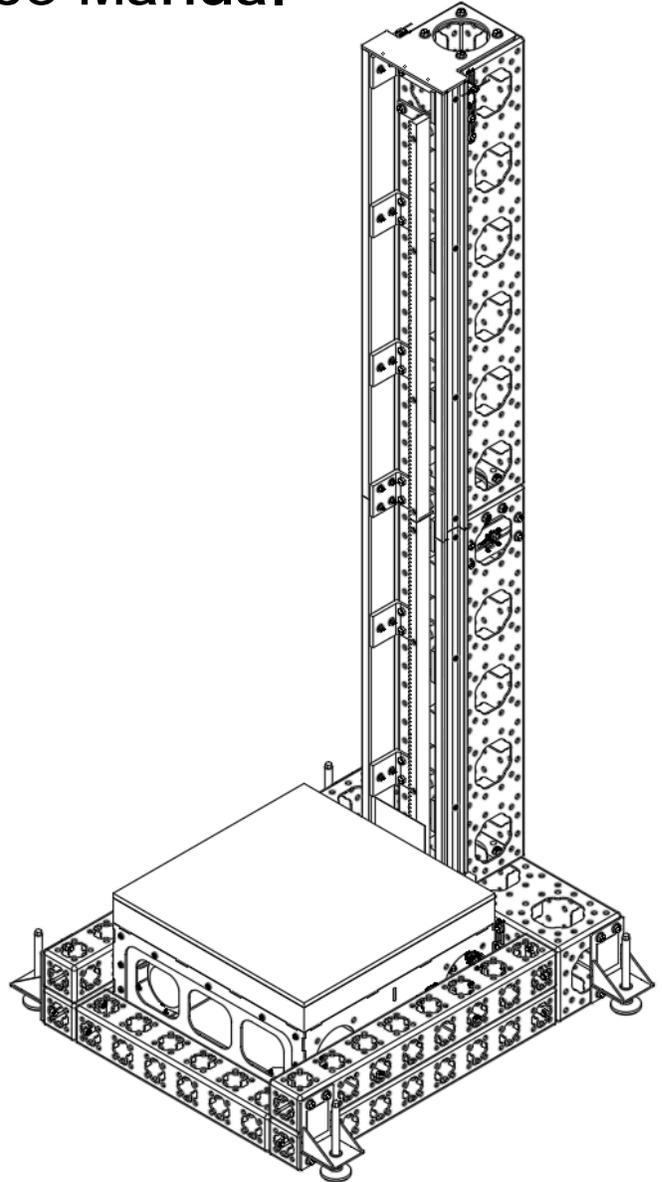


creative conners, inc.

Floorpocket Reference Manual

Version 1.0.1



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Floorpocket Reference Manual

1 – Getting Started

Congratulations on your purchase of the **Floorpocket** lift from Creative Conners, Inc. The **Floorpocket** is a lift designed to meet the demands of scenic automation in vertical applications.

This manual will direct you through:

1. Unpacking
2. Assembly, installation, and testing
3. Operation procedures

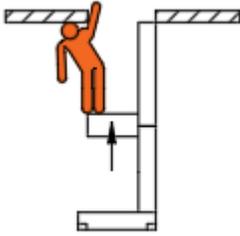
If you need help along the way contact us either on our website (www.creativeconners.com), via email (support@creativeconners.com), or by phone (401.289.2942)

1.1 A word about safety

The **Floorpocket** is a versatile and powerful machine for lifting scenery and performers. The **Floorpocket** can raise impressive loads effortlessly and swiftly from the traproom to the stage. Such power requires a great deal of respect and attentiveness to ensure that both performers and technicians are kept safe. Automated effects always carry significant risk, but the risk of injury is magnified when lifting scenery and people. Risks are further complicated when raising people and scenery through a hole. As you read this manual, you will see that many safeguards have been designed into both the machinery and controls of the **Floorpocket**, but this engineering rigor is only useful when leveraged by your diligent commitment to safety.

When used in the traproom of a typical production, a stage lift carries several major risks to people and scenery or props. Some such examples include:

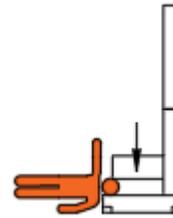
Table 1 - Typical Safety Hazards



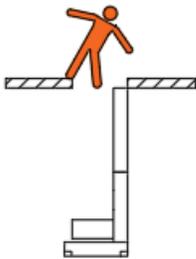
Crushing hazard when raising



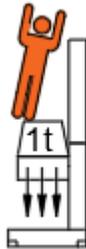
Crushing hazard when lowering



Severing hazard when lowering



Falling Hazard



Overweight hazard



Tip Over hazard



Entanglement Hazard

If these images and the associated risks fill you with dread, that's a healthy response. We share that dread and want to make sure you keep your stage safe.

Throughout the manual we will dive deeper into the safety systems included with the Floorpocket, Stagehand Pro AC, Safety Interlock and Spikemark.

1.2 Floorpocket Overview

The **Floorpocket** is designed for lifting. It is composed of three primary components:

- Base Tower
- Extension Tower(s)
- Motorized Platform

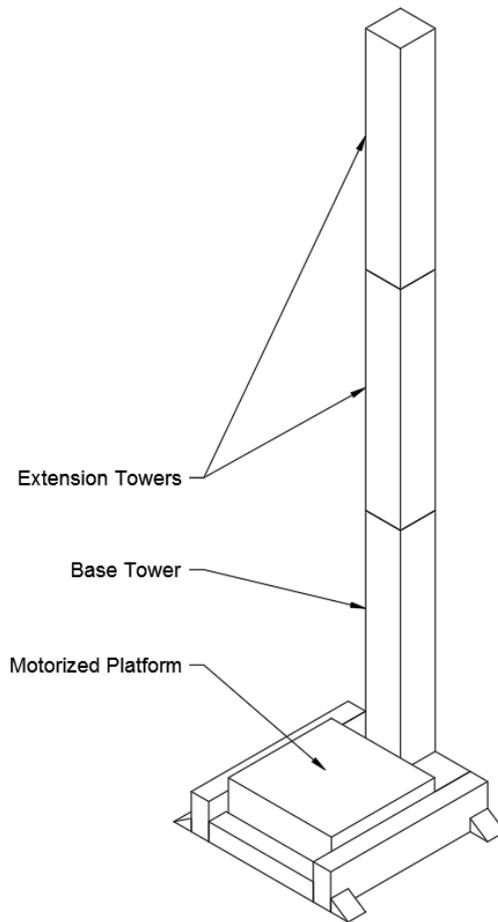


Figure 1 - Typical Floorpocket

The **Base Tower** is small enough to be rolled through a double-door. It is the foundation of the lift and provides up to 6' of vertical lift. The **Extension Tower(s)** are bolted onto the **Base Tower** to reach great heights. **Extension Towers** are available in practically any increment up to 6'. A maximum of two **Extension Towers** can be added to the **Base Tower** for a maximum 18'-0" of vertical lift. Both the **Base Tower** and **Extension Tower** are fitted with tracks and gear rack. The **Motorized Platform** climbs up the towers using these tracks and gear rack. It is capable of raising and lowering up to 1000 lb at speeds up to 18" per second. Since all the mechanics are enclosed in the platform, the **Floorpocket** can easily be reconfigured to different heights by changing the arrangement of **Extension Towers** without affecting the 1000lb load capacity.

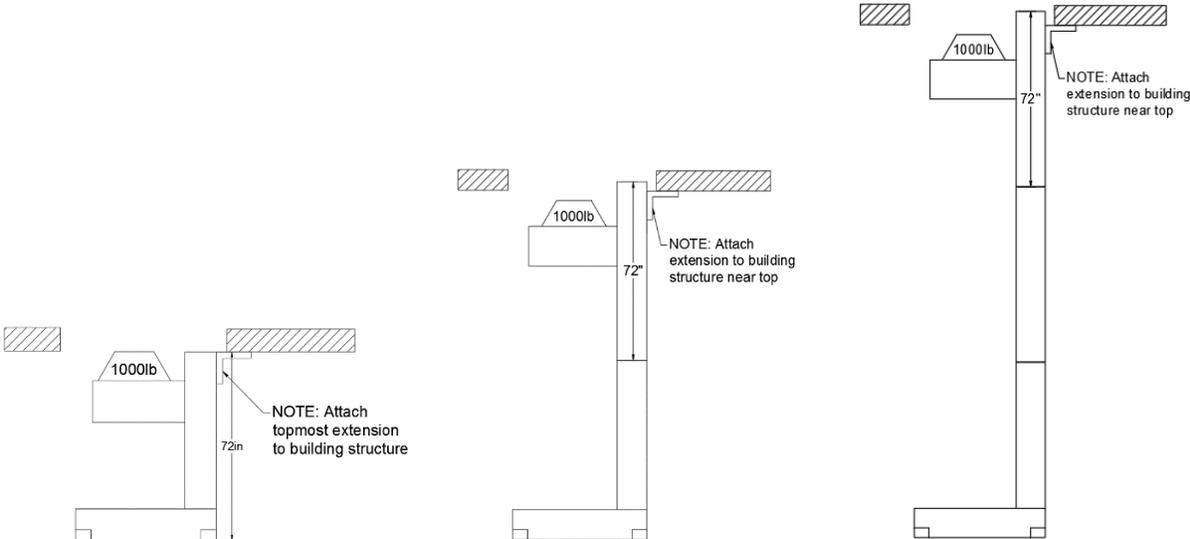


Figure 2 - Mast Connection

	<p>SAFETY NOTE</p> <p>The Floorpocket is required to be connected at the top of the mast, no matter the configuration. Any additional platforming must not overhang the lifting platform and should be attached to the lifting platform through the four mounting holes provided.</p>
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The Floorpocket base configuration includes 4 removable wheels for moving the unit without a pallet jack as well as 4 removable, adjustable feet. Both the wheels and feet are bolted through the base frame, see the details below.

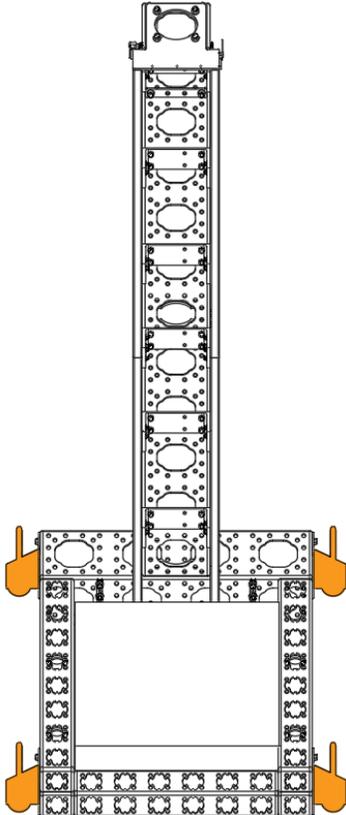


Figure 3 - Removable Wheels

Used to transport the Floorpocket and position in trap room. Not to be used with the lift raised.

