KNIGHT GLOBAL

Roller Chain Vertical Arm Servo Hoist Operation Manual

THIS MANUAL CONTAINS IMPORTANT INFORMATION REGARDING INSTALLATION, SAFETY, MAINTENANCE, AND OPERATION OF THE KNIGHT GLOBAL SERVO HOIST AND SHOULD BE AVAILABLE TO ALL PERSONNEL RESPONSIBLE FOR USING THE HOIST.

REV: 002-202110-KSHVAR

This manual provides important information for all personnel involved in the installation, operation and maintenance of the Knight Global Servo Hoist. All personnel must read this document before operating the equipment.

Every effort has been made to provide complete and accurate product information in this manual. However, due to product improvements and changes, discrepancies and omissions may be present. Visit our website at www. knightglobal.com for the updated information on all our products.

It is the responsibility of the end user to exercise common sense and judgment when performing the tasks described in this manual. If any procedure seems inaccurate, incomplete or unsafe please put the equipment in a safe condition and contact Knight Global service department for assistance.
Knight service department's phone number is: (248) 375-7962.

Throughout this manual there are steps and procedures that if not performed correctly can result in personal injury or equipment damage. The following signal words are used to identify the level of potential hazard.

WARNING

Indicates a hazard which will cause severe injury, death or substantial equipment damage.

CAUTION

Indicates a hazard which can or will cause injury or equipment damage.

NOTE

Notifies personnel of installation, operation or maintenance information which is important but not hazard related.

1. SAFETY

Knight Global cannot be aware of or provide for all the procedures by which the Servo Hoist operations or repairs may be conducted and the hazards which may result from each method. If operation or maintenance not specifically recommended by Knight Global is conducted, it must be ensured that product or personnel safety is not endangered by these actions. If not sure of an operation or maintenance procedure or step, personnel should place the Servo Hoist in a safe condition and contact a supervisor and/or Knight Global's service department for technical support. Modifications to upgrade, re-rate or otherwise alter this equipment shall be authorized only by the original equipment manufacturer.

If a below-the-hook lifting device or sling is used with the Servo Hoist, refer to ANSI/ASME B30.9 "Safety Standard for Slings", or ANSI/ASME B30.20 "Safety Standard for Below-the-Hook Lifting Devices".

Electrical equipment described in this manual are designed and built in compliance with ANSI/NFPA 70, "National Electrical Code". It is the responsibility of the system designer, system manufacturer, crane or rail manufacturer, installer, and user to ensure that the installation and associated wiring of the Servo Hoist and components are in compliance with ANSI/NFPA 70, and all applicable Federal, State and Local Codes.

Hazardous voltages are present in the Servo Hoist and components. Only properly trained and competent personnel should perform inspections or repairs on the Servo Hoist or accessories. Prior to performing any maintenance (mechanical or electrical) on the Servo Hoist, de-energize (disconnect) the main switch supplying power to the Servo Hoist. Lock out the power supply following standard plant procedures.

Ensure that the installation, inspection, testing, maintenance and operation are in compliance with ANSI/ASME B30.16 "Safety Standard for Overhead Hoists", OSHA Regulations, ANSI/NFPA 70, National Electric Code, and applicable ANSI/ASME standards. This is the responsibility of the owner/operator.

All personnel that will install, operate, inspect, test or maintain the hoist should read this manual and be familiar with all applicable portions of the referenced standards.

If clarification of any information in this manual or additional information is required, contact Knight Global. Do not install, operate, inspect, test or maintain the hoist unless all information is understood.

A. General Safety Precautions

- Do not operate the Servo Hoist before reading this technical manual.
- Allow only personnel trained in safety and operation of this Servo Hoist may operate the Servo Hoist.
- If the Servo Hoist is locked out or a “DO NOT OPERATE” sign is on the Servo Hoist or controls, do not operate the Servo Hoist until the lock or sign is removed by designated personnel.
- Before each shift or prior to use, inspect the Servo Hoist in accordance with the procedures defined in the Maintenance section of this manual.
- Never place your hand or fingers on a moving roller chain.
- Never run the chain over a sharp edge.
- Pay attention to the load at all times when operating the Servo Hoist.
- Ensure no personnel are in the path of the load.
- Do not lift the load over personnel.
- Never use a Servo Hoist for lifting or lowering people.
- Do not allow anyone to stand on a suspended load.
- Do not swing a suspended load.
- Never leave a suspended load unattended.
- Never cut or weld a suspended load.
- Do not operate a Servo Hoist if the chain is jumping, jamming, overloading or binding.
- Do not operate a Servo Hoist if it is generating excessive noise.
- Avoid collisions or bumping of the Servo Hoist.
- Do not operate Servo Hoist when damaged or malfunctioning.
- Do not remove load or handling device until tension is released from the chain.
- Discontinue operation of Servo Hoist after multiple unresolved faults. A system fault would be signified by the Red light on the Run-Stop button continuously flashing or the Run-Stop button having to be repeatedly reset.

B. Safety Devices

Motor Holding Brake

A motor holding braking system engages and holds the vertical axis in place in the event of a power outage or when the Run-Stop button is pressed.

Overload Capacity Protection

Protects the equipment and prevents the operator from lifting or moving more weight than the system is rated for. If the load weight exceeds the programmed capacity, the hoist will not lift any further until the excess load is removed. Downward motion is permitted when overloaded to allow the user to safely set the weight back down on a stable surface.

Run-Stop Push Button

If an operator needs to shut down the system immediately, the operator pushes the Run-Stop button. The system will not function until it is reset. To reset the system from the Run-Stop condition, the operator turns the button clockwise to release it from the depressed position. All virtual limits and programs remain intact.

2. INSTALLATION

Prior to installation, visually inspect the Servo Hoist for signs of damage or missing parts.

CAUTION

Prior to installation, the chain must be lubed with a light coat of machine or gear oil.
Knight recommends using Demag Chain Grease (P/N 665 009 44).
If Demag Chain Grease is not available, SAE 50 to 90 EP oil or equivalent may be used.
Follow the procedure detailed in section 4.4.3 “Chain Lubrication” of this manual.

CAUTION

Prior to placing this unit into service, the owners and user are advised to examine specific local and/or other regulations, including ANSI and OSHA regulations that may apply to the use of this product.

WARNING

A falling load can cause injury or death. Before installing this hoist read the “Safety” section of this manual.

Follow all procedures in this section for installation and set-up of the Servo Hoist.

Retain all product information supplied with the Servo Hoist for future reference.

Ensure that the supporting structure is able to support the weight of the system and load. The structure should be able to support 300 percent of the combined weight of the Servo Hoist and load. Do not use a supporting structure that tilts the Servo Hoist to one side or the other.

For safe and proper installation into a rail system, refer to the installation manual provided by the rail system manufacturer.

When installation is complete and prior to placing the Servo Hoist into operation, inspect the Servo Hoist following the instructions in section 4.4.2.1 “Recommendations for Periodic Inspections” of the “Maintenance” portion of this manual.

A. Introduction

Prior to installing and operating the Knight Servo Hoist, all operators using this device should be familiar with the main components of the lifting system. (Refer to Figure 2-1)

Servo Hoist: The Servo Hoist assembly is a powered lifting device. The upper drive assembly contains the servo motor with holding brake, gearbox, servo drive, power contactor, 24 VDC Power Supply, regen board, chain bucket, chain guide assembly, and AC Plug.

Cable Assembly: In most cases, a 19-pin straight cable carries signals from the Operator Control Interface (OCI) to the Servo Hoist. The control handle is connected to the OCI using either an 8-pin or 4-pin cable. Signals are passed from the control handle to the OCI and then to the Servo Hoist. Some examples are: Analog load cell voltages, digital inputs and outputs including direction commands, Lift Mode, Float Mode, and Run-Stop signals.

Control Handle: The main interface between the operator and the lifting device. The handle can be a fixture handle or a discrete up / down handle.

Load Monitoring Module (LMM): The LMM provides weight feedback from the fixture to the servo. It is used to verify the weight of a part, to ensure the system doesn't unclamp while it supports a part and during Float mode to name just a few.

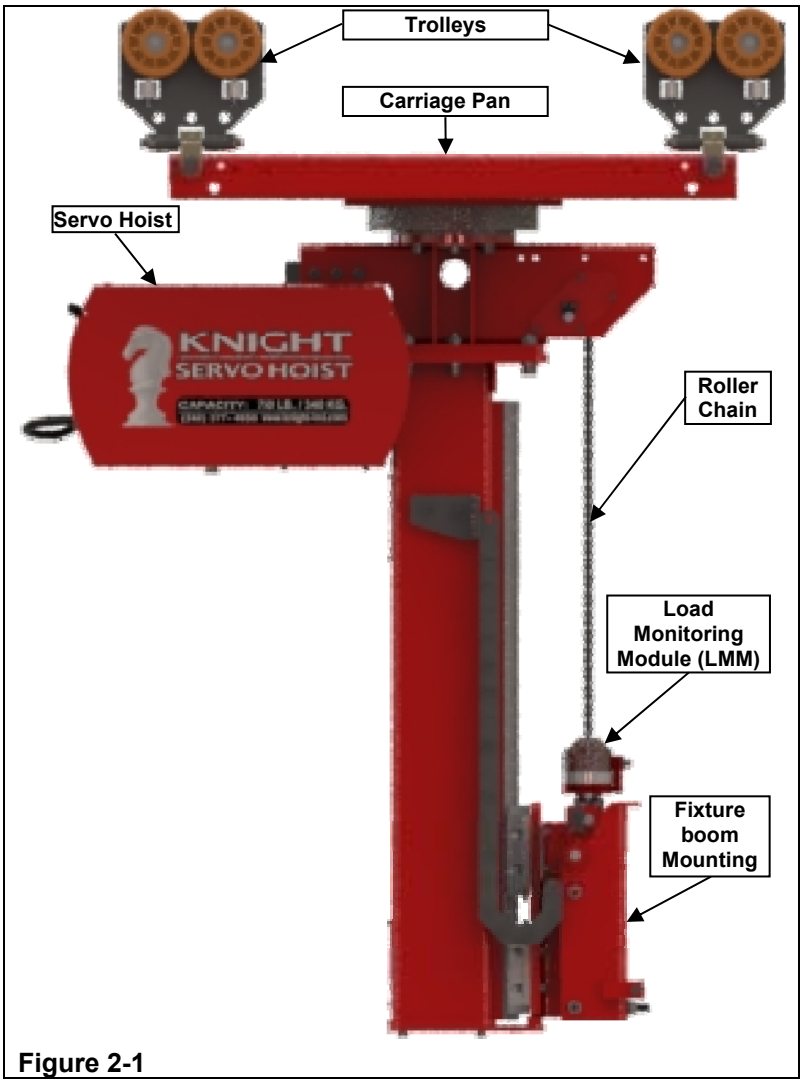


Figure 2-1

B. Initial Setup

Step 1: Unpacking

1) Unpack the Servo Hoist. Lift the hoist carefully out of packaging.
2) Keep the accompanying documents with the hoist or near the site of operation.

