

HIGH-5

INSTALLATION INSTRUCTIONS

208-230/460V Three-Phase Input using ABB ACS355 VFD



PATTERSON
THE AUTHORITY IN AIR MOVEMENT

For an electronic copy of these instructions, please visit www.pattersonfan.com/high-5

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IMPORTANT SAFETY INFORMATION

READ AND SAVE THESE INSTRUCTIONS

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:

WARNING: Installation and electrical wiring of this fan must be performed by qualified person(s) in accordance with all applicable codes and standards.

WARNING: Ensure that power is off before attempting installation.

WARNING: Installation of this fan must be completed in accordance with the procedures set forth in this manual, the National Electric Code, ANSI/NFPA 70, and any applicable local codes. Code compliance is the responsibility of the installer, and ultimately the end user.

WARNING: Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.

WARNING: Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.

WARNING: To reduce the risk of fire, electric shock or injury to persons, Patterson High-5s must be installed with Patterson High-5 supplied controllers that are marked (on their cartons) to indicate the suitability with this model. Other controllers cannot be substituted.

CAUTION: When service or replacement of a component requires the removal or disconnection of a safety device, the safety device is to be reinstalled or remounted as previously installed.

WARNING: Potential risk of fire, electric shock, or injury to persons during cleaning and user maintenance. Disconnect the fan from the power supply before servicing.

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.

WARNING: To reduce the risk of fire, electric shock, or personal injury, mount directly to a structural framing member.

ATTENTION: This fan is suitable for use with solid-state speed controls.

WARNING: This product can expose you to chemicals which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

MECHANICAL ITEMS INCLUDED IN YOUR SHIPMENT

- 1 Fan Drive Assembly
- 1 Beam Mounting Bracket
- 5 Fan Blades
- 5 Fan Blade Flaps
- 5 Fan Blade End Caps
- 4 1/4" Turnbuckles with jam nuts
- Gearbox Vent **(Must be installed)**
- Bolts, nuts, washers, and clamps of various sizes (see Installation Instructions for types and quantities)

ELECTRICAL ITEMS INCLUDED IN YOUR SHIPMENT

- 1 Lockable disconnect with installation instructions
- 1 ABB ACS355 Variable Frequency Drive (VFD) with remote keypad
 - a. One (1) VFD mounting bracket and hardware kit
 - b. 100 ft. of Cat 6 cable (with RJ45 connectors)
 - c. Three (3) wire crimps for motor control cable
 - d. One (1) Cat 6 cable strain relief
 - e. One (1) Remote control keypad box
 - f. One (1) ACS355 drive User's Manual
 - g. One (1) ACS355 drive Supplement Manual
 - h. One (1) motor control cable (fan motor to VFD)
 - i. Two (2) motor cable strain reliefs

FAN SAFETY COMPONENTS PROVIDED


- Drive Assembly safety cable (1)
- Guy wires (4)
- Blade Safety Brackets (5)

TOOLS TO GET STARTED

- Scissor lift
- Wrench and socket set (5/16"-3/4" needed)
- Cordless power driver with clutch and Phillips Bit
- 1/4" Nut driver
- Torque wrench
- Standard and Phillips screwdrivers
- Instrument screwdriver (1/8" flat blade)
- Wire stripper/cutter
- Level
- 1/8" "L" shaped Allen wrench
- Four (4) beam clamps with eye bolts



Check that all necessary parts are included with your shipment. Should an item be missing, contact Patterson immediately at (800) 768-3985.

FAN SPACING, PLACEMENT, & CLEARANCE

 Fans should be mounted such that the blades are a minimum of 10 feet above the floor. The ideal height is 20 to 25 feet. Also, ensure that the fan blades have a clearance equal to **15% of the fan's diameter in all directions**.

Care should be taken when installing the fan around a fire sprinkler system. The VFD is equipped with the ability to connect to a fire suppression system – stopping the fans in case of a fire. **However, it is the responsibility of the installer to read and comply with all local codes and regulations.**

MAINTENANCE

  Prior to performing any maintenance on the fan, it **MUST** be disconnected from the power source by means of the separate lockable disconnect (provided).

VFD Box – Clean heat dissipating fins on the back of the box periodically.

Gearbox – Periodic maintenance will ensure your fan remains operational for its intended life. While Patterson recommends the end-user check and change the gearbox oil annually, failure to do so will not void any warranties. Oil type used is Chevron® Delo Gear ESI 85W-140. Contact Patterson at (800) 768-3985 for availability.

Hub Grease – Hub should be inspected yearly to ensure proper lubrication. Grease type is Chevron Delo HD Moly 5%. There are two grease fittings, an upper and lower. Add grease as needed, filling each area slowly until grease passes through the upper seal.

Mounting Hardware – All nuts and bolts related to mounting of the fan unit should be checked for tightness annually. In addition, guy wires need to be inspected to ensure they remain taut and show no signs of fraying.

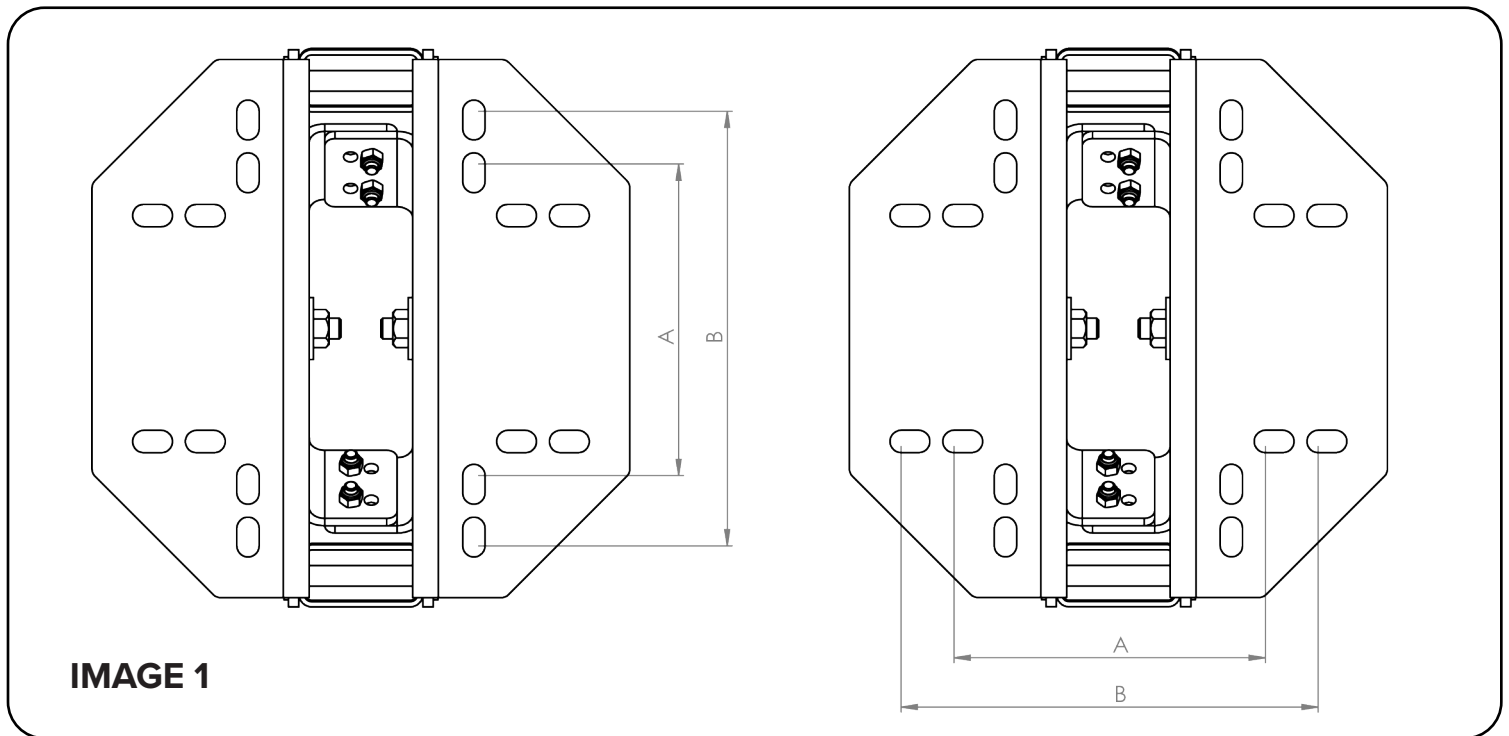
Blades – Blades can be occasionally wiped down with a damp cloth. A mild detergent can also be used if desired.