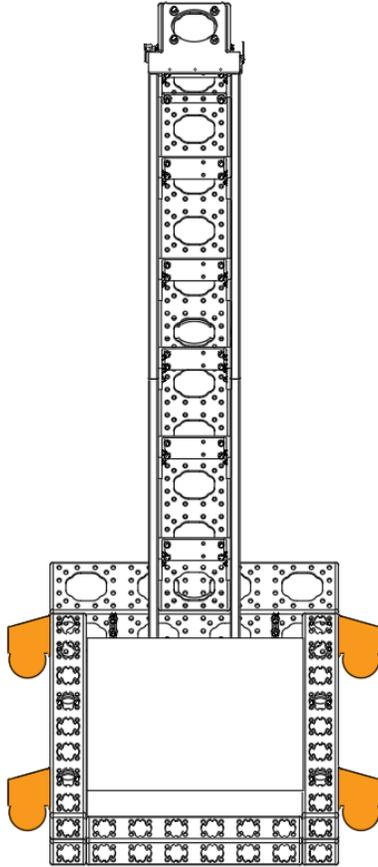


Figure 4 - Leveling Feet Locations

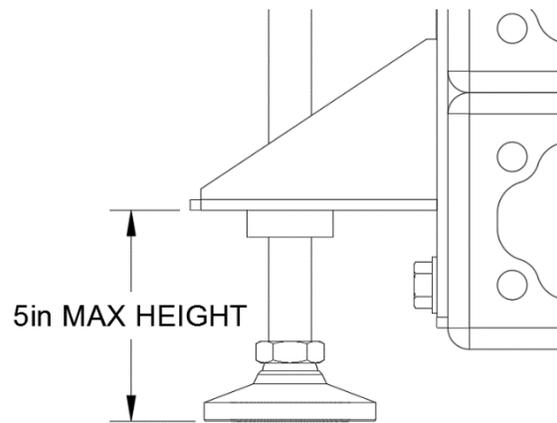


Figure 5 - Leveling Feet Detail

The bottom of the adjustable foot bracket can be no higher than 5” from the floor. It is the responsibility of the installer to determine the structural integrity of the venue floor. The total weight of a 12’-0” Floorpocket and fully loaded platform will be in the 2,700lb range.

NOTE: Depending on the installation circumstances it may be necessary to add bucking between the base of the Floorpocket and traproom walls.

1.3 Integrated Safety Features and Risk Analysis

The risks inherent in using a stage lift require not only sound mechanics, but also sophisticated controls that are fully integrated to the machine for safe operation. The **Floorpocket** lift is designed to be used with all the included safety features: FWD, REV & ULT limits, machine guarding and the **Safety Interlock Box** to incorporate safety mat and safe edge. In addition to the physical safety features, the communication and feedback between the **Stagehand Pro AC**, **Safety Interlock Box**, the **Showstopper 3 Base** and **Spikemark** are paramount in creating a safe operating environment.

Although these safety features are included, they are not intended to be the only risk reduction incorporated into your installation. It is crucial to the safe operation of the **Floorpocket** that the end user also investigates the risk of their specific installation and take steps to reduce and eliminate those risks. This could include using the incorporated safe edge and safety mats, but may also require additional safety mats or bumpers. Based on the specific conditions, it may

also require the creation and installation of a “lift box” to remove additional pinch points. It could also incorporate interlock switches.

In the end, although the machine is modular each installation is unique and requires a critical eye in the planning, installation and daily operation. Let’s dig into the details and discover how all the individual features of the machine and control system work in unison with the Stagehand Pro and Safety Interlock Control to raise the level of safety both above and below your stage.

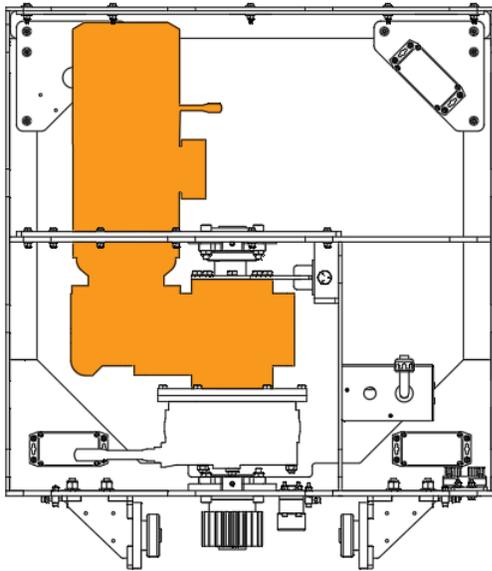


Figure 6 - Primary brake and encoder

The motor side brake is the primary brake used to hold the load. The integrated incremental encoder is used for position, overspeed detection as well as feedback for the Closed Loop Vector control. The Stagehand Pro AC uses these signals to automatically engage the brake if a fault is detected. The primary brake is also engaged anytime an E-Stop is pressed.

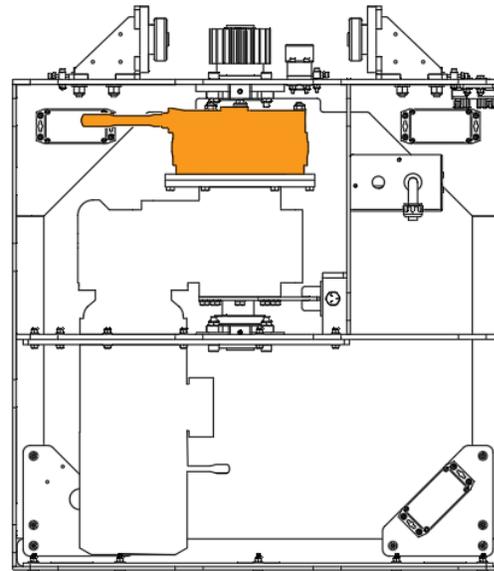


Figure 7 - Redundant brake

The load side brake is the secondary brake to the motor brake and protects against mechanical failure in the gear motor. The secondary brake is disengaged and engaged by the Stagehand as well as by any E-Stop signal.

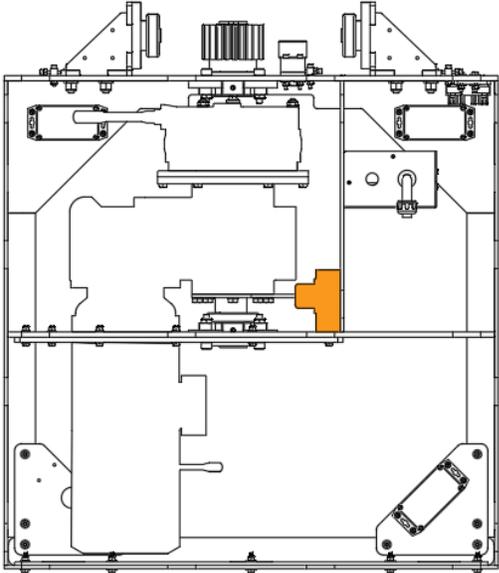
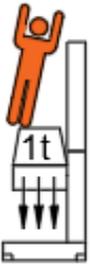


Figure 8 - Load Cell

The load cell determines if the load on the platform is overweight and will not allow movement if that condition is true. This precaution is necessary because: 1- The lift may be overloaded when lowered. 2- With redundant brakes we have more braking capacity than lifting capacity.

	<p>SAFETY NOTE</p> <p>Although the Load Cell mitigates the risk associated with an overweight load, care must still be taken when the platform is extended flush with the stage deck. A ladder or personnel lift should not be placed on the lifting platform, nor should any bracing be placed under the lifting platform for additional support unless approved by Creative Connors Inc. The Floorpocket is not to be used as an equipment elevator.</p>
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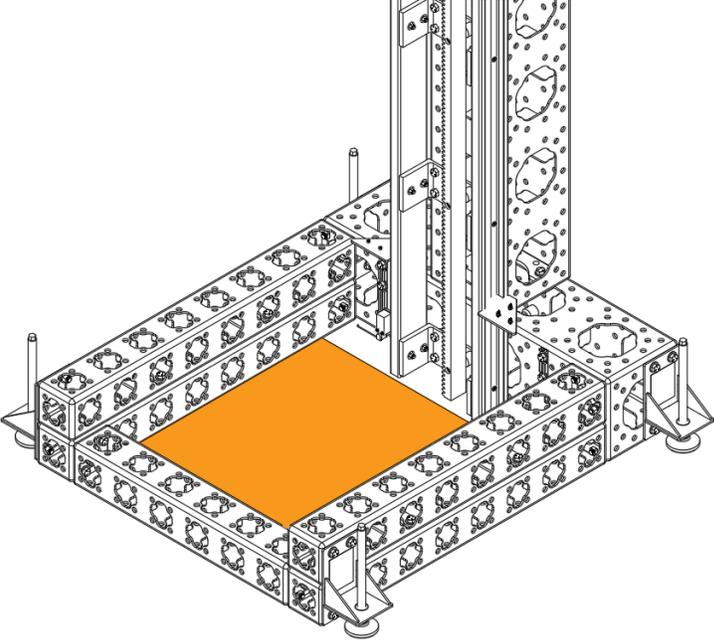
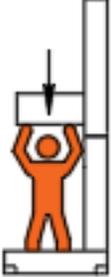


Figure 9 - Pressure mat

The Pressure Mat is incorporated into the Safety Interlock Box and is present to prevent a crushing hazard of a person or prop under the lifting platform. When the Mat is triggered it engages the REV limit on the Stagehand Pro.

	<p>SAFETY NOTE</p> <p>The Safety Mat is an important first step to mitigate a crushing risk. Some additional steps which may need to be incorporated to a specific installation can include:</p> <ul style="list-style-type: none">• Enclosing the elevator shaft and including safety interlock switches on the access door• Limiting access to the platform with guarding
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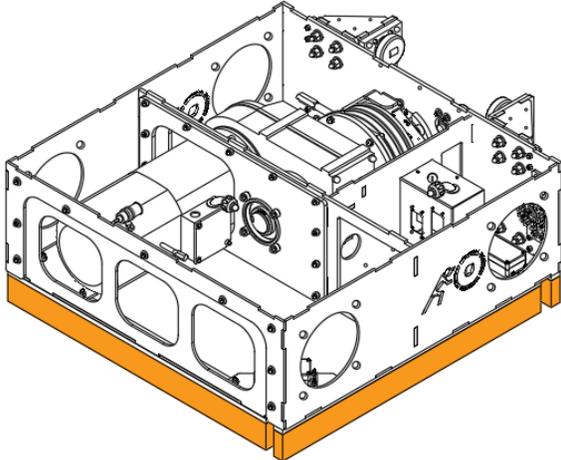


Figure 10 - Platform Safety Edge

To prevent shearing hazard as the platform moves down. This safety edge is controlled by the Safety Interlock box and, like the Safety Mat, engages the REV limit on the Stagehand if tripped.