Step 2: System Assembly

Knight Servo Hoists are typically delivered pre-assembled; if not, read the following sections.

2a) 8-pin and 19-pin Straight Cable Installation
2b) Roller Chain Installation to special Load Monitoring Module

Step 2a) 8-pin and 19-pin Straight Cable Installation:

1) Ensure power is removed from hoist.
2) The 19-pin straight cable should come pre-installed from the servo to the remote Operator Control Interface (OCI). (Refer to Figure 2-2)
3) The 8-pin cable should be pre-routed to the Load Monitoring Module (LMM). However, during shipping, it is disconnected from the LMM.
4) Unwrap the LMM from its protective covering.
5) Connect the 8-pin cable to the LMM. (Refer to Figure 2-3)
6) When both the 8-pin and 19-pin connectors are confirmed to be connected correctly, power can be applied to the system. (Refer to Figure 2-4 and 2-5)

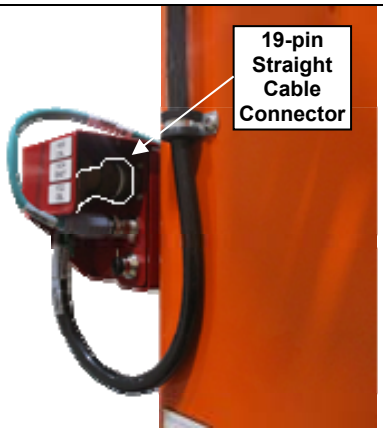


Figure 2-2

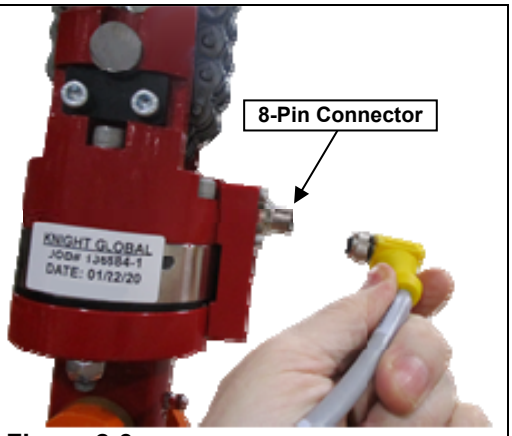


Figure 2-3

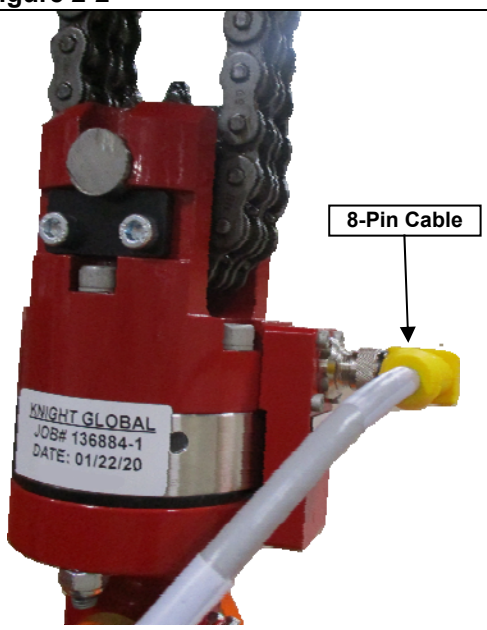


Figure 2-4

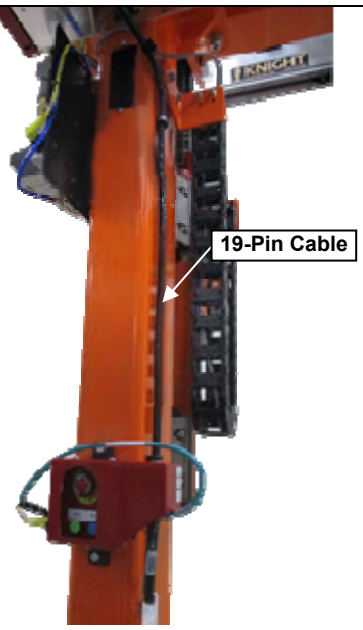


Figure 2-5

Step 2b) Roller Chain Installation to special Load Monitoring Module:

1) Ensure that the Load Monitoring Module (LMM) is correctly connected to the carriage arm. If it is not connected, please see section 4.8 “Load Monitoring Module Replacement” (Refer to Figure 2-6)
2) Place the middle side plates inside the LMM’s top recess. Use a M5x40 bolt to temporarily hold the middle side plates in place. Place the roller chain’s end over the middle side plates and use another M5x40 bolt to temporarily hold the roller chain in position. (Refer to Figure 2-6)
3) Insert the Master Link by gently pushing the M5x40 bolts out of their temporary positions. (Refer to Figure 2-6)
4) Place the side plate over the prongs of the master link. Using needle-nosed pliers, place the master link keeper clip over the side plate and fasten it in place. (Refer to Figure 2-6)
5) Place both of the master link retaining SHCS in the top of the LMM. One on each side of the master link. (Refer to Figure 2-10 and 2-11)
6) Connect the 8-pin cable to the LMM.

Figure 2-6

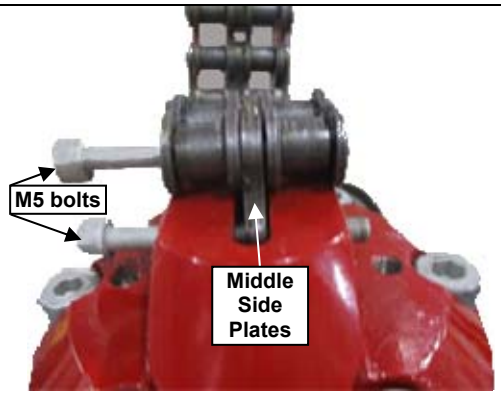


Figure 2-7

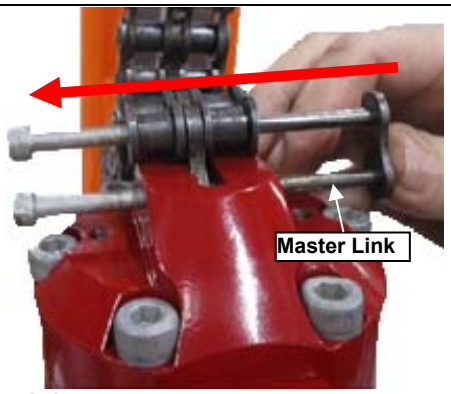


Figure 2-8

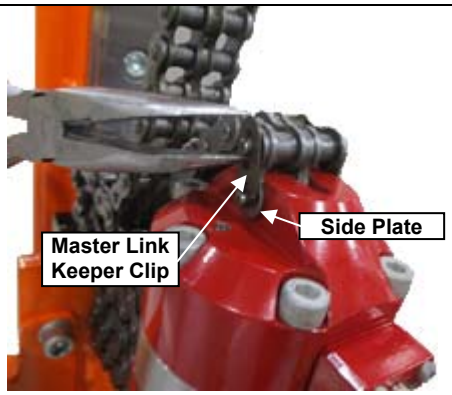


Figure 2-9

Figure 2-10

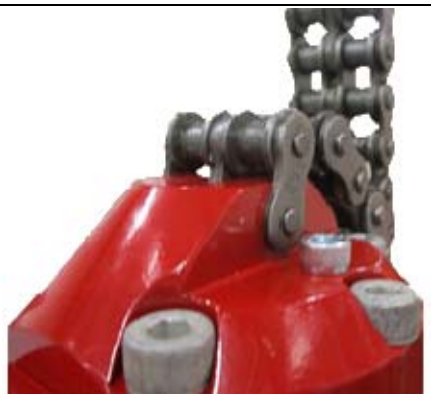


Figure 2-11

Step 3: Power Supply to Servo Hoist

Prior to installation visually inspect the Servo Hoist for signs of damage or missing parts.

Power Requirements: Call a Knight Representative to obtain the correct power requirements for your system.
Standard: 240 VAC, Single Phase, 50/60 Hertz.

Refer to system specific documentation for any special power requirements.

1) The Servo Hoist power is connected by a twist lock plug (Refer to Figure 2-12: Standard) or fed by a hard-wired circuit provided by end user. (Refer to Figure 2-13: CE Compliant)

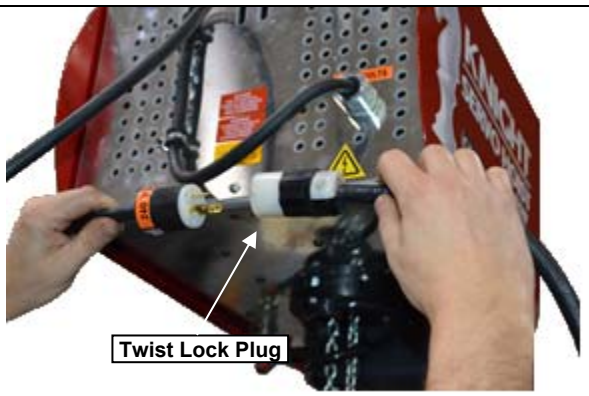


Figure 2-12: Standard

Figure 2-13: CE Compliant

Step 4: Releasing the Run-Stop button using the Remote Operator Control Interface

The Run-Stop button is engaged for shipping purposes.

