

creative conners, inc.

Stagehand Architectural

Reference Manual

Version 1.0

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Getting Started

The Stagehand Architectural is designed to make scenic automation safe and easy. It combines sophisticated control with a high-power Variable Frequency Drive (VFD) and redundant safety circuitry in single, simple device. This combination of features result in an elegant solution to use electric motors for moving scenery on stage.

This manual will guide you through:

- Unpacking
- Installation
- Powering up/Commissioning
- Operation
- Troubleshooting

If you need help along the way contact us on our website (www.creativeconners.com), via email (support@creativeconners.com), or by phone (401-289-2942 option 2).

What's included

Inside the box you should find the following:

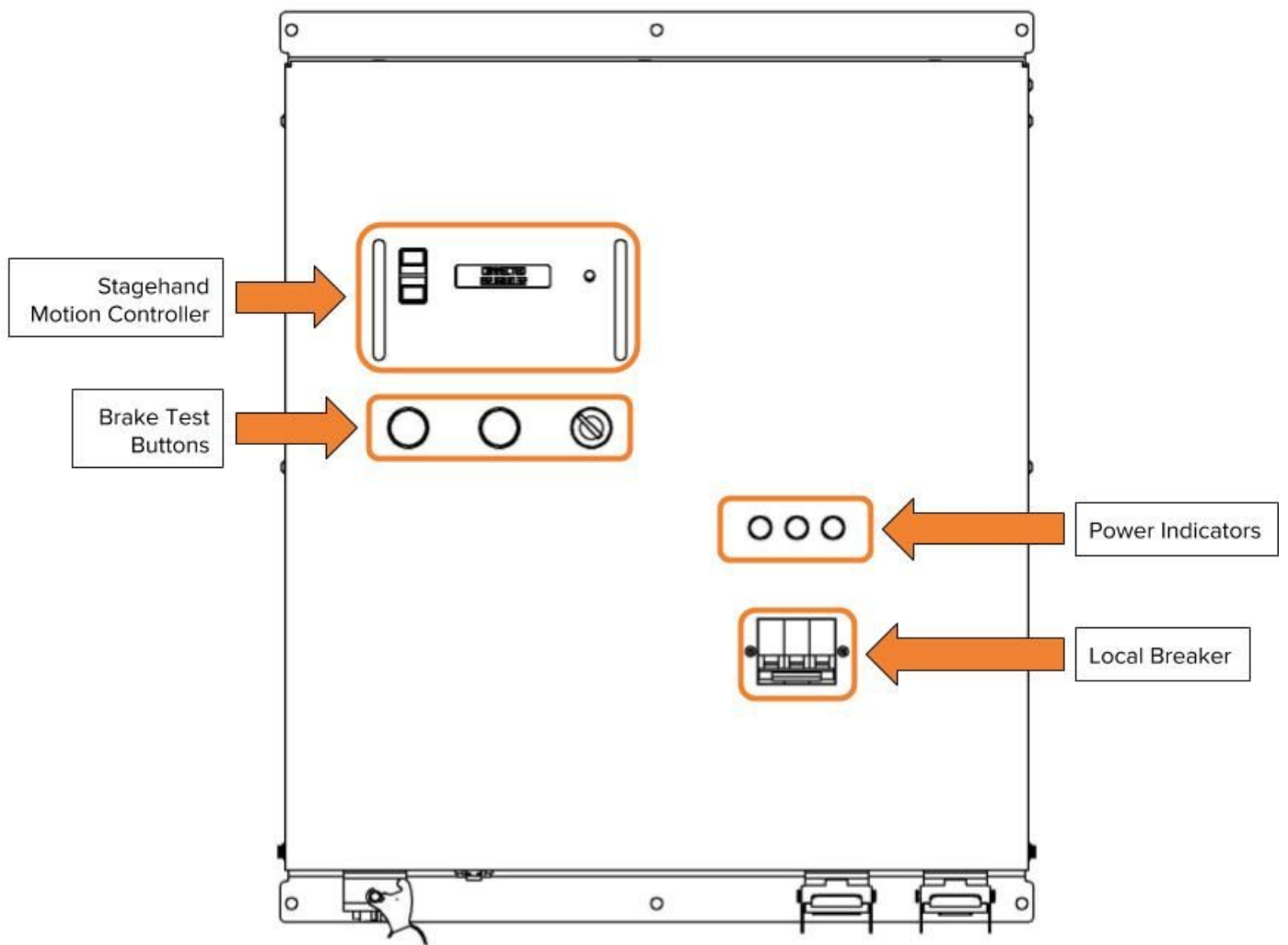
- Reference Manual
- Stagehand Architectural
- Mitsubishi A800 instructions on CD

If any of these items are missing, please contact us immediately for a replacement.

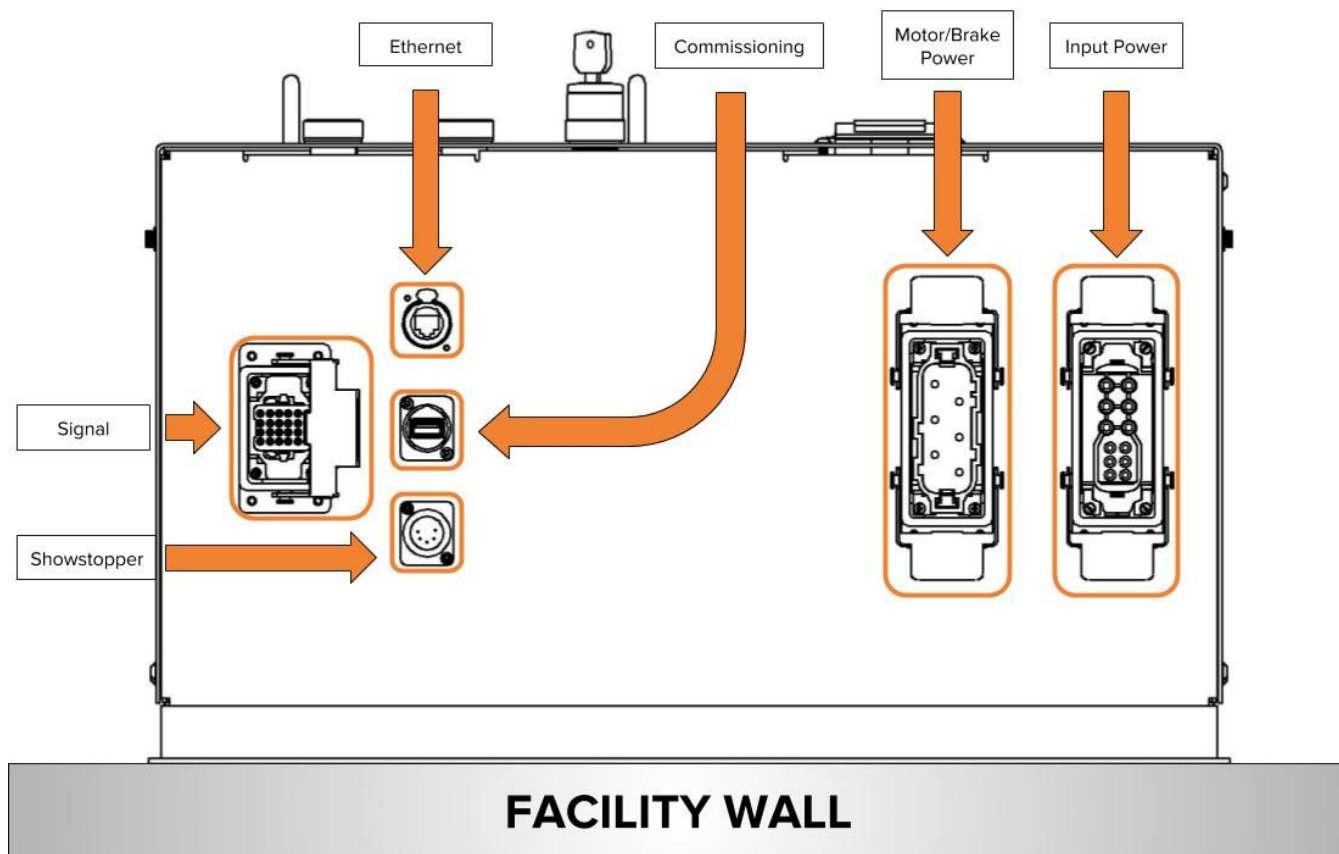
Any additional items are packed and shipped separately.

Features

The Stagehand Architectural has been created specifically as a permanent installation solution. The Stagehand Architectural shares many features of the Stagehand Pro:



Front View



Bottom View

Stagehand Models

The Stagehand Architectural comes in several configurations based on motor capacity.

