

# QHS-66

Multi-Sample Homogenizing System



**LabTech**

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LabTech QHS-66 Multi-Sample Homogenizer Processing System



Figure 1. LabTech QHS-66 Multi-Sample Homogenizer Processing System Homogenizer

## **I. Warranty**

### **Warranty**

LabTech warrants this system to be free from defects in materials or workmanship under normal use for a period not to exceed twelve (12) months from receipt. This warranty does not include normal wear from use, it doesn't apply to any instrument or part which has been altered nor any instrument which has been damaged through accident, negligence, misuse, abuse, or failure to follow operating instructions as well as the use of electric currents or circuits other than those specified on the plate affixed to the instrument.

Liability is limited to repair or replacement of the unit at the discretion of LabTech. This warranty is in lieu of all other warranties either expressed or implied.

Claims against this warranty must be made by first contacting the LabTech Service Department.

### **Repair Policy/Instructions**

NOTE: Please follow the below instructions if it has been determined that the instrument must be returned to LabTech for service. The instrument will not be accepted by the LabTech Service Department without first following these instructions.

Call the LabTech Service Department to obtain a Service and/or Return Authorization number (RA#), decontamination form and additional instructions.

Clean the instrument and package it in an approved shipping container.

Write the RA# on the outside of the shipping container.

## **II. Maintenance**

### **Care and Handling**

Please unpack the apparatus carefully and check that it is not damaged. It is important that any damage that occurred in transport is detected at the time of unpacking. If you do find such damage, the carrier must be notified immediately.

### **Maintenance and Service**

This instrument should be given the care normally required for any electrical instrument. Avoid wetting or unnecessary exposure to fumes. The painted finishes can be washed with water and soap or detergents, using a cloth or sponge. Do not allow water to get inside the instrument. Allow drying before using. Cleaning of the front door should only be with a micro fiber cloth to avoid scratching of the door. Any and all service of this instrument during the warranty period must be performed by a trained LabTech service representative.

### **Environmental Conditions**

#### **Non-Operating Storage:**

Temperature: -20<sup>0</sup> to 65<sup>0</sup> C (-4<sup>0</sup> to 149<sup>0</sup> F)

Humidity: 20% to 85% RH, non-condensing

**Operating Conditions:**

Temperature: 18<sup>0</sup> to 33<sup>0</sup> C (64<sup>0</sup> to 91<sup>0</sup> F)

Humidity: 20% to 85% RH, non-condensing

Altitude: 0 to 6,562 feet (2000 M) above sea level

Installation Category II and Pollution Degree 2 in accordance with IEC 664

### III. Safety

#### Safety Information

- Never run the instrument with the door open.
- Never place hands or any other part of the body inside the cabinet while the instrument is running.
- Do not try to add or remove a test tube while the instrument is running.
- Do not try and add material to a test tube while the instrument is running.
- Use of any accessories or attachments other than those supplied by the manufacturer may be hazardous.
- Running a mechanical generator without a liquid media can cause damage to the generator.
- Do not grab the generator while running.

**\*\*VARIOUS SAFETY POINTS WILL BE MADE THROUGH OUT THIS MANUAL AND THEY WILL APPEAR IN BOLD PRINT. FOR BOTH YOUR SAFETY AND THOSE AROUND YOU PLEASE NOTE THESE SAFETY POINTS.\*\***

### IV. QHS-66 Multi-Sample Homogenizer Processing System Introduction

#### Specifications

- a. Instrument Design
  - Step by step key pad and LCD instructions
  - Hinged clear polycarbonate door
  - Sound-abating enclosure
- b. Accommodates the Following Tube Sizes
  - 15 ml Rack
    1. 15ml conical tubes
    2. 15ml skirted conical tubes
    3. 16ml round bottom tubes
    4. 19ml round bottom tubes
  - 50ml Rack
    1. 50ml conical tubes