1) Turn Run-Stop button a quarter of a turn clockwise to release the Run-Stop. (Refer to Figure 2-14)
2) Please, refer to the Run-Stop mode functionality in section 3.C. “Servo Hoist Functionality Modes” of this manual for more information.
3) Ensure the Run-Stop is released before the servo is powered up.

Figure 2-14

Step 5: Control Handle Set-up

There are (3) three control handle configurations for a Knight Roller Chain system. This section discusses the correct setup of each of these.

5a) Fixture Handle setup
5b) Discrete Up / Down Handle setup
5c) Digital Wireless Remote Up / Down Controller with Run-Stop

Step 5a) Fixture Handle setup:

1) Set-up the fixture handle into the orientation in which it will be used in the application. Refer to the layout drawings for the application to determine this. (Refer to Figure 2-15)
2) Apply upward pressure on fixture handle until the green light on the Operator Control Interface (OCI) flashes. (Refer to Figure 2-16)
3) Once green light starts flashing, release the fixture handle and the GREEN light will illuminate.
4) Grasp the fixture handle and apply upward pressure until the chain starts feeding into the hoist. Continue this until the fixture is at a serviceable height.

Figure 2-15

Figure 2-16

Step 5b) Discrete Up / Down Handle setup:

1) Press the Up lever until the green light on the Operator Control Interface (OCI) starts to flash. (Refer to Figure 2-17)
2) Once the green light starts flashing, release the Up lever and the GREEN light will illuminate.
3) Press the Up lever again until the chain starts feeding into the hoist. Continue this until the fixture is at a serviceable height.

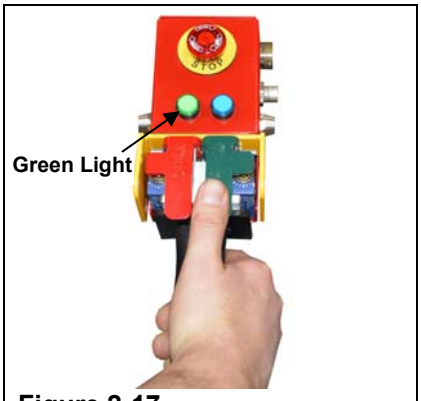


Figure 2-17

Step 5c) Digital Wireless Remote Up / Down Controller with Run-Stop:

1) Turn power switch from the 'OFF' position to the 'ON' position.
2) Turn the power switch from the 'ON' position to the momentary 'START' position. The switch will spring back to the 'ON' position.
3) Press the Up button until the green light on the Operator Control Interface (OCI) starts to flash. (Refer to Figure 2-18)
4) Once the green light starts to flash on the OCI, release the Up button and the GREEN light will illuminate.
5) Press the Up button again until the chain starts to feed into the hoist. Continue holding the Up button until the fixture is at a serviceable height.

Figure 2-18

	NOTE
	A continuously flashing GREEN light indicates a safe start activation fault. The system is sensing a command input during the Power-Up sequence. **Remedy** **Analog Handle: Release the handle and verify that the GREEN light illuminates solid. If the GREEN light still flashes after the handle is released, refer to section 7. "Troubleshooting".** **Up/Down Pendent: Release both buttons and verify that the GREEN light illuminates solid. If the GREEN light still flashes after the button is released, refer to section 7. "Troubleshooting".**

Step 6: Test Hoist Movement

Test the Servo Hoist movement by applying upward and downward pressure on the fixture handle. If the system uses a discrete Up / Down handle, press the Up and Down levers to move the fixture up and down.

Step 7: Back-Up Software

Knight Servo Hoists are pre-programmed prior to delivery. It is a good practice to back-up this software before initial operation. Refer to section 5.B. “Connecting to a Servo Hoist” for instructions on how to connect a laptop to the Servo Hoist and section 5.C. “Backing up the Knight Servo Hoist Software” on how to back-up the servo’s software.

Step 8: Software Adjustments (If necessary)

After making a back-up of the software in step 7, it may be necessary to adjust certain parameters in the software to ensure that the servo performs correctly for a specific application. Refer to the following first-time adjustments in section 5. ‘Software’.

- Verify the hoist’s maximum weight. This is also the Up Stop weight of the hoist.
- Verify the hoist’s minimum weight. This is also the Down Stop or pay out weight of the hoist.
- Verify the hoist’s fixture weight.
- Verify that the analog handle is balanced.
- Verify that the encoder offset is correct.

3. OPERATION

A. Principle of Operation

The Servo Hoist system receives a command to move up or down along the “Z” axis from any input force applied to a handle or by pressing an Up or Down lever.

B. Model Number

The Servo Hoist model number designates the Servo Hoist type and its specifications. (Refer to Figure 3-1) The first set of letters indicate the type of Servo Hoist. Please refer to Table 3-1 for the Servo Hoist Type prefix letters. The numbers following the Servo Hoist Type prefix letters reference the system’s rated capacity. The next (3) three numbers indicates the voltage and then the following number indicates the phase of the system.

The hoist’s model number and serial number can be found on the Knight identification label located on the Servo Hoist.

Letters	Servo Hoist Type *
KSHS	Single Chain with SDS
KSHTC	Twin Chain
KSHTCDM	Twin Chain Dual Motor
KSHFA	Floor Mounted Articulating Arm
KSHCA	Overhead Carriage Articulating Arm
KSHEA	Overhead Carriage-Mounted Extension Arm
KSHVA	Overhead Carriage-Mounted Vertical Arm
KSHVAA	Floor-Mounted Vertical Articulating Arm
KSHVAR	Roller Chain
KSHXZ	Servo Hoist and Tractors with X and Z Movement
KSHXYZ	Servo Hoist and Tractors with X, Y, and Z Movement

Table 3-1

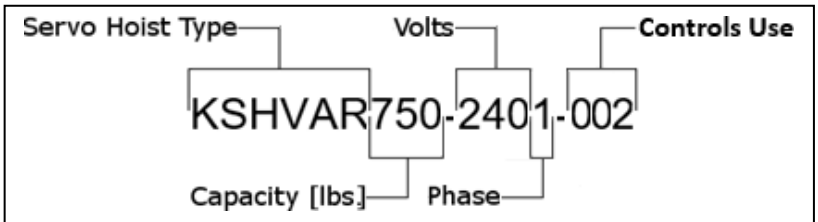


Figure 3-1: Servo Hoist Model Number Example

* For all models and specifications, refer to the website: https://www.knightglobal.com/servo.html.

Servo Hoist Control Configurations

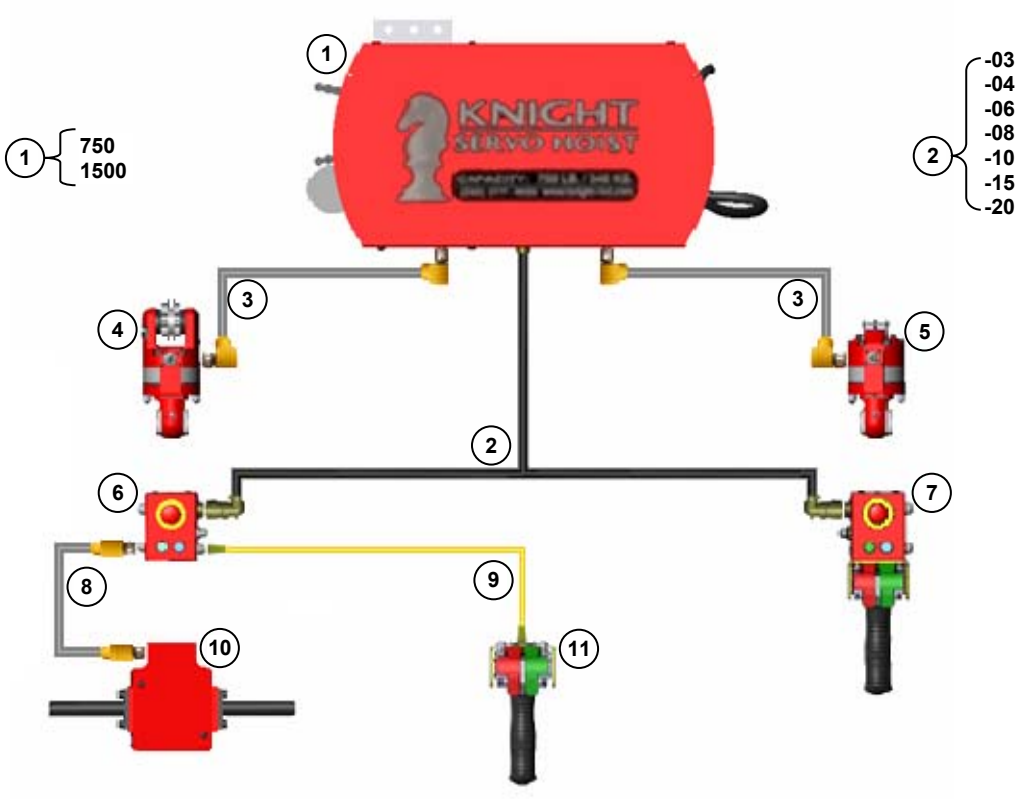


Figure 3- 2

NUMBER	DESCRIPTION
1	KNIGHT SERVO HOIST CAPACITY (LBS.)
2	KNIGHT 19-PIN STRAIGHT CABLE (FT.)
3	8-PIN CABLE (STANDARD LENGTHS)
4	KNIGHT REVEED LOAD MONITORING MODULE FOR ROLLER CHAIN APPLICATIONS
5	KNIGHT STANDARD LOAD MONITORING MODULE FOR ROLLER CHAIN APPLICATIONS
6	KNIGHT OPERATOR CONTROL INTERFACE (OCI)
7	KNIGHT OPERATOR CONTROL INTERFACE (OCI) WITH UP / DOWN 2-SPEED HANDLE
8	8-PIN CABLE (STANDARD LENGTHS)
9	4-PIN CABLE (STANDARD LENGTHS)
10	KNIGHT FIXTURE HANDLE
11	KNIGHT UP / DOWN 2-SPEED HANDLE

C. Servo Hoist Functionality Modes

Run-Stop

Step 1. Press the RUN-STOP button, located on the Operator Control Interface (OCI) module.