Model #	HP Rating	Input Power
400v Models		
SHPAC-ARC- 2HP -400V	2hp	10A FLA 3PH 400-480VAC 50/60Hz
SHPAC-ARC- 5HP -400V	5hp	20A FLA 3PH 400-480VAC 50/60Hz
SHPAC-ARC-10HP-400V	10hp	30A FLA 3PH 400-480VAC 50/60Hz
SHPAC-ARC-15HP-400V	15hp	50A FLA 3PH 400-480VAC 50/60Hz

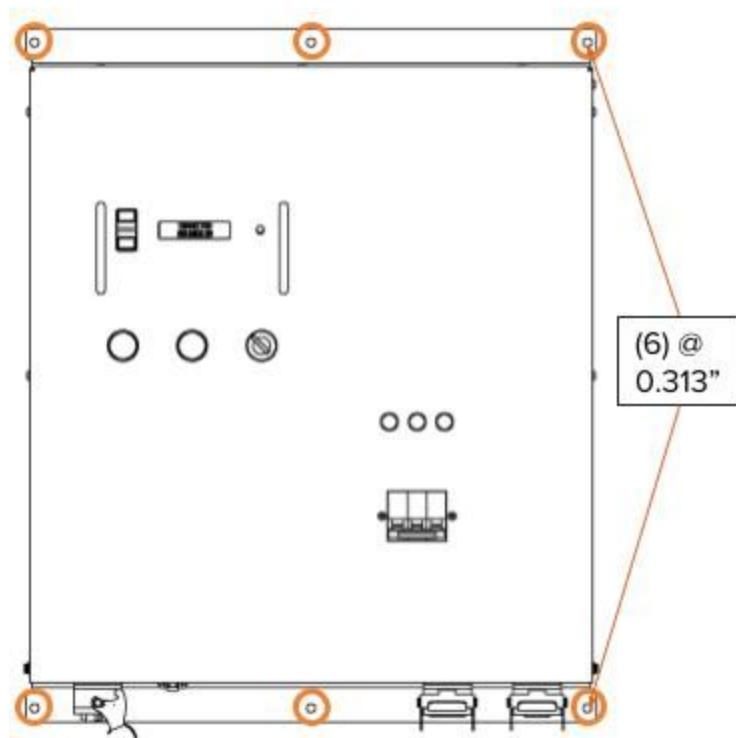
Stagehand Architectural Models

Installation

The Stagehand Architectural is designed to mount on a wall. When choosing a location, the Stagehand Architectural must be installed with the connectors facing down - this maintains the proper orientation of the internal VFD.

Wall Mounting

The Stagehand Architectural can be mounted to any wall with appropriate hardware for the wall type through the six mounting holes in the two mounting flanges. The wall and anchors must be capable of supporting 75lbs. A full scale mounting template is available at www.creativeconners.com.



Mounting Holes

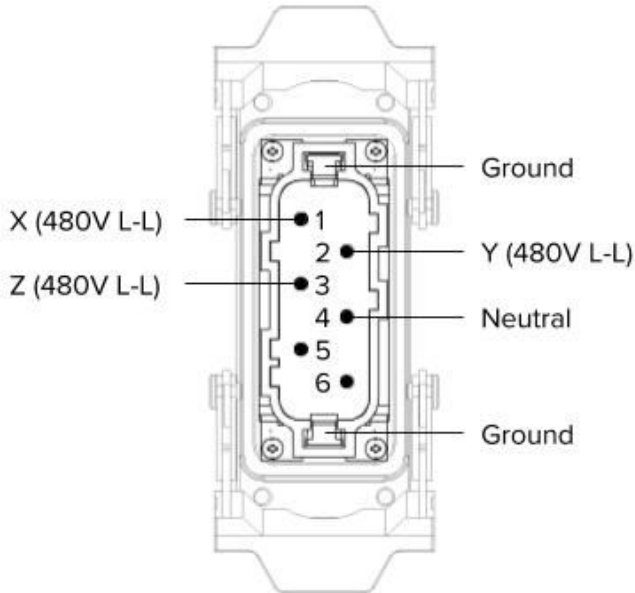
Powering Up

Once installed, the Stagehand Architectural requires mains power to get your motor moving. Depending on the model the input power will be between 200VAC-240VAC, 3-phase, 4 wire OR between 380VAC-500VAC, 3-phase, 5-wire.

Mains Power Connections

The power inlet on the Stagehand Architectural is a male 6 pin locking connector (IRC style)

IMPORTANT NOTE: This is formatted as a TABLE below

	
Wieland Electric 72.210.0653.0 IRC 16B 6P+G 35A 690V Male Insert	
400VAC Mains Connection Diagram	
380-500VAC, 3-phase, 5-wire connection	

Local Breaker

Each Stagehand Architectural includes a local breaker, sized for the rated input power.

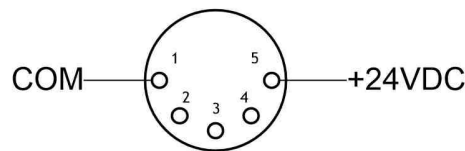
Power Indicators

The Stagehand Architectural includes three power indicators on the face of the unit, one for each phase of input power. All three indicators should be illuminated to insure proper functionality.

Showstopper

The Showstopper connection is a 5 pin XLR (DMX) connector located on the bottom of the Stagehand cabinet. It delivers +24VDC on pins 1 & 5 to power the E-Stop circuit in the Stagehand.

The Stagehand requires a 24vdc Emergency Stop signal from a Showstopper 3 Base in order to allow power to flow to the motor and brakes. Internally, the Stagehand Pro has a redundant, self-monitoring circuit to ensure that power will be removed from the motor and brakes instantly if the 24vdc Emergency Stop signal is interrupted. Before you can move any motor, you must connect the Stagehand to a Showstopper with a 5-pin XLR cable. The 5-pin XLR cable is not a DMX signal, but rather it was chosen as a convenient cable that is prevalent in many venues so you should always be able to find a spare cable when needed.



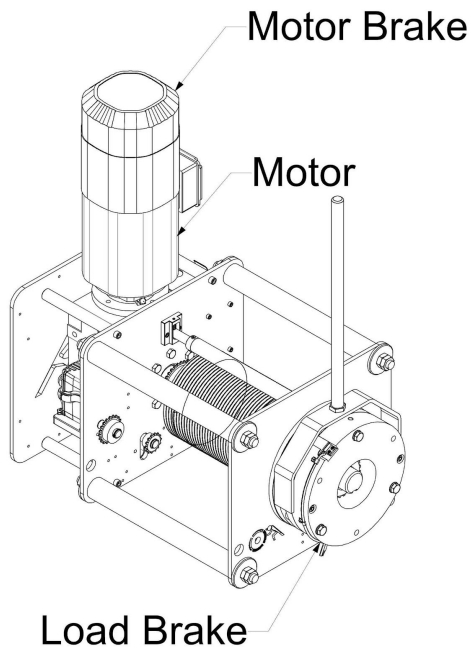
Showstopper 3 Wiring

Ethernet

To communicate with Spikemark and run cues in a show, the Stagehand needs to be connected to a network. Located on the bottom of the Stagehand, the Ethernet input will accept a CAT5 network cable with either a traditional RJ45 plug or a RJ45 plug with a Neutrik Ethercon shell installed (Mouser Part #568-NE8MC-B). The Ethercon shell is an XLR housing that slips over a network cable to provide additional strain relief and a positive-lock connection that makes it preferred backstage.

Motor/Brake Connections

Power output connections for a motor and two brakes have been combined into a single, 12-pin rectangular connector (Wieland 72.205.1253.0). The mating 12-pin plug is Wieland . Before we dive into the details of the pin-out, we should clarify what these three power sources are and why they exist. Below is a picture of Creative Conners' Spotline Hoist which serves as a nice example of a typical machine that needs all three power sources.

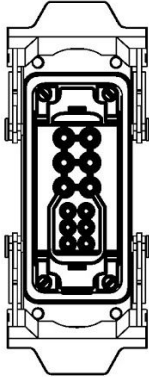


- Motor – this power source is 230vac 3-phase with a variable frequency from 0Hz – 60Hz. AC motors vary speed in response to a changing frequency. Every machine will require a motor power connection.
- Motor Brake – this power source is 230vac 1-phase with a fixed frequency that matches the input power source (typically 60Hz in the United States and 50Hz abroad). The motor brake is a small brake that holds the motor shaft in place when the machine is stopped. The motor brake uses the mechanical advantage of the speed reducer (aka gearbox) to increase its holding ability.
- Under normal operation, the motor brake is only engaged once the motor has come to a controlled, complete stop. The motor brake needs power to release. If power is removed, the motor brake will engaged by spring force.
 - This is a “fail-safe” brake, it fails to a safe condition by engaging when power is lost. Not all machines explicitly require a motor brake, but we recommend using motor brakes in all applications. All of Creative Conners’ machines are built with a motor brake.
- Load Brake – this power source is 230vac 1-phase with a fixed frequency that matches the input power source (typically 60Hz in the United States and 50Hz abroad). In lifting applications a second brake is required to provide redundant protection in case of equipment failure.
 - Often, this second brake is placed directly on the output side of the speed reducer. If either the speed reducer or the motor brake fails, a brake on the load side of the machine will be able to stop a falling load.
- If a brake is used on the output side (aka load side) of a speed reducer, then it must be much larger than the motor side brake since it isn’t able to use the mechanical advantage of the speed reducer to increase its holding power. Load brakes are not required on all machines. The additional expense is often not incurred for machines that are moving scenery laterally.