A diagram showing a hand touching a vertical safety edge. The hand is orange, and the safety edge is a vertical bar with a horizontal base. An arrow points to the contact point between the hand and the edge.	<p>SAFETY NOTE</p> <p>The Safe Edge is an important first step to mitigate the shearing hazard present between the Floorpocket base and the lifting platform. Some additional steps which may need to be incorporated to any installation can include:</p> <ul style="list-style-type: none">• Enclosing the elevator shaft and including safety interlock switches on the access door• Limiting access to the platform with guarding
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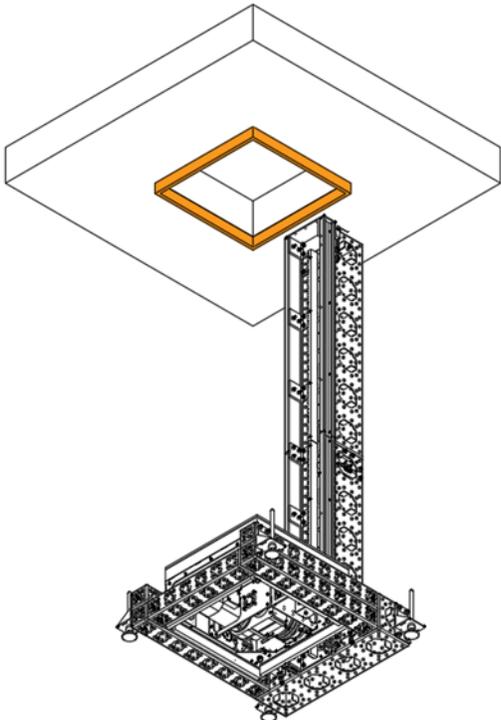


Figure 11 - Trap Safety Edge

The trap Safe Edge (AKA – the Halo Edge) is the only piece of the safety system which needs to be installed by the end user. The Halo prevents a shearing hazard between the lifting platform and the stage deck. The Halo Edge plugs through the Safety Interlock Box, and when engaged it triggers the FORWARD limit on the Stagehand Pro AC.

	<p>SAFETY NOTE</p> <p>The Safe Edge is an important first step to mitigate the shearing hazard present between the Floorpocket base and the lifting platform. Some additional steps which may need to be incorporated to any installation can include:</p> <ul style="list-style-type: none">• Enclosing the elevator shaft and including safety interlock switches on the access door• Limiting access to the platform with guarding
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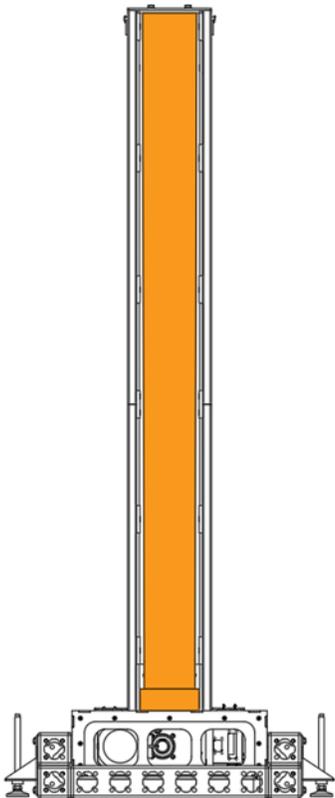


Figure 12 - Mast Machine Guarding

This guarding must be installed and functioning properly to avoid any entanglement of props, costumes or humans in the drive rack

An orange silhouette of a hand is shown being caught between two interlocking grey gears. This icon serves as a visual warning for the safety note.	<p>SAFETY NOTE</p> <p>The mast machine guarding must be installed to prevent any entanglement in the drive rack – it also has the handy side benefit of keeping the greasy drive rack from coming in contact with any priceless costumes. In addition to the mast guarding there are lexan guards installed over the guide wheels which must be installed.</p>
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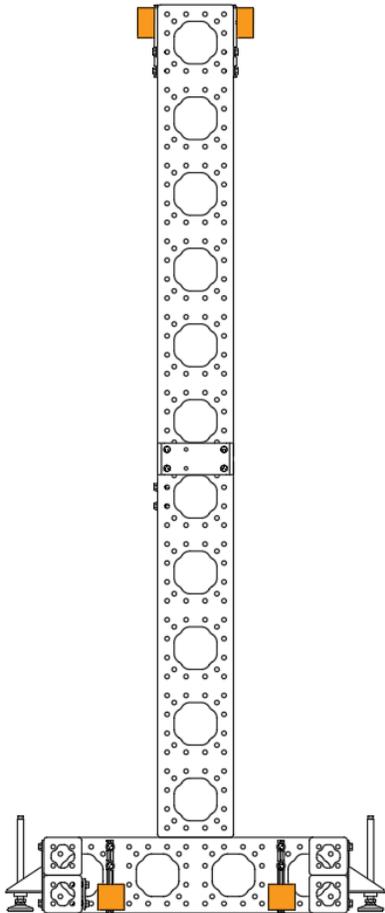


Figure 13 - Adjustable Limit Switches

Used to prevent overtravel when jogging manually, or if there is a failure with the encoder. Ultimate limits are a redundancy to protect against a primary limit failure

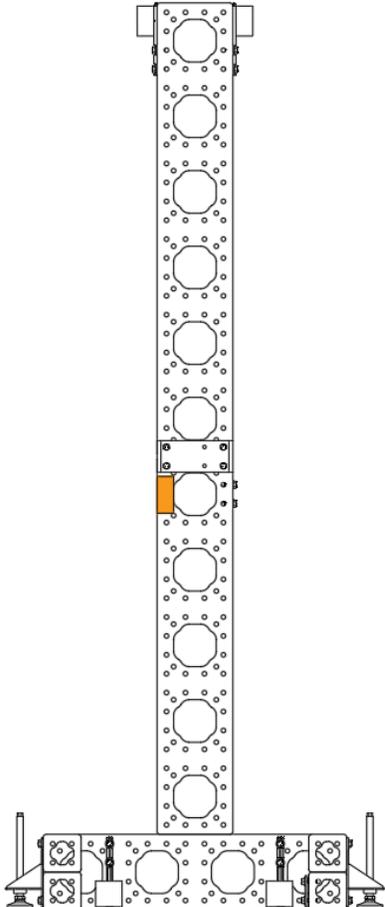


Figure 14 - Limit Switch Junction Box

For easy setup and tear-down, the limits need to be removed. The junction box is how the limits plug into the system and connect to a Stagehand.

2 - Installing and Assembling the Floorpocket

2.1 Unpacking the Floorpocket

The **Floorpocket** ships from the factory in a collapsed form factor on a custom pallet – A pallet jack is helpful, and what we use in the shop to move the palletized machine around. Once the **Floorpocket** is roughly in its desired location, the following steps are required to begin operation.

1. Remove any accessories from the **Floorpocket** platform.
2. Remove the plywood guards on the front, sides and rear of the **Floorpocket**. The guards are attached with carriage bolts and wing nuts.
3. Attach a lifting line to the top of the mast extension
NOTE: Mast extensions may weigh over 350lb. Safe rigging practices are an essential part of this process. Consult a qualified rigging professional before attempting this process.
4. Remove the banding holding the mast extension to the base frame.
5. Remove the mast extension from the base frame, setting aside the plywood guards behind and beneath the mast extension.

NOTE: Removing the mast extension requires careful consideration – not only of the pick points, but also the lifting method and the safety of any person in the vicinity of the lift. This process should only be completed by a qualified rigger.

2.2 Extending the Floorpocket

Extension Towers can be bolted onto the **Base Tower** to extend the overall height from 6'-0" up to 18'-0".

NOTE: Attaching a mast extension requires a coordinated effort with at least (3) individuals, and involves raising and suspending the mast extension over the heads of several of those individuals. Mast extensions may weigh over 350lb. Safe rigging practices are an essential part of this process. This process should be completed by a qualified rigger.

1. Clear the area around the **Floorpocket** and lifting machinery, and confirm overhead clearance.
2. Lift the mast extension into position above the **Floorpocket** base frame mast.
3. Lower the mast extension onto the base frame mast, using the (4) locator pins as guides. (See Figure 1 - Locator Pins)

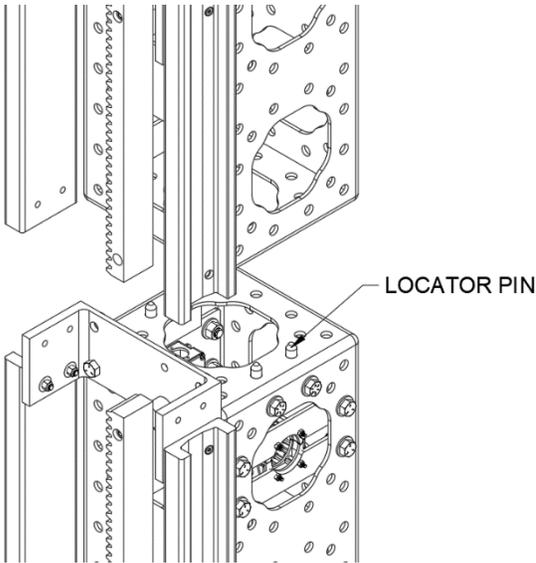


Figure 15 - Mast Alignment

- 4. Confirm the toothed face of the gear rack and the inner faces of the guide rails are flush at the seam. (See Figure 16 - Rack and Guide Rail Alignment and Figure 17 - Guide Rail Alignment)