- Drive power is removed from the system and the holding brake is set.
- The Run-Stop button will flash red.

Recovery:

Step 1. Reset the RUN-STOP button by twisting it a quarter of a turn clockwise.

Shut Down

Step 1. Press the RUN-STOP button, located on the Operator Control Interface (OCI).

Step 2. Follow the warning labels on the Servo Hoist and disconnect the power supplied to the unit.

Start Up

Step 1. Connect the power supply to the unit.

Step 2. Reset the RUN-STOP button by twisting it a quarter of a turn clockwise.

- The hoist will power up and the OCI's RED and GREEN indications will briefly flash when the system is ready to function.
- The unit will then default to No Mode: the OCI's GREEN, BLUE, and RED indicators will turn off.

No Mode

When the Servo Hoist powers up or if it is inactive for a continuous time period, the unit will shift to this energy saving mode. The factory default for the inactive time period is 15 minutes. The holding brake will engage and power will be removed from the motor while No Mode is active. When the unit is in No Mode, the OCI's GREEN, BLUE, and RED indicators will be off.

Lift Mode

Press the GREEN (Lift) button to place the Servo Hoist into Lift Mode.

- The GREEN (Lift) indicator will illuminate.

	NOTE
	A continuously flashing GREEN light indicates a safe start activation fault. The system is sensing a command input during the Power-Up sequence. **Remedy** **Analog Handle: Release the handle and verify that the GREEN light illuminates solid. If the GREEN light still flashes after the handle is released, refer to section 7. "Troubleshooting".** **Up/Down Pendent: Release both buttons and verify that the GREEN light illuminates solid. If the GREEN light still flashes after the button is released, refer to section 7. "Troubleshooting".**

Systems with a Fixture Handle Style Lift Controls:

Step 1. Apply force to the handle in the desired direction of travel (upward or downward).
The travel speed of the fixture is proportional to the force applied to the handle.

Systems with Discrete Up / Down Style Lift Controls:

Step 1. Press the Up or Down button to move the hoist in the desired direction.

NOTE

If the hoist is in No Mode and a lift command is given to the system, the hoist will automatically go into Lift Mode.

Float Mode

Step 1. Press the BLUE (Float) button to place the Servo Hoist into Float Mode.
When the BLUE button is pressed, a snapshot is taken of the load that is attached to the end of the hoist (i.e. the system records the weight suspended from the fixture).
The BLUE (Float) indicator will illuminate.

Step 2. Apply pressure to the top of the part to move it down or lift up on the part to move it up.
Do not use the lift controls to move the part as this will place the hoist back into Lift Mode.

WARNING

An operator should never be able to release a load while in Float mode. The operator must switch to Lift mode in order to release a load.

NOTE

If the Knight controls team programmed the hoist, it will never release or unclamp a part while it is in Float mode. The hoist will have to be switched to Lift mode for a part to be released or unclamped.

To change from Float Mode to Lift Mode, follow any of the steps below:

- Operate the lift controls. The hoist will automatically change to Lift Mode and then it will move the fixture up or down.
- Press the GREEN (Lift) push button and the unit will change into Lift Mode.
- Allow the Float Mode Timeout timer to expire. This timer is set at the factory to 5 minutes of non-use. To change this timer, refer to section 6. 'Variable Descriptions' in the Software section.

NOTE

The part must be picked up while the hoist is in Lift Mode and then the operator may place the Servo Hoist into Float Mode.

NOTE

Do not rest your hand on the part when pressing the Float push button. This can cause a bias or an incorrect zero value measurement to be processed and may cause unintended movement.

NOTE

Use of the Lift Mode controls will prevent the unit from remaining in or changing to Float Mode.

Travel Limits

NOTE

During operation (Lift or Float Mode) the hoist will ramp down in speed as the travel limits are approached.

NOTE

The absolute upper and lower travel limits are factory set to the physical limits of the Servo Hoist. Contact a Knight Global Representative for information regarding changes to these absolute limits.

Fault Mode

The Red light will flash.

Step 1. Press the RUN-STOP button, located on the Operator Control Interface (OCI).

- Drive power is removed from the system and the holding brake is set.
- The RUN-STOP button will flash red.

Recovery:

Step 1. Correct the situation that caused the fault.
Refer to section 7.B. “System Activity screens including Faults, Warnings and Error Codes” for a list of common faults.

Step 2. Follow the Start Up procedure to restore power to the unit.

4. MAINTENANCE

A. CHAIN AND HOIST INSPECTION

4.1 Inspection Overview

The inspection procedures and recommendations in this manual are based on ANSI/ASME B30.16 “Overhead Underhung and Stationary Hoists”. The following definitions and recommendations are from both specifications and pertain to the recommended inspection procedures in this manual.

Qualified Person: A person who, by possession of a recognized degree in an applicable field, or certificate of professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter at work.

Designated Person: A person selected or assigned by the employer or the employer’s representative as being competent to perform specific duties.

Abnormal Operating Conditions: Environmental conditions that are unfavorable, harmful, or detrimental to the operation of a hoist, such as excessively high or low ambient temperatures, exposure to weather, corrosive fumes, dust laden or moisture laden atmospheres, and hazardous locations.

4.2 Use of Chain Safely in Any Application

Overload: Never Overload the Chain - check the working load limit on the identification tag.	
Sharp Edges - Protect chain from coming in contact with sharp edges while in operation.	
Abrupt Movement - Lift and lower loads smoothly. Do not jerk.	
Extreme Temperatures - Do not expose alloy chain to temperatures of 400°F or higher or -40°F or lower.	

4.2.1 Knight recommends not using master links within a roller chain's length

Knight only uses master links at the ends of our roller chains. Knight never uses a master link within the working length of the roller chain.

WARNING

Do not use a master link within the working length of a roller chain.

NOTE

Knight always recommends that master links are only used at the ends of a roller chain.

4.3 Determining the Frequency of Chain Inspections

Knight recommends utilizing load criteria and duty cycle data when determining the frequency of inspections. Inspection frequency should be identified by a qualified person and is based on factors such as the severity of the environment the hoist is being used in, percentage of capacity lifts, cycle time and shock loading. Each Servo Hoist should be rated individually and inspections performed in accordance with that rating.

Proper maintenance depends on an evaluation of the severity of usage to which the hoist and the chains are subjected to in the specific application.

The overall determination of how often the hoist and chains should be inspected is a combination of its Service Rating Load Criteria (4.3.1) and its Service Class or Duty Cycle (4.3.2).

4.3.1 Service Rating Load Criteria

Light Service: Hoist and roller chain normally subjected to light loads and very rarely to maximum loads.

Moderate Service: Hoist and roller chain normally subjected to moderate loads but fairly frequently to maximum loads.

Heavy Service: Hoist and roller chain normally subjected to loads of heavy magnitude and frequently to maximum loads.

Very Heavy Service: Hoist and roller chain regularly subjected to maximum loads.

4.3.2 Service Class (Duty Cycle)

Service Class is determined by the total number of cycles the system has performed. (Table 4-1)

- Service Class 0: 0 to 20,000 loaded cycles.
- Service Class 1: 20,001 to 100,000 loaded cycles.
- Service Class 2: 100,001 to 500,000 loaded cycles.
- Service Class 3: 500,001 to 2,000,000 loaded cycles.
- Service Class 4: over 2,000,000 loaded cycles.

Cycles Per Day	Desired Life (Years)				
	1	5	10	20	30
5	0	0	0	1	1
10	0	0	1	1	2
25	0	1	1	2	2
50	0	1	2	2	3
100	1	2	2	3	3
200	1	2	3	3	4
300	2	3	3	4	4
750	2	3	4	4	4
1,000	2	3	4	4	4

Table 4-1: Service Class

Example: If the system is performing 100 cycles per day, it will progress though Service Classes during its use:

1 year	26,000 cycles	Service Class 1
5 years	130,000 cycles	Service Class 2
10 years	260,000 cycles	Service Class 2
20 years	520,000 cycles	Service Class 3
30 years	780,000 cycles	Service Class 3

4.4 Type of Inspections

The inspection procedure is divided into two general classifications based upon the intervals at which the inspections should be performed for the hoist and roller chain during regular use. The general classifications are herein designated as "frequent" and "periodic" with respective intervals between inspections as defined below.

In addition, visual observations shall be conducted during regular service for any damage or evidence of malfunction which might occur between regular inspections.

4.4.1 Frequent Inspection (Visual)

This is a visual examination of the hoist and the roller chain by the operator or other designated personnel, without requiring records to be made. This inspection should be carried out at the following intervals:

A.	Light Service	or	Service Class 0 / 1	– **Every Month**
B.	Moderate Service	or	Service Class 2	– **Every Two Weeks**
C.	Heavy Service	or	Service Class 3	– **Every Week**
D.	Very Heavy Service	or	Service Class 4	– **Every Day**

Additionally, the operator should check the system continually during operation to ensure that no malfunctions are occurring (such as abnormal noises or binding of the chain).

4.4.1.1 What to Look for During a Frequent Inspection

The Operator should examine the chain throughout its working length to detect any evidence of wear, distortion or external damage. Equipment should be operated under a load as near as possible to the usual operating load, in both directions and observe the functioning of the chain. The chain should feed smoothly into and out of the servo. Additionally, the operator should check the system continually during operation to ensure that no malfunctions are occurring.