PART 1

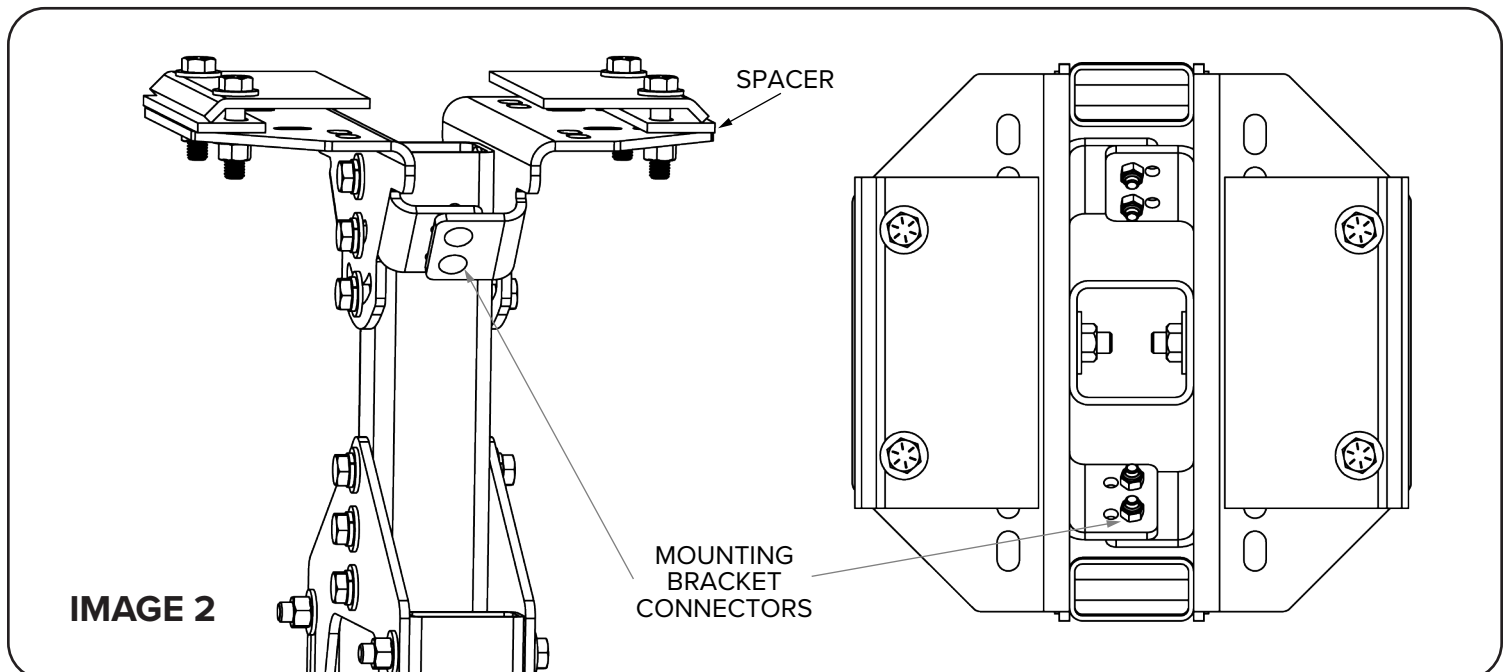
MECHANICAL INSTALLATION

STEP 1A – MOUNT TO AN EXISTING I-BEAM

- 1) It is important to attach the mounting bracket to the structure **first** and **then** connect the fan assembly. If the mounting surface isn't level, the mounting bracket can be mounted in either direction to allow the fan to swivel and hang straight.



- 2) Refer to Image 1 to determine which set of bolt slots to use:
 - a. For I-beam width less than $7\frac{1}{4}$ ", use slots labeled "A". I-beams wider than $7\frac{1}{4}$ " should use slots labeled "B".
 - b. For I-beam thickness greater than $\frac{1}{2}$ ", use the provided spacer as shown in Image 2.



- 3) If a down rod was ordered, adjust the mounting bracket connectors to their widest position. Refer to Image 2.
- 4) Attach clamp to I-beam structure, as shown in the diagram labeled Image 3. Torque GRADE 8 ½” bolts to 80 ft-lbs.

STEP 1B - MOUNT BETWEEN BAR JOISTS

- 1) This installation requires the spanning of building structure. While structures and distances may vary, we recommend using 2” steel tubing welded to a 3/8” thick steel plate as shown in the diagram labeled Image 4 (sold separately). Consult a structural engineer for spanning distances greater than eight feet.
- 2) Secure the spanning material to the building structure using ½” bolts, washers, and lock nuts (not provided) as shown in Image 4. Bolts should pass through the steel plate, and out the bottom of the joist or other structure. Torque bolts to 50 ft-lbs.
- 3) It is important to attach the mounting bracket to the spanning structure first and then connect the fan assembly. If the mounting surface isn't level, the mounting bracket can be mounted in either direction to allow the fan to swivel and hang straight.