2. 50ml skirted conical tubes
- c. Rack Capacity
  - 6 tubes per rack
- d. Modes
  - Fully automated (programmable)
  - Manual
- e. Programs
  - Ten (10) programs can be stored and recalled
- f. Program Functions
  - Process time – up to 99 hours, 59 minutes and 59 seconds
  - Speed
  - Oscillation – ON or OFF
- g. Mechanical Generators
  - 7mm diameter x 115mm long QHS-66 Multi-Sample Homogenizer Probe
  - 10mm diameter x 115mm long QHS-66 Multi-Sample Homogenizer Probe
- h. Mechanical Motor
  - 1 ¼ HP Brush type
- i. Speed Range
  - Mechanical homogenizer 2,000 to 18,000 rpm
- j. Electrical
  - 120 volts, 8 Amps, 50/60 Hz or 220 volts, 4 Amps, 50/60 Hz
- k. Dimensions
  - 10.58” wide x 16.12” high x 14.50” deep (269mm x 409mm x 368mm)
- l. Weight
  - 40 pounds (18.2kg)
- m. Power
  - 960 Watts
- n. Noise
  - 64 dB

## Description

The QHS-66 Multi-Sample Homogenizer can homogenize up to 6 samples at once in a quiet, compact, and time-saving unit while providing accurate processing speed during the homogenization cycle. The QHS-66 Multi-Sample Homogenizer allows for precise homogenizing and repeatability with limited concern of variations in sample size or viscosity. Up to 6 samples can be homogenized at one time in mere seconds giving you the maximum ability to homogenize up to 300 samples per hour. By freeing up a large amount of valuable lab time, homogenizing with the QHS-66 Multi-Sample Homogenizer results in significantly higher laboratory productivity.

With its automated processes, the QHS-66 Multi-Sample Homogenizer can produce more consistent homogenizing results compared to traditional non-automated and standard manual homogenizing methods. Homogenizer protocols vary within any lab and the QHS-66 Multi-Sample Homogenizer's programmability function can store up to 10 different programs in memory. For new homogenizing

trials or quick-runs, the QHS-66 Multi-Sample Homogenizer can be used in the manual mode for individual sample processing. All processing is contained in a sound-abating enclosure with a rounded clear polycarbonate door for a full view inside. The ergonomically arranged LCD and control panel allows for full viewing of programming parameters.

Each QHS-66 Multi-Sample Homogenizer unit comes equipped with a multi-pack of QHS-66 Multi-Sample Homogenizer Probes, which eliminates cross contamination as well as the time consuming, need to stop and clean a generator between samples. A clean QHS-66 Multi-Sample Homogenizer Probe can be used each time. LabTech's QHS-66 Multi-Sample Homogenizer Probes are known as the better alternative to disposable plastic generator probes, because our reusable QHS-66 Multi-Sample Homogenizer Probes are made from 316 Stainless Steel and PTFE. This superior design provides the ability to process more difficult samples, including tough tissues and frozen samples. Their infinitely reusable nature means you can use them again and again. When homogenizing is complete, the QHS-66 Multi-Sample Homogenizer Probes can be sterilized by any cleaning method, including flaming, autoclaving and chemical cleaning. Automation is made easy with the stress-free self-engagement and disengagement of the QHS-66 Multi-Sample Homogenizer Probes.

Another added benefit of the QHS-66 Multi-Sample Homogenizer is that there is no need to alter or change the tube you are continuously using in your research. Whether processing in small tubes or larger centrifuge tubes, the QHS-66 Multi-Sample Homogenizer can accommodate 15, 16, 19 and 50ml tubes allowing for minimum homogenizing volumes of 2 to 4.5ml respectively. Sample tube integrity is also maintained with our unique removable Spider Tube Rack design that incorporates easy tube replacement. Our superior designed oscillating Spider Tube Rack mimics the up down motion of handheld homogenizing and can perform 60 oscillations per minute for enhanced homogenizing performance.