- Check for visual signs or abnormal noises (grinding etc.) which would indicate a potential problem.
- Ensure controls function properly and return to neutral when released.
- Ensure the load chain feeds through the hoist correctly.
- Ensure that the chain doesn’t bind, is excessively noisy or “clicks” as it leaves the front of the servo.

If any of these abnormal conditions are evident, the Servo Hoist should be taken out of service and a detailed inspection and corrective actions should be taken by qualified maintenance personnel.

4.4.2 Periodic Inspection (Documented)

This is a thorough examination of the hoist and the roller chain conducted by a qualified person, making records of external conditions to provide a basis for the hoist's continuing evaluation. This Inspection should be carried out at the following intervals:

A. Light Service or Service Class 0/1 – **Yearly**
(equipment remains in place).

B. Moderate Service or Service Class 2 – **Every Six Months**
(equipment remains in place unless external conditions indicate that disassembly should be done to permit detailed inspection).

C. Heavy Service or Service Class 3 – **Every Three Months**
(equipment remains in place unless external conditions indicate the disassembly should be done to permit detailed inspection).

D. Very Heavy Service or Service Class 4 – **Every Six Weeks**
(equipment remains in place unless external conditions indicate that disassembly should be done to permit detailed inspection).

4.4.2.1 Recommendations for Periodic Inspections

Perform the inspection detailed under section 4.4.1.1 "What to Look for During a Frequent Inspection" of this manual.

Next, the roller chain should be cleaned for inspection, using any cleaning method that will not cause damage. Adequate lighting should be provided for the person inspecting the chain. The chain should be examined link by link for cracks, gouges, nicks, distortion, corrosion, deposits of foreign material, and for interlink wear. If wear is observed or if elongation is suspected, measure the chain using the supplied chain gauge shipped with the servo hoist.

4.4.2.2 Recommended Record Keeping for Periodic Inspections

Adequate records as a part of periodic inspection are essential for the proper use of a roller chain. The roller chain record should include a complete description and identification of the new chain, the date and results of each inspection, the date and results of each test and the date and description of any maintenance.

The record is a continuous history of the chain and shows that it has been regularly inspected and maintained in good operating condition.

When the chain is removed from service, a new record should be prepared for the replacement chain.

4.4.3 Chain Lubrication:

Keep roller chain well lubricated. Never operate a hoist when the roller chain does not flow freely and smoothly into and out of the gear box assembly or when it makes noises indicative of binding or other malfunctions. Replace the roller chain if it is visibly damaged in any way.

Clean, lubricate, and inspect the roller chain based on the frequent inspection criteria described in section 4.4.1. In a corrosive environment, lubricate more frequently than normal. Failure to maintain a clean and well lubricated roller chain will result in rapid roller chain wear that can lead to chain failure which can cause severe injury, death or substantial property damage.

If required, clean the chain with acid free solvent to remove rust or abrasive dust buildup before the chain is lubricated.

Lubricate each link of the chain with a light coat machine or gear oil. Knight recommends using Demag Chain Grease (P/N 665 009 44). Ensure that oil is applied to all roller chain links and rollers. Wipe off excess oil from the roller chain surfaces.
(Refer to Figure 4-2: Chain Lubrication – P/N 665 009 44)

If Demag Chain Grease is not available, SAE 50 to 90 EP oil or equivalent may be used. Substitute a dry lubricant for use in dusty environments.

Lubricate load pins with same lubricant used on the roller chain.

Operate the hoist and expose the maximum amount of roller chain, lubricate this length of chain and then open the inspection hole on the vertical mast and lubricate the roller chain as it is moving upwards to its top limit.

WARNING

Failure to maintain clean and lubricated roller chain will void the manufacturer's warranty.

Figure 4-2: Chain Lubrication - P/N 665 009 44

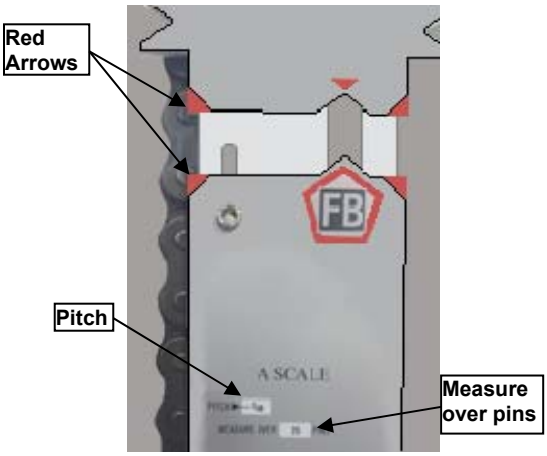
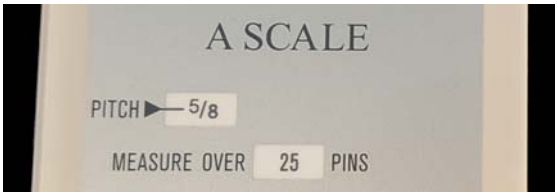
4.4.4 Roller Chain Maintenance:

Over time the roller chain elongates as it wears leading to a significant increase in potential chain failure. When the normal pitch length has been extended by 2-3%, the service life of the chain is significantly reduced and the ultimate breaking strength is considerably lower.
At 2% elongation a qualified service technician must set a safe time limit for replacement.
At 3% the chain must be replaced immediately.

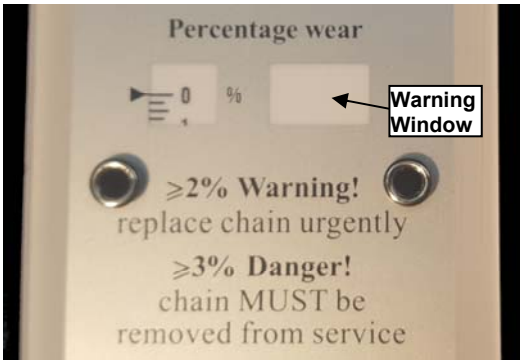
Knight Global provides a Roller Chain Gauge with each roller chain hoist.
The roller chain should be checked at intervals depending on the service and load conditions. (Refer to section 4.3)

4.4.4.1 Roller Chain Gauge Inspection Process:

Roller Chains should be cleaned for inspection, using any cleaning method that will not cause damage.

1. Close gauge to confirm calibration: Check the calibration by closing the slide fully.	
2. Read the 'Percentage Wear' window: When the gauge is fully closed, if the black arrow moves into the '+' or '-' zones, the gauge will not give an accurate measurement and should NOT be used. Similarly, if the 'V' jaws are damaged the instrument may also not perform accurately.	
3. Identify the pitch: Align the red arrows within the center of the pins on ONE of the OUTER link plates. Depending on ease of access, one pair of arrows will be more suitable than the others. The normal pitch will appear in the 'Pitch' window. The number of pins (n) that the chain is to be measured over will appear in the 'Measure over pins' window.	
4. Select the Correct side of the gauge: Select the correct scale according to pitch size. Once the pitch is determined, the number of pins to measure is displayed. Knight's Roller Chain uses the "A Scale" side. NOTE: "A Scale" side = 3/8", ½", 5/8", ¾", 1", 1 ¼", 1 ½", 2 ½", and 3". "B Scale" side = 1 ¾" x 2"	

Continued on next page

5. <u>Measure the Chain:</u> The chain should be cleaned and measured in its location while placed under approximately 1% of the minimum breaking load. If a set of check weights is not available, it is sufficient for the chain to be tensioned by the weight of the carriage and lift assist. Identify the section of the chain that regularly runs over the pulley as this part of the chain is most susceptible to wear. Measurements must then be made in at least 3 separate locations on this section. Place the 'V' jaw of the chain gauge over the first pin of one of the selected sections and then extend the slide until the other 'V' jaw reaches the final pin. The final pin will be the one that appeared in the 'Measure over pins' window as previously determined in step 3.	
6. <u>Read off the Percentage:</u> Check the 'Percentage Wear' windows. A percentage will appear in 0.25% (¼%) increments. If the chain has elongated by 2% or more, the warning window will be filled with red and necessary action must be taken.	

4.4.4.2 Lubricating the Servo Arm Roller Chain after replacement

After changing the roller chain, before a test load is lifted and before the hoist is put into operation as well as during normal operation when no load is attached, the chain link contact areas must be lubricated with Demag gear grease, part no. 665 009 44.

The chain link contact areas must be re-lubricated appropriately – after being cleaned – at intervals depending on the service and load conditions.

	NOTE
	Knight recommends the roller chain be lubricated periodically in accordance with section 4.4.3 Chain Lubrication.

Cut off the tip of the grease tube and inject grease into the chain's links by compressing the tube while you run the chain to its end positions to ensure complete and even lubrication of the chain.

B. PREVENTATIVE MAINTENANCE FOR KNIGHT SERVO HOIST

4.5 Servo Hoists Inspections

4.5.1 Recommendations for Frequent Inspections for Servo Hoists (Visual)

This is a visual examination by the operator or other designated personnel, without requiring records to be made. This inspection should be carried out at the following intervals recommended in section 4.4.1 'Frequent Inspection (Visual)'.

Additionally, the operator should check the system continually during operation to ensure that no malfunctions are occurring.

4.5.1.1 Servo Hoist:

- Visually inspect the Servo Hoist and ensure that it is in good general working order. Repair or replace any broken or missing parts.
- Cycle the Servo Hoist and listen for any abnormal noises (grinding, etc.). If any abnormal noises are evident, an inspection of the Servo Hoist must be performed.
- Inspect how the chain feeds through the Servo Hoist. If any binding is evident, clean and lubricate the chain (Refer to section 4.4.2 'Periodic Inspection (Documented)'. If the problem persists replace the chain.
- Cycle the Run-Stop button and ensure it functions correctly.

4.5.1.2 Load Shackle:

- Check the shackle for signs of wear.
- Ensure the load shackle is not cracked, nicked or gouged. Replace the shackle as necessary.
- Confirm all cotter pins and / or keepers are in place.

If any of these abnormal conditions are evident, the Servo Hoist should be taken out of service and a detailed inspection and corrective actions should be taken by qualified maintenance personnel.