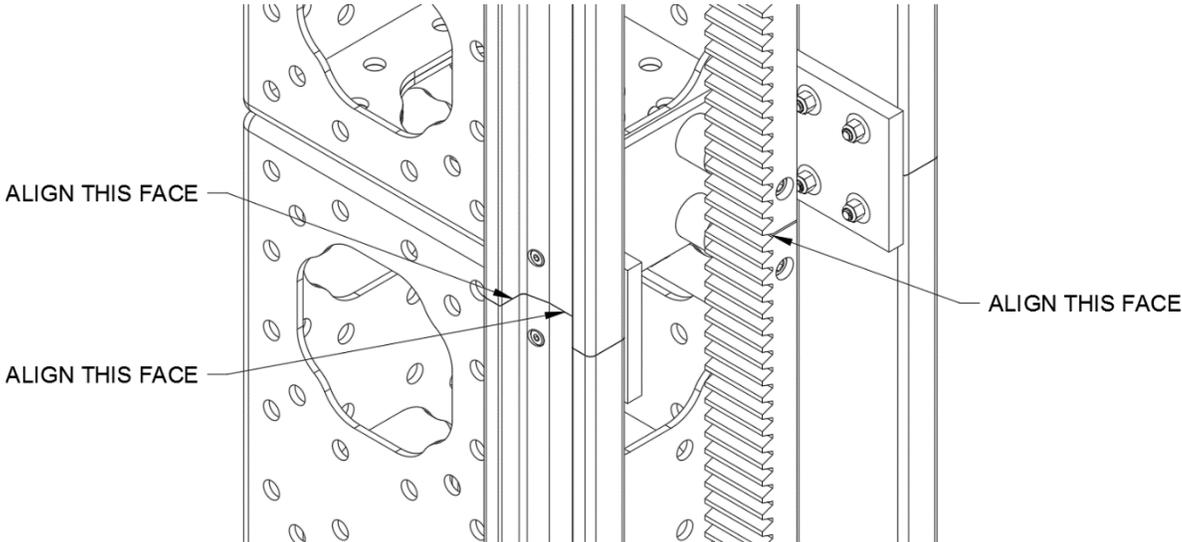


Figure 16 - Rack and Guide Rail Alignment

5.

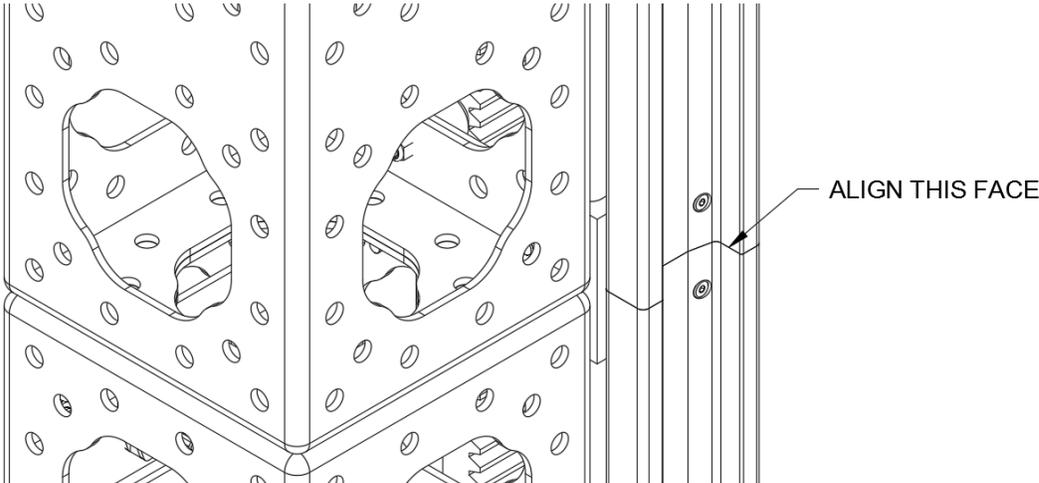


Figure 17 - Guide Rail Alignment

6. Connect the gear rack to the top mast bracket with the included 1/2" Socket-head cap screw, spacer, washer, and Nylock nut.

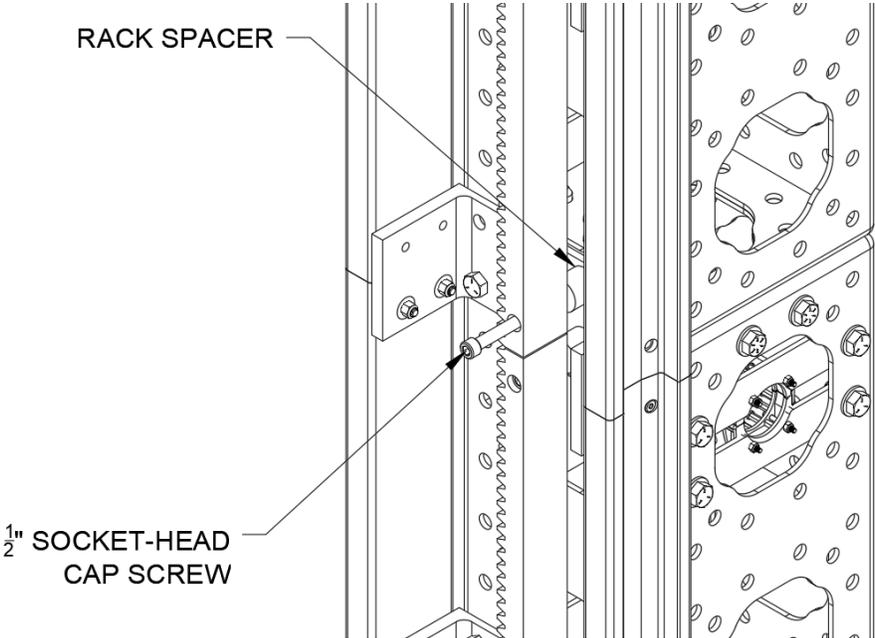


Figure 18 - Gear Rack Attachment

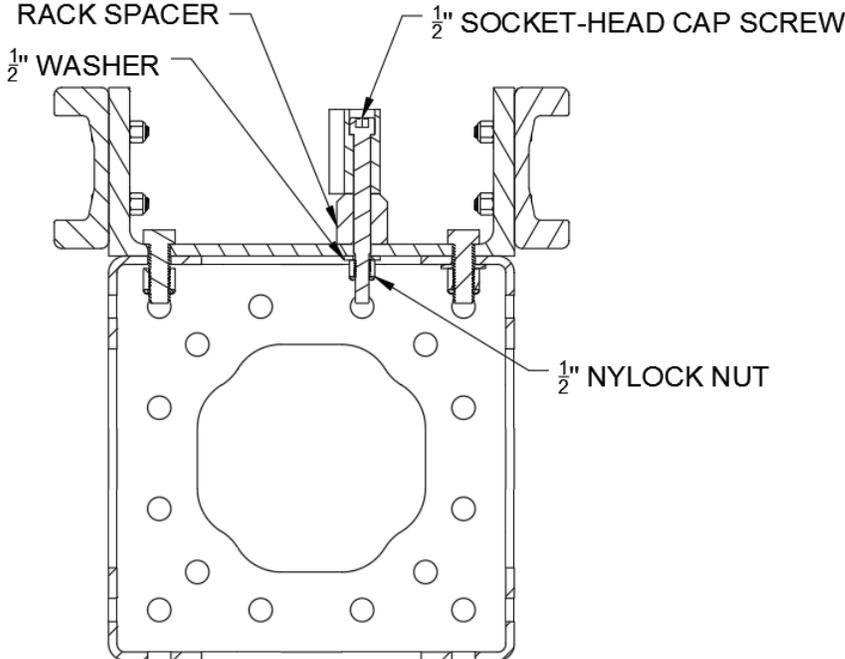


Figure 19 - Mast Section View

- 7. Connect the guide rails to the top mast bracket using the (4) included 3/8 inch low-head cap screws, washers and Nylock nuts.

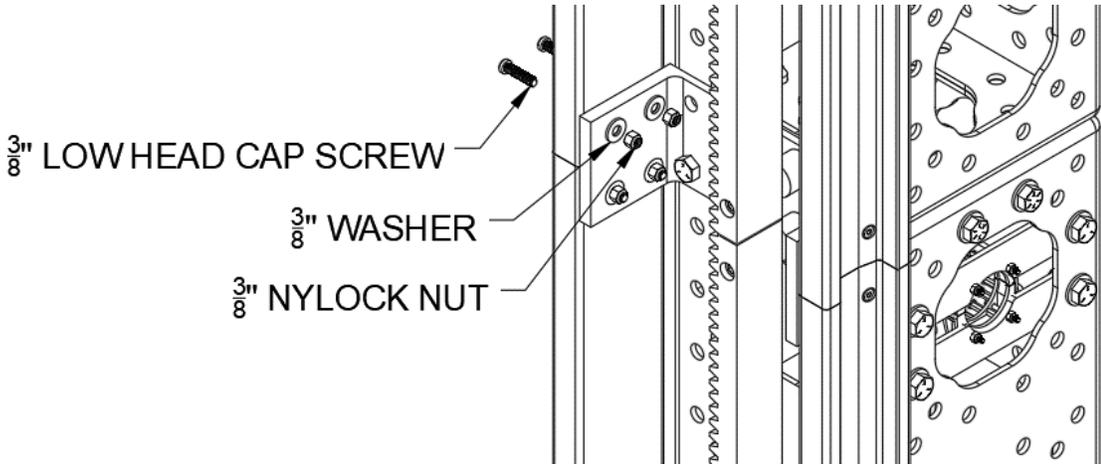


Figure 20 - Guide Rail Bracket Attachment

- 8. Use the included sets of 5/8 inch x 2 inch hex head cap screws, washers and nuts, along with the 12 inch ModTruss washer plates to attach the mast extension ModTruss to the base frame

mast ModTruss.

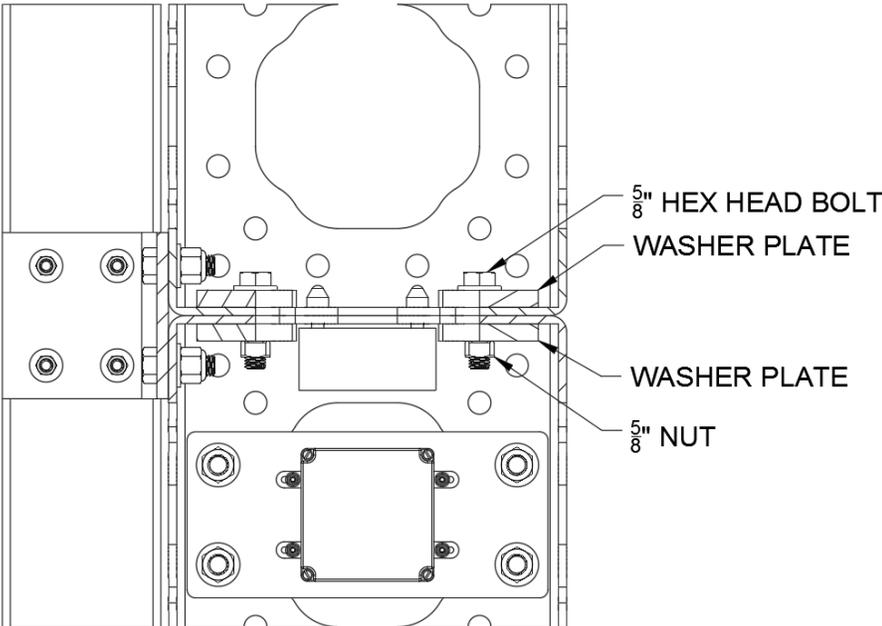


Figure 21 - ModTruss Connection Detail

- 9. Connect the top mast bracket to the top of the upper mast section and secure it using the included 5/8" x 1-1/4" hex-head cap screws, washers and Nylock nuts.