The QHS-66 Multi-Sample Homogenizer requires a 12 pack of QHS-66 Multi-Sample Homogenizer Probes as well as either a 15ml Spider Tube Rack or a 50ml Spider Tube Rack

## System Contents

The basic unit consists of the following:

- QHS-66 Multi-Sample Homogenizer Processing System
  - 220 Volts – part number 01-02620
- User/Service Manual
- Tool Kit
- Appropriate Power Cord (220 volt)

## Accessories

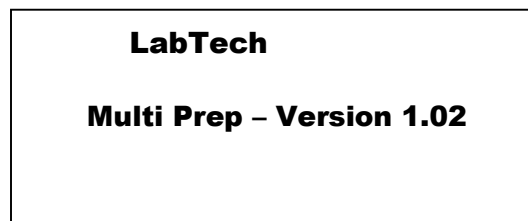
- 12-Pack of 7mm QHS-66 Multi-Sample Homogenizer Probes  
**Part Number PL-62-070MP-12**
- 12-Pack of 10mm Saw-Tooth QHS-66 Multi-Sample Homogenizer Probes  
**Part Number PL-62-010MP-12**

- Spider Tube Rack for 15ml conical, 16ml and 19ml round bottom tubes  
**Part Number PL-62-00150**
- Spider Tube Rack for 50ml conical tubes  
**Part Number PL-62-00500**
- QHS-66 Multi-Sample Homogenizer Probes (12/package)  
**Part Number PL-62-070MP-12**

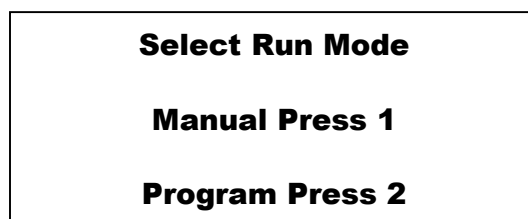
## V. Operating Instructions

### Initial Start Up Steps

1. The QHS-66 Multi-Sample Homogenizer should be unpacked and placed on a bench top strong enough to support a 40 pound object. Care should be taken as to not block the air flow inlets located on both sides of the housing as well as the fan located on the back of the housing.
2. Check that the voltage quoted on the label located on the back of the housing agrees with the available main voltage. Variations of +/- 10% are permissible.
3. Make sure that the switch located in the power input module on the back side of the housing is in the off (O) position.
4. Insert the end of the power cord into the power inlet module located on the back side of the housing and plug the other end into a properly grounded outlet.
5. Turn the switch located in the power input module on the back side of the housing to the on (-) position. At this time the internal fan will be on. This fan will run as soon as the unit is energized even if the ON/OFF button on the front panel has not been pressed.
6. Once the On/Off button is pressed on the front panel and power initiated, the LCD on the system front panel will show the following:



7. Once the power has been turned on, the system will go through a “Zero Position Check”. This means that the Generator Drive Platform will travel up to the full up position known as the “Zero Position” and the oscillation motor will turn to its full down position also known as “Zero Position”. During this travel you will hear a slight beeping sound until both “Zero Positions” have been reached. The LCD will change to the following:



### Setting Up Samples in the Spider Tube Rack and the Rack Platform

1. The QHS-66 Multi-Sample Homogenizer system requires one (1) Spider Tube Rack that will hold up to six (6) tubes. This can be either a 15ml rack or a 50ml rack.
2. Place up to six (6) tubes, with both sample and media in them into the proper size Spider Tube Rack.
3. Open the front door and slide the rack platform completely outward.
4. Slide the Spider Tube Rack into the Rack Platform by aligning the tab on the back of the Spider Tube Rack with the slot in the back side of the Rack Platform.

### Attaching the QHS-66 Multi-Sample Homogenizer Probe to the Rack Platform

1. Remove one QHS-66 Multi-Sample Homogenizer Probe from the package.
2. Insert the probe through one of the six (6) holes in the top of the Rack Platform down into the test tube. The QHS-66 Multi-Sample Homogenizer Probe is now keyed into the Rack Platform and aligned with the test tube.
3. Repeat this for each of the positions being used.