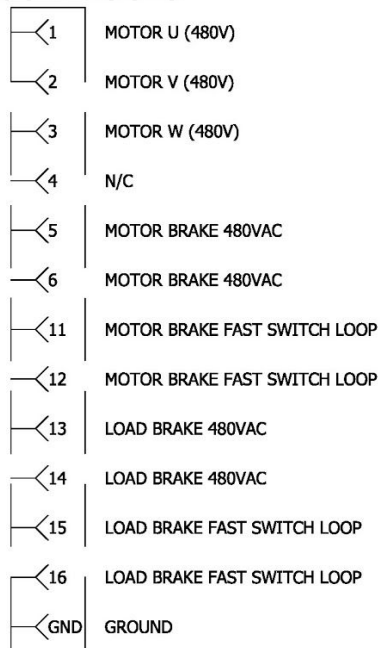
- Now that we have an understanding of the terminology the pin-out of the Motor and Brakes connector shown below has more relevance:

WIELAND 72.205.1253.0

77mm x 27mm (16B)
6P 40A / 6P 16A FEMALE



72.205.1253.0



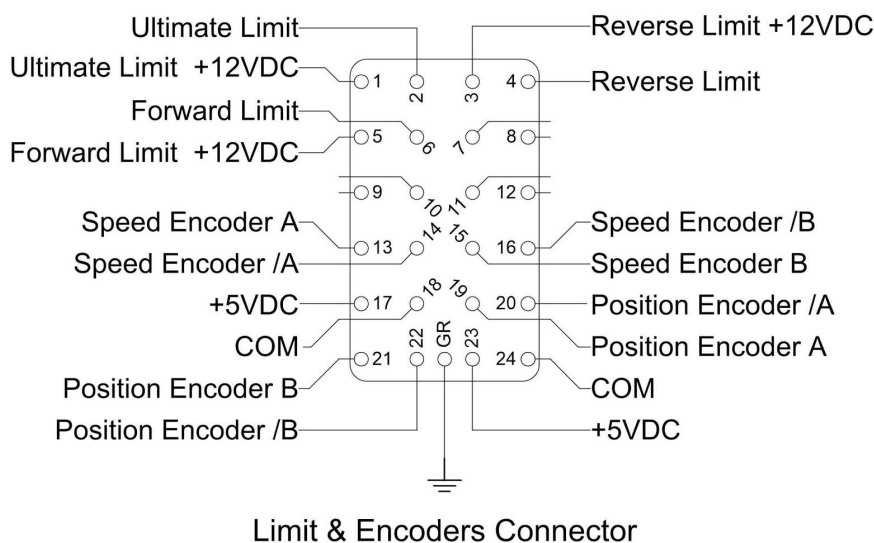
- Motor Power
 - 460VAC, 3-phase, variable frequency from 0Hz-60Hz
- Motor Brake Power
 - 460VAC 2-phase, 5A max 50/60Hz.

- Motor Brake Fast Switching Circuit – if you are using a DC brake with a rectifier that offers DC switching you can use this circuit to interrupt the DC power to the brake which will greatly reduce the time it takes to engage the brake.
- Load Brake Power
 - 460VAC 2-phase, 5A max 50/60Hz.
- Load Brake Fast Switching Circuit – if you are using a DC brake with a rectifier that offers DC switching you can use this circuit to interrupt the DC power to the brake which will greatly reduce the time it takes to engage the brake. If you are using a load brake you should use fast-brake switching. If the motor brake fails, the load brake will be required to

It is important to hook up the correct brake to the designated terminals of the connector. Load brakes are typically much slower to respond than motor brakes because of their necessary size. When moving the motor, the Stagehand will first release the load brake, wait 500ms for the brake to fully release, and then release the motor brake and start spinning the motor. The Stagehand uses this sequencing to make sure that the motion of your machine is smooth and quiet. If the load brake isn't allowed time to fully disengage then the machine will drive through the partially-engaged brake which prematurely wears the brake and makes a distracting noise. If you mistakenly swap the load & motor brake wires, the brake release sequence will be wrong and the machine will make a loud creak at the beginning of each movement.

Signal Connection

Two sets of encoder signals (one for speed monitoring and one for positioning) and three sets of limit switches (forward, reverse, and ultimate) are combined in one rectangular connector (INSERT CORRECT/CURRENT CONNECTOR).



All limit switch signals require Normally Closed (N.C.) switches. The Stagehand sources 12vdc on a pin of the each limit circuit and expects to see that 12vdc signal returned on the other pin when the limit is not activated. If the limit is either activated or disconnected or a wiring fault occurs, the 12vdc return signal is lifted and the Stagehand will enter a limit fault condition and disallow motion.

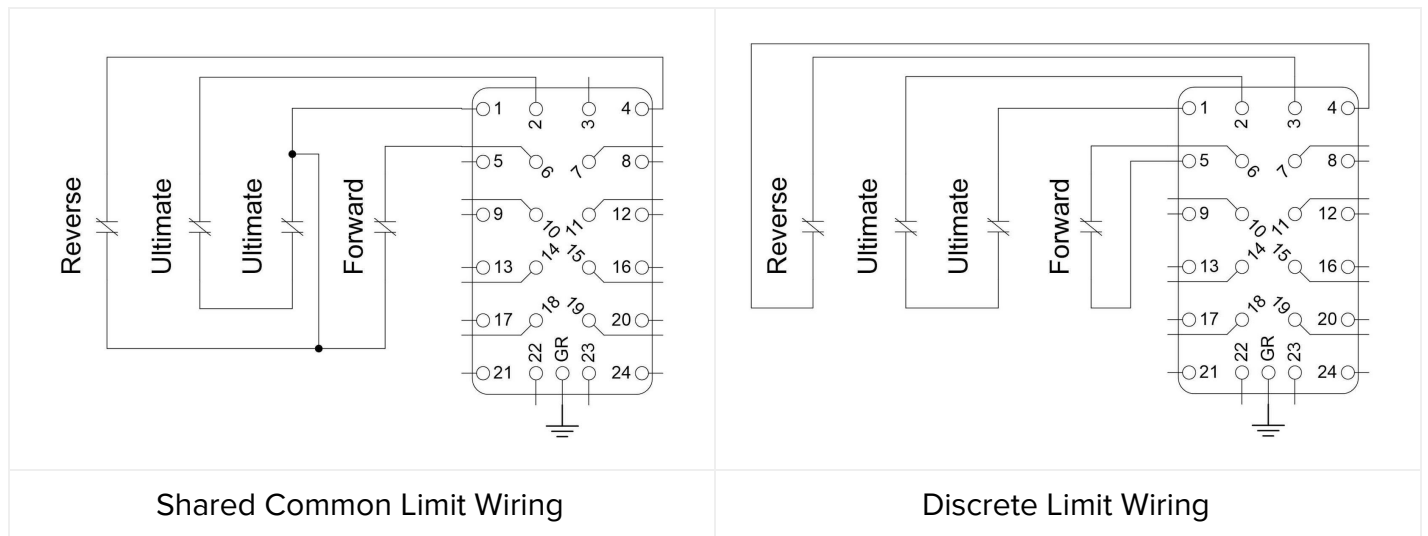
The limit switch inputs are used to protect against the motor traveling too far in a direction and causing damage or injury. When running in a cue, this is one of the safety features that guards against encoder failure. When jogging manually, this keeps you from accidentally traveling too far.

All encoder signals use differential line receivers which use a balanced signal transmitted over twisted-pair wires to drastically reduce electrical interference and thus reduce the opportunity for inaccurate encoder data. Encoders connected to the Stagehand must be equipped with differential line drivers to be compatible. Encoders are powered at 5.5VDC for broadest compatibility.

