

creative conners, inc.

# Stagehand Apprentice Reference Manual

Version 1.0.1





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## 1 – Getting Started

Congratulations on your purchase of the Stagehand Apprentice motion controller from Creative Conners, Inc. The Stagehand Apprentice brings the excitement of automation to theatres of all sizes. Combining the motion controller and motor drive into a compact package, The Stagehand Apprentice eliminates the clutter and complexity of other automation systems.

This manual will direct you through:

1. Unpacking
2. Installation and testing
3. Setup and Operational procedures

If you need help along the way contact us by email ([support@creativeconners.com](mailto:support@creativeconners.com)), online ([www.creativeconners.com](http://www.creativeconners.com)) or by phone (401-289-2942).

### *What's in the box?*

Inside the box you should find:

1. Quick Start Guide
2. Stagehand Apprentice motion controller
3. Rack ears with bolts
4. Mitsubishi D700 instruction manual on CD
5. If you purchased a 120VAC Stagehand Apprentice you will also have a cable mount Powercon True 1 connector

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

If you purchased any accessories (cables, adapters or hardware), those items are packaged separately.

### *Stagehand Apprentice Overview*

The Stagehand Apprentice performs two major functions: Motion control and power amplification. This means that Stagehand can:

1. Track the position and control the speed, acceleration and deceleration of a motor that is equipped with a compatible encoder.
2. Supply the necessary 3 phase power necessary to move the motor.
3. Stop motion when a limit switch is triggered.

Typically, these functions have been divided between several pieces of equipment, but the Stagehand packs all this functionality into one compact and convenient box.

After unpacking the Stagehand Apprentice, take a moment to familiarize yourself with its various connections, buttons and features. (Figure 1 shows the 5HP model)

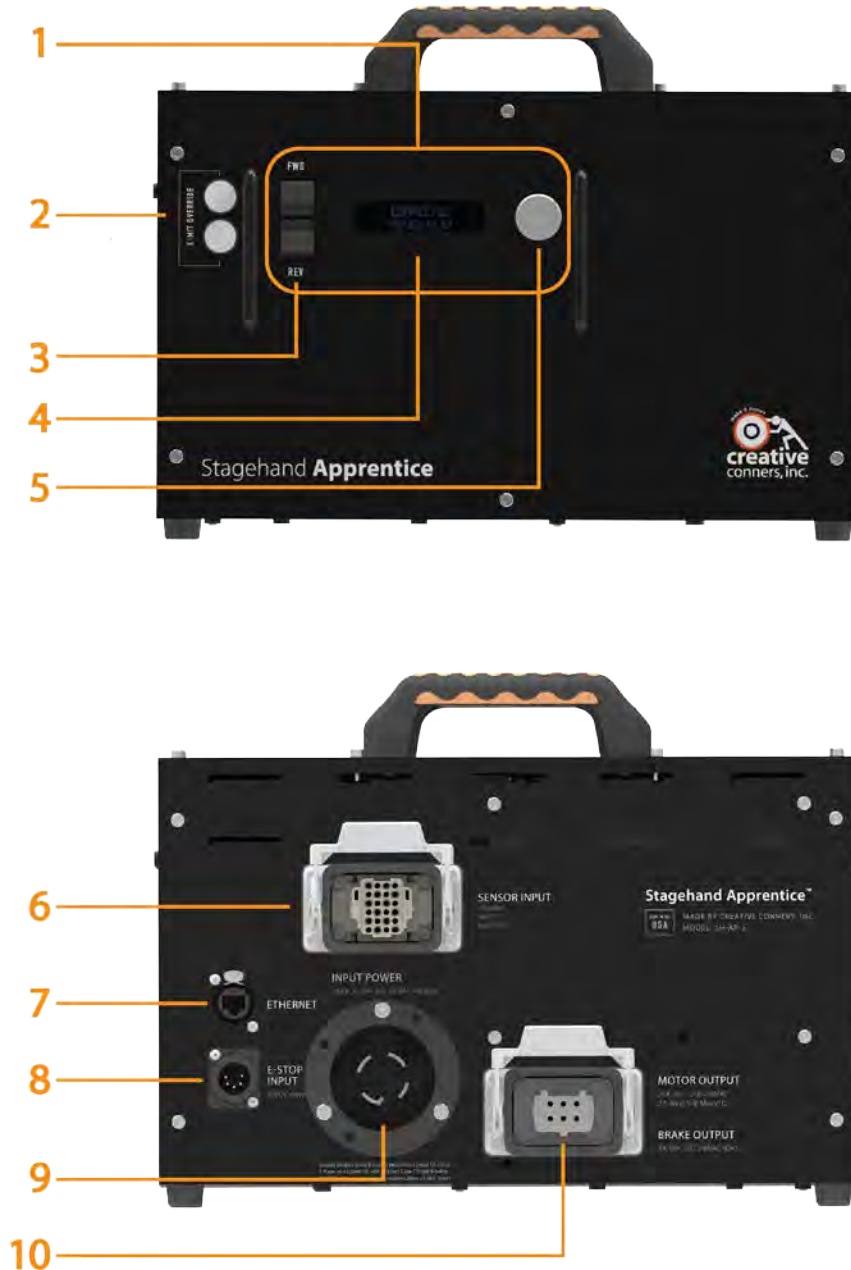


Figure 1 – Stagehand Features

1. **Stagehand Motion Controller** – The brains of the controller are located here.

2. **Momentary Limit Override buttons** – When pressed, the Stagehand will temporarily override the FWD or REV limits. This feature is intended to be used when manually jogging the motor.
3. **Forward and Reverse Manual Jog Buttons** – When pressed the Stagehand will switch to manual operation, allowing jogging in forward or reverse.
4. **OLED Display** – The OLED display shows information about the Stagehand’s status. When idle, it shows the current IP address and the network connection status to the PC running Spikemark.
5. **Multi-function Jog Wheel** – The Jog Wheel has two functions:
  - a. If either the FWD or REV jog buttons are pressed, the knob functions as a speed dial.
  - b. Clicking the wheel (it’s also a button) allows the user to set the IP Address.
6. **Sensor input** – This includes the encoder and both the Forward and Reverse limits
  - a. Encoder supply voltage is 12VDC, and receives position information from an incremental quadrature, line driver encoder.
  - b. Both FWD and REV limits should be wired as normally closed (N.C.)
7. **Ethernet** – The Ethernet receptacle accepts both the rugged Ethercon connectors as well as standard RJ45 connectors. The Stagehand Apprentice uses Ethernet to communicate with the PC running Spikemark software.
8. **Showstopper Input** – The E-Stop (Emergency Stop) receptacle is a 5-pin XLR connector (a.k.a. standard DMX cable). The E-Stop signal (24VDC) is provided by the Showstopper 3 Base. If the signal is present, the Stagehand is free to move, when the signal is interrupted all motion will stop.
9. **Mains Power** – This is the power input from the distribution panel, the connector varies based on the maximum capacity of the Stagehand
  - a. 1HP versions utilize a Powercon True1 (single-phase, 120V, 20A) connector
  - b. 5HP version utilize the familiar L15-30M connector
10. **Motor and Brake Output** – Both the brake and motor output is bundled in the single industrial connector.
  - a. 1HP Version
    - i. Motor output: 3-phase, 230VAC, 15A
    - ii. Brake output: Single phase, 120VAC
  - b. 5HP Version
    - i. Motor output: 3-phase, 230VAC, 30A
    - ii. Brake output: 208/230VAC

## ***Installing the Stagehand***

The Stagehand Apprentice ships from the factory with top handles and rubber feet installed, making it a snap to setup on any flat surface. The Stagehand Apprentice also includes Rack Ears if you prefer to rack the unit. No matter the mounting method, the Stagehand Apprentice should always be oriented horizontally.

### ***Standalone***

Out of the box, the Stagehand is ready to go: simply place the Stagehand on its feet, on a level surface. The integrated top handles make it easy to move and the rubber feet keep it planted firmly on the horizontal surface.

### ***Rack Mount***

If you prefer to rack up your Stagehands all you need to do is install the included rack ears and install the Stagehand in a rack. The Stagehand must remain horizontal when in use, to maintain proper heat ventilation.