### Removing the QHS-66 Multi-Sample Homogenizer Probe from the Rack Platform

1. With the door open and the Rack Platform pulled completely outward the QHS-66 Multi-Sample Homogenizer Probe can be removed from the Rack Platform two (2) different ways:
  - a. Lift the QHS-66 Multi-Sample Homogenizer Probe upward and out of the test tube.
  - b. Leave the QHS-66 Multi-Sample Homogenizer Probe in the test tube and remove both the test tube and the QHS-66 Multi-Sample Homogenizer Probe together by lifting both the QHS-66 Multi-Sample Homogenizer probe and the Spider Tube Rack upward and sliding the QHS-66 Multi-Sample Homogenizer Probes out of the slots in the front edge of the Rack Platform.

**\*\*CARE SHOULD BE TAKEN WHEN HANDLING THE QHS-66 MULTI-SAMPLE HOMOGENIZER PROBE ESPECIALLY WHEN REMOVING IT FROM THE RACK PLATFORM. DO NOT LET THE PROBE DROP AS THIS COULD DAMAGE THE TEETH OF THE PROBE. \*\***

### System Front Panel

The QHS-66 Multi-Sample Homogenizer is completely programmed and controlled by the operator using the "System Front Panel"

Ergonomic numeric keypad

4 Line LCD makes for simple programming and information readout during processing

Easy ON/OFF accessibility

Complete in-process control: MENU/PAUSE/START/STOP

Adjust RPM in manual mode by using UP/Down arrows

Select stored programs by entering program number or use Up/Down arrows

### Running in the Manual Mode

1. Place your loaded Spider Tube Rack into the QHS-66 Multi-Sample Homogenizer
  - a. Open the front door.
  - b. Slide the Rack Platform completely outward.
  - c. Place your loaded Spider Tube Rack into the Rack Platform.
  - d. Place a QHS-66 Multi-Sample Homogenizer Probe into each tube position being used.
  - e. Slide the Rack Platform completely inward.
  - f. Close the door.
2. With the LCD showing the following:

**Select Run Mode**  
**Manual Press 1**  
**Program Press 2**

3. Press 1 and the LCD will change to the following:

**Enter Motor RPM**  
**2000 – 18000**  
**XXXXX**

4. Enter the desired motor rpm and then press “Enter”.
5. Once you press “Enter” the LCD will change to the following:

**Enter Motor Run Time**  
**00:00:01 – 99:59:59**  
**XX:XX:XX**

6. Enter the length of time you wish to run and then press “Enter”.
7. Once you press “Enter” the LCD will change to the following:

**Tube Oscillation?**  
**Yes – Press 1**  
**No – Press 2**

8. If you select “Yes” the tube will oscillate up and down  $\frac{3}{4}$ ” while homogenizing. If you select “No” the tube will remain still during homogenizing. Once you have pressed either 1 or 2 the LCD will change to the following:

<b>RPM:</b>	<b>XXXXX</b>
<b>Time:</b>	<b>XX:XX:XX</b>
<b>Oscillate</b>	<b>XXX</b>
<b>Press Start to Run</b>	

9. Once you press “Start” the LCD will change to the following and the homogenizing motor will start to run at minimum rpm and the drive head will move downward engaging the QHS-66 Multi-Sample Homogenizer Probes.