Let's start with the limit signals:

- Ultimate Limit – a pair of Normally Closed (N.C.) switches can be wired in series to this pair of terminals to provide protection against Forward and Reverse Limit switch failures. Typically, an Ultimate Limit switch is positioned just beyond both the Forward and Reverse Limit switch. If an Ultimate Limit is activated, the Stagehand will disallow any further movement until the limit is physically cleared. In normal operation, there is never a reason to strike an Ultimate Limit. An Ultimate Limit signal indicates an equipment problem with at least one of the primary limit switches. The faulty equipment must be repaired and the Ultimate Limit must be mechanically reset before the Stagehand will allow motion.
- Reverse Limit – a Normally Closed (N.C.) switch can be wired to this pair of terminals. If the switch is activated, the Stagehand will not allow further motion in the reverse direction until the limit is cleared either by adjusting the switch mechanically or by moving in the forward direction far enough to clear the limit switch.
- Forward Limit – a Normally Closed (N.C.) switch can be wired to this pair of terminals. If the switch is activated, the Stagehand will not allow further motion in the forward direction until the limit is cleared either by adjusting the switch mechanically or by moving in the reverse direction far enough to clear the limit switch.

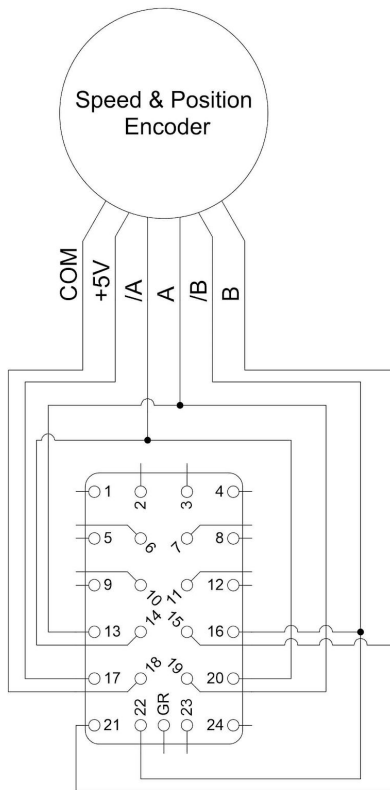
Since the Stagehand provides three (3) separate pins that all source 12vdc, one for each limit signal, you can reduce the wiring in your machine to four (4) wires by using just one of the 12vdc source pins and three (3) wires for the three limit return signals. Sometimes it is more convenient to wire a pair of conductors for each switch, other times it may be better to reduce the number of conductors by sharing a common voltage source. Both options are shown below:



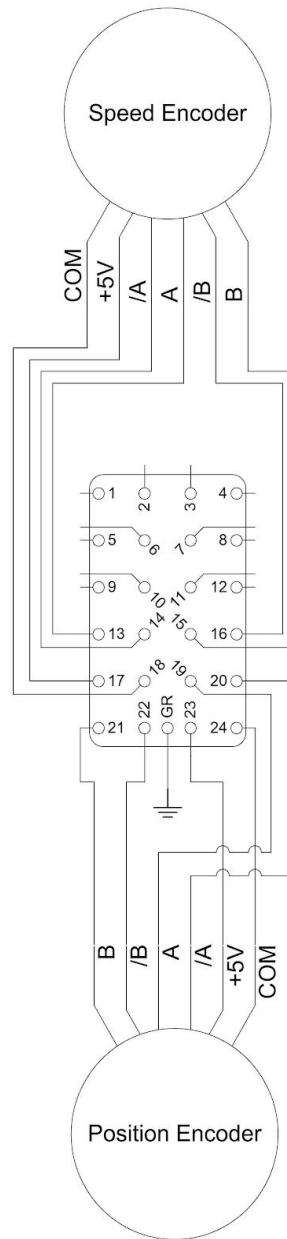
Now let's take a look at the encoder signals:

- **Speed Encoder** – a set of quadrature signals used by the Variable Frequency Drive (VFD) to accurately regulate speed. Unlike the Stagehand Classic controller, the Stagehand Pro requires a motor-mounted encoder for speed regulation. This same encoder may be wired for both speed and position data, but only if that encoder is mounted on the motor prior to the speed reducer. If the VFD detects that the Speed Encoder signal is missing or faulty, the VFD will enter a fault condition and the Stagehand won't allow motion until the encoder is repaired. This feature is vitally important in lifting applications so that the Stagehand can detect a free-falling load and engage the mechanical safety brakes.
- **Position Encoder** – a set of quadrature signals used by the motion controller to drive the motor to correct positions on cue. This encoder may be the same as the Speed Encoder or it may be a separate encoder. For instance, a scissor lift needs a speed encoder on the pump motor, but the positioning encoder should be placed directly on the lift platform since relationship between the motor rotation and platform position changes depending on the extension height of the lift as it raises and lowers. A deck winch however, can use a single encoder mounted on the motor for both speed and positioning.

As mentioned above, you can use either a single encoder mounted to the motor for both Speed and Position Encoder signals, or separate encoders mounted in different locations on the machine. Below are two drawings that show how to wire your encoder signals in both scenarios:



Single Encoder



Dual Encoder

Using the Stagehand

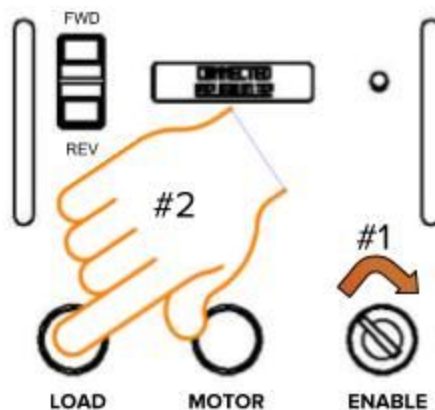
Brake Test

The Stagehand Architectural is equipped with dual independent brake circuits. Each brake can be independently, manually tested from the face of the Stagehand by enabling brake test mode with the Brake Test Enable key switch. Once enabled each brake can be tested individually using the illuminated Brake Test buttons. Only one brake can be tested at a time - if both brake test buttons are engaged simultaneously neither brake will be released.

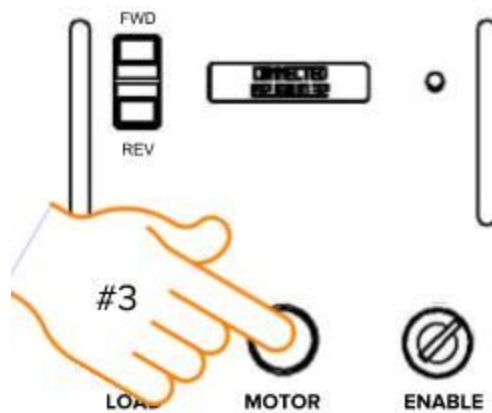
IMPORTANT NOTE: When the Brake Test Enable switch is activated you will not be able to use the Stagehand to control the attached motor. Spikemark will also display a Brake Fault while in Brake Test Mode.

To test that your brakes are operating correctly in a hoisting application, read through the following steps in their entirety and then perform each action as follows:

- Clear the stage below the suspended scenery
- Engage the Brake Test Enable key switch (#1 in image below). The Load Brake and Motor Brake buttons should become illuminated, indicating that the Stagehand is ready for testing.
- Press the Load Brake button (#2 in image below). This will manually release the Load Brake. The Motor Brake should still be engaged and will hold the load. If the suspended scenery slips down, release the Load Brake button immediately. Since the Motor Brake did not hold the load as expected, that brake has failed. **DO NOT OPERATE THE MACHINE UNTIL THE MOTOR BRAKE IS REPAIRED OR REPLACED. FAILURE TO REMOVE THE MACHINE FROM SERVICE COULD RESULT IN DAMAGE, INJURY, OR DEATH.**
 - Provided the Motor Brake passed the functional test, release the Load Brake button.



- Now press the Motor Brake button (#3 in image below). This will manually release the Motor Brake. The Load Brake should still be engaged and will hold the load. If the suspended scenery slips down, release the Motor Brake button immediately. Since the Load Brake did not hold the load as expected, that brake has failed. **DO NOT OPERATE THE MACHINE UNTIL THE LOAD BRAKE IS REPAIRED OR REPLACED. FAILURE TO REMOVE THE MACHINE FROM SERVICE COULD RESULT IN DAMAGE, INJURY, OR DEATH.**
- Release the Motor Brake button once Load Brake has passed the functional test



- Return the Brake Test Enable key switch to its original state. The Load Brake and Motor Brake buttons should no longer be illuminated.

If you are using the Stagehand to control a hoist, this procedure must be executed every night to ensure that all equipment is operating in a safe, reliable manner. If you are not using the Stagehand to control a hoist, it may be convenient to manually release the safety brakes at times, but it is not required.

Jogging the Motor

Before attempting to write and execute cues in Spikemark, it is prudent to ensure that the machine runs correctly. The simplest method to test the machine is to jog it manually from the face of the Stagehand using the jog buttons and wheel.