IMAGE 3

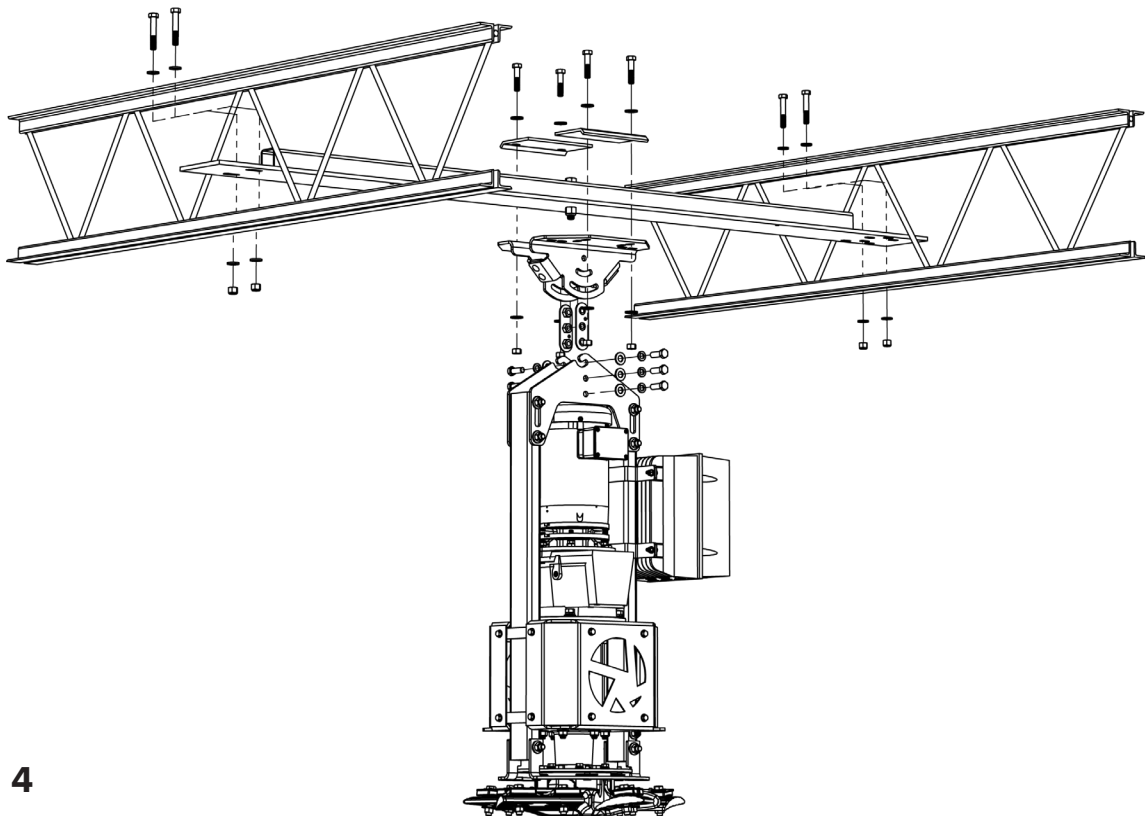
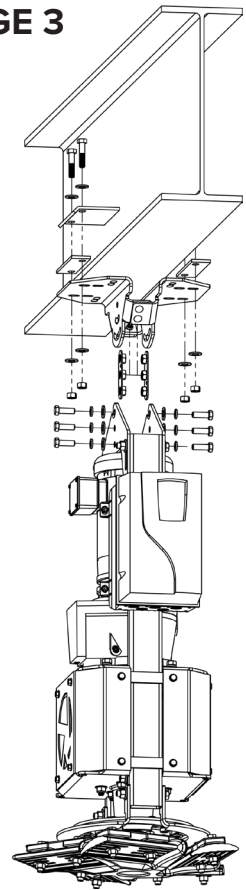
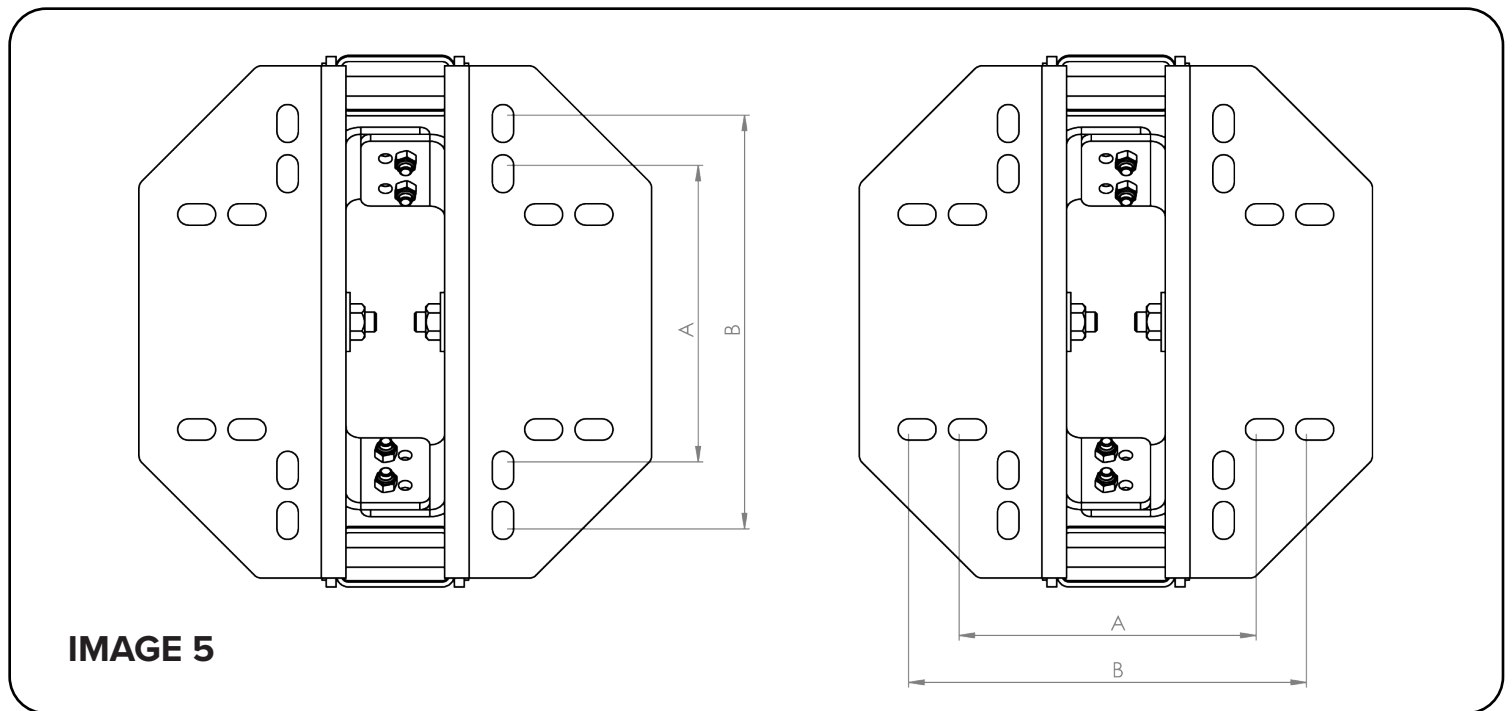
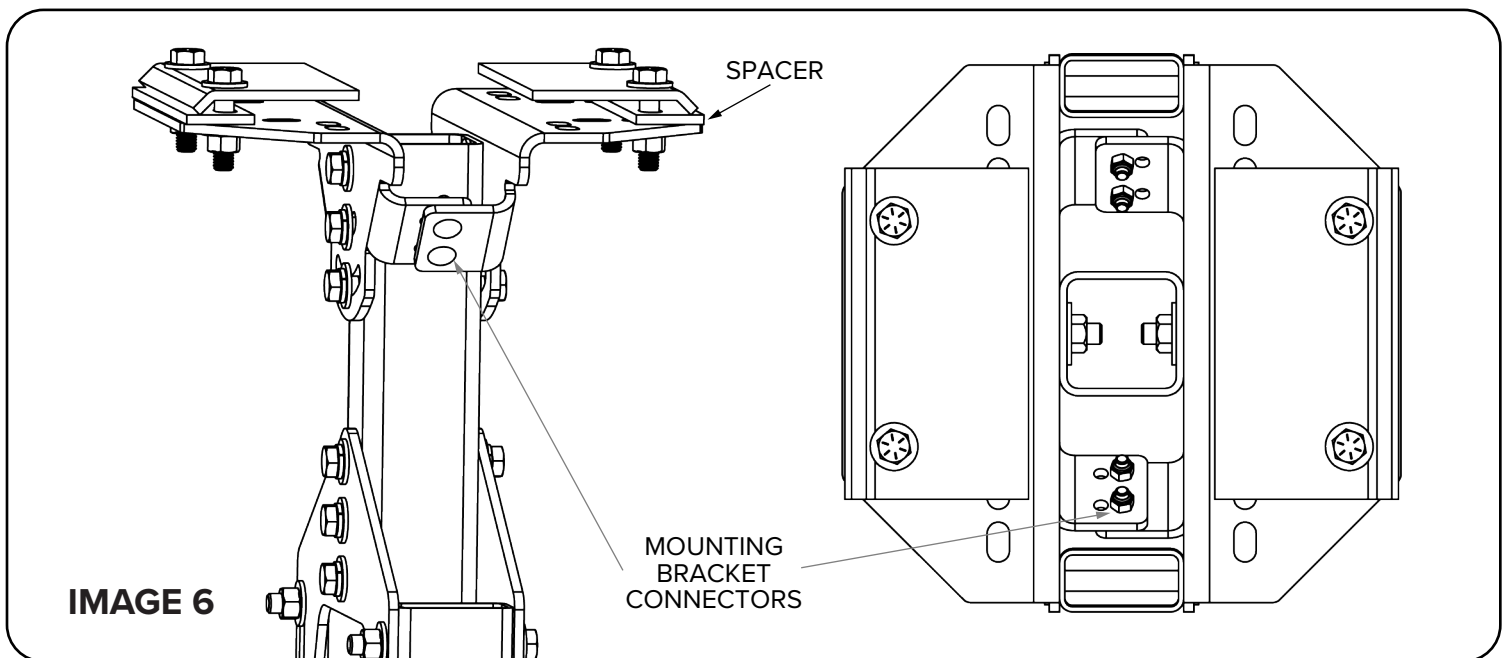