4.5.2 Periodic Inspection (Documented)

Perform the items listed in the section 4.4.1.1. 'What to Look for During a Frequent Inspection' in addition to the items listed below. All findings from this inspection should be recorded.

4.5.2.1 Supporting Structure:

- Check for distortion, wear and continued ability to support the load. Refer to manufacturers' instructions for overhead rail systems.

4.5.2.2 Rail Trolley (if applicable):

- Ensure wheels and side rollers run smoothly and are not excessively worn. Replace the wheels and side rollers as necessary.
- Visually check the nylon for cracks at the bearing and along the face of the wheel.

4.5.2.3 Fasteners:

- Check all fasteners and ensure they are not loose, missing or damaged.

4.5.2.4 Load Hook (if applicable):

- Inspect for cracks, wear or damage.
- Inspect the hook's throat for spreading and proper safety latch engagement.
- Measure the hook's throat at wear points: greater than ten percent wear in any throat zone requires replacement. Refer to manufacturer's instructions for wear zone information.
- Inspect the hook eye and chain nest and sleeve for correct functionality. Also, each should rotate without binding and should not be damaged.

4.5.2.5 Valves, Timers, and Switches:

- Check during an operation cycle to ensure the sequence is operating at optimum efficiency. Repair or replace if needed.

4.5.2.6 Wiring:

- Check for broken, loose, missing, and worn wires. Check all electrical cables for signs of age, wear, or damage, and make sure all connections are tight and secure. Repair or replace if needed.

4.5.2.7 Electrical Enclosures, Disconnect Boxes, and Circuit Breakers:

- Check for obvious signs of damage and repair or replace if needed.
- Verify disconnect is operational. Check for loose, bent, or broken components. Repair or replace if needed.
- Inspect for loose or broken terminals. Check for the presence of contaminants like dirt, dust, grease, or rust. Repair or replace if needed.

If any of these abnormal conditions are evident, the Servo Hoist should be taken out of service and a detailed inspection and corrective actions should be taken by qualified maintenance personnel.

4.5.2.8 Labels and Tags:

- Ensure that all labels are intact and legible. Replace as necessary. (Refer to Figure 4-3)

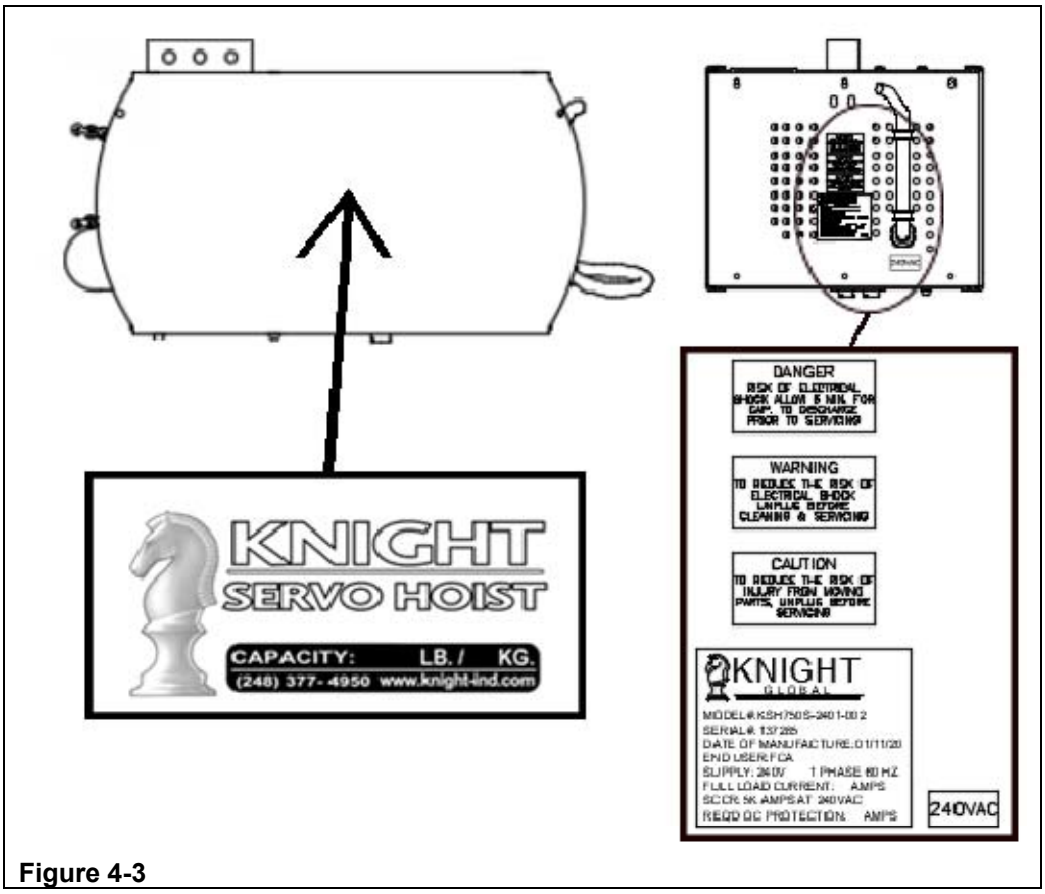


Figure 4-3

If any of the labels or warning tags listed above are missing, contact Knight Global at 248-377-4950 to order replacements.

4.6 Roller Chain Replacement for a Reeved system

The materials required for the chain replacement are:

a. Knight certified roller chain of correct length.
b. Roller chain master link and hardware.
c. Knight recommends to have (2) M5x40 bolts for temporary assembly use only.

Step 1. Record the physical measurement from the normally hanging fixture boom up to the bottom of the carriage. This measurement will be used at the end of this procedure.

Step 2. Open the Knight Servo Studio (KSS) program and backup all of the parameters. See section 5.C. “Backing up the Knight Servo Hoist Software” for details.
Record the “Real World Position (in)” located on the 5th row of the Quick View panel. This panel is located in the lower right-hand corner of the KSS screen. (Refer to Figure 4-4)

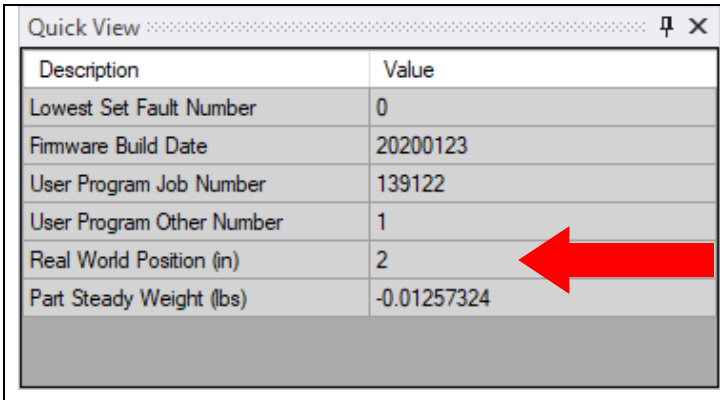


Figure 4-4

Step 3. Press the Run-Stop button and Remove Power from the unit.

Step 4. Using an alternative lifting device such as a forklift, following all federal, local and factory safety regulations, lift the fixture boom and slack the chain. (Refer to Figure 4-5)

Figure 4-5

Step 5. Locate the Keeper Load Pin and remove both of the M6 bolts. These bolts hold the plate that secures the Keeper Load Pin in place. (Refer to Figure 4-6)

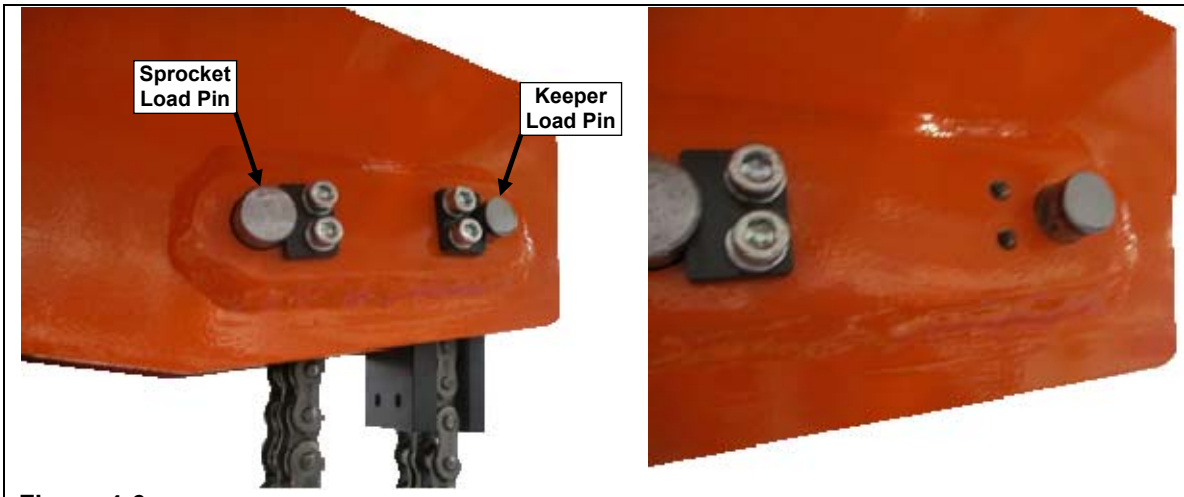


Figure 4-6

Step 6. Loosen the split clamp collar and begin to remove the load pin. (Refer to Figure 4-7)

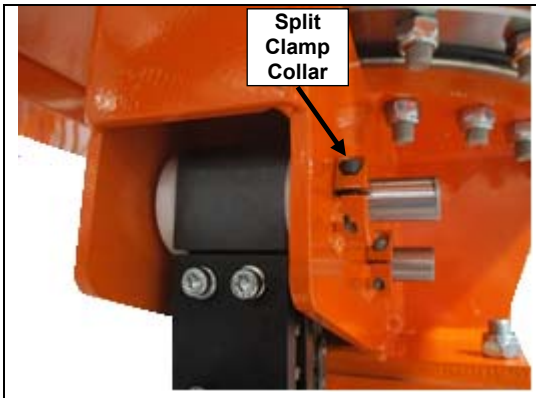


Figure 4-7

Step 7. As the load pin is removed, ensure the first Oilite washer and then the Delrin spacer are both retrieved and saved. (Refer to Figure 4-8)

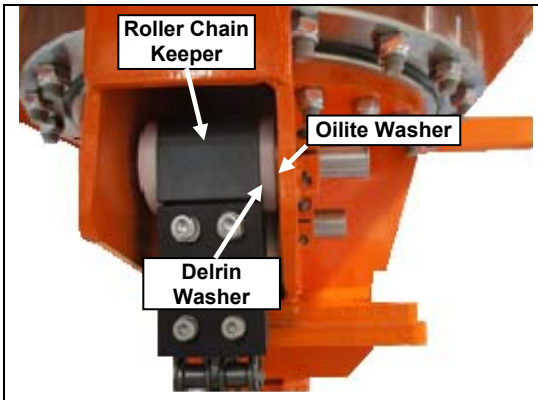


Figure 4-8

Step 8. Remove the Roller Chain Keeper and the other Oilite washer and Delrin spacer. At this point, the Keeper Load Pin should be free.