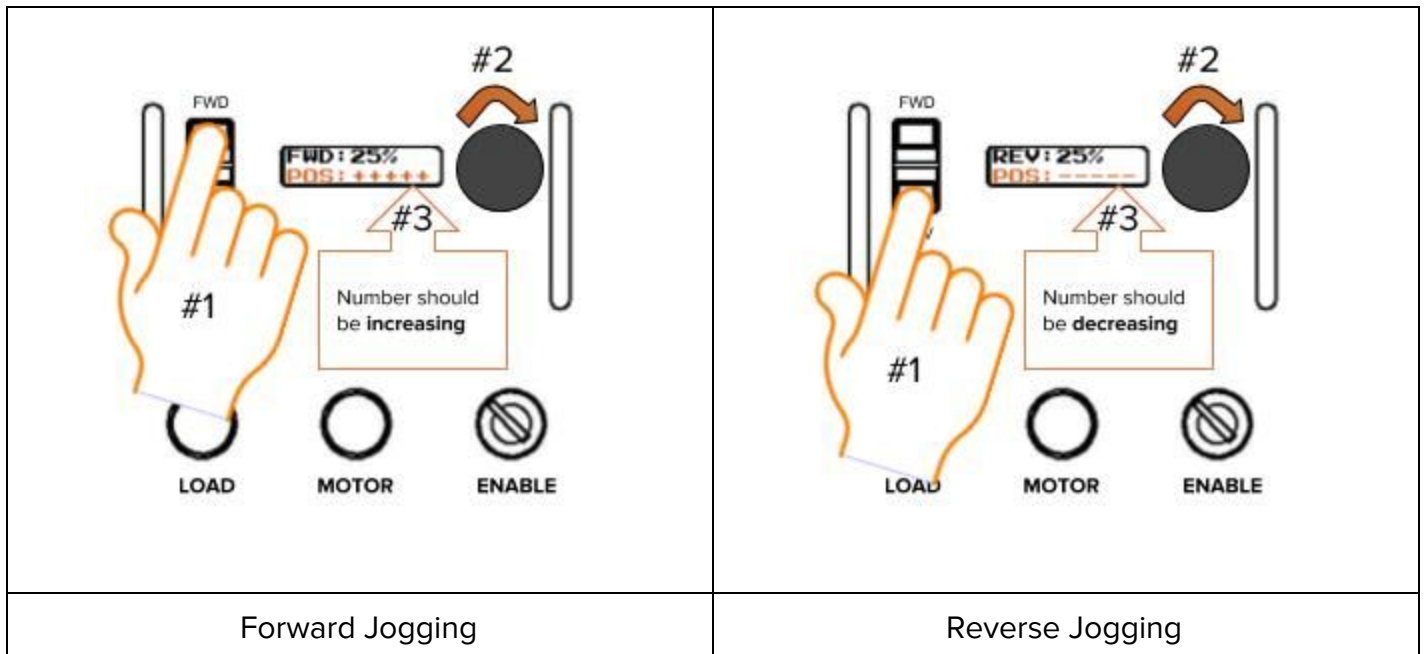
- Be sure the area is clear of any obstructions and everyone is clear from under the load.
- Release the Emergency Stop button on your Showstopper.
- Press and hold the Forward Button.
- While holding the Forward Button, turn the knob **clockwise** slowly. The brakes should release and the machine should begin to move. The Position Encoder counts are displayed on the Status Display. The counts should be increasing in positive value; if not, the motor and encoder are out of phase, and you'll need to rewire either the motor or the encoder. See the [troubleshooting section](#) for more details.

- Gradually rotate the knob **counterclockwise** until the machine stops.
- Release the Forward Button.

Forward Jogging

- Press the Reverse Button.
- While holding the Reverse Button, turn the knob **clockwise** slowly. The brakes should release and the machine should begin to move. The Position Encoder counts are displayed on the Status Display. The counts should be decreasing; if not, the motor and encoder are out of phase and you'll need to rewire either the motor or encoder. See the [troubleshooting section](#) for more details.
- Gradually rotate the knob **counterclockwise** until the machine stops.
- Release the Reverse Button

Reverse Jogging



If you strike a limit while jogging in the direction of the limit, the Stagehand will immediately stop the motor. If you strike a forward limit while jogging forward you will have to release the forward jog button and then jog in reverse. If you strike a reverse limit while jogging reverse you will have to

release the reverse jog button and then jog forward. If you strike an ultimate limit, you will have to physically clear the limit switch before restarting motion in either direction.

Auto-Tuning

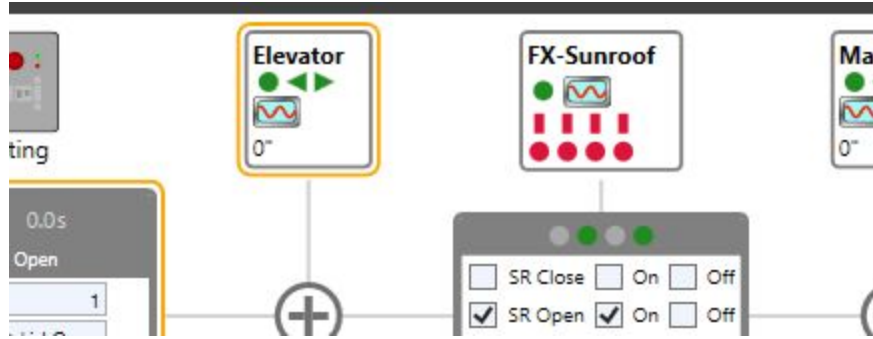
The Mitsubishi A800 Variable Frequency Drive (VFD) inside the Stagehand Architectural is responsible for precisely providing power to the motor to keep it moving at the pace demanded by the motion controller. For instance, if you write a cue to run a Pushstick winch at 24"/sec, the motion controller 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.

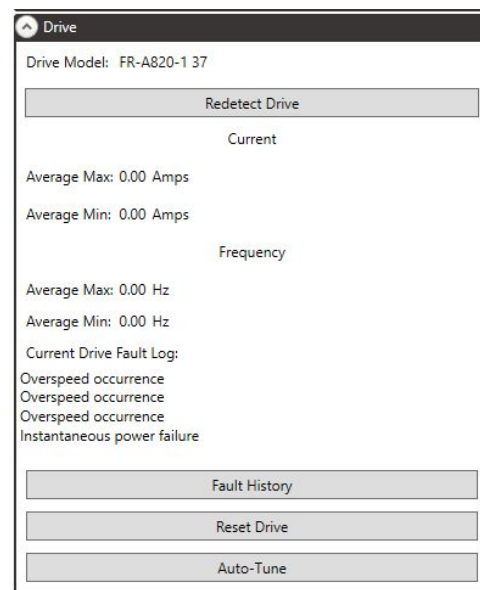
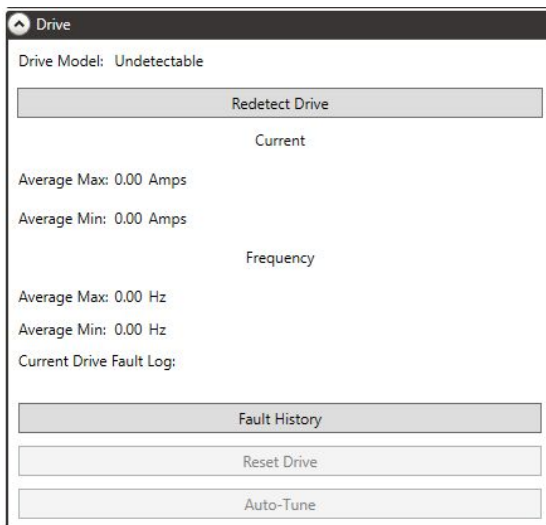
Auto-Tuning Through Spikemark 4

The ability to auto-tune with the press of a button was introduced with the release of Spikemark 4. Below are the steps for completing an auto-tune sequence through Spikemark. If you have not set up your motor in a Spikemark show file yet, and are unsure how to do so, go to www.creativeconnors.com, download the latest version of the Spikemark manual, and read through the section Moving Real Machinery with Spikemark.

- Open Spikemark 4 and select the motor you would like to auto-tune from across the top of the cue grid. We have selected "Elevator" for this example.
 - Ensure that your Stagehand is connected. If not, scroll down to Network in the Stagehand Editing Pane, and click Connect.



- In the Stagehand Editing Pane, scroll down to the Drive section. Your Drive Model should display as FR-A820 with a series of numbers following. If it does not (below to the left reads Undetectable), click on Redetect Drive, and allow several seconds for Spikemark to read information from the VFD.
 - If Redetect Drive does not display the correct, or any, Drive Model, return to the Network section, Disconnect the Stagehand, and Connect again. Note that if the status does not display “Connected,” the VFD will also not be able to communicate with Spikemark.



- Once the Drive Model has been displayed, and the VFD is ready, the Reset Drive and Auto-Tune buttons will no longer be greyed out. Click on Auto-Tune to open the Drive Auto-Tune window.

