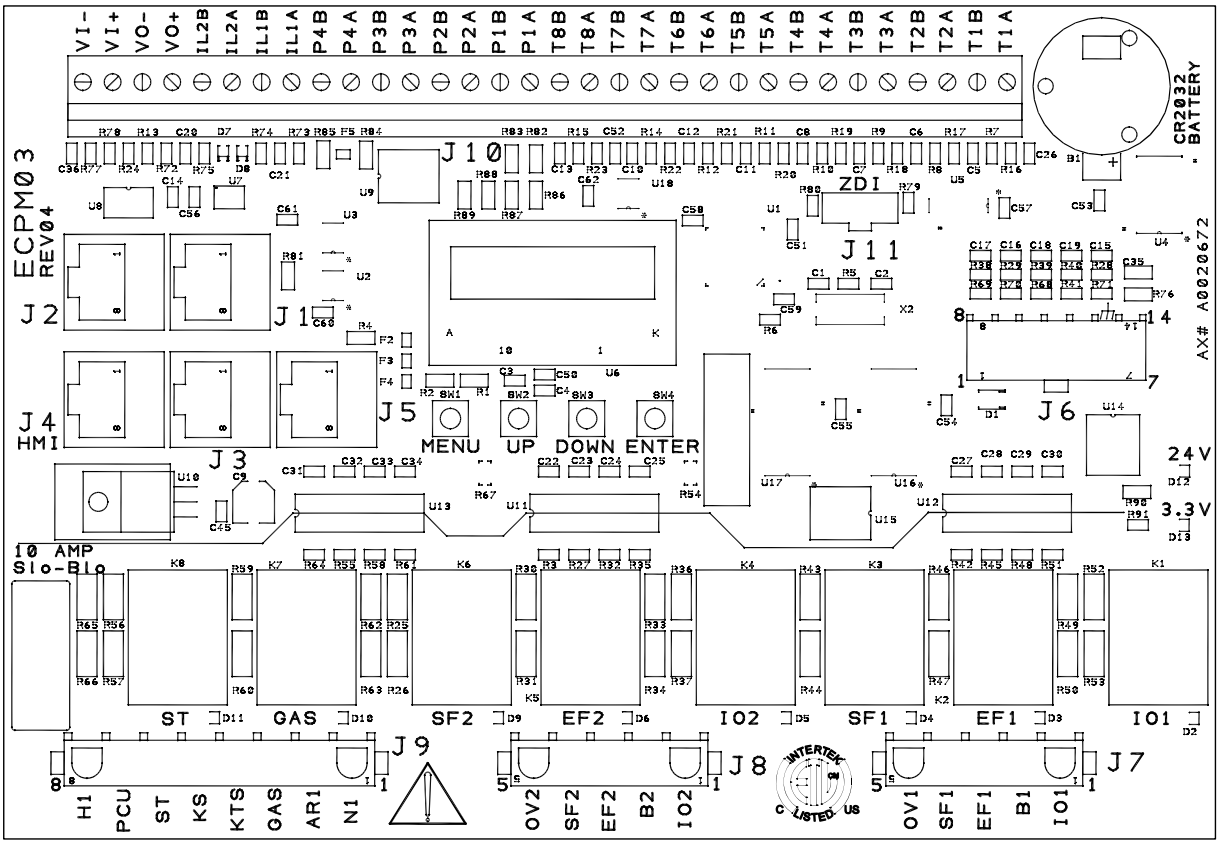


ECPM03 Board

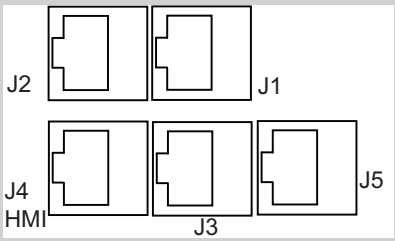
ECPM03 is the main control of the system. It receives all of the digital and analog inputs, and delivers all digital outputs for external devices.

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

Connector Descriptions



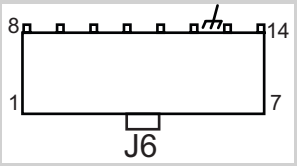
RJ45 Connectors



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, PCUAFM, HMI, and VFDs report through J3, J4 and J5. The order of connection is irrelevant.

Connector J6 contains factory only wiring for low voltage connections



Pin 1 - **24V DC** power input (positive side) to the board.

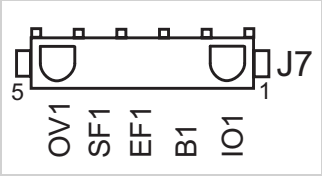
Pin 2 through pin 7 - Each open collector relay output (RO) sources **100 mA** max and is suitable for driving **24V DC** relays or indicator lamps.

Pin 8 through pin 12 - **4-20 mA** current inputs. 150 Ohm impedance to **24V DC** ground pin 14.

Pin 13 - Chassis ground connection, this pin connects to the **24V DC** ground through a paralleled 1000pf **2000V** capacitor and a 100k Ohm 1/4W resistor.

Pin 14 - **24V DC** power input (negative side) to the board. Ground or common side of the low voltage circuitry.

Connector J7 contains **120V AC** control connector for factory only wiring



Pin 1 - (IO1) output and input, this pin can source **120V AC** and detect the presence of **120V AC**.

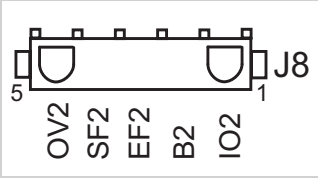
Pin 2 - (B1) input, this pin can detect the presence of **120V AC**.

Pin 3 - (EF1) output and input, this pin can source **120V AC** and detect the presence of **120V AC**.

Pin 4 - (SF1) output, this pin can source **120V AC**.

Pin 5 - (OV1) input, this pin can detect the presence of **120V AC**.

Connector J8 contains **120V AC** control connector for factory wiring



Pin 1 - (IO2) output and input, this pin can source **120V AC** and detect the presence of **120V AC.**

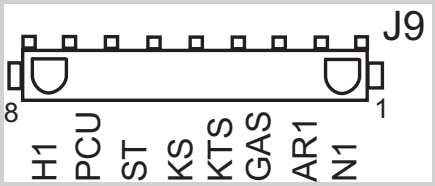
Pin 2 - (B2) input, this pin can detect the presence of **120V AC.**

Pin 3 - (EF2) output and input, this pin can source **120V AC** and detect the presence of **120V AC.**

Pin 4 - (SF2) output, this pin can source **120V AC.**

Pin 5 - (OV2) input, this pin can detect the presence of **120V AC.**

Connector J9 contains **120V AC** control connector for factory only wiring



Pin 1 - (N1) this is the neutral or return path for the detection of **120V AC** by the input pins. It would be connected to the neutral side of the **120V AC** supply.