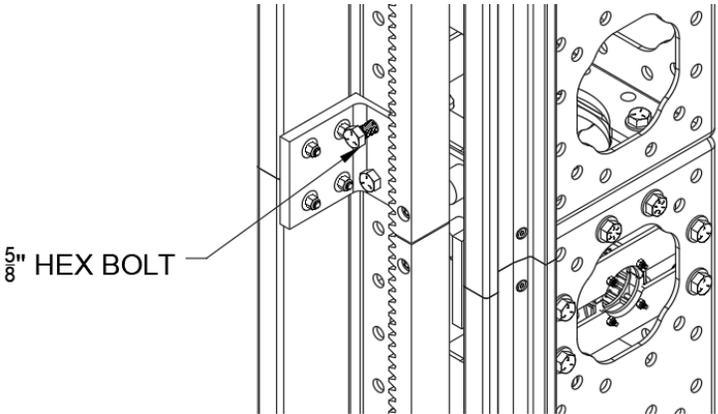


Figure 22 - Mast Bracket Attachment

- 10. Attach mast cap with included 5/8" x 1-1/4" hex head cap screws, washers and nylock nuts

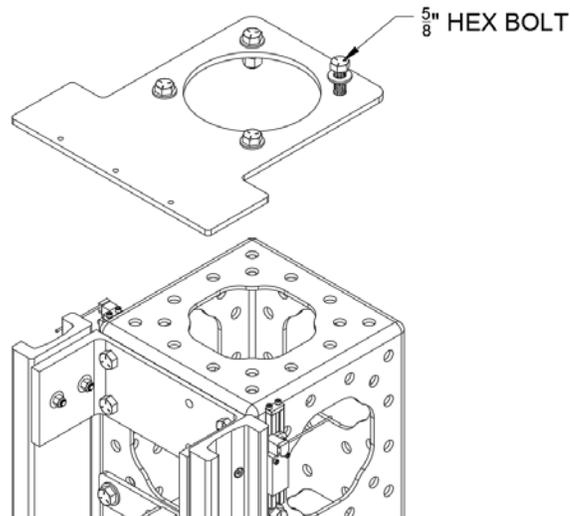


Figure 23 - Mast Cap

11. Confirm the surfaces from step 4 are still flush, and all connections are tightened to the following torques:

- 3/8" hardware – 23 ft-lb
- 1/2" hardware – 57 ft-lb
- 5/8" hardware – 112 ft-lb

2.3 Connecting the Floorpocket to the Safety Interlock Box and the Stagehand Pro AC

The Floorpocket lift requires a **Stagehand Pro AC** and a **Safety Interlock Box** for operation. The Stagehand Pro AC has several key safety features not found in other Stagehand controllers that are critical for safe operation.

- Closed Loop vector mode for zero speed control
- Overspeed detection
- Safety Relay
- Ultimate Limit inputs
- Dual brake control

Although these features add a significant level of safety to normal operation, the Floorpocket requires several additional safety systems, which are incorporated into the Safety Interlock Box. These additional systems include safety bumpers to reduce the risk of a shearing hazard as well as bumpers and mats to reduce the crushing risks, all associated with an elevator.

The **Safety Interlock Box** sits between the Stagehand Pro AC and the Floorpocket, reading signals from the safety sensors and interrupting motion if any safety sensor is activated. The schematic layout and connection diagrams below show how the system goes together.

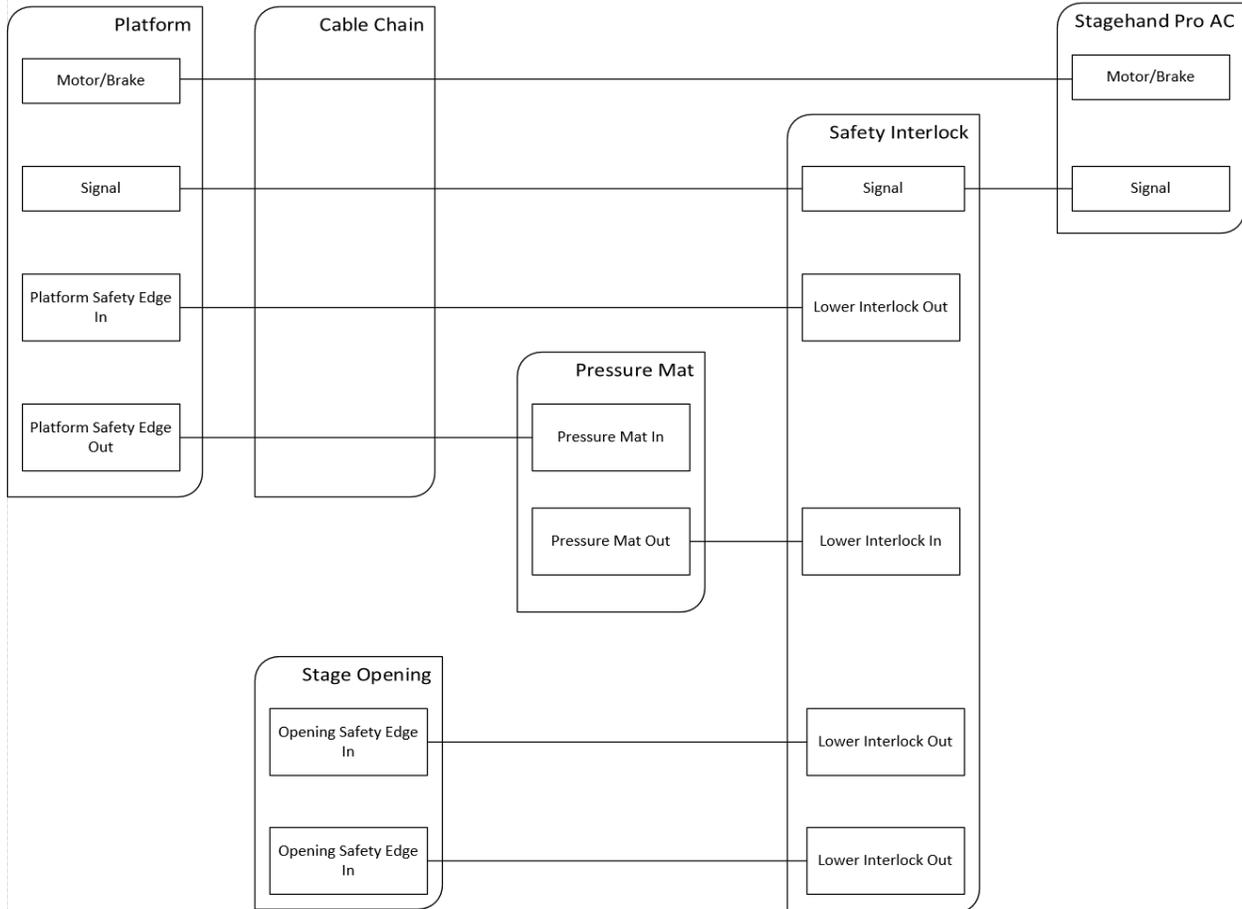


Figure 24 - Schematic Diagram

The following steps assume a completely disconnected **Floorpocket**.

1. Connect the forward, ultimate forward, reverse and ultimate reverse limit switches to the limit switch junction box in the mast.
2. Confirm the network cable (RJ45 Cat5) runs from the limit switch junction box to the electrical box on the **Floorpocket** platform.
3. Connect the signal connector to the **Safety Interlock Box**, going out the rear of the platform and into the mast.
4. Connect the motor/brake connector to the **Stagehand Pro AC**, going out the rear of platform and into the mast.
5. Connect the **Platform Edge In** tail into the **Safety Interlock Box (Rev Sensor Out)**.
6. Connect the **Platform Edge Out** tail to the **Safety Mat In** tail.
7. Connect the **Platform Edge In** tail to the **Safety Interlock Box (Rev Sensor In)**.
8. Enclose all cables running between the platform and mast in the included cable chain.
9. Surround the stage opening (if applicable) with safety edge sensors, and connect the sensor chain to the **Safety Interlock Box (Fwd Sensor In/Fwd Sensor Out)**.
10. Connect the **Safety Interlock Box** to the **Stagehand Pro AC**