IMAGE 4

- 4) Refer to Image 5 to determine which set of bolt slots to use:



- a. For spanning structure width less than $7\frac{1}{4}$ ", use slots labeled "A". Spanning structures wider than $7\frac{1}{4}$ " should use slots labeled "B".
- b. If spanning structure thickness is greater than $\frac{1}{2}$ ", use provided spacer as shown in Image 6.



- 5) If a down rod was ordered, adjust the mounting bracket connectors to their widest position. Refer to Image 6.
- 6) Attach clamp to spanning structure, as shown in the diagram labeled Image 4. Torque GRADE 8 $\frac{1}{2}$ " bolts to 80 ft-lbs.

STEP 2 - ATTACH FAN ASSEMBLY TO MOUNTING BRACKET

- 1) Using a scissor lift, raise the fan assembly and guide the hangers onto the top bolt of the mounting bracket (see Image 7). If using a down rod, bolt the down rod to the mounting bracket first and place the top bolts on the lower section of the down rod to guide the hangers onto.
- 2) Add the final four bolts through the mounting bracket (or lower down rod section) and secure the fan as shown in Image 8. Torque bolts to 65 ft-lbs.

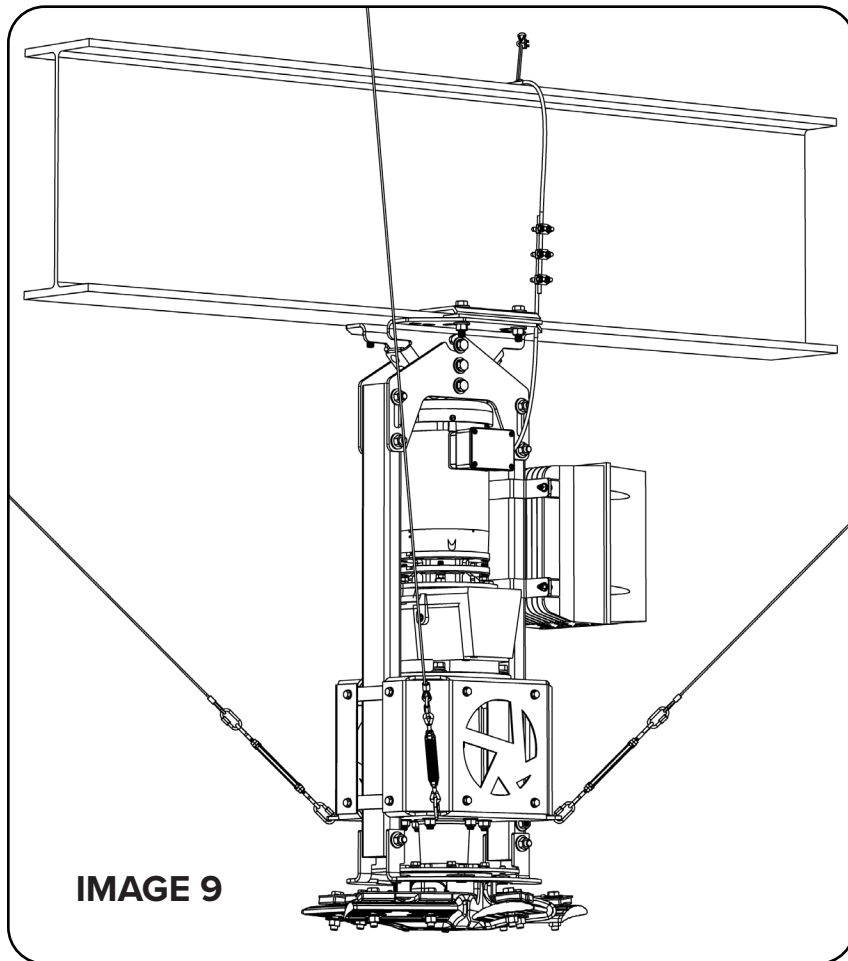
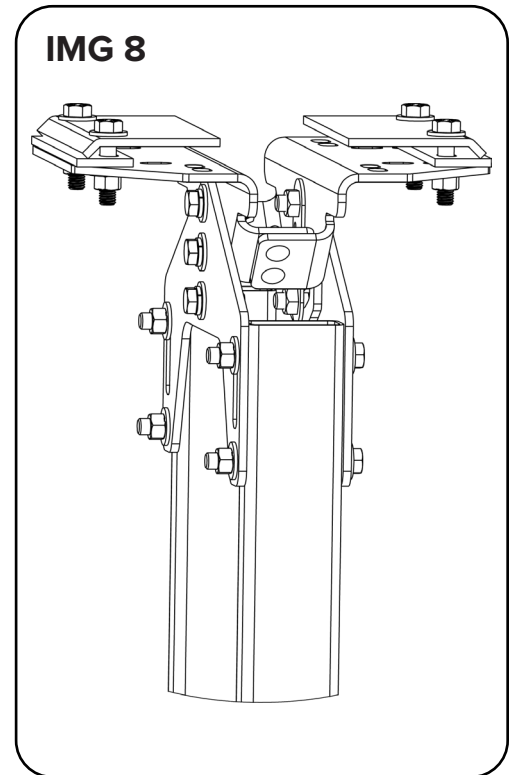
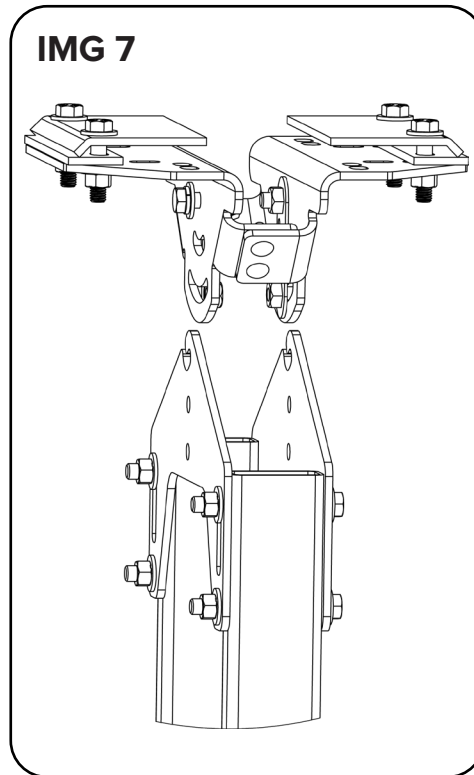