Pin 2 - (AR1) input, this pin can detect the presence of **120V AC.**

Pin 3 - (GAS) output, this pin can source **120V AC.**

Pin 4 - (KTS) input, this pin can detect the presence of **120V AC.**

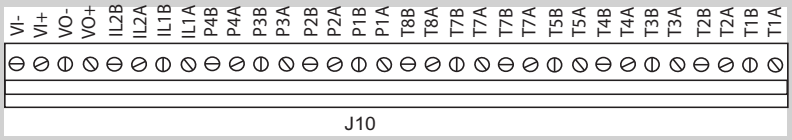
Pin 5 - (KS) output, this pin can source **120V AC.**

Pin 6 - (ST) output, this pin can source **120V AC.**

Pin 7 - (PCU) input, this pin can detect the presence of **120V AC.**

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 **120V AC** to all the pins described as **120V AC** outputs. The total current draw of all the **120V AC** outputs must not exceed 10 Amps.

Connector J10 contains low voltage field wiring connections



Pin 1 through pin 16 - thermistor probe inputs. 10k type B thermistors are connected to these inputs.

Pin 17, 19, 21, 23, 25, and 27 - sources **24V DC** which is current limited through an onboard **200 mA** PTC Poly-Fuse. This is the high side of the pulse with modulated outputs, and low voltage inputs listed below.

Pin 18, 20, 22, and 24 - Open collector PWM outputs, **100 mA** max each. Suitable for driving the optoisolated PWM speed control inputs of EC motors.

Pin 26, 28 - low voltage inputs, suitable for detecting dry contact closures with pins 25, 27 above.

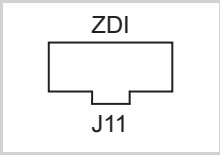
Pin 29 - **0-10V DC** output, **5 mA** max, suitable for driving instrumentation inputs.

Pin 30 - negative, common or ground side of the above **0-10V DC** output.

Pin 31 - **0-10V DC** input, 10k Ohm impedance to ground or common.

Pin 32 - negative, common or ground side of the above **0-10V DC** output.

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

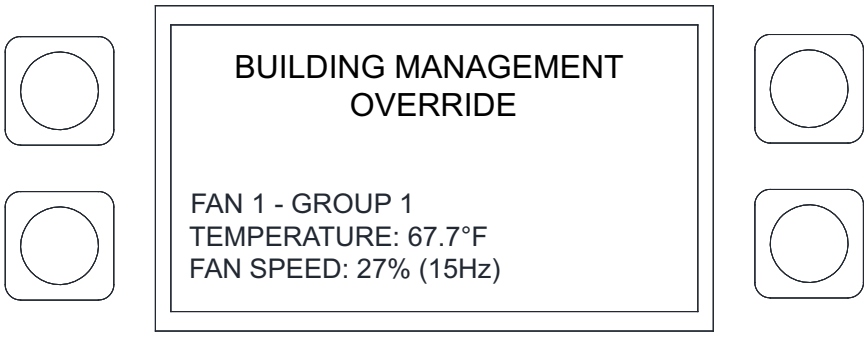
Pin 5 - Gnd

Pin 6 - NC

Building Management System

All controls are equipped with the ability to control the fans via a dry contact BMS interlock. There are two interlocks available: IL1 is for low voltage (**24V DC**), and IO1 is for high voltage (**120V AC**). The two interlocks will force the fans to different speeds. The low voltage interlock will force the fans to operate at the low voltage BMS speed. The high voltage interlock will force the fans to operate at the maximum VFD frequency. If both interlocks are used at the same time, the high voltage interlock takes precedence, and fans will go to their maximum defined speeds. Either BMS interlock will override both Auto and/or Manual mode.

Figure 45 - BMS Mode Display



Emergency Shutdown Interlock

On the ECPM03 circuit board, near the top left of the board, there are terminals IL2A and IL2B. Closing a dry contact between these two terminals will stop all fans, sound an alarm, and display EMERGENCY SHUTDOWN on the HMI. The audible alarm can be temporarily muted with the MUTE button. This is a 24V DC signal that is designed to be used in conjunction with a Building Fire Alarm panel or similar. Once the contact is opened up between these two terminals, a manual reset is required to exit the emergency mode. Pressing the CLEAR button will force the HVLS control to enter the mode that it was in previous to the Emergency mode. Emergency Shutdown is the highest priority command. It supersedes all other modes, including, System Bypass, BMS mode, auto mode, and manual mode. Priorities are:

1. Emergency Shutdown (Highest Priority)
2. System Bypass
3. BMS (Building Management System) Mode
4. DDC (Direct Digital Control) Mode

Manual/Auto Mode from HMI (Lowest Priority)

Low Voltage BMS Interlock

On the ECPM03 circuit board, near the top left of the board, there are terminals IL1A and IL1B. Closing a dry contact between these two terminals will turn the fans on and bring all fans to a defined BMS speed. When a 0-10V DC signal is detected by pin VIN, located on the ECPM03 circuit board, all fans will modulate between the low voltage and the high voltage speed based on input voltage. The BMS speed is defined for each fan on the ECPM03 board, which will be discussed later in this manual. Once the contact is opened up between these two terminals, the HVLS control will enter the mode that it was in previous to BMS mode.

High Voltage BMS Interlock

There is a high voltage set of terminal blocks inside the enclosure. These blocks are labeled IO1 and H1. The high voltage BMS interlock should be energized by closing a dry contact placed between terminals H1 and IO1. When this occurs for HVLS applications, the fan(s) will run at the maximum defined VFD speed until the contact is opened up. Once the contact is opened up between these two terminals, the HVLS control will enter the mode that it was in previous to BMS mode. When this occurs for General Ventilation Fan applications (during a fire signal), the fan(s) will run at their maximum defined VFD speed until the contact is opened up. Once the contact is opened up between these two terminals, the General Ventilation Fan control will enter the mode that it was in previous to BMS mode.