<b>Set RPM: XXXXX</b>	
<b>Actual RPM: XXXXX</b>	
<b>Set Time: XX:XX:XX</b>	
<b>Time Rem: XX:XX:XX</b>	

10. If the door is not closed and/or the Rack Platform is not fully inserted, the LCD will display the following:

<b>Carriage Disengaged</b>	
<b>Load Carriage</b>	
<b>Press Start</b>	

11. Open the door and push the Rack Platform completely inward.
12. Close the door and press “Start”.
13. The QHS-66 Multi-Sample Homogenizer will begin to process the samples and the LCD will display the following

<b>Set RPM:</b>	<b>XXXXX</b>
<b>Actual RPM:</b>	<b>XXXXX</b>
<b>Set Time:</b>	<b>XX:XX:XX</b>
<b>Time Rem:</b>	<b>XX:XX:XX</b>

14. When the time selected has been reached the LCD will change to the following:

**Processing Completed**  
**RPM: XXXXX T: XX:XX:XX**  
**Oscillation: XXX**  
**Press Menu**

15. This display will show the rpm that the system was running at when time ran out, the time that was set and whether oscillation was turned on or off.
16. Once you press "Menu" the LCD will change to the following which places you back to the initial setup screen.

**Select Run Mode**  
  
**Manual – Press 1**  
**Program – Press 2**

Running in the Program Mode – Creating a Program:

1. Place your loaded Spider Tube Rack into the QHS-66 Multi-Sample Homogenizer
  - a. Open the front door.
  - b. Slide the Rack Platform completely outward.
  - c. Place your loaded Spider Tube Rack into the Rack Platform.
  - d. Slide the Rack Platform completely inward.
  - e. Close the door.
2. With the LCD showing the following:

**Select Run Mode**  
  
**Manual Press 1**  
**Program Press 2**

3. Press 2 and the LCD will change to the following:

**Retrieve or Create**  
**a Program?**  
**Retrieve - Press 1**  
**Create - Press 2**

4. If 2 was pressed to create a program the LCD will change to the following:

**Select Program ^ v**  
**Program: # & Enter**  
**RPM: XXXXX - Osc: XXX**  
**Time: XX:XX:XX**

5. This display will allow you to review what programs may be in memory as well as empty programs by indexing through the programs using the up and down arrows on the key pad or by entering a program number from 0 to 9. Once a program number is chosen and you have pressed "Enter" the LCD will change depending on the program chosen. If the program number chosen has information already saved in it the LCD will change to the following:

**Overwrite Program ?**  
**Program #X**  
**Yes - Press 1**  
**No - Press 2**

6. If 1 is pressed the LCD will change to the following and if 2 is pressed the LCD will change back to the "Select Program" screen.

**Enter Motor RPM**  
**2000 - 18000**  
  
**XXXXX**

7. Enter the desired rpm and press "Enter". The LCD will change to the following:

**Enter Motor Run Time**  
**00:00:01 - 99:59:59**  
  
**XX:XX:XX**

8. Enter the desired run time in HH:MM:SS format and press “Enter”. The LCD will then change to the following:

**Tube Oscillation ?**  
  
**Yes – Press 1**  
**No – Press 2**

9. Once you have selected “Oscillation” by pressing number 1 for “Yes” or number 2 for “No” the LCD will change to the following:

**RPM:            XXXXX**  
**Time:            XX:XX:XX**  
**Oscillation:     XXX**  
**Press Start to Run**

10. By pressing the “Start” button the program is now saved within the unit the homogenizing motor will run at minimum rpm and the drive head will move downward engaging the QHS-66 Multi-Sample Homogenizer Probes.
11. If the door is not closed and/or the Rack Platform is not fully inserted, the LCD will display the following:

**Carriage Disengaged**  
**Load Carriage**  
**Press Start**

12. Open the door and push the Rack Platform completely inward.
13. Close the door and press “Start”.
14. Once you press “Start” the LCD will change to the following and the drive head will move downward engaging the QHS-66 Multi-Sample Homogenizer Probes.