To rack mount the Stagehand Apprentice:

- Remove the four SHCS holding the two plastic handles on the top of the Stagehand

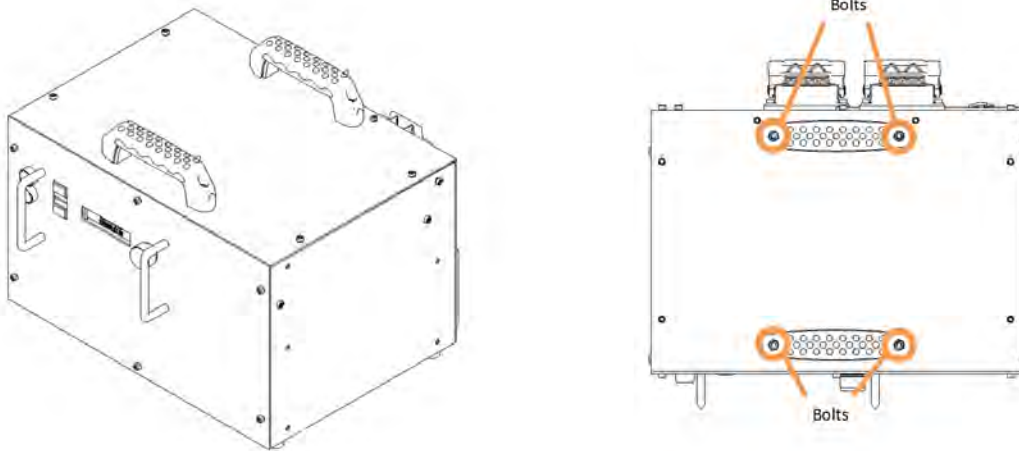


Figure 2 – Top handle removal for rack mounting



- Remove the four SHCS and rubber feet from the bottom of the Stagehand

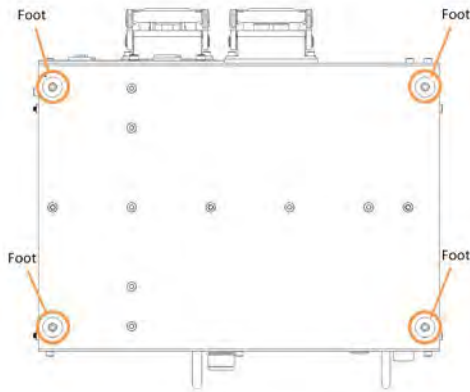


Figure 3 – Rubber Foot removal for rack mounting

- Install the rack ears on each side of the Stagehand with the included hardware, 3x SHCS per side.

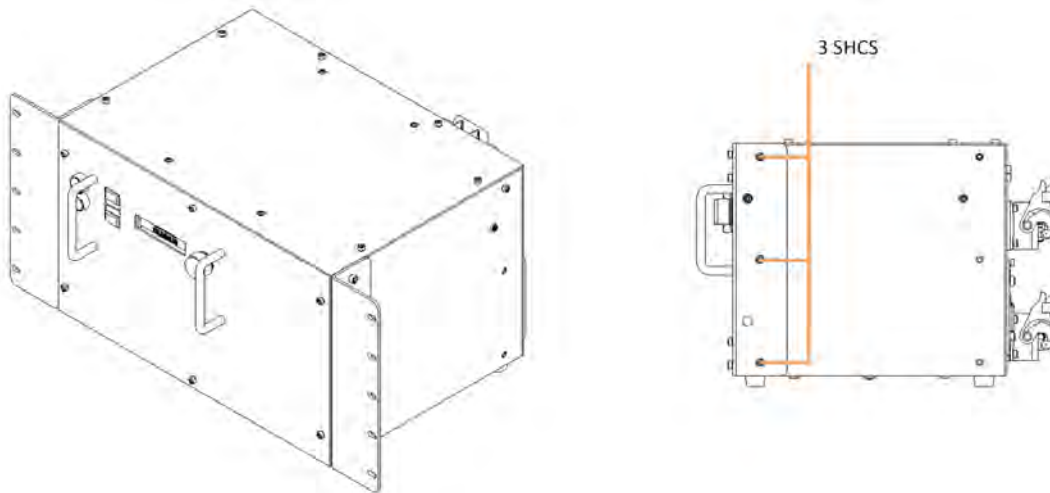


Figure 4 – Installation of Rack Ears

- Secure the Stagehand in an equipment rack, keeping it horizontal

### ***Making the Connections***

Thanks to the introduction of the industrial locking connectors we have reduced the number of cable connections on the Stagehand from eight to five.

### ***Hooking up power***

With either configuration, making the power connection is simple and secure. Both the 120VAC single-phase Powercon and the 208VAC 3-phase L15-30 are locking connectors. Simply align the nub on the Powercon connector or the tab on the L15-30, insert the connector and turn.



208VAC, 3 phase power connection

120VAC, single phase power connection

Figure 5 – Stagehand Apprentice Power Connections

Once power is connected and turned on, the OLED display will light up and show a rolling list of faults as well as an IP address. The faults will cycle through EMERGENCY STOP, DRIVE FAULT, BRAKE FAULT, FWD LIMIT, REV LIMIT and will clear once the E-Stop is connected and released.



Figure 6 – Stagehand Rolling Fault Screens

**Hooking up the E-Stop**

The Emergency Stop circuit is powered through standard DMX cable (a.k.a 5-pin XLR). The E-Stop cable needs to plug directly from a Showstopper Base or Hub into the Stagehand. Be sure to engage the Showstopper mushroom button prior to plugging in the E-Stop cable.

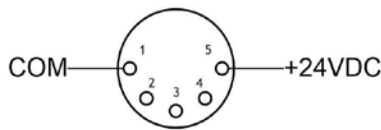


Figure 7 – E-Stop Wiring

**Hooking Up and Configuring the Network Connection**

The Stagehand Apprentice connects to the PC running Spikemark software through a network switch and the Stagehand Network. The Stagehand Apprentice Ethernet connector accepts both Neutrik Ethercon and standard RJ45 connectors.

Each Stagehand requires a unique IP Address to communicate with Spikemark. To set the IP Address, press the Jog Wheel.



Figure 8 – Set IP Address Screen

Use the jog wheel to scroll to the part of the IP address to change and click the wheel. Turn the jog wheel until the desired number is showing, set it by pressing the jog wheel. All Stagehand and Showstopper devices ship from the factory with a default IP Address in the range of 192.168.10.xxx. Feel free to set the IP Addresses to any range which works for you, as long as each IP Address is in the same range. Once the IP address is set, scroll to “OK” and click the wheel, the IP Address is now set.

Stagehand Firmware REV45 also allows you to set the Subnet Address. To unlock the subnet menu simply press and hold the jog wheel until the display shows the Set Subnet screen. The default subnet of **255.255.255.0** should suffice for almost everyone, though if you are integrating the Stagehand and Spikemark with show control systems you may need to adjust the Subnet.

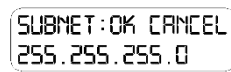


Figure 9 – Set Subnet Address Screen

### ***Hooking up a motorized effect***

Now that you have the input power, network and E-Stop connected it’s time to hook up your machine. One of the space-saving decisions includes the introduction of Industrial Rectangular Connectors on the Stagehand Apprentice. The Motor and Brake cable are specific to the Stagehand Apprentice, though the Signal Cable is shared between the Apprentice and Pro lines

### ***Signal Connection***

Connecting the Encoder, Forward/Reverse/Ultimate<sup>1</sup> limits is accomplished through a single locking connector (IRC - 44mm X 27mm (6B) 24P 10A). This is the same connector and pinout we use with the Stagehand Pro Signal cables. Compatible connectors are available

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<sup>1</sup> The Stagehand Apprentice can support an Ultimate limit circuit, though it is jumped internally from the factory. If you would like to include the ultimate limit circuit in your system, please contact support@creativeconners.com. We will be happy to walk you through the process of removing the internal jumpers.

from a variety of suppliers. No matter the motor capacity of your Apprentice, the signal wiring is the same.