Table 11 - Automatic Mode Operation Summary

Monitoring Points	Units	Configurable Item	Range/Limit
Power	Kw	Low Voltage Speed	BMS Fan Speed
Current	Amps	High Voltage Speed	Max VFD Speed
Speed	Hz	Temperature Units	°F/°C
Motor Voltage	Volts		
% Load	%		
Run Time	Hours		
VFD Temp	°F/°C		

Network

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

Communication Module (Optional)

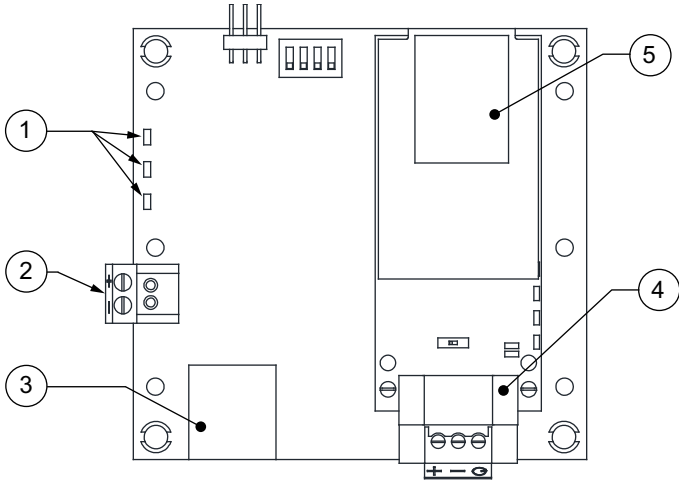
The Communication Module, PN: **SCADA**, is included in all CASlink equipped panels. It obtains operational data from various connected components. This communication wiring is either RS-485 shielded twisted pair wiring or RJ45 Cat 5 Ethernet wiring.

BACnet

BACnet IP or BACnet MS/TP (**Figure 46**) compatibility can be implemented with this package through a Protocessor, 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 Protocessor 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 Protocessor 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 46 - BACnet



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

Device Instance, MAC Address, Baud Rate

Some applications may require that the Protocessor 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 Protocessor. The computer used must be assigned a static IP address of 192.168.1.xxx and a subnet mask of 255.255.255.0.

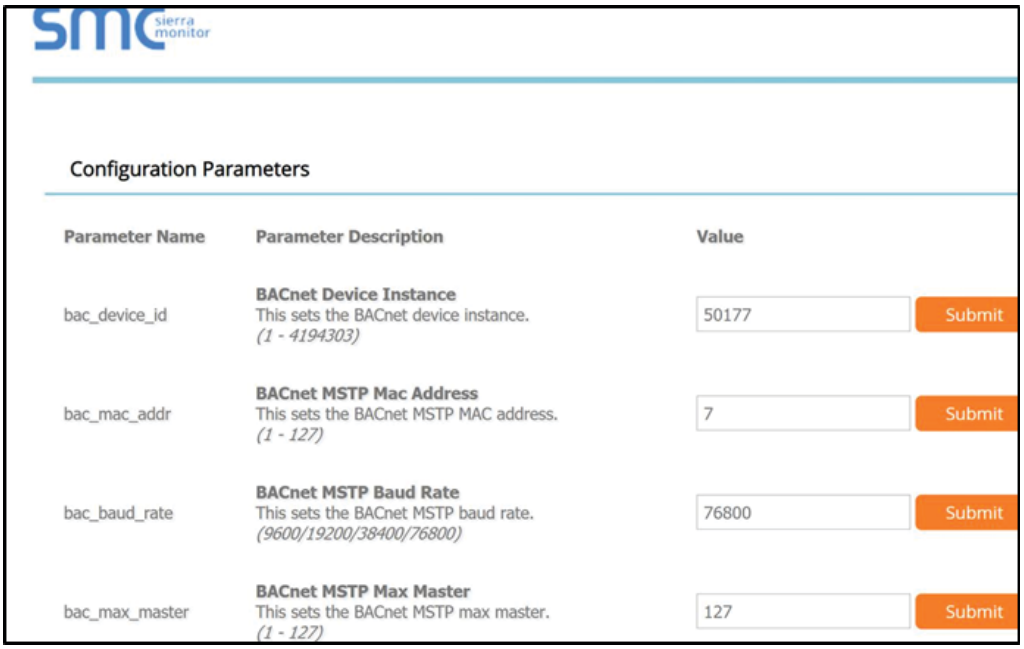
To access the Web Configurator, type the IP address of the Protocessor in the URL of any web browser. The default IP address of the Protocessor is 192.168.1.24. Once the landing page has loaded, if required, log in using “admin” for the username and password. If the default “admin” password does not 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 47** 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 47 - Configuration Parameters Page