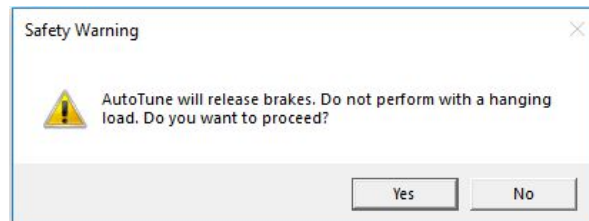
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Drive Auto-Tune

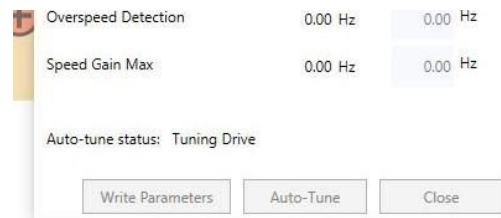
	Drive Value	Your Value
Rated Motor Current	16.00 Amps	16.00 Amps
Rated Motor Voltage	230.0 Volts	230.0 Volts
Rated Motor Capacity	3.70 Kw	3.70 Kw
Number Motor Poles	4	4
<i>Advanced Settings</i>		
Baseline Frequency	60.00 Hz	60.00 Hz
Rated Motor Frequency	60.00 Hz	60.00 Hz
Gain Frequency	60.00 Hz	60.00 Hz
Encoder PPR	1024	1024
Overspeed Detection	65.00 Hz	65.00 Hz
Speed Gain Max	60.00 Hz	60.00 Hz
Auto-tune status:		
<div style="display: inline-block; border: 1px solid #ccc; padding: 2px 10px; margin: 0 5px;">Write Parameters</div> <div style="display: inline-block; background-color: #c00; color: white; padding: 2px 10px; margin: 0 5px;">Auto-Tune</div> <div style="display: inline-block; border: 1px solid #ccc; padding: 2px 10px; margin: 0 5px;">Close</div>		

- Verify that the parameter settings under Drive Value are accurate and correspond to your motor placard.
 - NOTE: The values in the DRIVE VALUE column are currently set on the VFD. The values in the YOUR VALUE column are populated from the existing values, and may not be appropriate for the motor attached to your Stagehand.
 - Consult the motor placard for the correct values and simply enter them in the appropriate box in the YOUR VALUE column.
 - Once the correct values are entered, click the Write Parameters button. After a few seconds you will see the Drive Value update. If you do not, close the Drive Auto-Tune window and open it again. If the value is still not changed, attempt to write it again. If it is still incorrect, see the instructions below for [manually setting parameters](#).
- Once your parameters are all set, click the red Auto-Tune button. You will be prompted to verify that you have no hanging loads since the Auto-Tune sequence. **The Stagehand Architectural will NOT release brakes during Auto-Tune.** The Spikemark warning is overzealous to anticipate the behavior of user-made controllers based around the Stagehand motion platform. Both the Stagehand Architectural and the Stagehand Pro are smart enough to hold brakes during auto-tuning.. Click OK and wait for about a minute while the VFD performs the auto-tuning sequence.

- In the background, Spikemark will indicate that there is a Brake Fault.
- The motor will make a series of humming, buzzing, and chirping sounds in various rhythms during this process. This is normal.
- You will be unable to close the Drive Auto-Tune window during this process.

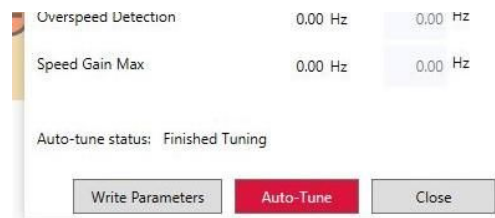


- During the tuning process, the status will change to “Tuning Drive”



1.

- Once the noises stop, the auto-tuning process is complete. Spikemark will no longer display a Brake Fault warning, the VFD will reset, and the status will change to “Finished Tuning.” You will then be able to close the Drive Auto-Tune window.



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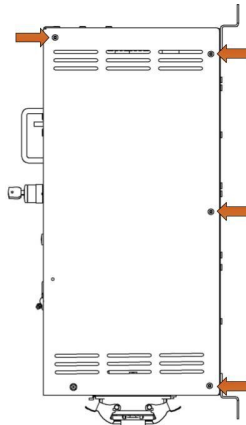
- Once you verify that Spikemark does not read a Brake Fault, indicating that the PLC program for the brakes has been restarted, you can return the Stagehand to normal operations.
 - NOTE: If Spikemark or the Stagehand Display are indicating a Brake Fault see the [Troubleshooting section](#) for turning on the PLC program.

Auto-Tuning from the VFD

The Stagehand Architectural uses the Mitsubishi A800’s internal PLC to ensure safe operation of the redundant brake circuits. This PLC feature must be turned off in order to run the “auto-tuning” procedure. Once the brake-checking program is stopped, the Stagehand 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 autotuning procedure to run, you must

enable the keyed Brake Test button and press 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:

- Confirm the E-Stop is released.
- Lower the front cover, allowing access to the interior of the Stagehand Architectural.
 - There are eight (8) screws, four on either side panel that need to be removed. This allows the front face and side walls to rotate forward and be suspended on a line.



Access Screw Locations

- 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).

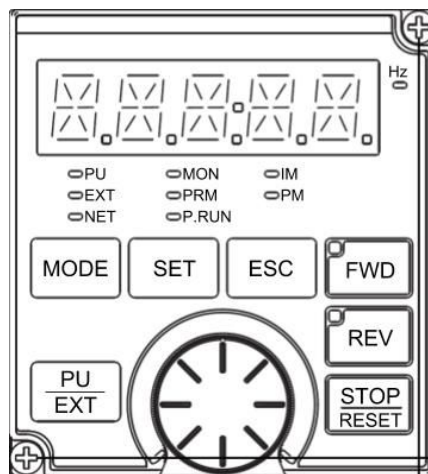


Figure 27

- Scroll the wheel to find parameter P 414.

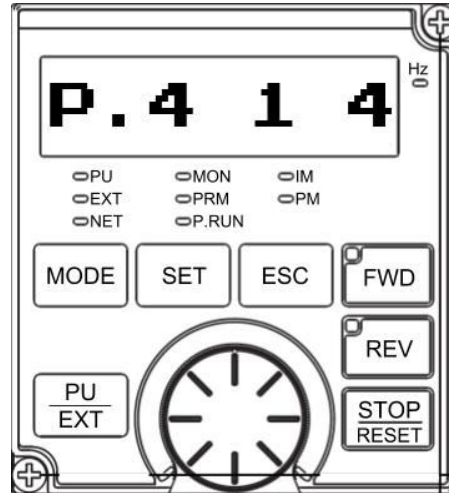


Figure 28

- 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.

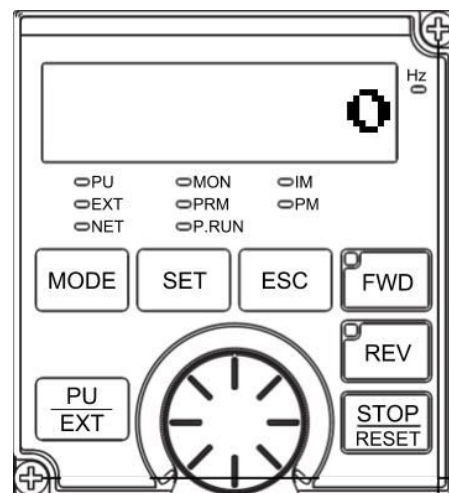
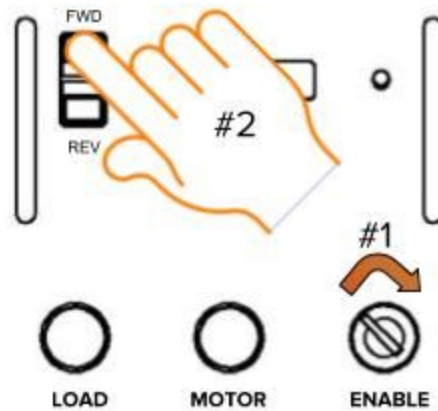


Figure 29

- 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). All of Creative Conners' machines use 4-pole motors.
 - 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, or until the keypad displays a 1 without flashing.
- Enable the keyed Brake Test Button. See #1 in the image below.
- Press and hold the Forward button on the Stagehand motion controller (not the VFD keypad). See #2 in the image below.
- You must hold this for about a minute while the VFD performs the auto-tuning procedure. The VFD keypad will display 2 while running the auto-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.



- Once the motor stops making noises, the auto-tuning sequence is complete. Release the Forward button, and disengage the Brake Test Enable key switch.
 - 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 A800 manual for more details on the error. The explanation can be found starting on page 433.

- 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 2 to turn on 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.
- 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.