All limit switch signals require Normally Closed (N.C.) switches. The Stagehand sources 12vdc on a pin of each limit circuit and expects to sense a 12vdc signal returned on the other pin when the limit is not activated. If the limit is either activated, or disconnected, or a wire breaks, 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.

The encoder signal uses differential line receivers which employ 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 12vdc, please confirm your encoder is 12vdc compliant.

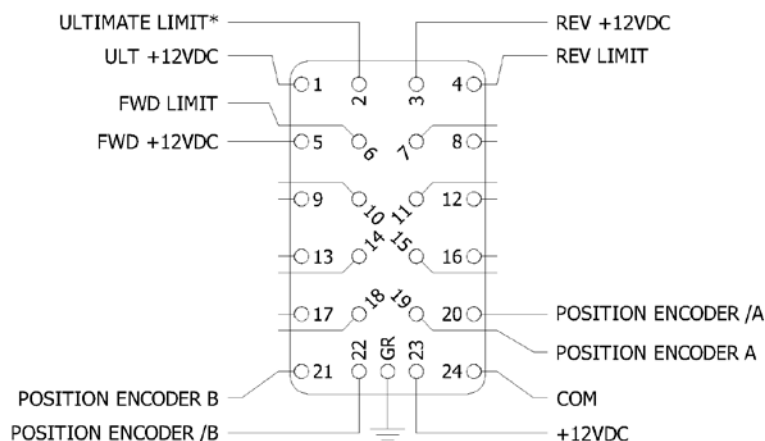


Figure 10 – Stagehand Apprentice Signal Connector

**Let's start with the limit signals:**

- 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, (pins 1, 3 & 5) 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:

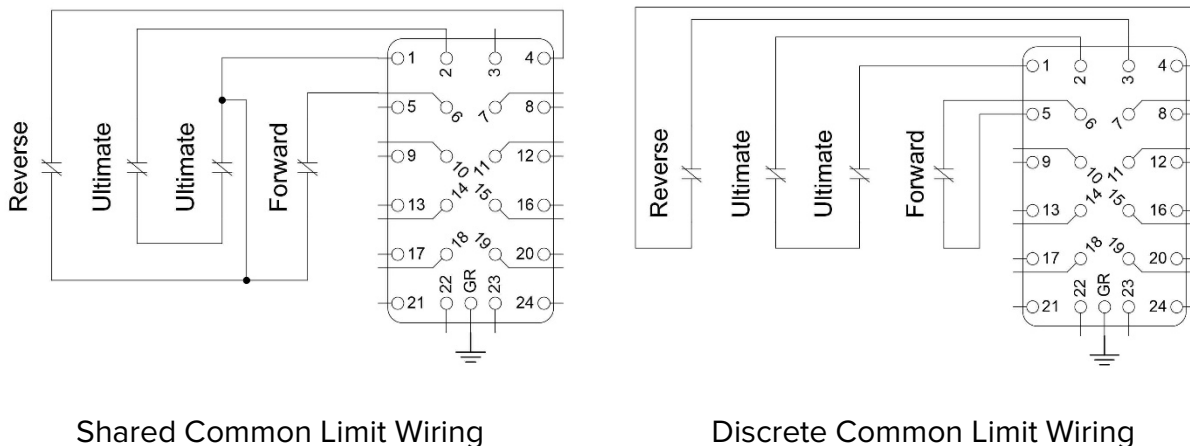


Figure 11 – Typical Limit Wiring Schemes

**Now let's look at the encoder signal.**

Although the Stagehand Apprentice shares the signal cable with the Stagehand Pro, there are a few notable changes. First and foremost, the Stagehand Apprentice **outputs 12VDC** to power the Incremental, Quadrature Line Driver encoder. In contrast, the Stagehand Pro outputs 5VDC. **Your position encoder must be 12VDC compliant to work with the Stagehand Apprentice.** Additionally, the Stagehand Apprentice only powers and detects for a position encoder. Lacking a secondary speed encoder, the Stagehand Apprentice is not suited for closed loop vector control or for overhead lifting.

If you are building your own machine we recommend a PPR of 1024-2500 for a motor side encoder and anything above 4,000 PPR for the load side. For reference, the dancer wheel encoder included with the Revolver is a 10,000 PPR model.

### ***Motor and Brake Connection***

Power output for both the motor and brake have been combined into a single IRC - 44mm X 27mm (6B) 6P 16A Female socket. As with the signal connectors, the motor and brake connectors are available from several manufacturers and suppliers. The wiring of the connector will vary slightly depending on the Stagehand Apprentice Model. For instance, the 1HP, 120VAC single phase Stagehand Apprentice power cord will output 120VAC on pin 4. While the 5HP, 208VAC three phase Stagehand Apprentice power cord will output 220VAC across pins 5 & 6. Refer to the following diagram for details.

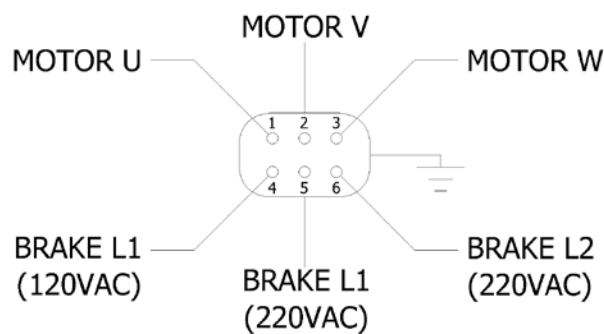


Figure 12 – Motor/Brake Power Connections

## **2 – Using the Stagehand**

Now that all the connections are made, it's time to *Make It Move™!* The first time you apply power to your machine it should be done without a load attached. It can be quite scary if a multi-ton piece of scenery is yanked around by a misbehaving machine, so make sure to do your first test run in the shop or on an empty stage without any scenery connected.

### ***Manual Operation***

Before you can write complex cues in Spikemark, let's make sure the machine runs fine when jogging it manually using the buttons and knobs on the face of the Stagehand.

- Release the Emergency Stop button on your Showstopper
- Confirm the Stagehand display is not displaying “SET IP” or “SET SUBNET”.
  - If so, use the jog wheel to highlight CANCEL and click the wheel
- Press the Forward Button.
- While holding the Forward Button turn the Knob Clockwise slowly.
  - The brake 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 encoder. See the troubleshooting section for more details.
- Gradually rotate the Knob counterclockwise until the machine stops.
- Release the Forward Button.
- Press the Reverse Button.
- While holding the Reverse Button turn the Knob Clockwise slowly.
  - The brake 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.

If you strike a limit while jogging in the direction of the limit, the Stagehand will immediately stop the motor. This is a necessary safety feature, though during machine prep and load in running into the limits can be frustrating – especially when you are certain no accident will occur. To address this frustration, the Stagehand Apprentice includes forward and reverse momentary limit override buttons to the left of the OLED display.

To bypass a limit, press and hold either the FWD or REV limit override and continue jogging the motor. Once the motor has been tested, and functions correctly you will need to set the physical hard limits before attaching scenery and running the motor in a cue.

If you are using the ultimate limit circuit and you strike it, you must physically clear the limit switch before restarting motion in either direction. Although the Stagehand Apprentice supports an ultimate limit circuit, it is jumped internally from the factory. If you would like to include the ultimate limit circuit in your system, please contact [support@creativeconners.com](mailto:support@creativeconners.com). We will be happy to walk you through the process of removing the internal jumpers.

### ***Computer Control with Spikemark***

Once all the physical connections are made, IP Addresses are set and you have moved the motor manually, it's time to open Spikemark, connect your Stagehand and write a cue. Adding the Stagehand to Spikemark is as easy as adding the motor (Ctrl-M) and setting the IP Address in Spikemark to match the one on the Stagehand. Finally, press the CONNECT button in the Stagehand Properties pane on the right.

Once Spikemark is connected to the Stagehand it will recognize the Stagehand Apprentice. You will see this information displayed in the Hardware pane on the right-hand side of

Spikemark. The Stagehand Apprentice can reset a drive fault from within Spikemark. This feature only works with the Stagehand Apprentice.

From the properties pane, you can set many additional parameters. Refer to the Spikemark manual for details.