IMAGE 9

STEP 3 - ATTACH VFD TO FAN

- 1) Using the hardware packet provided, attach the VFD to the side of the frame with the VFD brackets. A properly installed VFD is shown in Image 9 (I-beam mount) or Image 10 (mount with spanning structure).

INSTALLER PLEASE NOTE: Customers may request that the VFD NOT be mounted on the fan so that it can be accessed. It is important to emphasize that after installation, there is no reason to get to the drive. ALL of the information, resets, error codes and parameters are accessed from the remote keypad only. If the customer insists, Belden 29522C Multi-Conductor 600V VFD cable should be used. Failure to use proper VFD cable may result in operational issues with the drive or fan and can shorten life expectancy.

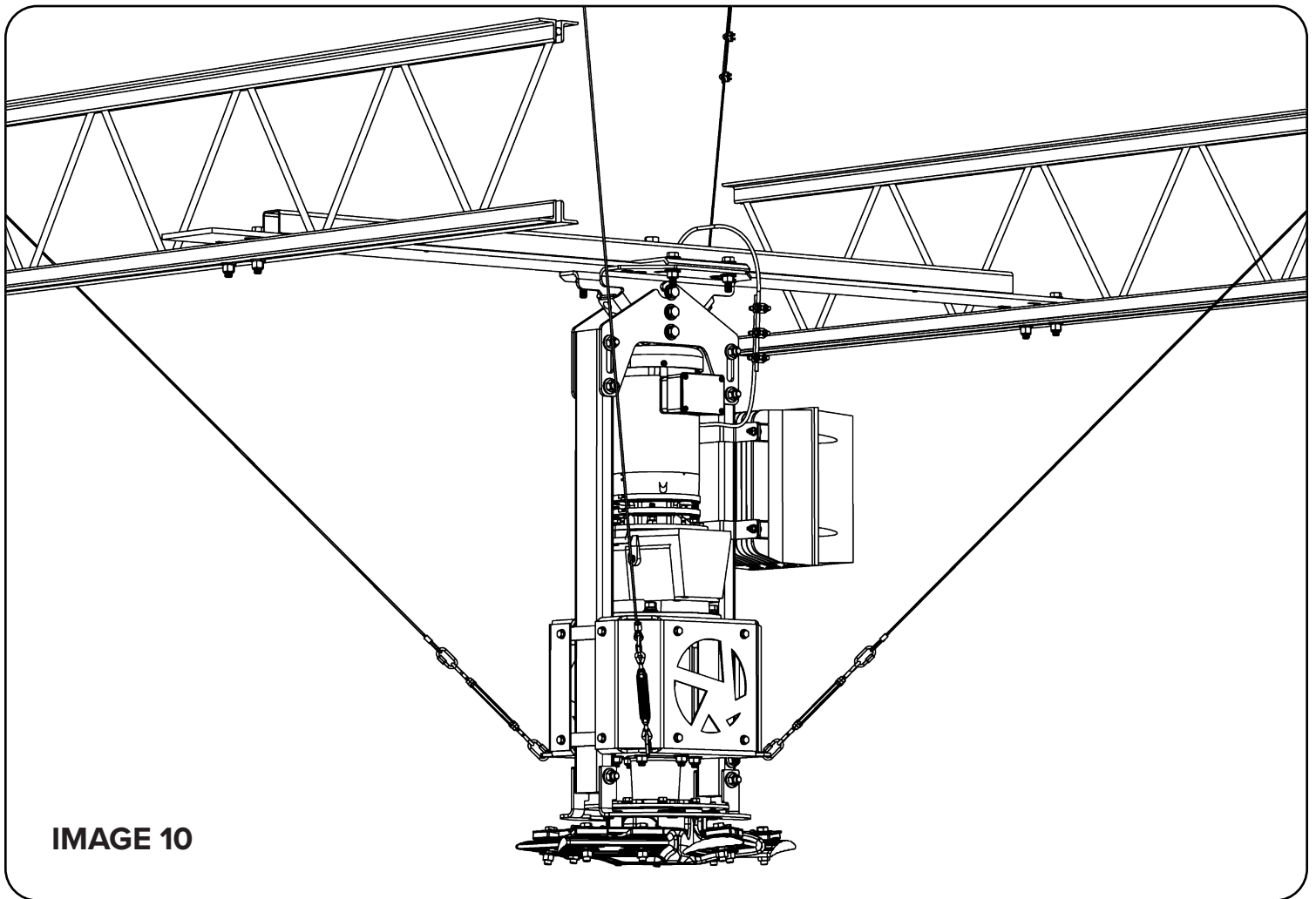


IMAGE 10

STEP 4 - INSTALL FAN ASSEMBLY SAFETY CABLE



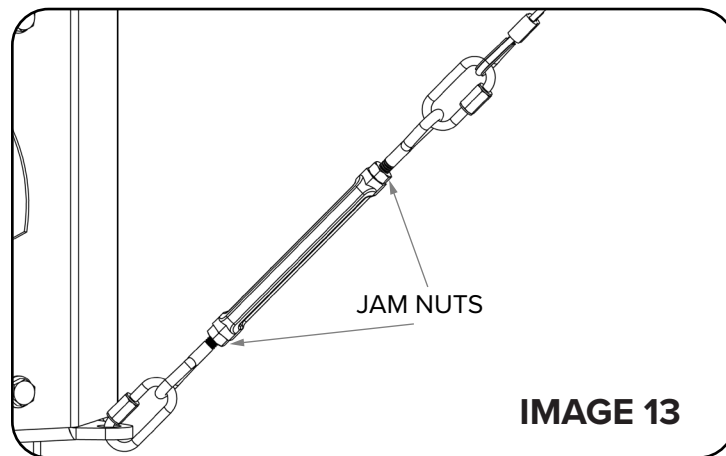
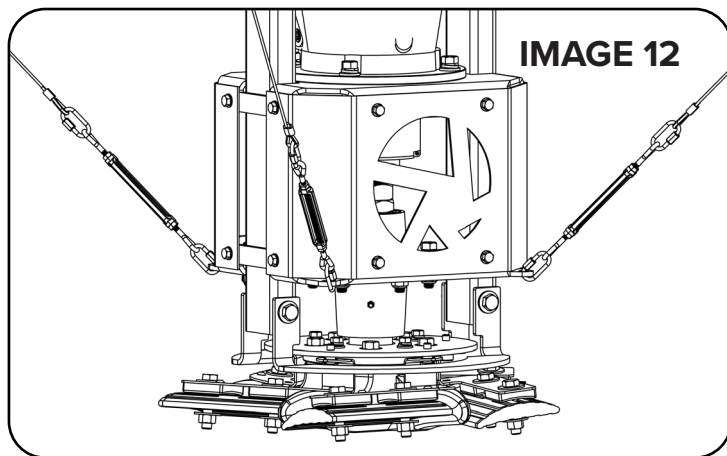
Note: This step is required. Failure to install the safety cable may void the manufacturer's warranty.