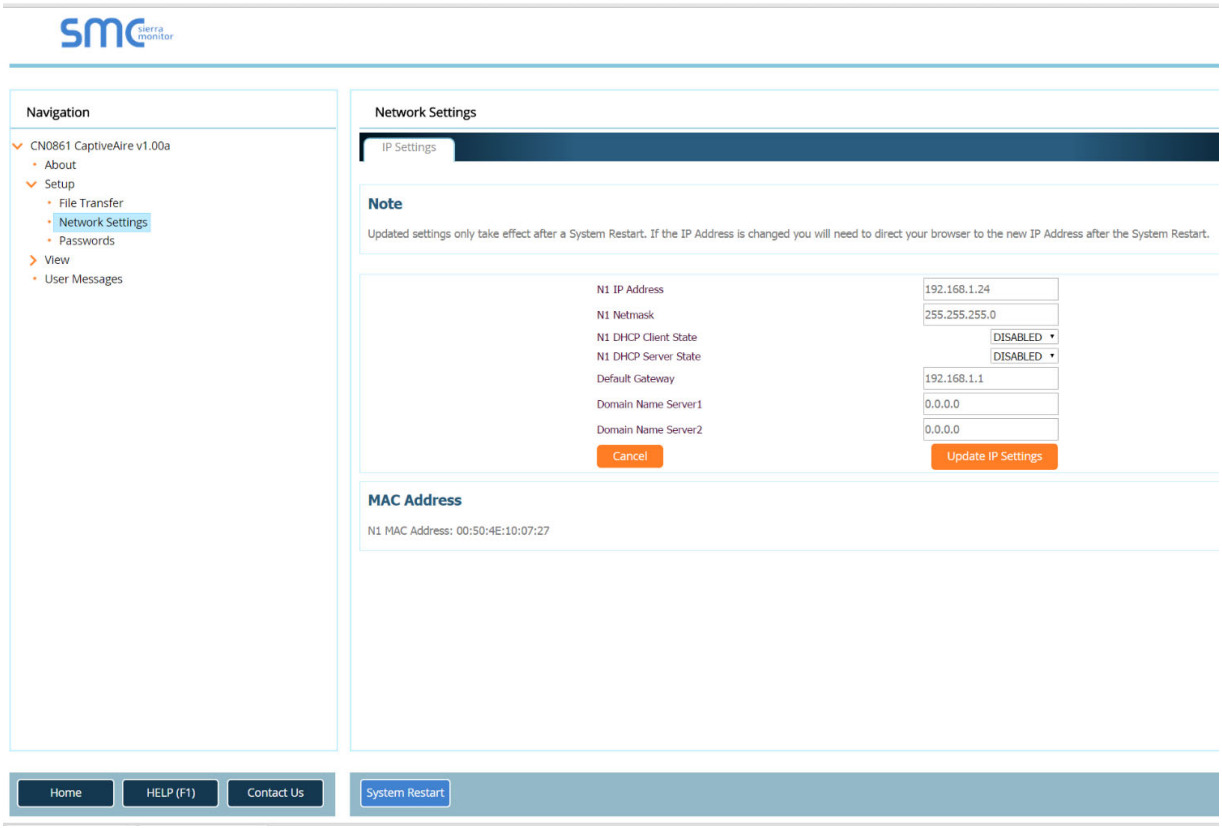


Changing the IP Address

Some BACnet IP applications may require changing the IP address of the Protocessor. To change the IP address, go to the internal server by typing the default IP address of the Protocessor, 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 48** 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 48** 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.”

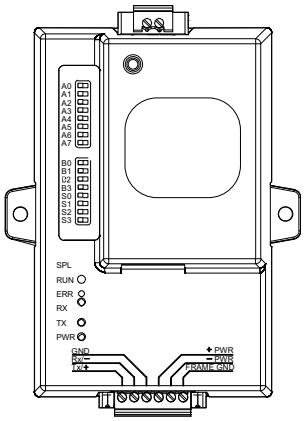
Figure 48 - Network Settings Page



LonWorks

LonWorks compatibility (**Figure 49**) 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 49 - LonWorks



Commissioning on a LonWorks Network

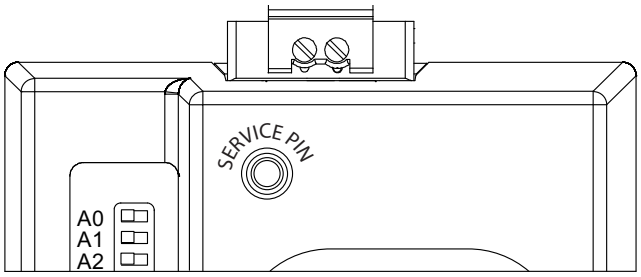
During the commissioning process by the LonWorks administrator (using a LonWorks Network Management Tool), the user will be prompted to hit the Service Pin in the ProtoNode. This pin is located in the front face, and it can be pressed by inserting a small screwdriver and tilting it towards the LonWorks Port. Refer to **Figure 50** 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 50 - 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 Object Name	BACnet Object ID	Modbus Register	BACnet Data Type	LON SNVT Name	LON SNVT Type	Function	Default	Range	Description
TempSensor1	1	9000	ANALOG INPUT	nvoTempSens1	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor2	2	9001	ANALOG INPUT	nvoTempSens2	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor3	3	9002	ANALOG INPUT	nvoTempSens3	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor4	4	9003	ANALOG INPUT	nvoTempSens4	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor5	5	9004	ANALOG INPUT	nvoTempSens5	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor6	6	9005	ANALOG INPUT	nvoTempSens6	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor7	7	9006	ANALOG INPUT	nvoTempSens7	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor8	8	9007	ANALOG INPUT	nvoTempSens8	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor9	9	9008	ANALOG INPUT	nvoTempSens9	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor10	10	9009	ANALOG INPUT	nvoTempSens10	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor11	11	9010	ANALOG INPUT	nvoTempSens11	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor12	12	9011	ANALOG INPUT	nvoTempSens12	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor13	13	9012	ANALOG INPUT	nvoTempSens13	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor14	14	9013	ANALOG INPUT	nvoTempSens14	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor15	15	9014	ANALOG INPUT	nvoTempSens15	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor16	16	9015	ANALOG INPUT	nvoTempSens16	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor17	17	9016	ANALOG INPUT	nvoTempSens17	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor18	18	9017	ANALOG INPUT	nvoTempSens18	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor19	19	9018	ANALOG INPUT	nvoTempSens19	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor20	20	9019	ANALOG INPUT	nvoTempSens20	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor21	21	9020	ANALOG INPUT	nvoTempSens21	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor22	22	9021	ANALOG INPUT	nvoTempSens22	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor23	23	9022	ANALOG INPUT	nvoTempSens23	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor24	24	9023	ANALOG INPUT	nvoTempSens24	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor25	25	9024	ANALOG INPUT	nvoTempSens25	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor26	26	9025	ANALOG INPUT	nvoTempSens26	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor27	27	9026	ANALOG INPUT	nvoTempSens27	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor28	28	9027	ANALOG INPUT	nvoTempSens28	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor29	29	9028	ANALOG INPUT	nvoTempSens29	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor30	30	9029	ANALOG INPUT	nvoTempSens30	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor31	31	9030	ANALOG INPUT	nvoTempSens31	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
TempSensor32	32	9031	ANALOG INPUT	nvoTempSens32	SNVT_count_f	Monitor	-	-	Room Temperature with 1 decimal precision
HMISensor1	33	9032	ANALOG INPUT	nvoHMISens1	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor2	34	9033	ANALOG INPUT	nvoHMISens2	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor3	35	9034	ANALOG INPUT	nvoHMISens3	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor4	36	9035	ANALOG INPUT	nvoHMISens4	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor5	37	9036	ANALOG INPUT	nvoHMISens5	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor6	38	9037	ANALOG INPUT	nvoHMISens6	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor7	39	9038	ANALOG INPUT	nvoHMISens7	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor8	40	9039	ANALOG INPUT	nvoHMISens8	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor9	41	9040	ANALOG INPUT	nvoHMISens9	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
HMISensor10	42	9041	ANALOG INPUT	nvoHMISens10	SNVT_count_f	Monitor	-	-	HMI Temperature with 1 decimal precision
FrequencyF1	43	5000	ANALOG INPUT	nvoFreqF1	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF2	44	5001	ANALOG INPUT	nvoFreqF2	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF3	45	5002	ANALOG INPUT	nvoFreqF3	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF4	46	5003	ANALOG INPUT	nvoFreqF4	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF5	47	5004	ANALOG INPUT	nvoFreqF5	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF6	48	5005	ANALOG INPUT	nvoFreqF6	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF7	49	5006	ANALOG INPUT	nvoFreqF7	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF8	50	5007	ANALOG INPUT	nvoFreqF8	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF9	51	5008	ANALOG INPUT	nvoFreqF9	NVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
FrequencyF10	52	5009	ANALOG INPUT	nvoFreqF10	SNVT_count_f	Monitor	-	-	VFD Frequency with 1 decimal precision (Hz)
AmperageF1	53	5010	ANALOG INPUT	nvoAmpsF1	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF2	54	5011	ANALOG INPUT	nvoAmpsF2	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF3	55	5012	ANALOG INPUT	nvoAmpsF3	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF4	56	5013	ANALOG INPUT	nvoAmpsF4	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF5	57	5014	ANALOG INPUT	nvoAmpsF5	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF6	58	5015	ANALOG INPUT	nvoAmpsF6	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF7	59	5016	ANALOG INPUT	nvoAmpsF7	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF8	60	5017	ANALOG INPUT	nvoAmpsF8	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF9	61	5018	ANALOG INPUT	nvoAmpsF9	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
AmperageF10	62	5019	ANALOG INPUT	nvoAmpsF10	SNVT_count_f	Monitor	-	-	VFD (Fan) Amperage with 1 decimal precision (A)
PowerF1	63	5020	ANALOG INPUT	nvoPowerF1	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF2	64	5021	ANALOG INPUT	nvoPowerF2	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF3	65	5022	ANALOG INPUT	nvoPowerF3	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF4	66	5023	ANALOG INPUT	nvoPowerF4	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF5	67	5024	ANALOG INPUT	nvoPowerF5	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF6	68	5025	ANALOG INPUT	nvoPowerF6	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF7	69	5026	ANALOG INPUT	nvoPowerF7	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF8	70	5027	ANALOG INPUT	nvoPowerF8	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF9	71	5028	ANALOG INPUT	nvoPowerF9	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
PowerF10	72	5029	ANALOG INPUT	nvoPowerF10	SNVT_count_f	Monitor	-	-	VFD (Fan) Power with 2 decimal precision (KW)
VFDFaultF1	73	5030	ANALOG INPUT	nvoVFDFaultF1	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF2	74	5031	ANALOG INPUT	nvoVFDFaultF2	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF3	75	5032	ANALOG INPUT	nvoVFDFaultF3	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF4	76	5033	ANALOG INPUT	nvoVFDFaultF4	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes

BACnet Object Name	BACnet Object ID	Modbus Register	BACnet Data Type	LON SNVT Name	LON SNVT Type	Function	Default	Range	Description
VFDFaultF5	77	5034	ANALOG INPUT	nvoVFDFaultF5	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF6	78	5035	ANALOG INPUT	nvoVFDFaultF6	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF7	79	5036	ANALOG INPUT	nvoVFDFaultF7	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF8	80	5037	ANALOG INPUT	nvoVFDFaultF8	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF9	81	5038	ANALOG INPUT	nvoVFDFaultF9	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDFaultF10	82	5039	ANALOG INPUT	nvoVFDFaultF10	SNVT_count	Monitor	-	-	Reference VFD Manual Fault Codes
VFDVoltageF1	83	5040	ANALOG INPUT	nvoVFDVoltsF1	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF2	84	5041	ANALOG INPUT	nvoVFDVoltsF2	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF3	85	5042	ANALOG INPUT	nvoVFDVoltsF3	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF4	86	5043	ANALOG INPUT	nvoVFDVoltsF4	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF5	87	5044	ANALOG INPUT	nvoVFDVoltsF5	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF6	88	5045	ANALOG INPUT	nvoVFDVoltsF6	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF7	89	5046	ANALOG INPUT	nvoVFDVoltsF7	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF8	90	5047	ANALOG INPUT	nvoVFDVoltsF8	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF9	91	5048	ANALOG INPUT	nvoVFDVoltsF9	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDVoltageF10	92	5049	ANALOG INPUT	nvoVFDVoltsF10	SNVT_count	Monitor	-	-	Voltage from VFD to Fan Motor (VAC)
VFDLoadF1	93	5060	ANALOG INPUT	nvoVFDLoadF1	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF2	94	5061	ANALOG INPUT	nvoVFDLoadF2	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF3	95	5062	ANALOG INPUT	nvoVFDLoadF3	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF4	96	5063	ANALOG INPUT	nvoVFDLoadF4	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF5	97	5064	ANALOG INPUT	nvoVFDLoadF5	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF6	98	5065	ANALOG INPUT	nvoVFDLoadF6	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF7	99	5066	ANALOG INPUT	nvoVFDLoadF7	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF8	100	5067	ANALOG INPUT	nvoVFDLoadF8	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF9	101	5068	ANALOG INPUT	nvoVFDLoadF9	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDLoadF10	102	5069	ANALOG INPUT	nvoVFDLoadF10	SNVT_count	Monitor	-	-	Motor Load as a % of VFD Output Current (%)
VFDTempF1	103	5050	ANALOG INPUT	nvoVFDTempF1	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF2	104	5051	ANALOG INPUT	nvoVFDTempF2	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF3	105	5052	ANALOG INPUT	nvoVFDTempF3	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF4	106	5053	ANALOG INPUT	nvoVFDTempF4	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF5	107	5054	ANALOG INPUT	nvoVFDTempF5	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF6	108	5055	ANALOG INPUT	nvoVFDTempF6	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF7	109	5056	ANALOG INPUT	nvoVFDTempF7	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF8	110	5057	ANALOG INPUT	nvoVFDTempF8	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF9	111	5058	ANALOG INPUT	nvoVFDTempF9	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
VFDTempF10	112	5059	ANALOG INPUT	nvoVFDTempF10	SNVT_count_f	Monitor	-	-	VFD Heat sink Temperature (degrees C)
BMSOverrideActive	113	5300-0	BINARY INPUT	nvoBMSOverride	SNVT_count	Monitor	-	-	0 = No Hard Wired BMS Override, 1 = Hard Wired BMS Override
BoardFuseBlown	114	5300-4	BINARY INPUT	nvoPCBFuseAlert	SNVT_count	Monitor	-	-	0 = Fuse OK, 1 = Blown or Missing ECPM03 Fuse
EmergencyShutdown	115	5300-5	BINARY INPUT	nvoERShutdown	SNVT_count	Monitor	-	-	0 = No Emergency Shutdown, 1 = Hard Wired Emergency Shutdown
ErrorTempSensor1	116	5400-0…1	ANALOG INPUT	nvoERRTempS1	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor2	117	5400-2…3	ANALOG INPUT	nvoERRTempS2	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor3	118	5400-4…5	ANALOG INPUT	nvoERRTempS3	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor4	119	5400-6…7	ANALOG INPUT	nvoERRTempS4	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor5	120	5400-8…9	ANALOG INPUT	nvoERRTempS5	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor6	121	5400-10…11	ANALOG INPUT	nvoERRTempS6	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor7	122	5400-12…13	ANALOG INPUT	nvoERRTempS7	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor8	123	5400-14…15	ANALOG INPUT	nvoERRTempS8	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor9	124	5401-0…1	ANALOG INPUT	nvoERRTempS9	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor10	125	5401-2…3	ANALOG INPUT	nvoERRTempS10	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor11	126	5401-4…5	ANALOG INPUT	nvoERRTempS11	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor12	127	5401-6…7	ANALOG INPUT	nvoERRTempS12	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor13	128	5401-8…9	ANALOG INPUT	nvoERRTempS13	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor14	129	5401-10…11	ANALOG INPUT	nvoERRTempS14	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor15	130	5401-12…13	ANALOG INPUT	nvoERRTempS15	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor16	131	5401-14…15	ANALOG INPUT	nvoERRTempS16	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor17	132	5404-0…1	ANALOG INPUT	nvoERRTempS17	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor18	133	5404-2…3	ANALOG INPUT	nvoERRTempS18	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor19	134	5404-4…5	ANALOG INPUT	nvoERRTempS19	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor20	135	5404-6…7	ANALOG INPUT	nvoERRTempS20	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor21	136	5404-8…9	ANALOG INPUT	nvoERRTempS21	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor22	137	5404-10…11	ANALOG INPUT	nvoERRTempS22	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor23	138	5404-12…13	ANALOG INPUT	nvoERRTempS23	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor24	139	5404-14…15	ANALOG INPUT	nvoERRTempS24	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor25	140	5405-0…1	ANALOG INPUT	nvoERRTempS25	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor26	141	5405-2…3	ANALOG INPUT	nvoERRTempS26	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor27	142	5405-4…5	ANALOG INPUT	nvoERRTempS27	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor28	143	5405-6…7	ANALOG INPUT	nvoERRTempS28	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor29	144	5405-8…9	ANALOG INPUT	nvoERRTempS29	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor30	145	5405-10…11	ANALOG INPUT	nvoERRTempS30	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor31	146	5405-12…13	ANALOG INPUT	nvoERRTempS31	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorTempSensor32	147	5405-14…15	ANALOG INPUT	nvoERRTempS32	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor1	148	5408-0…1	ANALOG INPUT	nvoERRHMISens1	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor2	149	5408-2…3	ANALOG INPUT	nvoERRHMISens2	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor3	150	5408-4…5	ANALOG INPUT	nvoERRHMISens3	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor4	151	5408-6…7	ANALOG INPUT	nvoERRHMISens4	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor5	152	5408-8…9	ANALOG INPUT	nvoERRHMISens5	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor6	153	5408-10…11	ANALOG INPUT	nvoERRHMISens6	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor7	154	5408-12…13	ANALOG INPUT	nvoERRHMISens7	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor8	155	5408-14…15	ANALOG INPUT	nvoERRHMISens8	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor9	156	5409-0…1	ANALOG INPUT	nvoERRHMISens9	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI
ErrorHMISensor10	157	5409-2…3	ANALOG INPUT	nvoERRHMISens10	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Broken Sensor, 2 = Missing Sensor, 3 = Missing Board/HMI