Step 9. Lay the Roller Chain Keeper on a supported surface. (Refer to Figure 4-9)

Figure 4-9

Step 10. Remove the two M5 bolts and two M6 bolts from the cover of the Roller Chain Keeper. (Refer to Figure 4-10)

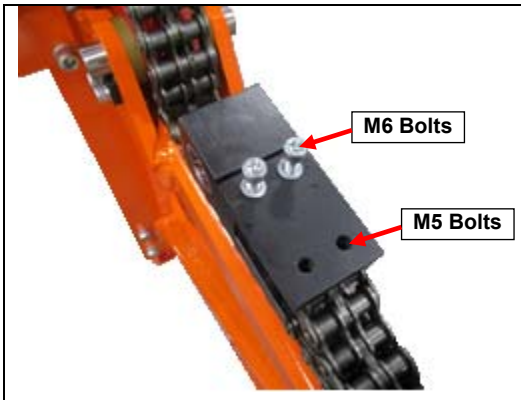


Figure 4-10

Step 11. Using needle-nosed pliers and a screwdriver, remove the master link keeper clip from the roller chain. (Refer to Figure 4-11)

Figure 4-11

Step 12. Remove the master link side plate. (Refer to Figure 4-12)

Figure 4-12

Step 13. Remove the master link. It is recommended that you use a bolt to retain the middle side plates so they don't fall out of the Roller Chain Keeper. Bolt size: M5x40. (Refer to Figure 4-13)

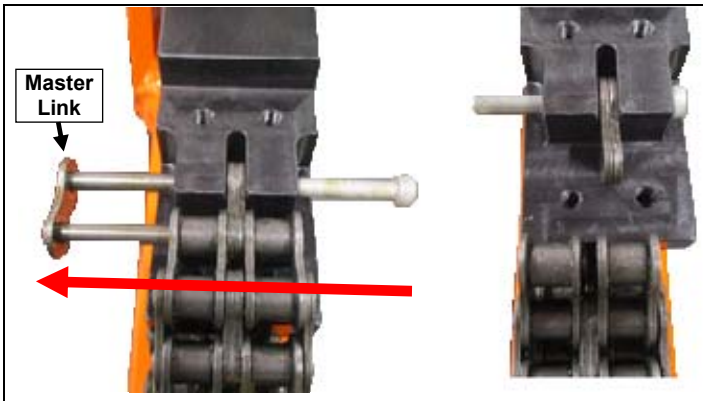


Figure 4-13

Step 14. The chain is now disconnected from the Roller Chain Keeper. (Refer to Figure 4-14)

Figure 4-14

Step 15. Open the roller chain's inspection cover in the back of the vertical mast. Feed the roller chain out of the inspection panel. (Refer to Figure 4-15)

Figure 4-15

Step 16. Attach the NEW roller chain section to the OLD roller chain section using a roller chain master link and all other hardware. (Refer to Figure 4-16)

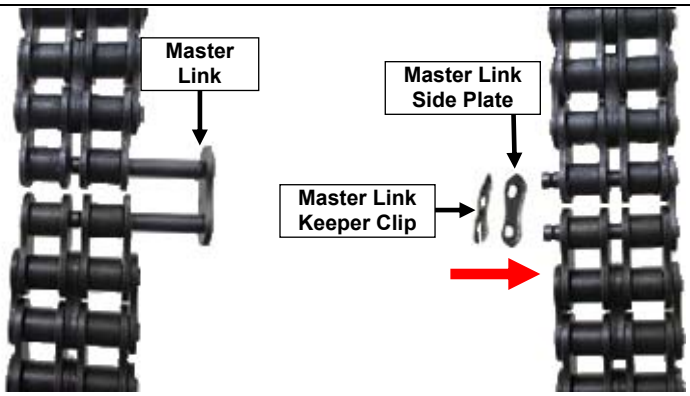


Figure 4-16

Step 17. Reconnect Power. Reset the Run-Stop button and use the Chain Payout function to move the NEW chain through the servo.
See section 5.G. "Operating Chain Payout Mode" for details.
Ensure that the NEW roller chain is paid out far enough to go over the Sprocket Load Pin and roller, down to the Load Monitoring Monitor (LMM) and back up to the Keeper Load Pin. (Refer to Figure 4-17)

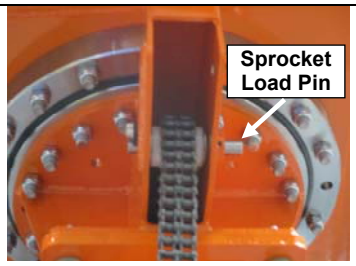


Figure 4-17

Step 18. Disconnect the NEW roller chain from the OLD roller chain. Correctly dispose of the OLD roller chain.

Step 19. Put the free end of the NEW roller chain inside the vertical mast by putting it inside the inspection panel. Secure the roller chain's Inspection cover.

Step 20. Totally assemble the end of the NEW roller chain to the Roller Chain Keeper by using the steps listed above in reverse order.

Step 21. For Step 13, Knight recommends that two M5 bolts are used to line up the pieces of the master link with the chain. Bolt size: M5x40. (Refer to Figure 4-18)

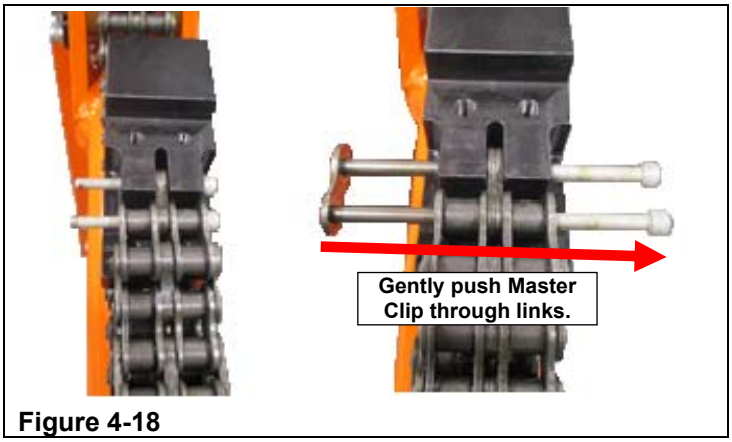


Figure 4-18

Step 22. After the NEW roller chain is fully hung, following all federal, local and factory safety regulations, use the alternative lifting method in Step 4 and lower the fixture boom.

Step 23. Use the handle controls and move the NEW roller chain into the vertical mast and lift the fixture boom.

Step 24. Ensure the physical height of the fixture boom is the same as the measurement obtained in Step 1.

Step 25. Reset encoder offset by using the steps recording in section 5.F “Encoder Offset Setup Procedure”.

Step 26. Ensure the “Real World” position matches the previously recorded value from Step 2.

Step 27. Ensure that the upper and lower limits are validated correctly.

Step 28. Lubricate the roller chain. See section 4.4.3 “Chain Lubrication” for details.

Step 29. The system is now ready to put back in service.

4.7 Roller Chain Replacement for a Non-Reeved system

The materials required for the chain replacement are:

a. Knight certified roller chain of correct length.
b. Roller chain master link and hardware.
c. Knight recommends to have (2) M5x40 bolts for temporary assembly use only.

Step 1. Record the physical measurement from the normally hanging fixture boom up to the bottom of the carriage. This measurement will be used at the end of this procedure.

Open the Knight Servo Studio (KSS) program and backup all of the parameters. See section 5.C. “Backing up the Knight Servo Hoist Software” for details.

Record the “Real World Position (in)” located on the 5th row of the Quick View panel. This panel is located in the lower right-hand corner of the KSS screen. (Refer to Figure 4-19)

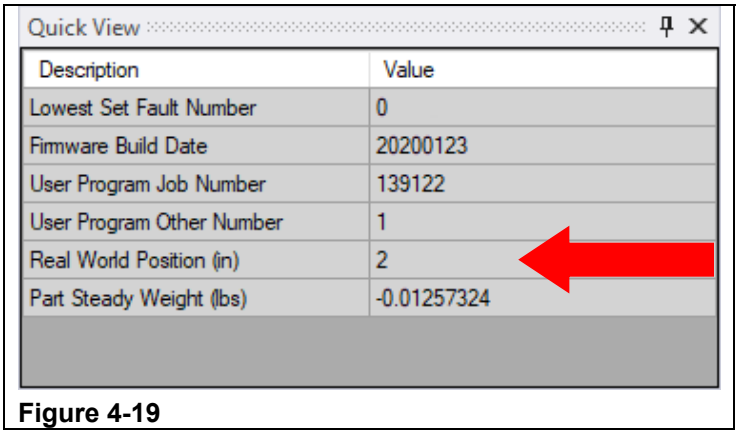


Figure 4-19

Step 2. Press the Run-Stop button and Remove Power from the unit.