- 1) Pass one end of the safety cable under the hangers. Refer to Images 9 and 10 for more information.
- 2) The opposite end of the safety cable should be passed over the top of the I-beam or other mounting structure. Connect the two ends of the cable together by means of three saddle clamps (provided) in the manner shown in Image 11.
- 3) Tighten the saddle clamps securely using a ½" socket. Torque to 15 ft-lbs



IMAGE 11

STEP 5 - INSTALL GUY WIRES



 **Note:** For maximum stability, the angle formed between the guy wire and the ceiling should be **less** than 45 degrees.



Note: This step is required. Failure to install the guy wires properly may void the manufacturer's warranty AND become a safety hazard.

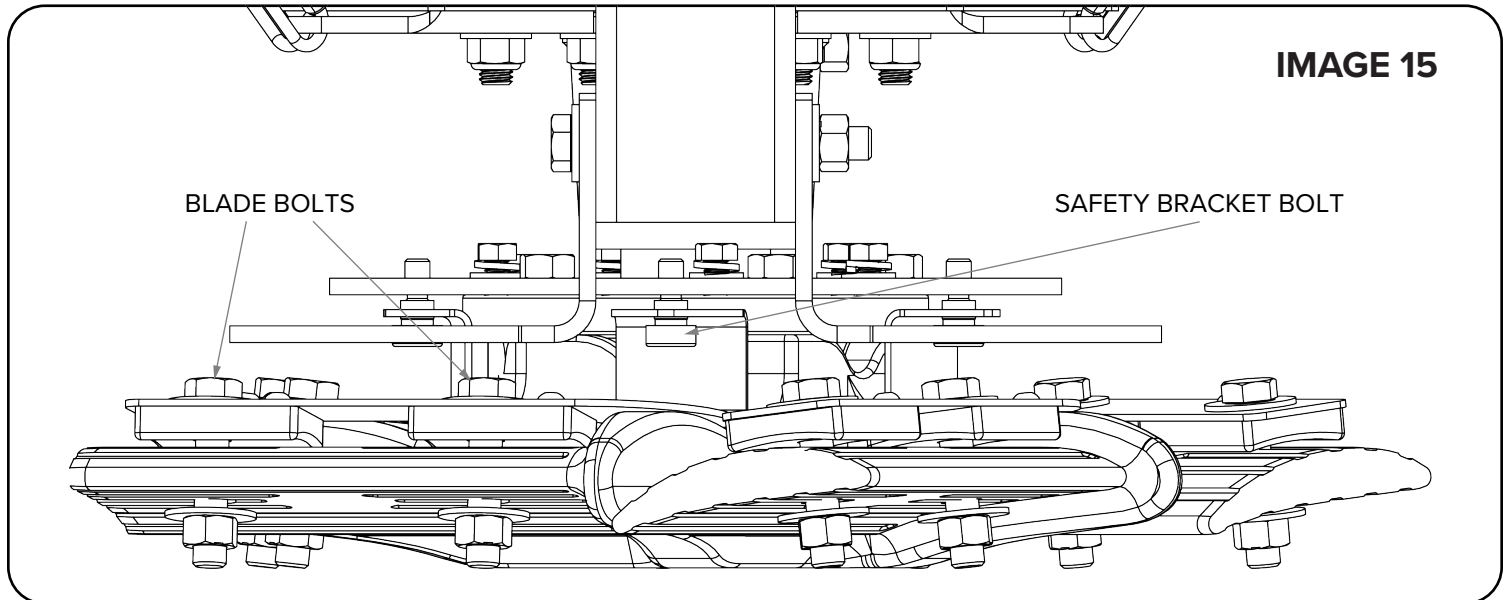
The following steps should be performed with the aid of a scissor lift.

- 1) Attach the looped end of the guy wire to the turnbuckle located on the fan assembly. It should appear like the Image 13.
- 2) Pass the opposite end of the guy wire through the eye bolt of a beam clamp (not supplied). **Thimbles must be used to protect the cable from damage. Refer to Image 14.**
- 3) Reduce the slack in each cable, making sure the fan assembly remains in the vertical position. Use 3 saddle clamps to crimp the end of the guy wire together (Image 14). Ensure saddle clamps are positioned so that the teeth on the nut side grab the end of the cable that is most likely to slip.
- 4) Repeat steps 1 – 3 for the remaining three guy wires.
- 5) Once all guy wires are in place, use the turnbuckles to take out any remaining slack. Periodically check the fan assembly with a level to ensure it remains in the vertical position. Continue adjusting by means of the turnbuckles until all cables are satisfactory. Guy wires should be taut, but not overstressed. Recheck all saddle clamps for tightness.
- 6) **Tighten all jam nuts on turn buckles (Image 13). This step is required. Failure to install the guy wires properly may void the manufacturer's warranty AND become a safety hazard.**

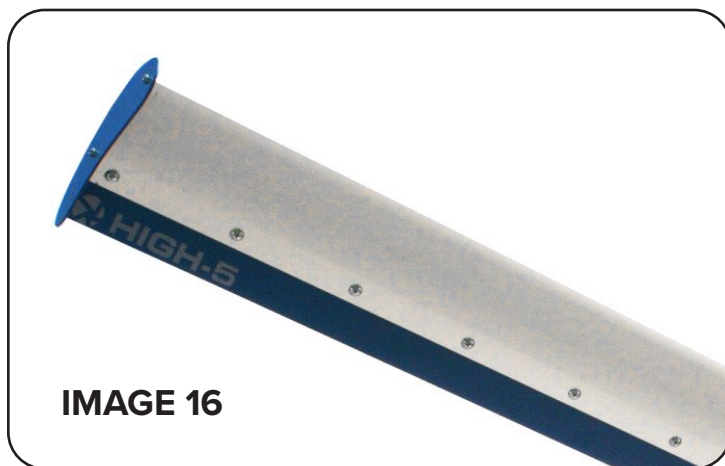


STEP 6 - INSTALL FAN BLADES & SECURE BLADE SAFETY BRACKET

- 1) Care should be taken when installing the blades to ensure they are not bent or damaged, as this may affect fan performance.
- 2) Remove blade bolts, nuts, and washers from blade “paddle” on the fan’s hub. Carefully slide the fan blade into position until all blade bolt holes on the fan, blade, and safety bracket are aligned. Replace blade bolts, nuts, and washers. Torque to 65 ft-lbs.