### ***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. 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!

### ***Adjusting VFD parameters***

Another item missing from the Stagehand is the VFD keypad. Unlike the Battery Backup which was removed completely the keypad is still there, it is just located inside the Stagehand. To access the VFD keypad you will need to remove the top cover of the Stagehand and you will see it located on the VFD. See below for the location of the seven SHCS that need to be removed.

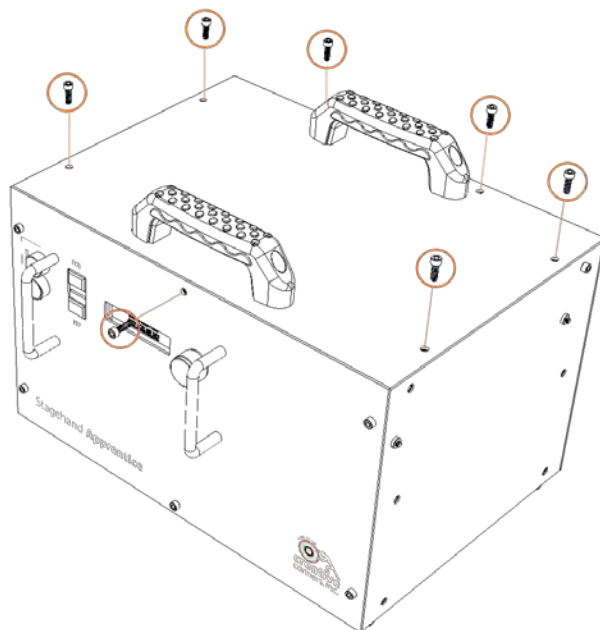


Figure 13 – VFD Access



***Adjustments from the keypad***

Once you have the cover off, setting the parameters on the D700 series VFD is a straightforward process. Press the MODE button until "P." is displayed. Use the scroll wheel to find the parameter to change and press the SET button. Make the adjustment with the wheel and press SET to save the new value. Once all the parameters are set press MODE until 0.00 is displayed.

On the following page is a table of the default D700 drive parameters.

**Default Mitsubishi Drive Parameters**

Parameter	Description	Value	Description
<b>77</b>	Parameter write selection	2	allow parameter writes regardless of status ****SET THIS ONE FIRST***
<b>1</b>	Maximum Frequency	120Hz	max output frequency
<b>7</b>	Acceleration time	0	seconds
<b>8</b>	Deceleration time	0	seconds
<b>9</b>	Motor full load amps	16A/3.7A	16A for 5Hp; 3.7A for 1Hp
<b>13</b>	Starting frequency	0.5	Motor won't start until the speed signal is at least this value.
<b>30</b>	Regenerative function	1	External brake resistor, L1/L2/L3 power source
<b>70</b>	Regenerative brake duty	10.00%	duty cycle of the braking resistor
<b>71</b>	Motor type	3	Other mfg. standard motor
<b>72</b>	Carrier frequency	15	Reduces output noise
<b>73</b>	Analog input selection	1	Terminal 2 input 0 to 5V without reversing
<b>79</b>	Control mode	2	Keypad disabled, external control
<b>80</b>	Motor capacity	3.7/0.75	3.7 kilowatts for 5Hp; 0.75Kw for 1Hp
<b>83</b>	Motor voltage	230V	Motor voltage
<b>84</b>	Motor rated frequency	60Hz	Motor rated frequency
<b>118</b>	PU communication speed	96	Value x 100 = comm. speed bps
<b>119</b>	PU communication stop bit length	0	Stop bit = 1. Data length = 8
<b>120</b>	PU communication parity check	0	Without parity check
<b>121</b>	Number of PU communication retries	9999	If a communication error occurs, the inverter will not come to trip
<b>122</b>	PU communication check time interval	9999	No communication check
<b>123</b>	PU communication waiting time setting	50	Set the waiting time between data transmission to the inverter and the response
<b>124</b>	PU communication CR/LF selection	0	Without CR/LF
<b>125</b>	Terminal 2 frequency setting gain frequency	60Hz	** Max frequency (adjust for overspeed) **
<b>190</b>	RUN output	199	Fault output (normally closed, opens if fault)
<b>192</b>	Relay output	0	Running
<b>197</b>	SO terminal	180	Safe Stop output (normally closed, opens if stopped)
<b>C4 (903)</b>	Terminal 2 frequency setting gain	100	Converted % of the gain side voltage (current) of terminal 2 input. (adjust for overspeed) **

### ***VFD Auto-Tuning***

The Mitsubishi D700 Variable Frequency Drive (VFD), like many VFDs, 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 procedure:***

1. Confirm the E-Stop is released
2. Set parameter 77 to '2' (allow parameter writes regardless of status)
3. Set parameter 9 to the motor rating (check the connected motor nameplate)
4. Set parameter 71 to 3 (other mfg. standard motor)
5. Set parameter 80 to the motor capacity (confirm correct value from the motor nameplate)
6. Set parameter 83 to 230V
7. Set parameter 96 to 11 (offline auto-tuning without moving)
8. Press and hold the FWD jog button on the face of the Stagehand to begin the tuning process

During the tuning process the keypad displays "12". If it completes successfully, the keypad will display "13". If there was an error, the keypad displays "9". For more information see the Mitsubishi D700 series manual starting at page 105.

## 3- Troubleshooting

### *Most common issues*

<b>Problem</b>	<b>Solution</b>
<b>When running forward, the encoder position decreases. When running reverse, the encoder position increases</b>	<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"><li>• Swap two power legs on the motor by swapping the wires on Pin 1 and Pin 2 inside the motor plug.</li></ul> <p>– OR –</p> <p>Re-wire the position encoder to match the motor polarity:</p> <ul style="list-style-type: none"><li>• Swap signal A with signal B</li><li>• Swap signal /A with signal /B</li></ul>
<b>The OLED status display is dark, but the main power indicator is on.</b>	<p>The motion controller may be disconnected internally, to fix it:</p> <ul style="list-style-type: none"><li>• Unplug the power cord from the Stagehand. Remove the motion controller by loosening the 4 #10 socket head cap screws surrounding the motion controller.</li><li>• Gently pull the faceplate forward to view the back side of the circuit board behind the faceplate.</li><li>• Check that all terminal blocks are securely mated onto the circuit board.</li></ul>
<b>Motor runs roughly or makes strange noises when jogging manually.</b>	<p>Run the auto-tuning procedure outlined on page 14.</p>
<b>The FWD LIMIT or REV LIMIT fault messages are displayed on the status screen and the motor won't move.</b>	<ul style="list-style-type: none"><li>• Make sure the Encoder/Limits cable is plugged into the rear of the Stagehand.</li><li>• Check the placement of your limit switches, if either are physically activated, adjust the placement to clear one or both switches.</li></ul>

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	<ul style="list-style-type: none"><li>• Check the limit switch wiring, confirm that the switches are wired Normally Closed (N.C.)</li><li>• Use the limit override button to allow you to jog the machine off the limit</li></ul>
<b>ULT LIMIT fault message is displayed on the status screen</b>	<p>One (or both) Ultimate limits are engaged. Check limits and clear manually before moving.</p> <p>If you are not using the ULT limits, call Creative Conners.</p>
<b>I'm trying to jog or run the motor, but nothing is happening and the status display shows "SET IP" or "SET SUBNET"</b>	<p>The motion controller is in IP/Subnet Address setting mode, which happens when the knob is pressed (either intentionally or just bumped in passing). Confirm the IP or Subnet Address is correct and 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 operate the motor again.</p>
<b>Drive faults whenever the motor tries to move. Stagehand displays "DRIVE FAULT" and the Drive fault icon is showing in Spikemark</b>	<p>There are a few reasons why the drive may be faulting:</p> <ul style="list-style-type: none"><li>• Confirm the drive fault is cleared. Clear a drive fault by either:<ul style="list-style-type: none"><li>○ Removing mains power for 30 seconds</li><li>○ Reset the drive from the Stagehand menu in Spikemark</li></ul></li><li>• Confirm the brake is releasing by checking voltage at the motor/brake cable</li><li>• Confirm the machine is free to move (no obstruction in the deck track)</li><li>• Open the Apprentice and look up the fault code in the Mitsubishi manual that is shown on the VFD keypad.</li></ul>
<b>The motor operates great with the manual jog controls on the Stagehand but will not operate from Spikemark</b>	<ul style="list-style-type: none"><li>• Confirm the Stagehand Apprentice is connected to the Stagehand Network with a CAT5 cable</li><li>• Confirm the IP Address and Subnet Address are set correctly</li><li>• Confirm the IP Address of the Stagehand matches in Spikemark</li><li>• Confirm Spikemark is in LIVE mode</li></ul>
<b>Motor won't run in cue</b>	<ul style="list-style-type: none"><li>• Confirm the Stagehand is connected and clear of any faults</li></ul>