Understanding the Stagehand Display

The two-line alphanumeric display on the Stagehand motion controller uses OLED technology to make it easy to read backstage without a distracting backlight. It also has excellent viewing angles making it easier for you and other operators to see status information at a glance. The Stagehand is primarily used through our Spikemark software, but it is handy to have some bits of information displayed on the Stagehand's faceplate for those times that you are working onstage near the machinery and not sitting in front of a computer running Spikemark. Also during shop setup, load-in, and strike you may not have Spikemark running and need to manually operate the Stagehand. The following list explains the information that you can glean from the Stagehand display.

Network Connectivity



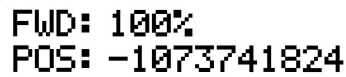
NOT CONNECTED
192.168.100.100

Figure 30

When sitting idle, the Stagehand will display its IP address on the bottom line and whether the Stagehand is actively connected to Spikemark. Connected means that the Stagehand has an active

connection with a Spikemark computer, Disconnected means that the Stagehand is not actively communicating with Spikemark.

Encoder Position




```
FWD: 100%
POS: -1073741824
```

Figure 31

If you press either the Forward or Reverse jog button, the Stagehand will display the direction it is traveling and current speed as a percentage of full power on the top line. On the bottom line it will display the Position Encoder's counter in raw encoder counts. Inside Spikemark the position data will be shown in scaled units, such as feet or inches, but on the Stagehand the raw encoder counts are displayed since the Stagehand isn't aware of Spikemark's Position Scale. The position information is helpful when testing equipment in the shop prior to load-in. You can use a Stagehand to power up a machine and confirm that the encoder is working properly by watching the counts increase and decrease when running forward and reverse respectively. If counts decrease when running forward you know that the motor and encoder polarity are mismatched and should be rewired before attempting to run cues.

Limits



```
REV LIMIT
192.168.100.100
```

Figure 32

When a Forward, Reverse, or Ultimate Limit is struck the top line of the display will flash an appropriate fault message in rotation with any other fault messages. If you strike a directional limit switch, either forward or reverse, you will have to run the motor in the opposite direction to clear the fault message. If you strike an ultimate limit you will have to physically clear the limit switch before the fault message will clear.

Drive Fault



```
DRIVE FAULT
192.168.100.100
```

Figure 33

The VFD has many fault conditions that can cause it to interrupt power to the motor and cease motion. Mechanical overload, encoder signal loss, over-speed, and under-voltage are just a few of the common faults that will render a Stagehand unresponsive. All of these faults register a common "Drive Fault" message on the status display and in Spikemark. Consult the Mitsubishi A800 manual

for the exact fault description (the error code is displayed on VFD keypad). To clear a drive fault, correct the cause of the fault and then either cycle the Emergency Stop or press the STOPIRESET button on the VFD keypad.

Brake Fault



BRAKE FAULT
192.168.100.100

Figure 34

The Stagehand monitors the force-guided relay switches which control power to both brake circuits. If the Stagehand detects that a relay has failed to operate properly, it will not allow the remaining, properly-operating brake to release nor will it allow the motor to move. In order to clear this fault, the Stagehand must be returned to Creative Conners for service.

Emergency Stop

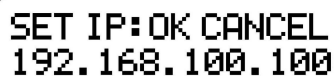


EMERGENCY STOP
192.168.100.100

Figure 35

When the Emergency Stop circuit is activated, or unplugged, the Emergency Stop fault message will be added to the flashing fault messages. Any motion that was occurring when the Emergency Stop was detected will be stopped. To clear the fault, release the Emergency Stop button on the Showstopper. Once the fault is cleared, any motion that you wish to execute will have to be restarted. If you were jogging, you will need to release the jog button and start again. If you were running a cue through Spikemark, that cue will need to be re-loaded and run again. At no time will the Stagehand immediately restart after an Emergency Stop fault is cleared, since such behavior could pose a serious safety risk.

Set an IP Address for Spikemark Cueing



SET IP:OK CANCEL
192.168.100.100

Figure 36

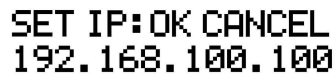
When you are ready to write and run complex cues with Spikemark, you may need to assign a new IP address to the Stagehand. Every device on the automation network must have a unique, but similar, static IP address. The easiest address scheme to adopt is to share the first three segments of the IP address and just alter the last segment. We typically use addresses that start:

192.168.10.xxx

The last number can be any value from 0 – 255, but no devices on the network can share the same value.

To set the IP address of the Stagehand:

- Press the Knob. The Knob serves double-duty as a typical rotary knob and a button (much like a car stereo knob).
- The SET IP address screen will be displayed just like the picture below:



SET IP: OK CANCEL
192.168.100.100

- There is a blinking cursor on the display, turning the knob will scroll the cursor through the various fields. By turning the Knob, scroll over to the last segment of the IP address which is 32 by default.
- Press the Knob to select the last segment and make it adjustable.
- Turn the Knob to set a new value.
- Once you are happy with the new value, press the Knob to accept the value.
- By turning the Knob, scroll over to the OK and then press the Knob to set the new address and return to the primary display screen. If you want to cancel the changes you made to the IP address, place the cursor over CANCEL and press the Knob.

Setting the Subnet Mask

Each Stagehand has the ability to not only set the network IP address, but the Subnet Mask for even more networking flexibility. The standard Subnet Mask setting is 255.255.255.0.

To change the Subnet Mask of the Stagehand:

- Press and hold the Knob for five (5) seconds. The SUBNET MASK screen will display as shown below.



SUBNET: OK CANCEL
255.255.255.0

- There is a blinking cursor on the display. Turning the knob will scroll the cursor through the various fields. Turn the knob to the field you would like the change.
- Press the Knob to select the field.

- Turn the Knob to the new desired value.
- Once you are happy with the new value, press the Knob to accept the value.
- Repeat this for all desired field changes.
- Once all fields are at the desired values, rotate the Knob to scroll over to the OK, and then press the Knob to set the Subnet Mask, and return to the primary display screen. If you want to disregard any changes you made to the Subnet Mask, scroll the cursor over to CANCEL and press the Knob. This will cancel all changes and return you to the primary display screen.

Persistent Position

For those long-time customers, you may notice the beloved battery backup is missing. Thanks to the release of Persistent Position with Spikemark 3.7.0, the battery backup is no longer necessary. The encoder position data is now stored in the Stagehand after 20 seconds at idle, and when an Emergency Stop has been detected. This means you no longer need to worry about powering down your Stagehand and losing your current position. Your Stagehand now remembers the last position stored, no matter if that was from last night or last month. Feel free to turn that company switch off every night!

Troubleshooting

Common Problems

Problem	Solution
When running forward, the encoder position decreases. When running reverse, the encoder position increases	<p>The encoder and motor have electrically inverse polarity. You need to either change the motor wiring or the encoder wiring.</p> <p>Re-wire the motor to match the encoder polarity:</p> <ul style="list-style-type: none">• Swap two power legs on the motor by swapping the wires on Pin 1 and Pin 2 inside the motor plug. <p>– OR –</p> <p>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>
The OLED status display is dark, but the main power indicator is on.	<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.
Motor runs roughly or makes strange noises when jogging manually.	<p>Run the auto-tuning procedure outlined on page .</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 rear of the Stagehand. ● Check the placement of your limit switches, if both are physically activated, adjust the placement to clear one or both switches. ● Check the limit switch wiring, confirm that the switches are wired Normally Closed (N.C.)
<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>Drive faults whenever the motor tries to move.</p>	<p>There are a few reasons why the drive may be faulting. The first step is to look up the fault code in the Mitsubishi manual that is shown on the VFD keypad. Here are some possible codes and solutions:</p> <ul style="list-style-type: none"> ● ETHN – overload caused either by too much load, or failure of the brakes to release. Make sure the brake(s) are wired correctly and plugged in. ● ELF – output phase loss caused by the motor being disconnected. Make sure the motor is properly wired and plugged in. ● EOSD – 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. ● EECT – encoder signal loss. The Speed Encoder is disconnected, make sure it's wired up and plugged in. ● EOS – over speed. 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.
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Auto-Tuning Issues

Drive not detected

Brake fault is displayed after auto-tuning

VFD Error Codes

Technical Support

Despite our best efforts and intentions to provide reliable equipment and clear instructions, there may come a time that you need more direct, personal help. We are happy to do that too. Please get in touch in whatever way is most convenient.

Phone

You can reach us weekdays from 8:30am – 5:00pm EST at 401-289-2942 x2. If you call outside of normal business hours (like during tech, or pre-show check, or intermission), one of us will be on-call. If we do not answer the call immediately don't despair – we are diligently checking voicemails and will call back as soon as possible.