- 3) Install blade flaps using ¼” bolts and end caps using #10 x ½” screws provided. Ensure ¼” bolts are tight on flaps. The pan head of the bolts go into the countersinks in the bottom of the blades. Refer to Images 16 and 17 for more information.
- 4) Repeat steps 2 – 3 for the remaining four blades.



**THIS COMPLETES THE MECHANICAL
INSTALLATION OF YOUR HIGH-5 FAN.**

PART 2

ELECTRICAL INSTALLATION



WARNING: This portion of the installation **MUST** be completed by a licensed electrician with knowledge of all national and local electrical codes.



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STEP 1 - BREAKER SIZING

- 1) Refer to Table 1 below for recommended circuit breaker sizing based on input voltage and fan motor horsepower.

TABLE 1

VFD Model	Input V	Input Max Amp/ Recommended Fuse	Output V	Output A,
ACS 355 series	460, 3ph, 1 HP	3.4/20	0-460, 3ph	2.4
ACS 355 series	460, 3ph, 2 HP	5.8/20	0-460, 3ph	4.1
ACS 355 series	230, 3ph, 1 Hp	7.6/20	0-240, 3ph	4.7
ACS 355 series	230, 3ph, 2 Hp	12/20	0-240, 3ph	7.5

STEP 2 - RUN INPUT POWER CABLE & INSTALL LOCKABLE DISCONNECT

References: Chapter 6 of the ACS355 User's Manual

WARNING: The Lockable Disconnect must be installed per local electrical codes. **AT MINIMUM** it must be installed outside the diameter of the fan blades.

- 1) Be sure to size the input power cable properly for the application. Most installations will require 12-gauge wire. However, longer runs of power cable may require 10-gauge or higher.
- 2) Run input power cable from the power source into the top of the Lockable Disconnect, using the appropriately sized knockout.
- 3) Connect conductors to terminals L1, L2, and L3, respectively. Ground wire should be fastened to the protective earth (PE).
- 4) Continue running input power to the drive by connecting three conductors to terminals T1, T2, and T3, respectively. A ground wire should be fastened to the protective earth (PE) provided.
- 5) Connect the opposite end of the input power cable to the VFD in the manner shown under the heading "Connecting the Power Cables" in the "ACS355 User's Manual." The three conductors should be connected to U1/L, V1/N, and W1, respectively. The ground wire should be connected in the manner shown in Image 18.

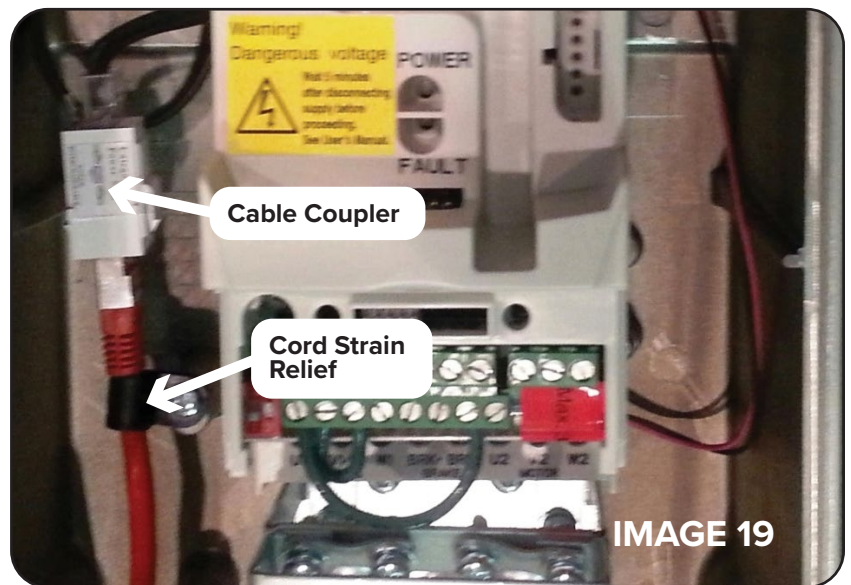
STEP 4 - MOUNT THE REMOTE KEYPAD & CONNECT TO THE VFD

⚠️ ⚡ CAUTION: It is vitally important that the remote keypad is **ALWAYS** mounted outside the blade radius of the fan. This is especially important for the daisy chaining configuration (see page 25). The daisy chaining process requires access to the keypad while the fan is in motion.

1) Once a desired location is found, affix the remote keypad to the wall using the mounting pads attached to the keypad enclosure.

2) Run the Cat 6 cable up to the fan-mounted VFD via the shortest possible path. If possible, avoid lighting and other noise-producing electrical equipment. Running the cable inside conduit is optional.

3) Pass the Cat 6 cable through the strain relief and then into the bottom of the drive. Connect to the cable coupler and secure to the inside of the drive as shown in Image 19. **DO NOT** connect the cable directly to the receptacle on the face of the VFD. Be sure to tighten the strain relief on the bottom of the VFD.



4) Replace the cover of the VFD and screw down securely.

STEP 5 - CONNECT THE VFD TO A FIRE SUPPRESSION SYSTEM (OPTIONAL)

⚠️ ⚡ WARNING: There should be no voltage on the fire suppression system cable. Placing voltage on the VFD terminal block will destroy the unit and void all manufacturers' warranties.

⚠️ ⚡ CAUTION: **DO NOT** connect Patterson High-5 fans to the fans of another company for purposes of fire suppression. A separate line must be run for Patterson fans **ONLY**.

⚠️ ⚡ CAUTION: If the drive will not be connected to any fire suppression system, the factory installed jumper across 9 & 15 **MUST** remain in place.

1) Remove the factory installed jumper between terminals 9 and 15. The terminal block is located at the bottom of the ACS355. For more information, refer to Image 18 on page 18.

2) Connect the fire suppression system wires to terminals 9 and 15. Again, the fire system cable will leave the drive enclosure out of one of the holes on the bottom, using a strain relief (**not provided**).

3) Drive is now wired to shut down upon activation of any fire suppression signal.

THIS COMPLETES THE ELECTRICAL INSTALLATION OF YOUR HIGH-5 FAN.

PART 3

DAISY CHAINING

This section is optional and is not necessary to complete the installation of your fan.