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- Execute the auto-tuning procedure noted on page 14
  - Tune the motor within Spikemark, see the Spikemark manual for details.
- 

### ***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. 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/>.

## 4 – Specifications

### *Physical Specifications*

	<b>Height</b>	<b>Width</b>	<b>Depth</b>	<b>Weight</b>
<b>Stagehand Apprentice With handles and feet</b>	10-5/8"	14"	13-1/4"	26lbs
<b>Stagehand Apprentice With Rack Ears</b>	8-3/4"	19"	13-1/4"	28.5lbs
<b>Shipping Specifications</b>	14-1/2"	16-3/4"	18-1/4"	35lbs

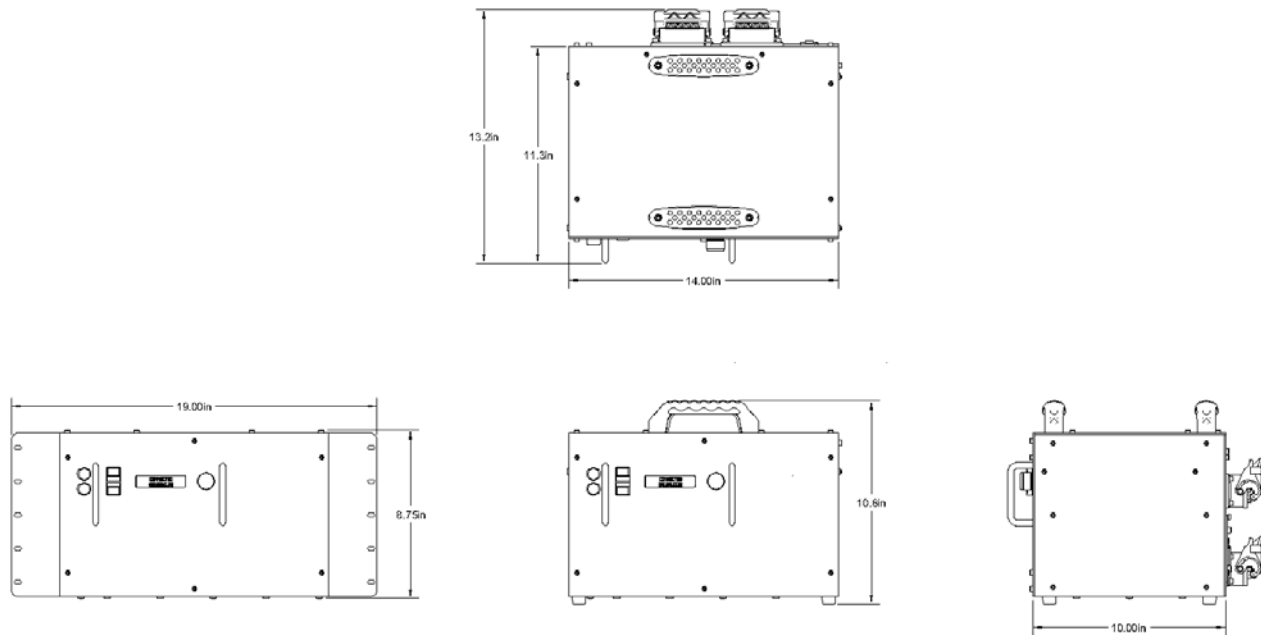


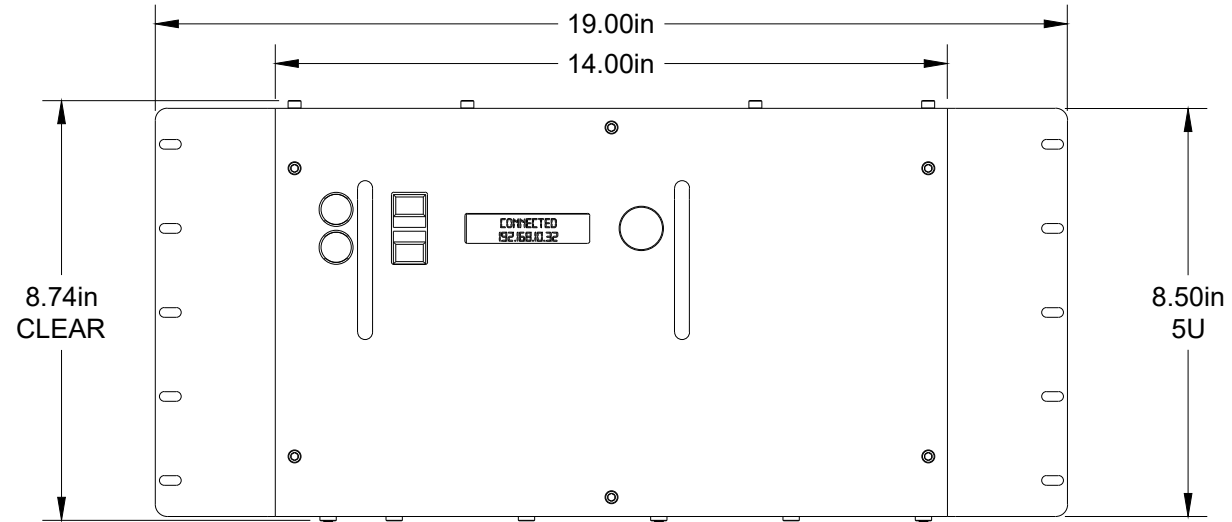
Figure 14 – Stagehand Apprentice Overview