BACnet Object Name	BACnet Object ID	Modbus Register	BACnet Data Type	LON SNVT Name	LON SNVT Type	Function	Default	Range	Description
StateVFD1	158	5550-LB	ANALOG INPUT	nvoStateVFD1	SNVT_count	Monitor	-	-	1 = Off by Temperature, 2 = Off by High Temperature Alarm, 3 = Off by Low Temperature Alarm, 4 = Off by Emergency Shutdown, 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	159	5550-HB	ANALOG INPUT	nvoStateVFD2	SNVT_count	Monitor	-	-	
StateVFD3	160	5551-LB	ANALOG INPUT	nvoStateVFD3	SNVT_count	Monitor	-	-	
StateVFD4	161	5551-HB	ANALOG INPUT	nvoStateVFD4	SNVT_count	Monitor	-	-	
StateVFD5	162	5552-LB	ANALOG INPUT	nvoStateVFD5	SNVT_count	Monitor	-	-	
StateVFD6	163	5552-HB	ANALOG INPUT	nvoStateVFD6	SNVT_count	Monitor	-	-	
StateVFD7	164	5553-LB	ANALOG INPUT	nvoStateVFD7	SNVT_count	Monitor	-	-	
StateVFD8	165	5553-HB	ANALOG INPUT	nvoStateVFD8	SNVT_count	Monitor	-	-	
StateVFD9	166	5554-LB	ANALOG INPUT	nvoStateVFD9	SNVT_count	Monitor	-	-	
StateVFD10	167	5554-HB	ANALOG INPUT	nvoStateVFD10	SNVT_count	Monitor	-	-	
MBFaultHMI1	168	5350-0	BINARY INPUT	nvoMBFaultHMI1	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI2	169	5350-1	BINARY INPUT	nvoMBFaultHMI2	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI3	170	5350-2	BINARY INPUT	nvoMBFaultHMI3	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI4	171	5350-3	BINARY INPUT	nvoMBFaultHMI4	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI5	172	5350-4	BINARY INPUT	nvoMBFaultHMI5	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI6	173	5350-5	BINARY INPUT	nvoMBFaultHMI6	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI7	174	5350-6	BINARY INPUT	nvoMBFaultHMI7	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI8	175	5350-7	BINARY INPUT	nvoMBFaultHMI8	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI9	176	5350-8	BINARY INPUT	nvoMBFaultHMI9	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultHMI10	177	5350-9	BINARY INPUT	nvoMBFaultHMI10	SNVT_count	Monitor	-	-	0 = No Fault, 1 = HMI Modbus Communication Fault
MBFaultVFD1	178	5352-0	BINARY INPUT	nvoMBFaultVFD1	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD2	179	5352-1	BINARY INPUT	nvoMBFaultVFD2	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD3	180	5352-2	BINARY INPUT	nvoMBFaultVFD3	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD4	181	5352-3	BINARY INPUT	nvoMBFaultVFD4	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD5	182	5352-4	BINARY INPUT	nvoMBFaultVFD5	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD6	183	5352-5	BINARY INPUT	nvoMBFaultVFD6	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD7	184	5352-6	BINARY INPUT	nvoMBFaultVFD7	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD8	185	5352-7	BINARY INPUT	nvoMBFaultVFD8	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD9	186	5352-8	BINARY INPUT	nvoMBFaultVFD9	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultVFD10	187	5352-9	BINARY INPUT	nvoMBFaultVFD10	SNVT_count	Monitor	-	-	0 = No Fault, 1 = VFD Modbus Communication Fault
MBFaultEXP1	188	5354-0	BINARY INPUT	nvoMBFaultEXP1	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Expansion Board Modbus Communication Fault
MBFaultEXP2	189	5354-1	BINARY INPUT	nvoMBFaultEXP2	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Expansion Board Modbus Communication Fault
MBFaultEXP3	190	5354-2	BINARY INPUT	nvoMBFaultEXP3	SNVT_count	Monitor	-	-	0 = No Fault, 1 = Expansion Board Modbus Communication Fault
ButtonG1	191	13020	BINARY VARIABLE	nviButtonG1	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG2	192	13021	BINARY VARIABLE	nviButtonG2	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG3	193	13022	BINARY VARIABLE	nviButtonG3	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG4	194	13023	BINARY VARIABLE	nviButtonG4	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG5	195	13024	BINARY VARIABLE	nviButtonG5	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG6	196	13025	BINARY VARIABLE	nviButtonG6	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG7	197	13026	BINARY VARIABLE	nviButtonG7	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG8	198	13027	BINARY VARIABLE	nviButtonG8	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG9	199	13028	BINARY VARIABLE	nviButtonG9	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
ButtonG10	200	13029	BINARY VARIABLE	nviButtonG10	SNVT_count	Control	0	0 or 1	Fan Group State, 1 = ON , 0 = OFF in DDC Manual Mode
SpeedG1	201	13030	ANALOG VARIABLE	nviSpeedG1	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG2	202	13031	ANALOG VARIABLE	nviSpeedG2	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG3	203	13032	ANALOG VARIABLE	nviSpeedG3	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG4	204	13033	ANALOG VARIABLE	nviSpeedG4	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG5	205	13034	ANALOG VARIABLE	nviSpeedG5	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG6	206	13035	ANALOG VARIABLE	nviSpeedG6	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG7	207	13036	ANALOG VARIABLE	nviSpeedG7	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG8	208	13037	ANALOG VARIABLE	nviSpeedG8	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG9	209	13038	ANALOG VARIABLE	nviSpeedG9	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
SpeedG10	210	13039	ANALOG VARIABLE	nviSpeedG10	SNVT_count	Control	0%	0 to 100%	Fan Group Speed, 0% = Min Fan Group Speed, 100% = Max Fan Group Speed
DirectionF1	211	13010	BINARY VARIABLE	nviDirF1	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF2	212	13011	BINARY VARIABLE	nviDirF2	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF3	213	13012	BINARY VARIABLE	nviDirF3	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF4	214	13013	BINARY VARIABLE	nviDirF4	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF5	215	13014	BINARY VARIABLE	nviDirF5	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF6	216	13015	BINARY VARIABLE	nviDirF6	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF7	217	13016	BINARY VARIABLE	nviDirF7	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF8	218	13017	BINARY VARIABLE	nviDirF8	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF9	219	13018	BINARY VARIABLE	nviDirF9	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
DirectionF10	220	13019	BINARY VARIABLE	nviDirF10	SNVT_count	Control	0	0 or 1	Fan Direction, 0 = Forward, 1 = Reverse
ModeG1	221	13000	BINARY VARIABLE	nviModeG1	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG2	222	13001	BINARY VARIABLE	nviModeG2	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG3	223	13002	BINARY VARIABLE	nviModeG3	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG4	224	13003	BINARY VARIABLE	nviModeG4	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG5	225	13004	BINARY VARIABLE	nviModeG5	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG6	226	13005	BINARY VARIABLE	nviModeG6	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG7	227	13006	BINARY VARIABLE	nviModeG7	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG8	228	13007	BINARY VARIABLE	nviModeG8	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG9	229	13008	BINARY VARIABLE	nviModeG9	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
ModeG10	230	13009	BINARY VARIABLE	nviModeG10	SNVT_count	Control	0	0 or 1	Fan Group Mode, 0 = DDC Auto, 1=DDC Manual
MaxG1	231	10246	ANALOG INPUT	nviMaxG1	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG2	232	10254	ANALOG INPUT	nviMaxG2	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG3	233	10262	ANALOG INPUT	nviMaxG3	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG4	234	10270	ANALOG INPUT	nviMaxG4	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG5	235	10278	ANALOG INPUT	nviMaxG5	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG6	236	10286	ANALOG INPUT	nviMaxG6	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG7	237	10294	ANALOG INPUT	nviMaxG7	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG8	238	10302	ANALOG INPUT	nviMaxG8	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG9	239	10310	ANALOG INPUT	nviMaxG9	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MaxG10	240	10318	ANALOG INPUT	nviMaxG10	SNVT_count	Monitor	55 Hz/80 Hz	Min to Max	Maximum VFD Group Frequency (Hz), 1 decimal precision, i.e. 45.5 Hz = 455
MinG1	241	10247	ANALOG INPUT	nviMinG1	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG2	242	10255	ANALOG INPUT	nviMinG2	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG3	243	10263	ANALOG INPUT	nviMinG3	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG4	244	10271	ANALOG INPUT	nviMinG4	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335