**Set RPM:        XXXXX**  
**Actual RPM:    XXXXX**  
**Set Time:       XX:XX:XX**  
**Time Rem:      XX:XX:XX**

15. The LCD will continue to show this information until the run time has elapsed. Once the time has elapsed the homogenizing motor will stop, the oscillation motor will go to its “zero” position and the rack will retract to its “zero” position. The LCD will change to the following:
16. The LCD will continue to show this information until the run time has elapsed. Once the time has elapsed the homogenizing motor will stop, the oscillation motor will go to its “zero” position and the rack will retract to its “zero” position. The LCD will change to the following:

**Processing Completed**  
**Program #X OSC: XXX**  
**RPM: XXXXX T: XX:XX:XX**  
**Press Enter**

17. The display will allow you to see what the particular settings were and what the program number was. Once you press the “Enter” key the LCD will change to the following:

**Run Program # Again**  
  
**Yes – Press 1**  
**No – Press 2**

18. If number 1 (Yes) is pressed the LCD will change to the following:

**RPM:            XXXXX**  
**Time:          XX:XX:XX**  
**Oscillation:    XXX**  
**Press Start to Run**

19. If number 2 (No) is pressed the LCD will change to the following:

**Select Run Mode**  
  
**Manual Press 1**  
**Program Press 2**

### Effect of the “Pause” and the “Stop” Buttons

If at any time during the running of the homogenizer the “Pause” or the “Stop” buttons are pressed the following will happen:

### The “PAUSE” Button

- a. Pressing of the “Pause” button will stop the homogenizing motor, the oscillation motor will go to the “Zero” position and stop and the rack will go to its “Zero” position. The LCD will change to the following:

**Pause**  
**RPM: XXXXX T: XX:XX:XX**  
**Resume – Press Start**  
**Finish – Press Menu**

- b. If you then want to resume the homogenizing of the samples press the “Start” button and the rack will reload, the mechanical homogenizing motor and the oscillation motor will resume where they were prior to pressing the pause button. The remaining time will be counted down from the point of the pause.
- c. If you press the “Menu” button you will be returned to the main menu.

### The “Stop” Button

1. Pressing of the “Stop” button will stop all movement. The homogenizing motor and the oscillation motor will turn off if they were running and the rack will remain in whatever position it might have been in. The LCD will change to the following:

**EMERGENCY STOP**  
  
**Press Menu To**  
**Unload Tube Rack**

2. When the “Menu” button is pressed the oscillation motor will go to its “Zero” position and the rack will go to its “Zero” position. The LCD will change to the following:

**Select Run Mode**  
**Manual Press 1**  
**Program Press 2**

## VI. Maintenance of the QHS-66 Multi-Sample Homogenizer Generator Probes

### Cleaning the QHS-66 Multi-Sample Homogenizer Generator Probe as an Assembly

- The QHS-66 Multi-Sample Homogenizer Generator Probe can be autoclaved as an assembly as well as rinsed in solvents that do not have an effect on 316 stainless steel and PTFE.

- **Cleaning**
  - Immediately after you have finished working with the QHS-66 Multi-Sample Homogenizer Generator Probe, it must be cleaned so that the substance residues do not stick to the generator probe and allow small bacterial cultures to form. For this purpose, the generator probe should be run in a solvent which dissolves the substance residue and does not harm the generator probe. The inner components are cleaned as the solvent is pumped through the generator probe.
- **Sterilization**
  - Chemical Process – Germicidal solutions (formalin, phenol, alcohol etc.) can disinfect in most cases. However, residues of the germicide must subsequently be removed with sterilized water.
  - Sterilizing by humid heat – This means sterilizing with steam at a pressure of 2 bar above atmosphere and at a temperature of 120°C.
  - Sterilizing by hot air – Hot air sterilization is normally carried out at 160 to 190°C.
  - Flaming – This method can be used with caution, however, it is only effective on external surfaces.