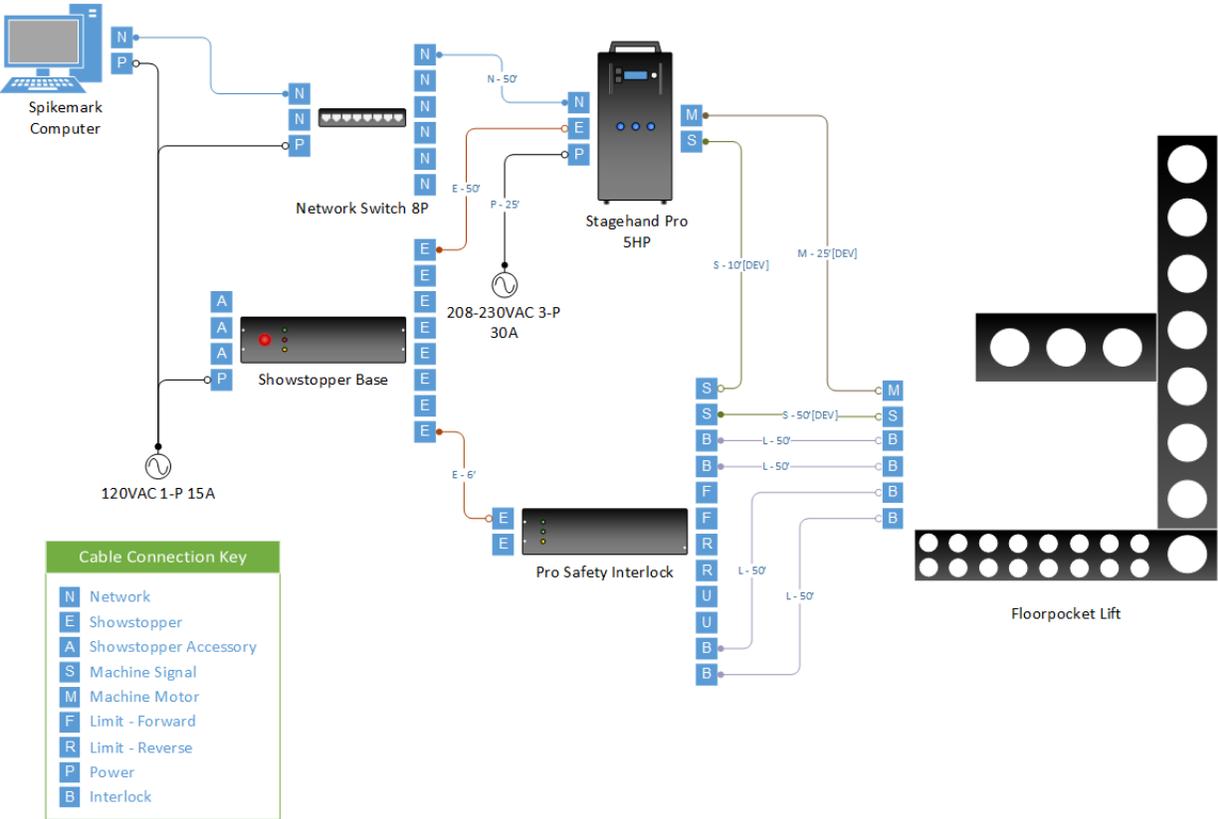


Figure 25 - Hook Up

2.4 Testing Brake Functionality

The **Stagehand Pro AC** is equipped with a brake testing feature. This feature allows you to check the functionality of the primary and secondary brakes. It is vital to perform this test on a regular basis, to confirm that both brakes are working as expected. Since there are two brakes on the machine, it is impossible to detect a single brake failure during normal operation. If one brake were to be jammed open, the machine would still operate as expected but the result of a second brake failure would be catastrophic. By testing for a brake failure nightly, you can detect a single failure and have the lift serviced to restore braking redundancy. Before initiating the brake test ensure the lift is clear of people and scenery, if one of the brakes is not functioning the lifting platform could drop.

On the front of the Stagehand Pro AC you will see three buttons:

- Brake test enable
- Load Brake Release
- Motor Brake Release

To test the brake functionality:

1. Press and hold the illuminated **Brake Test Enable** button, the two brake release buttons will illuminate.

- 2. Press and hold the “load brake release”. You should hear the load brake release.
- 3. Press and hold the “motor brake release”. You should hear the motor brake release.
 - a. NOTE: You cannot press both brake release buttons at the same time

2.5 Testing the motor

To confirm that your motor is properly connected to the **Stagehand Pro AC** you should test these conditions:

- 1. *E-Stop* – Release the E-Stop button on **Showstopper**. You should hear a “click” from inside the Stagehand, this is the E-Stop contactor closing. The LCD display should show that the E-Stop is released by switching the status display to: “Not Connected” indicates that the Stagehand is not communicating with a computer running Spikemark.



Figure 26 - Not Connected

- 2. *Brake release* – Press the **fwd** jog button. You should hear a distinct “click” from your redundant brake quickly followed by the motor brake. This is the sound of the brake releasing. Release the **fwd** job button. You should hear a click of the brakes engaging.
- 3. *Motor Motion* – Press the **fwd** jog button and slowly turn the knob clockwise. The motor should begin moving. Turn the knob counterclockwise to slow the motor to a stop, then release the jog button. Repeat with the rev jog button.
- 4. *Encoder* – When jogging the motor the LCD will display the encoder counts. While jogging the motor verify the counts are increasing while running in the forward direction and decreasing while running in the reverse direction.

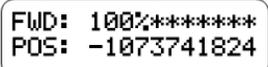


Figure 27 - Encoder Counts

- 5. *Limit Switches* – Manually activate the ultimate forward limit and the forward limit then activate the ultimate reverse limit and reverse limit. The LCD display on the Stagehand should indicate when a limit is detected

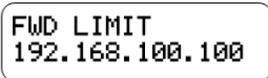


Figure 28 – Forward Limit

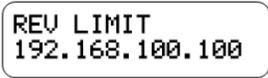


Figure 29 - Reverse Limit

2.6 Manually Releasing the Brakes

Both the motor and redundant brake can be manually released if required by the user. The release handle for the motor brake is stored on the motor and is screwed into the slot on the top of the motor. The release handle for the redundant brake is packaged separately, this handle threads onto the redundant brake.

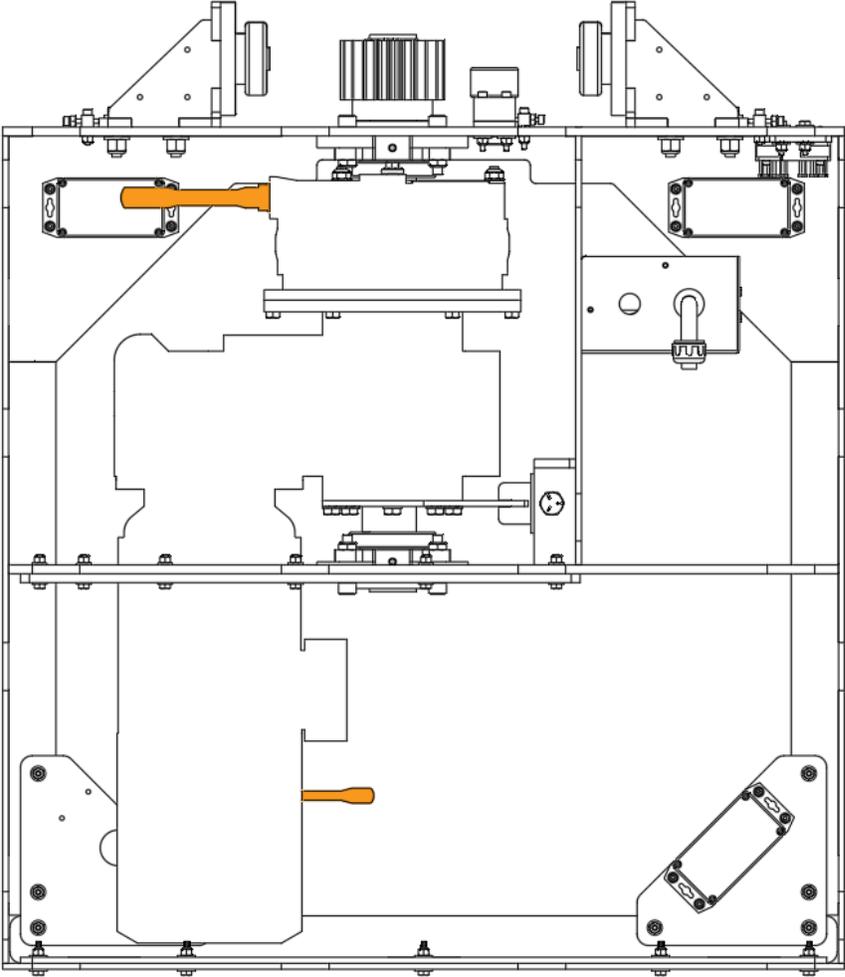


Figure 30 - Brake Release Locations

3- Inspection Checklists

The following is a checklist to inspect the **Floorpocket** prior to operation. It is necessary to perform the checklists detailed below to ensure all components of the **Floorpocket** are operating correctly. If any component fails the test do not use the **Floorpocket** and consult Creative Conners Inc.

3.1 Pre-Install

3.1.1 Mechanical

- Confirm all structural/mechanical connections are secured to the proper torque settings.
- Confirm base frame is level.
- Confirm gear rack and linear rail alignment.
- Confirm platform is level.
- Confirm platform is rigid and stable.
- Inspect gear rack and pinion for excessive wear.
- Lubricate gear rack and pinion.
 - Recommendation: Microlube GB 0, Mobilux EP 111
- Confirm rack safety guard is installed
- Confirm plastic safety guards above and below guide rollers are installed

3.1.2 Electrical

- Confirm Floorpocket jogs in both directions.
- Confirm Stagehand Pro AC is receiving encoder signals.
 - Position value should increase while lift moves FWD/upward.
 - Position value should decrease while lift moves REV/downward.
- Confirm Stagehand Pro AC displays proper limit information when limit switches or safety bumpers are engaged.
 - FWD Limit
 - FWD limit at top of travel
 - Halo safety edge
 - Ultimate FWD Limit
 - ULT FWD limit at top of travel
 - REV Limit
 - REV limit at bottom of travel
 - Platform bumper edge
 - Safety mat
 - Ultimate REV Limit
 - ULT REV limit at bottom of travel
- Confirm brake operation with brake test sequence.

3.2 Preshow

- Run brake test sequence.
- Connect the Stagehand Pro AC to Spikemark
 - Confirm current position
- Confirm safety mat and safe edge is connected and functioning
- Check Limit Placement/Operation
 - FWD Limit
 - Physical switch at top of travel
 - Halo safety edge
 - ULT FWD Limit
 - Physical switch at top of travel
 - REV Limit
 - Physical switch at bottom of travel
 - Platform bumper edge
 - Safety mat
 - Ultimate REV Limit
 - ULT REV limit at bottom of travel
- Confirm smooth operation over entire range of motion.
- Run a test cue in Spikemark, confirming all safety interlocks are functioning correctly and target position is achieved.

4 – Floorpocket Operation

Below is a flow chart for proper Floorpocket operation. It is important for the end user to understand and recognize the normal sequence of operation to be able to quickly recognize problems.