BACnet Object Name	BACnet Object ID	Modbus Register	BACnet Data Type	LON SNVT Name	LON SNVT Type	Function	Default	Range	Description
MinG5	245	10279	ANALOG INPUT	nviMinG5	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG6	246	10287	ANALOG INPUT	nviMinG6	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG7	247	10295	ANALOG INPUT	nviMinG7	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG8	248	10303	ANALOG INPUT	nviMinG8	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG9	249	10311	ANALOG INPUT	nviMinG9	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
MinG10	250	10319	ANALOG INPUT	nviMinG10	SNVT_count	Monitor	15 Hz	Min to Max	Minimum VFD Group Frequency (Hz), 1 decimal precision, i.e. 33.5 Hz = 335
ActivationTempG1	251	10244	ANALOG INPUT	nviActTempG1	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG2	252	10252	ANALOG INPUT	nviActTempG2	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG3	253	10260	ANALOG INPUT	nviActTempG3	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG4	254	10268	ANALOG INPUT	nviActTempG4	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG5	255	10276	ANALOG INPUT	nviActTempG5	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG6	256	10284	ANALOG INPUT	nviActTempG6	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG7	257	10292	ANALOG INPUT	nviActTempG7	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG8	258	10300	ANALOG INPUT	nviActTempG8	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG9	259	10308	ANALOG INPUT	nviActTempG9	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ActivationTempG10	260	10316	ANALOG INPUT	nviActTempG10	SNVT_count	Monitor	75 Deg F	40 to 100	Fan Group Activation Temperature (Deg F), 1 decimal precision, i.e. 72.5 deg = 725
ModulationG1	261	10245	ANALOG INPUT	nviModulationG1	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG2	262	10253	ANALOG INPUT	nviModulationG2	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG3	263	10261	ANALOG INPUT	nviModulationG3	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG4	264	10269	ANALOG INPUT	nviModulationG4	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG5	265	10277	ANALOG INPUT	nviModulationG5	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG6	266	10285	ANALOG INPUT	nviModulationG6	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG7	267	10293	ANALOG INPUT	nviModulationG7	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG8	268	10301	ANALOG INPUT	nviModulationG8	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG9	269	10309	ANALOG INPUT	nviModulationG9	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
ModulationG10	270	10317	ANALOG INPUT	nviModulationG10	SNVT_count	Monitor	5 Deg F	1 to 15 Deg	Fan Group Modulation Band (Deg F), 1 decimal precision, i.e. 12.1 deg = 121
OccupiedG1	271	11100-0	BINARY INPUT	nviOccupancyG1	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG2	272	11100-1	BINARY INPUT	nviOccupancyG2	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG3	273	11100-2	BINARY INPUT	nviOccupancyG3	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG4	274	11100-3	BINARY INPUT	nviOccupancyG4	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG5	275	11100-4	BINARY INPUT	nviOccupancyG5	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG6	276	11100-5	BINARY INPUT	nviOccupancyG6	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG7	277	11100-6	BINARY INPUT	nviOccupancyG7	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG8	278	11100-7	BINARY INPUT	nviOccupancyG8	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG9	279	11100-8	BINARY INPUT	nviOccupancyG9	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
OccupiedG10	280	11100-9	BINARY INPUT	nviOccupancyG10	SNVT_count	Monitor	0	0 or 1	Occupancy state for Fan Group x, where 0 = "unoccupied" and 1 = "occupied"
FilterMaintenanceAlert	281	12550-0…1	ANALOG INPUT	nvoFiltersMA	SNVT_count	Monitor	0	Code = 0-2	Maintenance Status, where 0 = no maintenance, 1 = maintenance check, 2 = maintenance change
BoltsandCablesMaintenanceAlert	282	12550-2…3	ANALOG INPUT	nvoBoltCableMA	SNVT_count	Monitor	0	Code = 0-2	Maintenance Status, where 0 = no maintenance, 1 = maintenance check, 2 = maintenance change
OilMaintenanceAlert	283	12550-4…5	ANALOG INPUT	nvoOilMA	SNVT_count	Monitor	0	Code = 0-2	Maintenance Status, where 0 = no maintenance, 1 = maintenance check, 2 = maintenance change
BatteryMaintenanceAlert	284	12550-6…7	ANALOG INPUT	nvoBatteryMA	SNVT_count	Monitor	0	Code = 0-2	Maintenance Status, where 0 = no maintenance, 1 = maintenance check, 2 = maintenance change