## Electrical Specifications

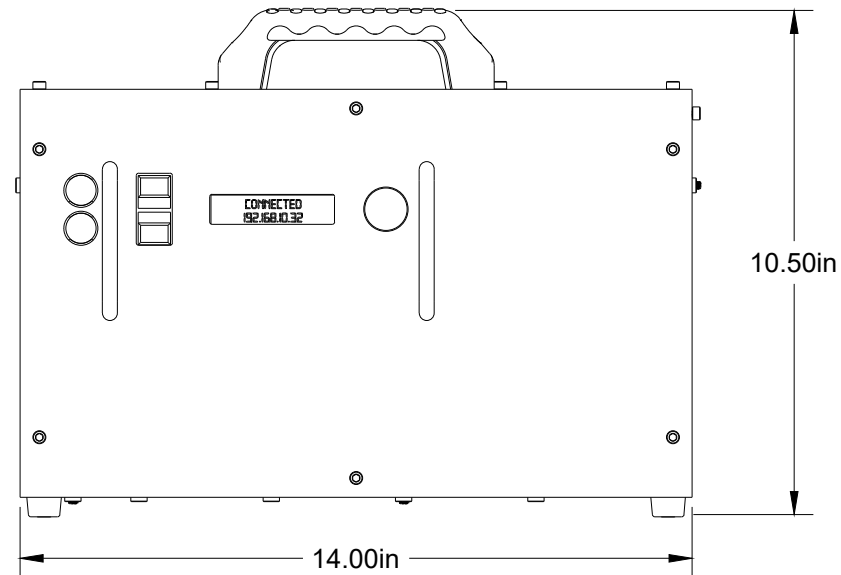
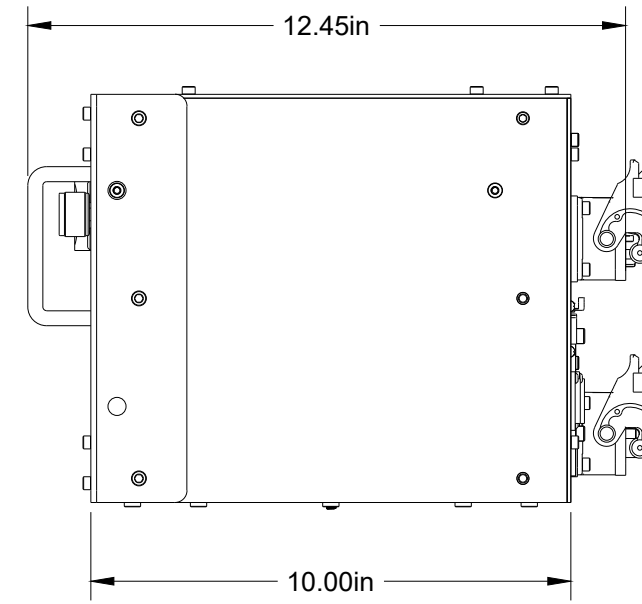
	<b>1HP, Single Phase</b>	<b>5HP, Three Phase</b>
<b>Input Voltage</b>	<b>120VAC, single phase</b>	<b>208VAC, three phase</b>
<b>Max Input Current</b>	20 amps. Supply proper branch circuit protection using UL Class T fuses or a Listed UL 489 Molded Case Circuit Breaker (MCCB) with a maximum allowable rating of 20A.	30 amps. Supply proper branch circuit protection using UL Class T fuses or a Listed UL 489 Molded Case Circuit Breaker (MCCB) with a maximum allowable rating of 30A.
<b>Integrated VFD</b>	FR-D710W-042	FR-D720-165
<b>Motor Output Voltage</b>	230VAC 0.2Hz-60Hz	230VAC 0.2Hz-60Hz
<b>Max Motor Output</b>	1HP	5HP
<b>Min Motor Output</b>	1/2HP	2HP
<b>Minimum Motor Speed</b>	.5Hz	.5Hz
<b>Maximum Motor Speed</b>	60Hz	60Hz
	Overspeed motor by adjusting Parameters 125 and 903	
<b>Motor Brake Voltage</b>	120VAC 50/60Hz	220VAC 50/60Hz
<b>Motor Brake Output Current</b>	10A Max	5A Max
<b>Emergency Stop Input Voltage</b>	24VDC	24VDC
<b>Emergency Stop Input Current</b>	520mA	520mA
<b>Forward Limit Switch Voltage</b>	12VDC	12VDC
<b>Forward Limit Switch Current</b>	10mA	10mA
<b>Forward Limit Switch Contact Type</b>	Normally Closed (N.C.) dry contact	Normally Closed (N.C.) dry contact
<b>Reverse Limit Switch Voltage</b>	12VDC	12VDC
<b>Reverse Limit Switch Current</b>	10mA	10mA
<b>Reverse Limit Switch Contact Type</b>	Normally Closed (N.C.) dry contact	Normally Closed (N.C.) dry contact
<b>Ultimate Limit Switch Voltage</b>	12VDC	12VDC
<b>Ultimate Limit Switch Current</b>	10mA	10mA
<b>Ultimate Limit Switch Contact Type</b>	Normally Closed (N.C.) dry contact	Normally Closed (N.C.) dry contact
	Ultimate limit circuit is bypassed internally. Contact support@creativeconnors.com if Ultimate limits are required.	
<b>Control Input</b>	10Base-T Ethernet	10Base-T Ethernet
<b>Position Encoder Input</b>	12VDC Quadrature encoder with differential line driver	12VDC Quadrature encoder with differential line driver
<b>Encoder Power Supply Voltage</b>	12VDC	12VDC
<b>Maximum Encoder Position</b>	1,073,741,823 counts	1,073,741,823 counts
<b>Minimum Encoder Position</b>	-1,073,741,824 counts	-1,073,741,824 counts
<b>Maximum Encoder Velocity</b>	15,999,023 counts/second	15,999,023 counts/second
<b>Maximum Acceleration</b>	15,999,023 counts/second/second	15,999,023 counts/second/second




x/x = +/- 1/16"  
 .xx = +/- 0.010  
 .xxx = +/- 0.003



FRONT VIEW  
WITH RACK EARS



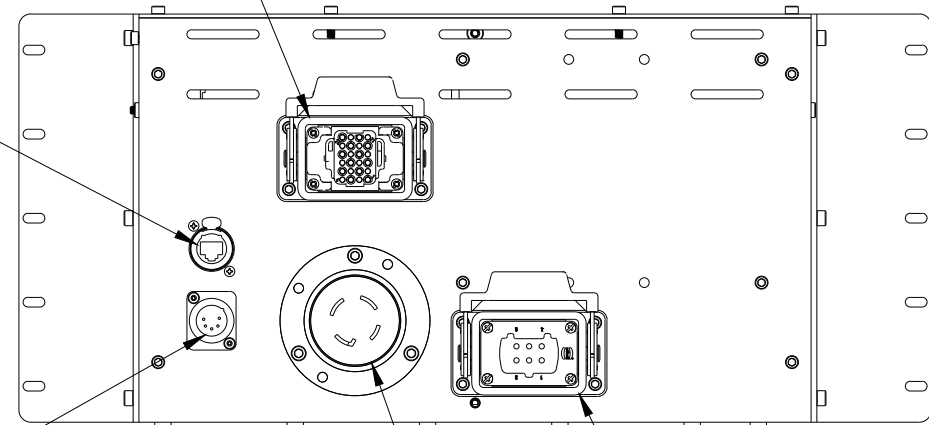
FRONT VIEW  
RACK EARS REMOVED

	PROJECT			Stagehand Apprentice
	TITLE			Overview
This drawing is the property of Creative Conners, Inc. Copyright 2017. All rights reserved.				
APPROVED	SIZE	CODE	DWG NO	REV
CHECKED	B			
DRAWN Mike Wade 9/9/2017	SCALE 1-1/2" = 1'-0"	WEIGHT	SHEET 1/2	

SIGNAL INPUT  
IRC-44MM x 27MM (6B)  
BULKHEAD BASE WITH LEVER  
Han DD 24P Female Insert

ETHERCON  
RJ-45

XLR 5 PIN  
MALE



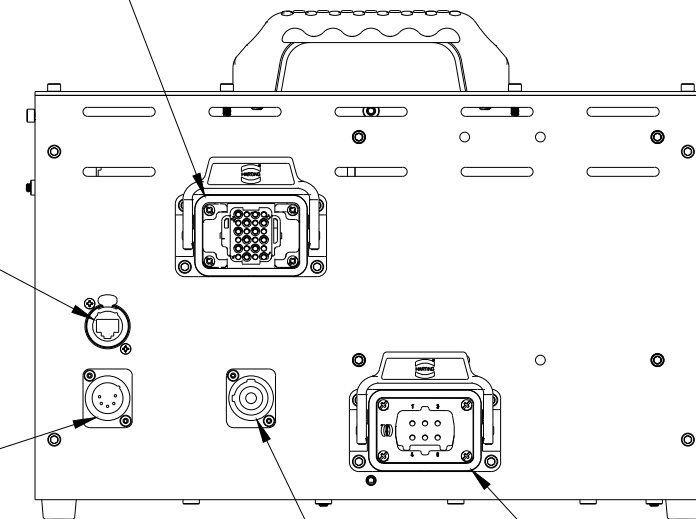
NEMA  
L15-30M

MOTOR/BRAKE OUTPUT  
IRC-44MM x 27MM (6B)  
BULKHEAD BASE WITH LEVER  
Han E 6P 16A Female Insert

SIGNAL INPUT  
IRC-44MM x 27MM (6B)  
BULKHEAD BASE WITH LEVER  
Han DD 24P Female Insert

ETHERCON  
RJ-45

XLR 5 PIN  
MALE



NEUTRIK  
NAC3MPX

MOTOR/BRAKE OUTPUT  
IRC-44MM x 27MM (6B)  
BULKHEAD BASE WITH LEVER  
Han E 6P 16A Female Insert