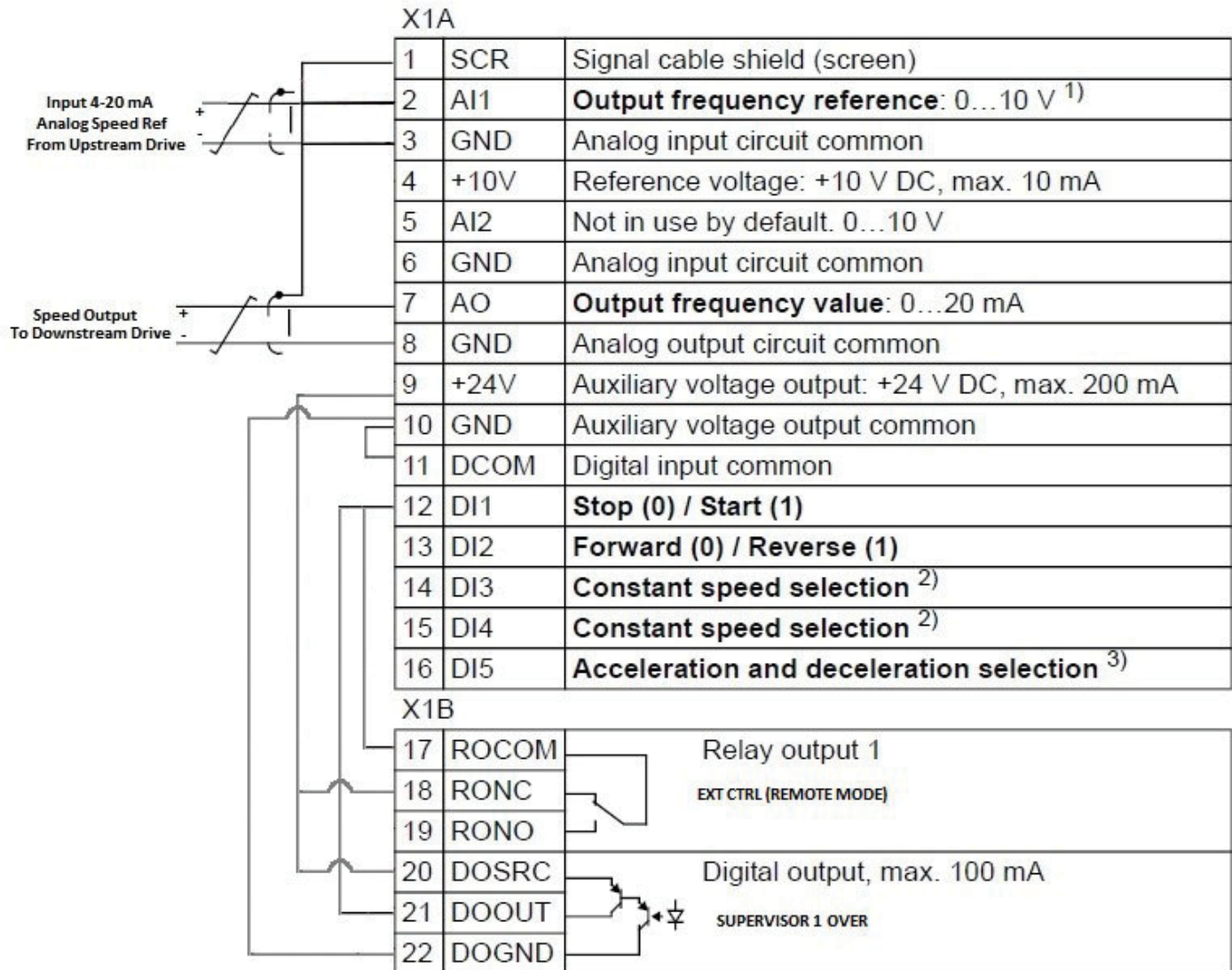


WARNING: Please read carefully and completely before beginning the daisy chaining procedure.

Daisy chaining is a set up by which the output of one VFD is tied to the input of the next VFD downstream. This allows for a master/follower configuration. The “master” fan remains in LOCAL mode, while all the “followers” are set to REMOTE. The followers will then rotate at the same speed as the master fan.

Note: Any fan in the daisy chain can be set to LOCAL (LOC) mode for local control. **However, all of the fans downstream will begin to rotate at the speed of that fan, NOT the designated master.**

Each follower must be wired according to the diagram below. The VFD designated as the master will be wired in exactly the same manner, but **without wiring ANYTHING into terminals 2 and 3 on the VFD.**



KEY POINTS FOR DAISY CHAINING:

- 1) Wire for daisy chaining must be: 2-conductor with ground, **18 AWG**, double shielded.
- 2) Based on the wiring diagram, please note that only the “speed output to downstream drive” end of the daisy chain wire shield is connected to the drive at terminal 1. The shield on the input side (terminals 2 and 3) is **not** connected.

- 3) Please note the series of jumpers in the above diagram. These must be connected in addition to the daisy chain input/output wiring. Two of the jumpers are already factory installed (see below). The rest must be connected at the time of fan installation. The numbers in the diagram correspond to numbers on the drive's terminal block (see Image 18 on page 18 of these instructions).

Factory installed jumpers – 10 & 11 / 9 & 15

Field installed jumpers – 9 & 18 / 9 & 20 / 10 & 22 / 12 & 17 / 12 & 21

- 4) Make sure that the DIP switch labeled “1” is in the ON (or up) position. This switch is located to the left of I/O terminal block pin #9. Refer to Image 18 on page 22 for more information.
- 5) To reduce noise and potential drive interruption, it is recommended that daisy chain wire be run through conduit.

6) **SPEED SCALING:**

Because of line losses, downstream followers may initially rotate at a slower speed than that of the master. To rectify this problem, perform these steps:

Make sure the “master” fan is in LOCAL mode and all “followers” are in REMOTE mode. If it is safe to do so, turn the master fan on to maximum speed. All fans should begin spinning at this time. Note the maximum speed on the master unit's keypad (in RPMs).

- a. Go to the first downstream follower. If the unit is rotating at the same speed as the master, no additional action is necessary. However, if the speed is slower than the master, go to Step (b).
- b. Unlock the follower's parameter set:
 - i. Set the fan in local mode by pressing the LOC/REM button.
 - ii. Press the MENU key on the keypad.
 - iii. Highlight the PARAMETERS option. Press ENTER.
 - iv. Use the up/down arrow keys to highlight parameter group 16. Press SELECT.
 - v. Scroll down to parameter 1603 PASS CODE. Enter the pass code shown next to the parameter's description on page 211 of the “ACS355 User's Manual.” You will use the up/down arrow keys to enter the code. Once entered, press the SAVE key.
 - vi. Scroll up and select parameter 1602 PARAMETER LOCK. Using the arrow keys, change the status from LOCKED to OPEN. Press the SAVE key.
 - vii. Continue pressing the EXIT key until you arrive at the keypad's output screen. Return the fan to REMOTE mode by pressing the LOC/REM button.
- c. Once the parameter set has been unlocked, the fan speed will need to be scaled to match that of the master. To accomplish this:
 - i. Press the MENU key on the keypad.
 - ii. Highlight the PARAMETERS option. Press ENTER.
 - iii. Use the up/down arrow keys to highlight parameter group 01. Press SELECT.
 - iv. Scroll down to parameter 0120 AI 1. This is a read-only parameter. Jot down or remember its value, expressed as a percentage (%). Press EXIT until you reach the keypad output screen.
 - v. Place the fan in LOCAL control by pressing the LOC/REM button.
 - vi. Navigate back to parameter group 13. Press SELECT.
 - vii. Find parameter 1302 MAXIMUM AI1. Using the arrow keys, enter the percentage from parameter 0120. Press the SAVE key.

- viii. Press EXIT until you reach the keypad output screen. Return the fan to REMOTE mode. The fan should immediately start to speed up to match the master.
- d. Repeat Steps (b) and (c) for each additional downstream follower. It is advisable to re-lock each fan's parameter set after adjusting the speed scale, reversing the instructions in Step (b). This will prevent unnecessary tampering with fan drive parameters.
- e. Once all followers have been properly scaled, return to the master fan and set the desired speed for the daisy-chained system.

For additional questions concerning the daisy chain configuration, contact Patterson engineering at (800) 768-3985.

THIS COMPLETES THE HIGH-5 DAISY CHAINING INSTRUCTIONS.



HIGH-5