Email

Email is a very convenient tool for tech support, whether you are experiencing a tech stopping issue or if you don't have a time-critical problem. Emails sent to support@creativeconners.com are distributed to the entire tech support staff, meaning that even if one of us is tied up or out of the office someone will see your email. If you are encountering an issue with a specific cue in a show, please email the show file along with the relevant log file from Spikemark with a description of the issue and ideally a date and time of the incident. We respond within 24 hours, though usually it's only a matter of minutes.

Web

Our forum has some cobwebs these days, not too many folks prefer it over the phone or email, but we still check it religiously every day and answer any questions that come up. Feel free to check it out here <http://creativeconners.com/phpBB3/>.

Specifications

Electrical Specifications

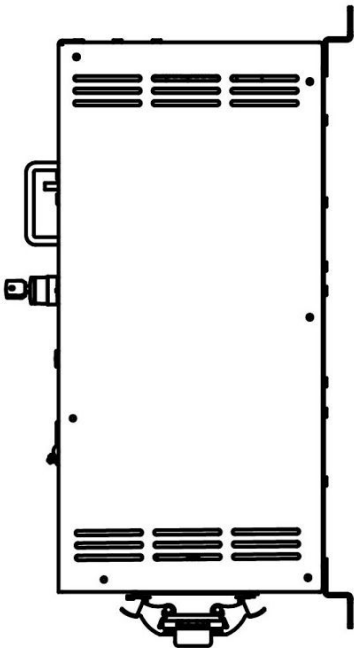
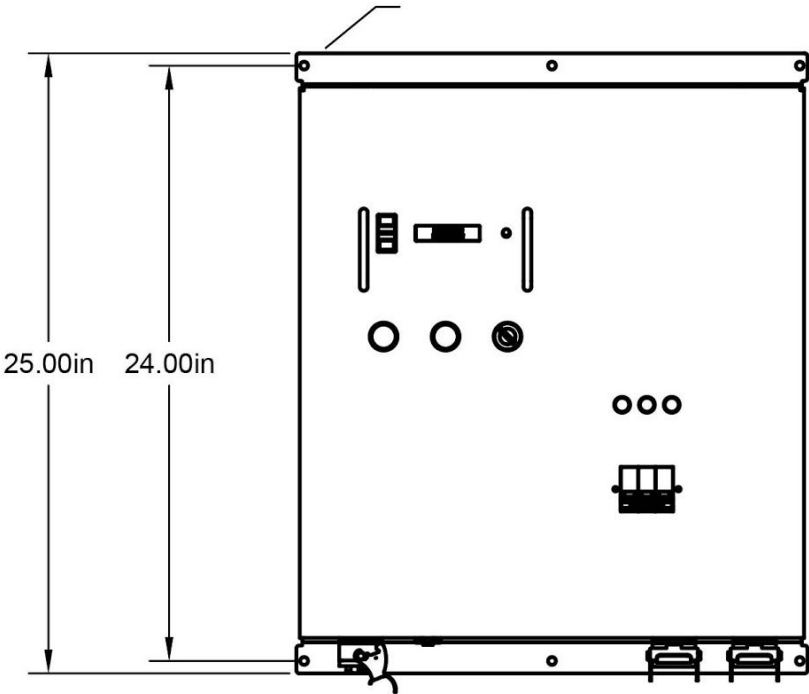
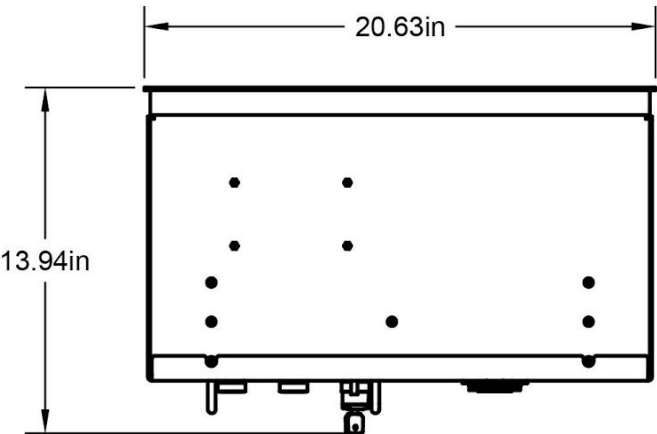
Performance Specifications

Description	Value
Maximum Encoder Position	1,073,741,823 counts
Minimum Encoder Position	-1,073,741,824 counts
Maximum Encoder Velocity	15,999,023 counts/second
Maximum Acceleration	15,999,023 counts/second/second

Physical Specifications

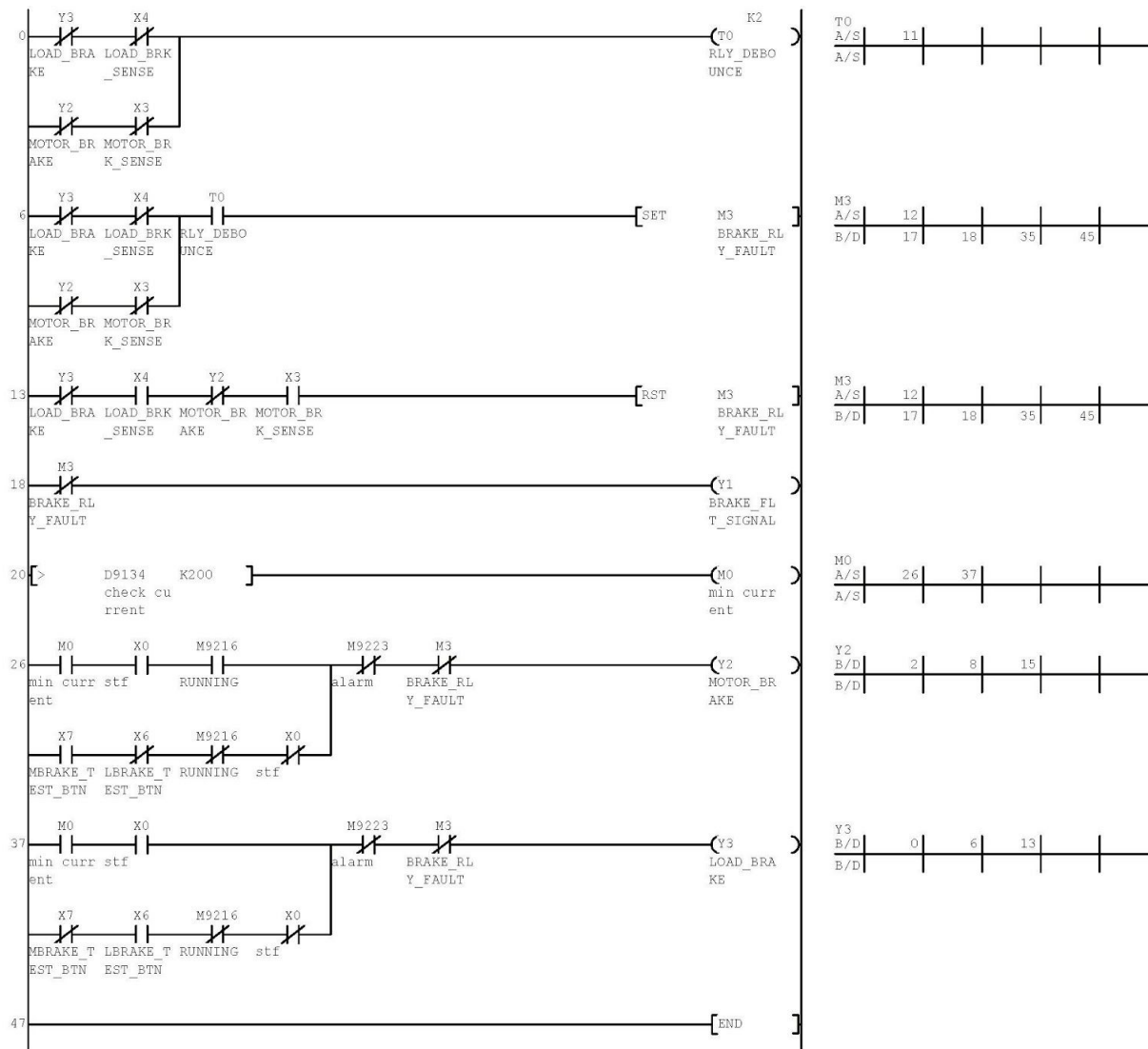
	Height	Width	Depth	Weight
Stagehand Architectural with Mounting Brackets	25"	20.63"	13.13"	75 lb (2-5hp) 85 lb (10hp)
Shipping Specifications	26"	26"	20"	75 lb (2-5hp) 85 lb (10hp)

Drawing



Mitsubishi A800 Parameters

PLC Ladder Logic



Wiring Diagram

REV'SIONS		
Rev.	Drawn	Date
A	GBC	4/24/18
B	GBC	5/30/18

REV'SIONS		
Rev.	Drawn	Date
A	GBC	4/24/18
B	GBC	5/30/18