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.
Insufficient 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.
Excessive Vibration and Noise	Damaged or unbalanced blade	Replace blade.
	Gears need lubrication or replacement	Lubricate or replace.
	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
18-27	Internal Fault
28	Remote Keypad Lost
29	Assertion Level Fault
30 - 33	Internal Fault
34	Comm. Module Failure
35 - 44	Network Fault

Refer to VFD manufacturer manual for further details.

HMI Fault List

Fault Message on HMI	Potential Cause	Corrective Action
HIGH TEMP ALARM SENSOR XX	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 XX	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 XX	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 XX	HMI not connected or assigned incorrectly	Install HMI or change HMI address using bottom 2 buttons on HMI.
MODBUS FAULT FAN XX	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.
SENSOR FAULT SENSOR XX 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 XX 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 10Kohm thermistor.
SENSOR FAULT SENSOR XX 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	Replace ECPM03 fuse and verify there is no short-circuit, and load is below 10 amps.
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

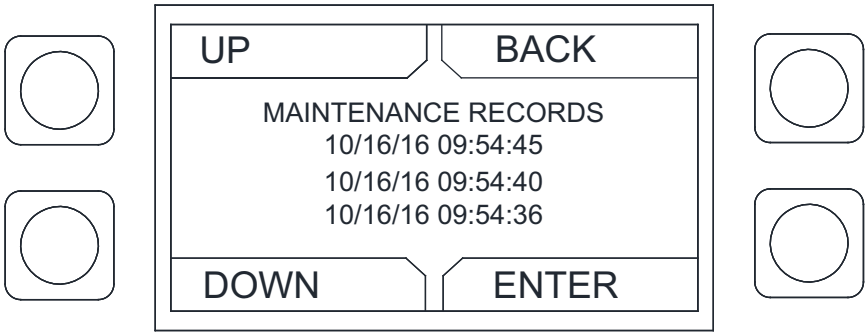
The HVLS control system stores maintenance events in its on-board memory. These maintenance events can either be manually entered or can be logged out of the maintenance alerts that will appear on the screen at the proper time intervals. Maintenance alerts and logged maintenance events are also made 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 51 - Maintenance Screen



Maintenance Documentation

Date	Service Performed	Date	Service Performed
.			

Date	Service Performed	Date	Service Performed
.			

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 void without completion of this form)

Job Information

Job Name	
Address	
City	
State	
Zip	
Phone Number	
Fax Number	
Contact	
Purchase Date	
Quantity of Fan(s)	
Size of Fan(s)	
Service Company	
Address	
City	
State	
Zip	
Phone Number	
Fax Number	
Contact	
Start-up Date	

Unit Information

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

Name Plate and Unit Information	
Model Number	
Serial Number	
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.