PROJECT

Stagehand Apprentice

TITLE

Rear Panel Detail  
1HP & 5HP

APPROVED

CHECKED

DRAWN Mike Wade 9/9/2017

SIZE

B

CODE

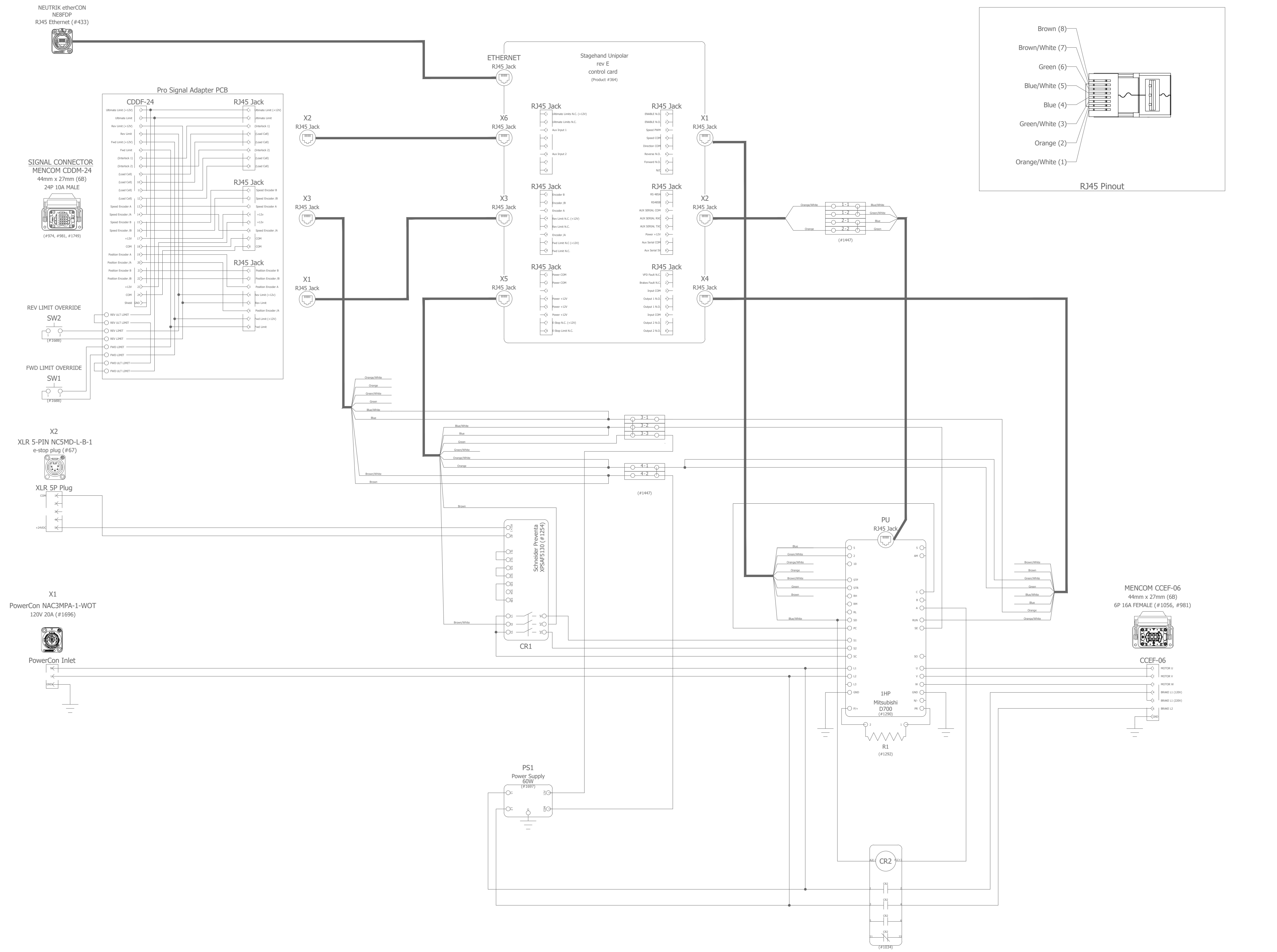
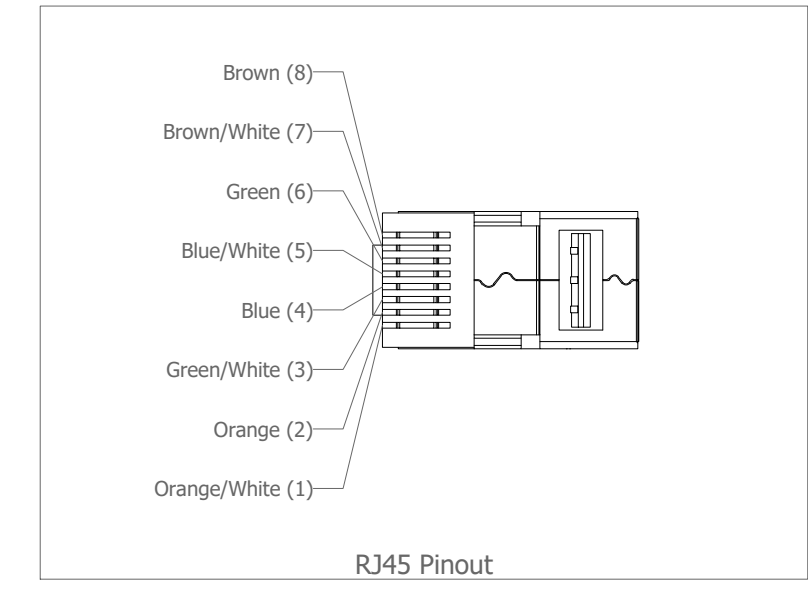
DWG NO

REV

SCALE 3" = 1'-0" WEIGHT

SHEET 2/2

REVISIONS			
Rev.	Drawn	Date	Revisions
A	gbc	12/3/16	Moved brake contactor supply to VFD
B	mrw	9/15/17	Adjusted encoder voltage notation



Stagehand Apprentice 1HP  
Wiring Diagram  
Scale: as noted  
Drawn on: 10/14/16  
Drawn By: gbc