Manual Operation

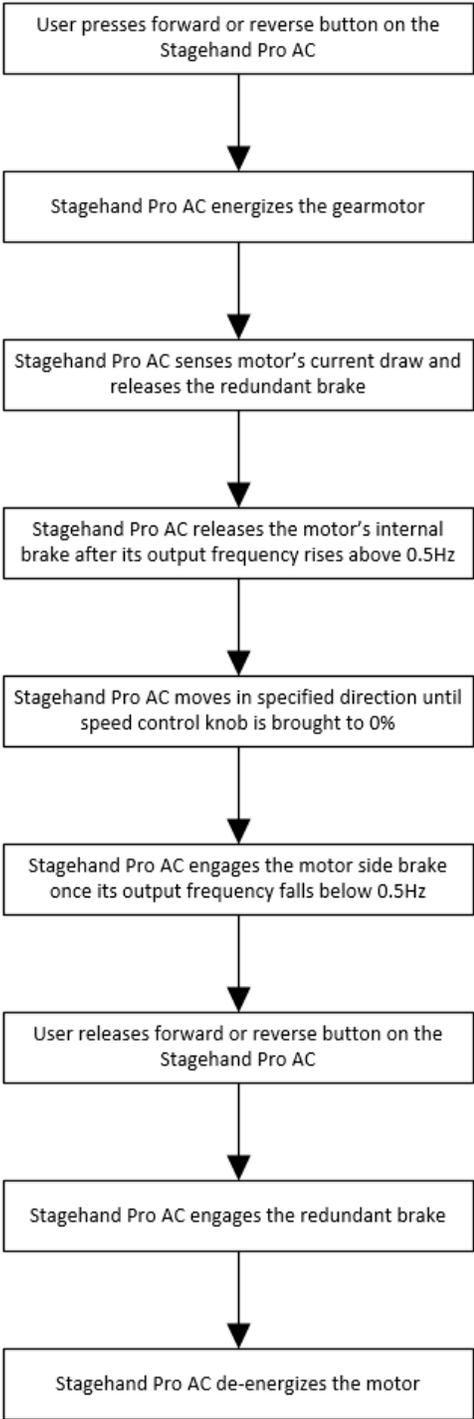


Figure 31 - Manual Operation

Spikemark Operation

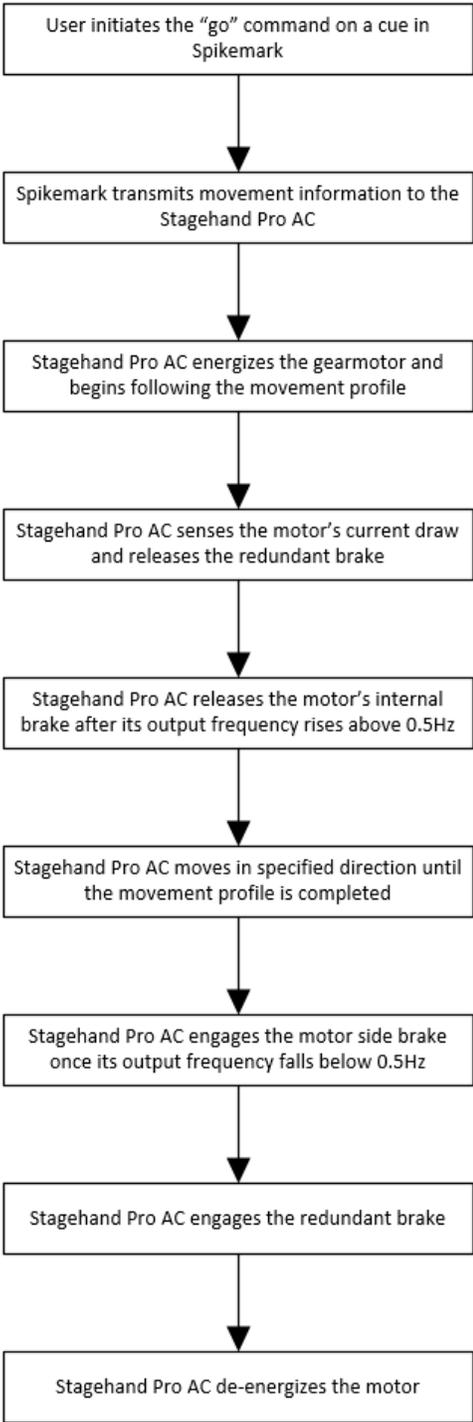


Figure 32 - Spikemark Operation

5 - Troubleshooting

Though the combination of **Floorpocket**, **Spikemark**, **Stagehand Pro AC**, and **Showstopper 3** strives to make automation easy, there are certainly times when things don't work. This part of the guide will give you some earned advice about what to culprits to look for when motors refuse to move.

Problem	Solution
<p>When running forward (UP), the encoder position decreases. When running reverse (DOWN), the encoder position increases</p>	<p>The encoder and motor have electrically inverse polarity. You need to either change the motor wiring or the encoder wiring. Re-wire the encoder to match the motor polarity:</p> <ul style="list-style-type: none"> • Swap signal A with signal B • Swap signal /A with signal /B <p>You may need to rewire both the Position and Speed encoder signals.</p>
<p>The OLED status display is dark, but the main power indicator is on.</p>	<p>The motion controller may be disconnected internally, to fix it:</p> <ul style="list-style-type: none"> • Unplug the power cord from the Stagehand. Remove the motion controller by loosening the 4 #10 socket head cap screws surrounding the motion controller. • Gently pull the faceplate forward to view the back side of the circuit board behind the faceplate. • Check that all terminal blocks are securely mated onto the circuit board.
<p>Motor runs roughly or makes strange noises when jogging manually.</p>	<p>Run the auto-tuning procedure outlined on page 35 of this manual</p>
<p>Both the FWD LIMIT and REV LIMIT fault messages are displayed on the status screen and the motor won't move.</p>	<ul style="list-style-type: none"> • Make sure the Encoder/Limits cable is plugged into the Stagehand Pro AC, Safety Interlock Box and Floorpocket. • Check limit switch connects at the limit junction box • Check the placement of your limit switches, if both are physically activated, adjust the placement to clear one or both switches.

<p>I'm trying to jog the motor, but the status display shows "SET IP"</p>	<p>The motion controller is in IP Address setting mode, which happens when the knob is pressed (either intentionally or just bumped in passing). Turn the knob until the cursor is blinking over the word CANCEL and then press the knob. The motion controller will now be in normal mode and can jog the motor again.</p>
<p>Floorpocket manually jogs smoothly but has jerky motion in a cue</p>	<ul style="list-style-type: none"> • Use the brake test buttons on the Stagehand Pro to ensure that both brakes are disengaging. • Confirm all VFD parameters are set correctly. • Run the auto tune process outlined in the Stagehand Pro AC manual. • Adjust the PID tuning parameters in Spikemark (see Spikemark manual). • Call Creative Conners Inc.
<p>Stagehand Pro AC displays "Brake Fault"</p>	<ul style="list-style-type: none"> • Ensure the motor/brake cable is plugged in. • Use the brake test buttons on the Stagehand Pro to ensure that both brakes are disengaging. • Call Creative Conners Inc.
<p>When trying to move the Stagehand Pro AC displays "Drive Fault"</p>	<ul style="list-style-type: none"> • Ensure that the motor and brake connector is plugged in • Ensure that the signal cable is connected to the Stagehand Pro, Safety Interlock box and Floorpocket • Ensure that the control cable connector is plugged in • Refer to Section 6.3, for the code, or look up the VFD fault code in the VFD Manual • Call Creative Conners Inc. with the fault code displayed on the Mitsubishi keypad.

6 – Technical Support

Though we try our best to produce reliable products and clear instructions, there may come a time when you need personal support.

Phone Support

You can call our technical support at 401-289-2942 Monday-Saturday from 8:30am – 5:30pm EST.

Email

If you have a technical question you can email **us at** support@creativeconners.com.

Web Support

There is an active user support forum on our website.
<http://www.creativeconners.com/phpBB2/index.php>

7 – Specifications

7.1 Physical Specifications

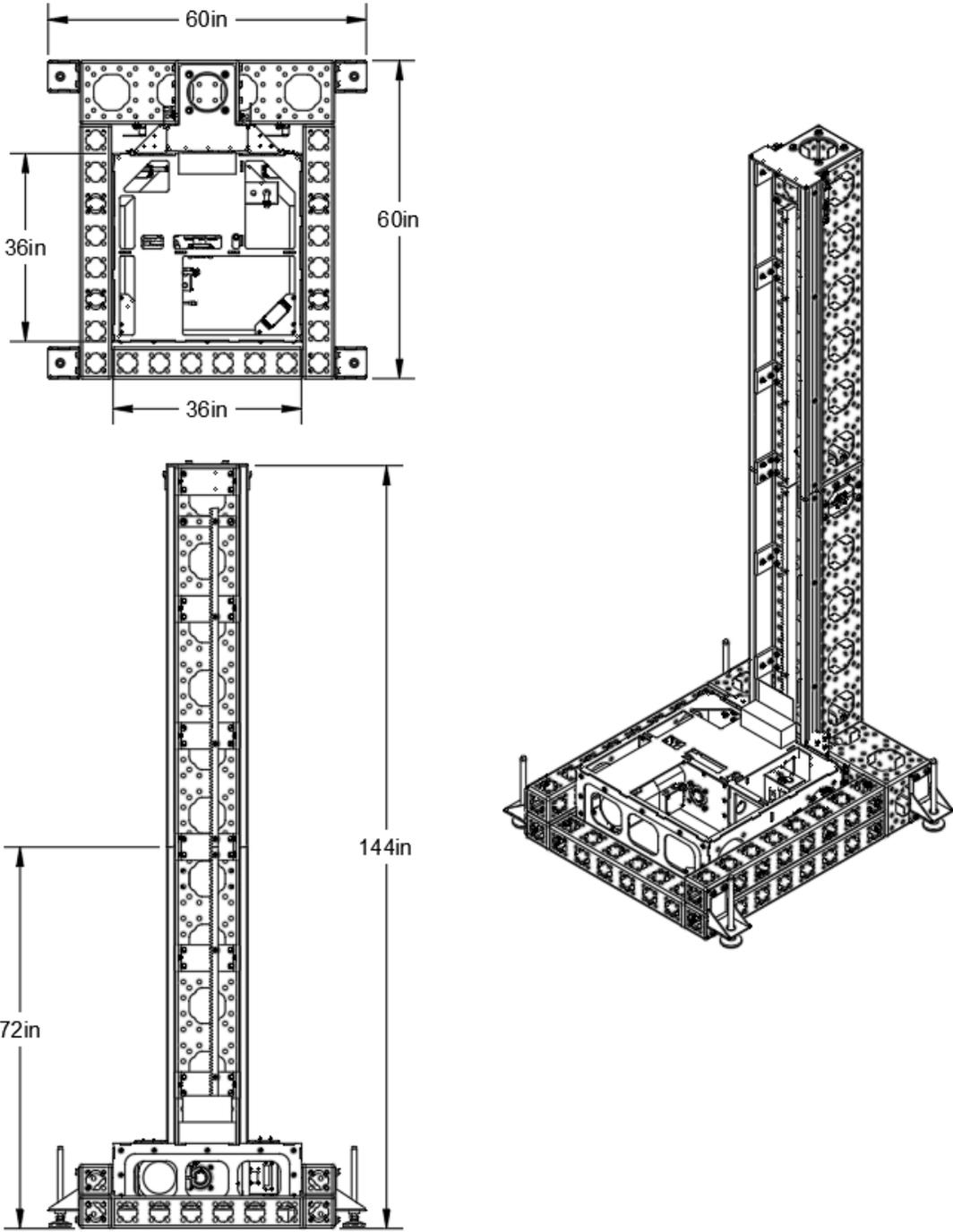


Figure 33 - Dimensions

7.2 Specifications

Input voltage	230VAC, 60 Hz 3-phase
Max input current	15.1 amps
Capacity	1,000lbs
Max lifting speed	18"/sec
Base Weight	1,250lbs
6'-0" Mast Extension weight	350lbs

7.3 VFD Settings and Fault Codes

In addition to properly setting the parameters, the Mitsubishi VFD is equipped with an auto-tuning function. This helps the VFD control the attached motor as efficiently as possible. If the VFD encounters an issue it will display a fault code on the VFD keypad. A list of common fault codes, with their corrective actions are listed below.