### **Cleaning the QHS-66 Multi-Sample Homogenizer Generator Probe as Parts**

1. Disassembly of the QHS-66 Multi-Sample Homogenizer Generator Probe
  - a. Insert the allen wrench end of the screw driver (supplied in the tool kit) across and through the open slot of the generator tube.
  - b. While firmly holding the drive collar at the upper end of the generator, turn the screwdriver counter-clockwise. If the drive collar is not held securely it will spin with the screwdriver, thereby not allowing the knife and rotor shaft assembly to be unscrewed from the drive collar.
  - c. With the drive collar removed, the knife and rotor shaft assembly will slide out the bottom of the generator tube.
  - d. The upper PTFE bearing can now be removed from the upper end of the generator tube.
  - e. The lower PTFE bearing can now be removed from the lower end of the generator tube.
  - f. All of the parts from the QHS-66 Multi-Sample Homogenizer Generator Probe can now be placed on a tray and autoclaved as necessary.
- **Sterilization**
  - Chemical Process – Germicidal solutions (formalin, phenol, alcohol etc.) can disinfect in most cases. However, residues of the germicide must subsequently be removed with sterilized water.
  - Sterilizing by humid heat – This means sterilizing with steam at a pressure of 2 bar above atmosphere and at a temperature of 120°C.
  - Sterilizing by hot air – Hot air sterilization is normally carried out at 160 to 190°C.
  - Flaming – This method can be used with caution, however, it is only effective on external surfaces.
2. Assembly of the QHS-66 Multi-Sample Homogenizer Generator Probe

- a. Insert the upper PTFE bearing into the upper end of the generator tube – bearing flange out. (the upper and lower bearings are the same therefore they are interchangeable)
- b. Place the lower PTFE bearing into the lower end of the generator tube – bearing flange out.
- c. Slide the knife and rotor shaft assembly into the lower end of the generator tube until the knife is flush with the end of the tube. Make sure that the threaded end of the shaft comes through the upper PTFE bearing.
- d. With your finger keeping the knife flush with the bottom of the tube, hand tighten the drive collar.
- e. Place the allen wrench end of the screwdriver across and through the open slot of the generator to ensure tightness of the assembly and again holding the drive collar firmly while turning the screwdriver clockwise.

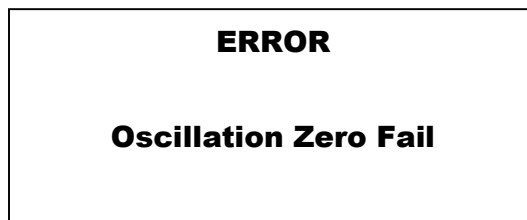
## VII. Trouble Shooting

### Error Codes

1. Platform Failure
  - a. Description: Trigger if upper or lower limit switch is not reached within 30 seconds of turning on the platform.
  - b. Displayed:



2. Oscillation Zero Failure
  - a. Triggered if oscillation fails to “zero” after 30 seconds
  - b. Displayed:



3. Mechanical Over-speed
  - a. Triggered when difference between actual and commanded RPM is one-half of max RPM
  - b. Displayed:



4. Mechanical Loss of Signal
  - a. Triggered if speed signal is lost for 8 seconds.
  - b. Displayed:

**ERROR**  
**Loss of Signal Error**

5. Mechanical Never-Speed
  - a. Triggered if speed is “never” detected within 8 seconds
  - b. Displayed:

**ERROR**  
**Never-Speed Error**

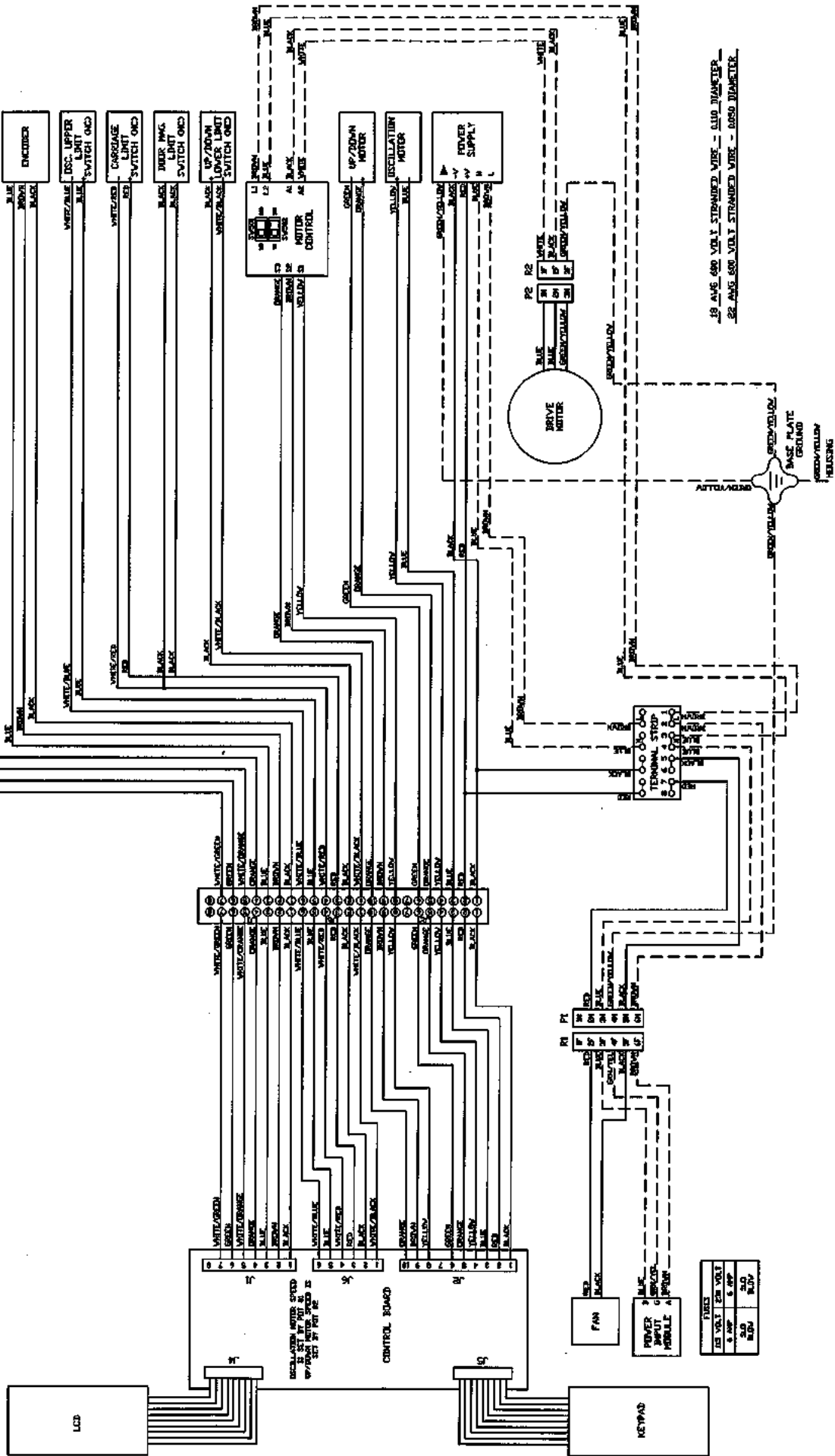
6. Carriage Disengaged
  - a. Triggered if Carriage is not fully inserted and/or the door is not closed
  - b. Displayed:

**Carriage Disengaged**  
**Load Carriage**  
**Press Start**

## **VIII. Wiring Diagram**

A full page wiring diagram is located at the back of this manual

LIMIT CONTROL SWITCH AND END SETTINGS	
UP VOLTS	DOWN VOLTS
UP VOLTS	DOWN VOLTS
DOWN VOLTS	UP VOLTS
DOWN VOLTS	UP VOLTS



18 AWG 600 VOLT STRANDED WIRE - 1/16" DIAMETER  
 22 AWG 600 VOLT STRANDED WIRE - 0.050" DIAMETER

FUSES	
25 VOLT 250 VOLT	5 AMP
25 VOLT 250 VOLT	5 AMP
25 VOLT 250 VOLT	5 AMP

**IX. Notes**

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