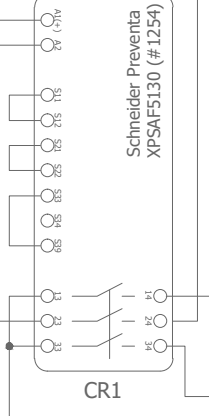
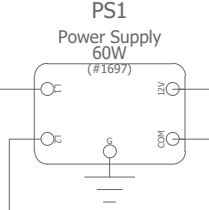
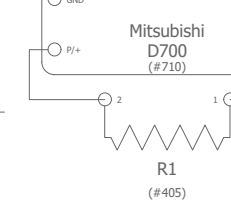
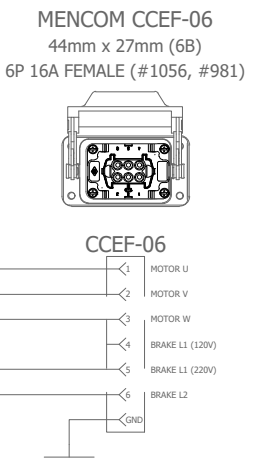
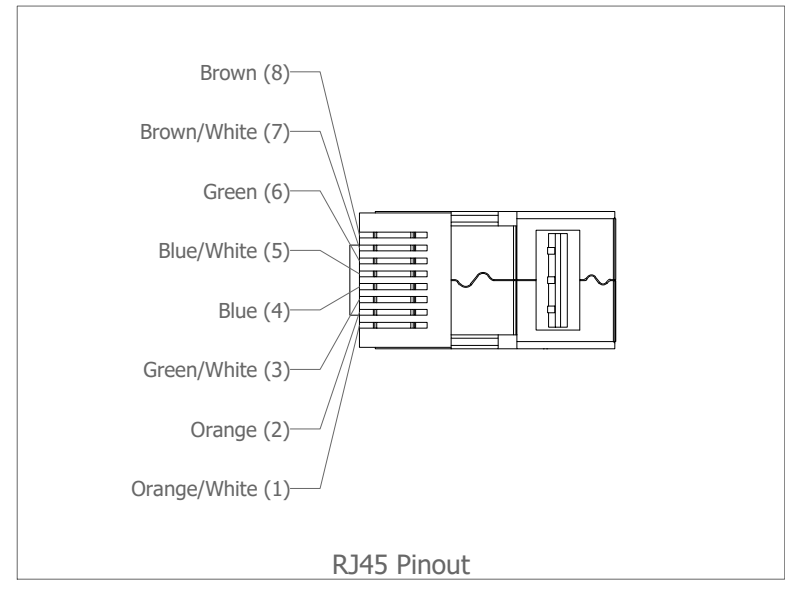
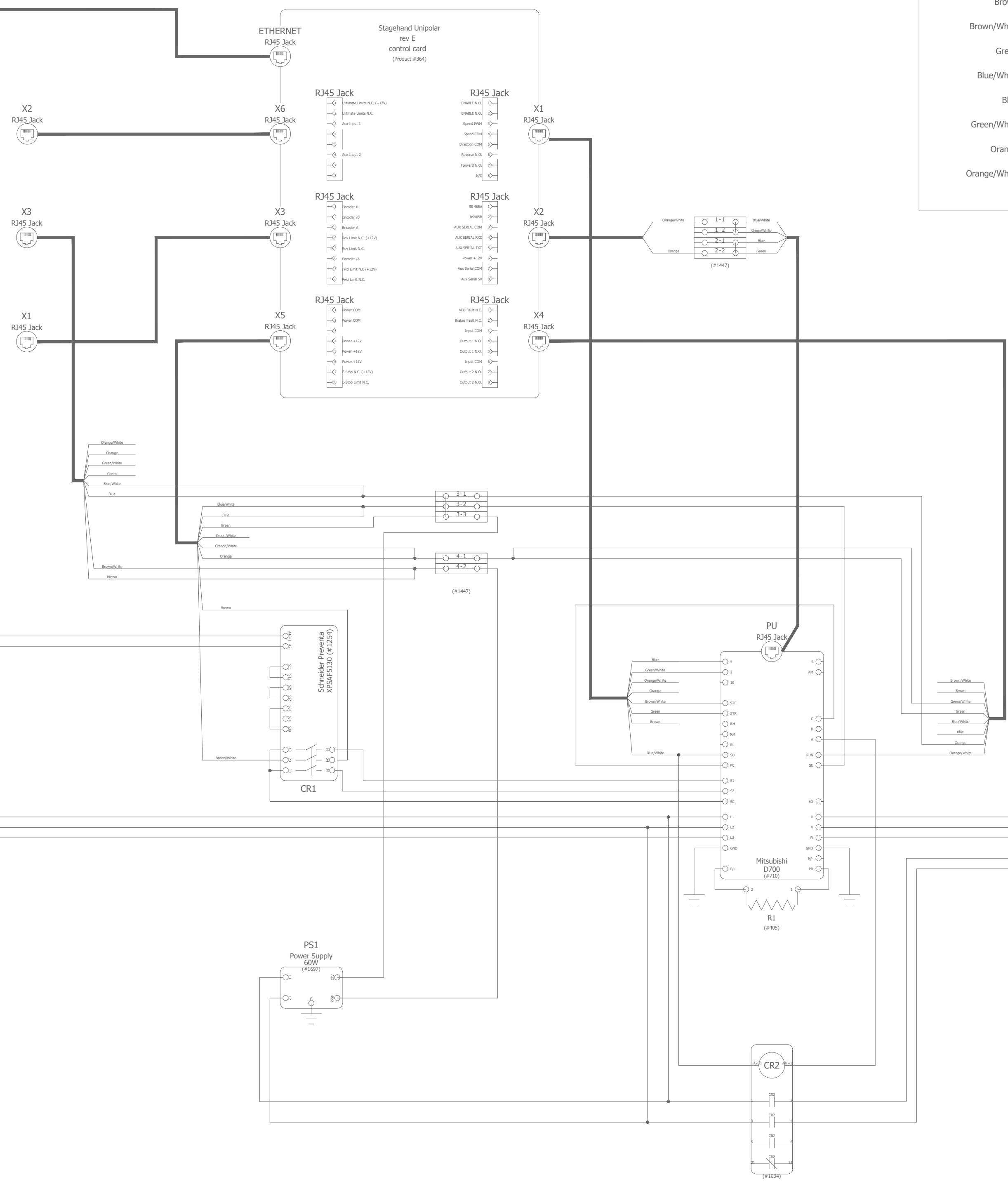
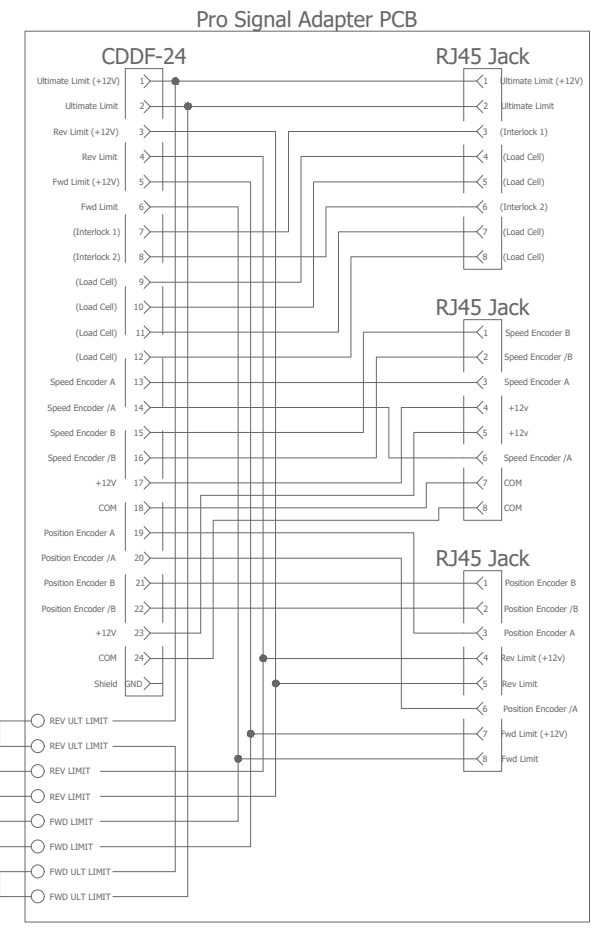
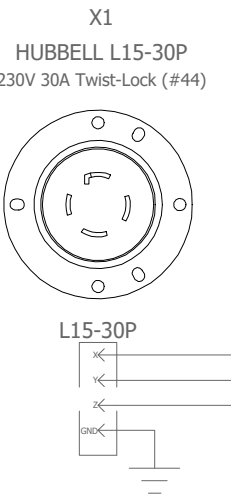
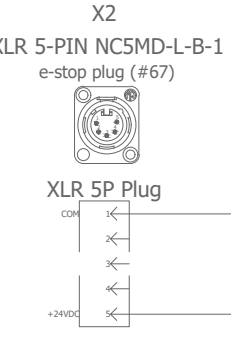
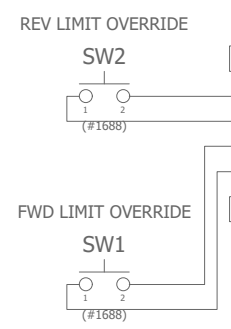
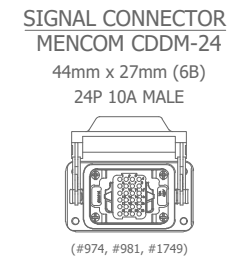
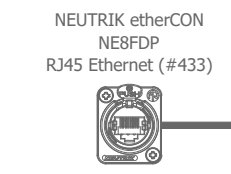
tolerances:  
% : ±1/16"  
.xx : ±0.010  
.xxx : ±0.003

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REVISIONS			
Rev.	Drawn	Date	Revisions
A	gbc	12/3/16	Moved brake contactor supply to VFD
B	mrw	9/15/17	Adjusted encoder voltage notation



Stagehand Apprentice 5HP  
Wiring Diagram  
Scale: as noted  
Drawn on: 10/14/16  
Drawn By: gbc



tolerances:  
 $\frac{X}{X}$  :  $\pm \frac{1}{16}$ "  
.xx :  $\pm 0.010$   
.xxx :  $\pm 0.003$   
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