One of the first steps in the troubleshooting process is to confirm that the parameters are all set correctly. The next step is to run the auto tuning procedure.

7.3.1 VFD Parameter Settings

The parameter settings on the Mitsubishi Variable Frequency Drive (VFD) are tailored to make the unit work effectively with each machine. Below is a list of the parameters that are changed from the factory defaults, and what they do. Viewing and changing the parameters is a straightforward process. On the VFD keypad press the MODE button until a 'P' is displayed. Use the wheel to scroll to the desired parameter number and press the SET button. The display will change and display a number value. Use the wheel to adjust the value and press SET. To make no change, simply press the SET button. When all settings are confirmed/adjusted press the mode button 3 times until the display shows 0.00.

Parameter Code	Description	Value	Description
1	Maximum Frequency	120Hz	max output frequency
7	Acceleration time	0	Seconds*
8	Deceleration time	0	Seconds*
9	Motor full load amps	17	Amps
13	Starting frequency	0.5	Motor won't start until the speed signal is at least this value.
30	Regenerative function	1	External brake resistor, L1/L2/L3 power source
70	Regenerative brake duty	10%	Duty cycle of the braking resistor
71	Motor type	3	Other mfg. standard motor
72	Carrier frequency	15	Reduces output noise
73	Analog input selection	14	+/-10vdc with reversing enabled
77	Parameter write selection	2	Allow parameter writes regardless of operation status
79	Control mode	2	Keypad disabled, external control

80	Motor capacity	3.7	Kilowatts
81	Motor poles	4	Poles
83	Motor voltage	230V	Volts
84	Motor rated frequency	60Hz	Hertz
118	PU communication speed	96	9600bps
119	PU communication stop bit length	0	Data length: 8 bits, stop bit: 1 bit
120	PU communication parity check	1	With odd parity check
122	PU communication check time interval	9999	Without communication check
180	RL terminal input	9999	General input (used to sense load brake relay status)
181	RM terminal input	9999	General input (used to sense motor brake relay status)
182	RH terminal input	50	SQ signal, sequence run for PLC mode. Must be shorted to run, open to program
183	RT terminal input	9999	General input (used to sense load brake test button)
184	AU terminal input	9999	General input (used to sense motor brake test button)
190	RUN output	199	Alarm signal, normally on shuts off if there's a fault
191	SU output	9999	General output (used by PLC to indicate a brake relay failure)
192	IPF output	9999	General output (used by PLC for motor brake)
193	OL output	9999	General output (used by PLC for load brake)
252	Override bias	97%	Percentage of analog signal to use for speed signal
285	Overspeed deviation	5	Hz difference between commanded speed and actual that will trip an overspeed fault
292	Automatic accel/decel	0	Normal mode
359	Encoder rotation direction	1	CCW forward
369	Number of encoder pulses	1024	Pulses
374	Overspeed Detection	62Hz	Inverter shuts down if motor speed is greater than 62Hz (freefall)
376	Encoder loss detection	1	Signal loss detection shuts down vfd if encoder stops working
414	PLC function	A700=1 A800=2	Enable PLC to run brake switching logic, must be turned off to auto-tune motor

800	Control method	0	Vector control, speed control
802	pre-excitation selection	1	Servo lock
818	Easy Gain tuning response level	2	Easy gain tuning response level governs the adaptive tuning aggression. Range from 1-15. Default = 2
819	easy gain tuning setting	1	Gain is calculated with load calculation. Default (off) = 0
820	Speed control P gain 1	-	Auto-set based on Pr. 819, default w/o Easy Gain = 20
821	Speed control Integral time 1	-	The integral time during speed control is set.
850	brake selection option	1	Zero speed control
853	Speed deviation time	0.3	Seconds that an overspeed can occur before faulting
880	Load inertia ratio	-	Set the load inertia ratio for the motor. Auto-set based on Pr. 819, default w/o Easy Gain = .33
C15	Terminal 1 Gain Frequency	100%	Gain increase for analog speed signal input (adjusted since input is really only 8.8vdc)

Table 2 - Mitsubishi A800 Parameters

* Stagehand motion controller enforces a minimum acceleration/deceleration time of (1) second. The drive will add no additional acceleration/deceleration ramp when these parameters are set to 0.

7.3.2 Common Mitsubishi A800 VFD Fault Codes

If the VFD encounters an error a code will be displayed on the VFD keypad. A drive fault can be cleared by power cycling the VFD (engaging the E-Stop) or by pressing the STOP/RESET button on the keypad. A list of common fault codes and corrective actions are listed below. Reference the Mitsubishi A800 manual for additional fault codes.

Error Code	Name	Description
E.ECT	Encoder Signal Loss	The Speed Encoder is disconnected, make sure it's wired up and plugged in.
E.OSD	Speed Deviation Error	Caused by a mismatch between encoder feedback and command motor speed. Make sure the Speed Encoder is properly wired and plugged in.
E.OS	Over Speed Occurrence	The motor was running faster than the maximum value programmed for the drive. This usually means the motor was in free fall. Remove the load from the motor and begin testing in a controlled environment to determine if the machine is healthy.
E.THN	Overload Trip	Primary causes are either too much load or a failure of the brake(s) to release. Confirm the

		lifting platform is not overloaded or binding, then check brake functionality.
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Table 3 - Mitsubishi A800 Common Fault Codes

7.3.3 Stagehand Pro AC Auto Tuning

In addition to properly setting the parameters, the Mitsubishi VFD is equipped with an auto-tuning function. This helps the VFD control the attached motor as efficiently as possible. Below are instructions to run the auto-tuning procedure on a Stagehand Pro AC.

The Mitsubishi A800 Variable Frequency Drive (VFD) inside the Stagehand Pro is responsible for precisely providing power to the motor to keep it moving at the pace demanded by the motion controller. For instance, if you write a cue to run a Pushstick winch at 24"/sec, the motion controller sends a small signal to the VFD describing the desired speed, and then the VFD is in charge of controlling the motor rotation accurately. In order for the VFD to have the best possible control of motor speed, it needs some knowledge of the motor's electrical character. Depending on the motor and the scenery load, auto-tuning can have a dramatic effect on machine performance. Jerky movements can become silky-smooth and low-speed movements that struggled appear effortless after auto-tuning.

The Mitsubishi A800, like many VFD's, has a built-in "auto-tuning" procedure which electrically probes the motor to give the VFD a better understanding of the motor it is tasked with controlling. This procedure should be run every time you connect the Stagehand to a different motor since different motors have different electrical properties. The operation typically takes less than a minute and does not move the motor shaft substantially, but will release the motor brake so the drive can sense the motor's reaction to applied power. The Stagehand Pro uses the Mitsubishi A700's internal PLC to insure safe operation of the redundant brake circuits. This PLC feature must be turned off in order run the "auto-tuning" procedure. Once the brake-checking program is stopped, the Stagehand Pro notices that there is a problem in the brake circuit and disallows any action to take place on the VFD, including "auto-tuning". To override the fault condition and allow the auto-tuning procedure to run, you must press and hold the Brake Test button and the Forward button on the Stagehand Pro. These details may sound a little confusing, but in practice the procedure is simple if you follow these steps:

- Turn off PLC mode using the VFD keypad:
 - Enter the Parameter Setting mode by pressing the MODE button on the VFD keypad until the display reads P.XXX (where XXX is any number from 0 – 999).



- Scroll the wheel to find parameter P 414.



- Press the SET button to adjust the parameter.
- Make a note of the current setting. It is either 1 or 2. You will need to restore this parameter after the tuning is done.

- Scroll down to the value 0 to turn off the PLC program.



- Press the SET button to accept the new value.
- Restart the VFD by either cycling power to the Stagehand, or by pressing the Emergency Stop button on the Showstopper and release it. Activating the Emergency Stop circuit will remove power from the VFD.
- Set the following parameters on the VFD keypad using the same process outlined above:
 - Set Parameter 9 equal to the rated current of the motor.
 - Set Parameter 71 equal to 3. This is the setting for a general purpose motor.
 - Set Parameter 81 equal to the number of motor poles appropriate for the base rpm of the motor (2 for 3600 rpm, 4 for 1800 rpm, 6 for 1200 rpm).
 - Set Parameter 83 equal to the rated voltage of the motor.
 - Set Parameter 96 equal to 1. This will execute auto-tuning without moving the motor.
- Press the MODE button three times until the keypad displays a 1 without flashing.
- Press and hold the Brake Test button.
- While holding the Brake Test button, press and hold the Forward button on the Stagehand motion controller (not the VFD keypad).
- You must press both buttons for about a minute while the VFD performs the auto-tuning procedure. The keypad will display 2 while running the tuning procedure. The motor will make some very odd noises during auto-tuning, it sounds like the motor is chirping in various rhythms. This is normal.
- If the auto-tuning completes successfully, the VFD keypad will display 3. If there was an error another number will be shown. Consult the Mitsubishi A700 manual for more details on the error. The explanation can be found starting on page 190.
- Once auto-tuning is complete, you must restart the PLC program in the VFD:
 - Enter the Parameter Setting mode by pressing the MODE button on the VFD keypad until the display reads P.XXX (where XXX is any number from 0 – 999).
 - Scroll the wheel to find parameter P.414.

- Press the SET button to adjust the parameter.
- Scroll down to the value 1 or 2 to turn on the PLC program. **NOTE: You must restore the same value that was originally used. Mitsubishi A700 models use a value of 1, Mitsubishi A800 models use a value of 2.**
- Press the SET button to accept the new value.
- Restart the VFD by either cycling power to the Stagehand, or by pressing the Emergency Stop button on the Showstopper and release it. Activating the Emergency Stop circuit will remove power from the VFD.
- After the VFD turns on, confirm the **P.RUN** light on the VFD keypad is illuminated and **not** flashing. This indicates that the brake logic is functioning correctly.

With the auto-tuning complete, and the PLC program restarted you can return the Stagehand to normal operation.

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