Step 3. Using an alternative lifting device such as a forklift, following all federal, local and factory safety regulations, lift the fixture boom and slack the chain.

Step 4. Disconnect the 8-pin cable from the Load Monitoring Module (LMM).

(Refer to Figure 4-20)

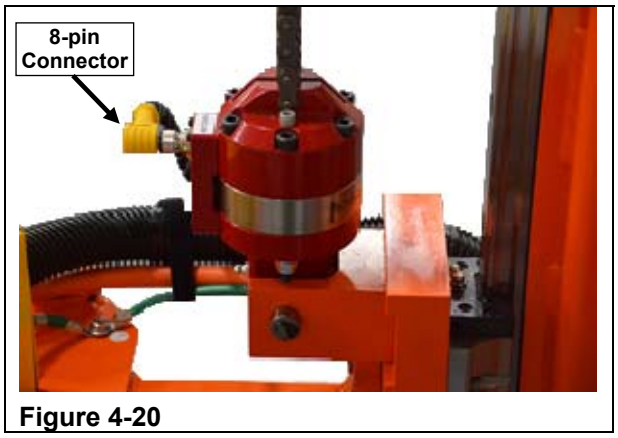


Figure 4-20

Step 5. Disconnect the OLD roller chain from the Load Monitoring Module (LMM).

Step 6. Open the roller chain's inspection cover in the back of the vertical mast. Feed the roller chain out of the inspection panel. (Refer to Figure 4-21)

Figure 4-21

Step 7. Attach the NEW roller chain section to the OLD roller chain section using a roller chain main link and all other hardware. (Refer to Figure 4-22)

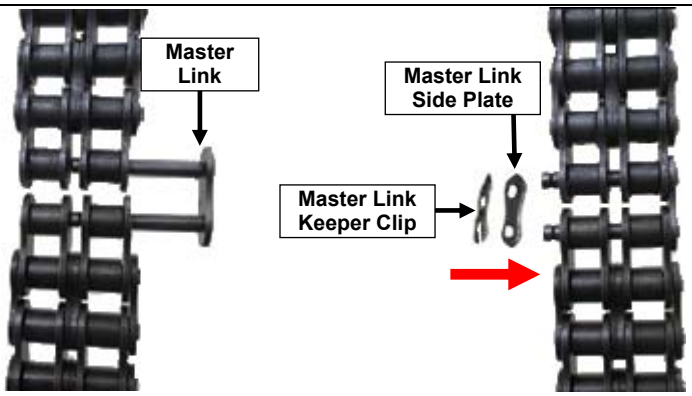


Figure 4-22

Step 8. Reconnect Power. Reset the Run-Stop button and use the Chain Payout function to move the NEW chain through the servo.
See section 5.G. "Operating Chain Payout Mode" for details.
Ensure that the NEW roller chain is paid out far enough to reach the Load Monitoring Monitor (LMM).

Step 9. Disconnect the NEW roller chain from the OLD roller chain. Correctly dispose of the OLD roller chain.

Step 10. Put the free end of the NEW roller chain inside the vertical mast by putting it inside the inspection panel. Secure the roller chain's inspection panel cover.

Step 11. Place the middle side plates inside the LMM's top recess.
Use a M5x40 bolt to temporarily hold the middle side plates in place.
Place the roller chain's end over the middle side plates and use another M5x40 bolt to temporally hold the roller chain's links in position. (Refer to Figure 4-23)

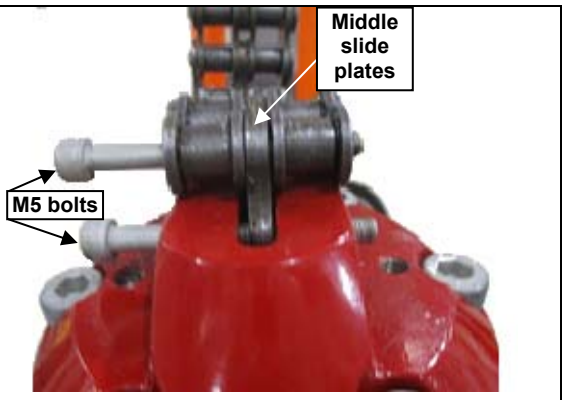


Figure 4-23

Step 12. Insert the Master Link by gently pushing the M5 bolts out of their temporary position. (Refer to Figure 4-24)

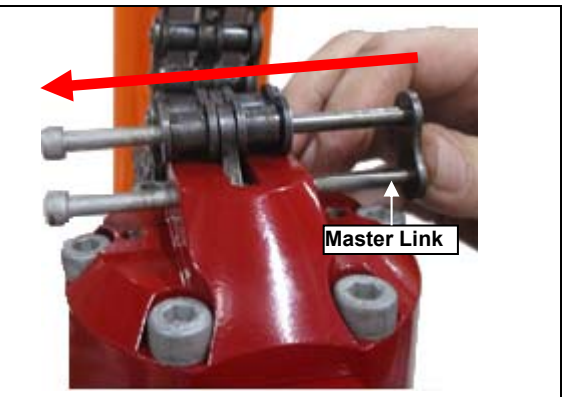


Figure 4-24

Step 13. Place the Master Link Slide Plate on the Master Link's prongs.

Step 14. Using needle-nosed pliers, place and fasten the master link keeper clip in place. (Refer to Figure 4-25)

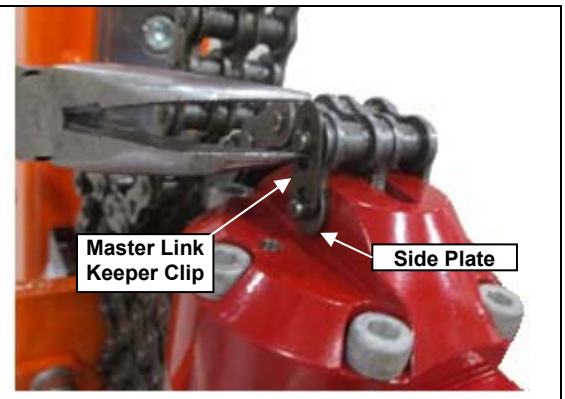


Figure 4-25

Step 15. Place both of the master link retaining SHCS in the top of the LMM. One on each side of the master link. (Refer to Figure 4-26)

Figure 4-26

Step 16. Ensure that the 8-pin cable is correctly connected to the LMM.

Step 17. After the NEW roller chain is fully hung, following all federal, local and factory safety regulations, use the alternative lifting method in Step 4 and lower the fixture boom.

Step 18. Use the handle controls and move the NEW roller chain into the vertical mast and lift the fixture boom.

Step 19. Ensure the physical height of the fixture boom is the same as the measurement obtained in Step 1.

Step 20. Reset encoder offset by using the steps recording in section 5.F “Encoder Offset Setup Procedure”.

Step 21. Ensure the “Real World” position matches the previously recorded value from Step 2.

Step 22. Ensure that the upper and lower limits are validated correctly.

Step 23. Lubricate the roller chain. See section 4.4.3 “Chain Lubrication” for details.

Step 24. The system is now ready to put back in service.

4.8 Load Monitoring Module Replacement

This procedure can be used for both non-reeved and reeved systems.

Step 1. Record the physical measurement from the normally hanging fixture boom up to the bottom of the carriage. This measurement will be used at the end of this procedure.

Step 2. Open the Knight Servo Studio (KSS) program and backup all of the parameters. See section 5.C. “Backing up the Knight Servo Hoist Software” for details.
Record the “Part Steady Weight (lbs)” located on the 6th row of the Quick View panel. This panel is located in the lower right-hand corner of the KSS screen.
(Refer to Figure 4-27)

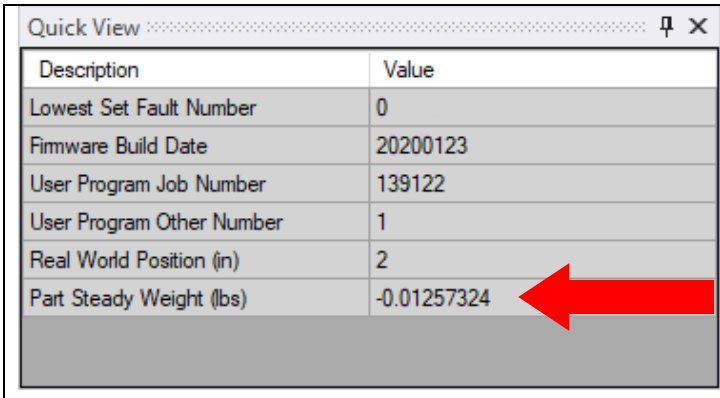


Figure 4-27

Step 3. Press the Run-Stop button and Remove Power from the unit.

Step 4. Using an alternative lifting device such as a forklift, following all federal, local and factory safety regulations, lift the fixture boom and slack the chain.
(Refer to Figure 4-28)

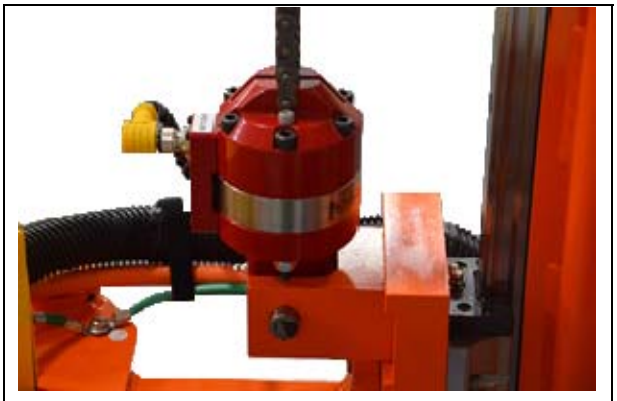


Figure 4-28

Step 5. Remove both of the M6 bolts from the load pin keeper plate.
Ensure to save all the pieces. (Refer to Figure 4-29)

Figure 4-29

Step 6. Remove the load pin being sure to keep both the urethane Spacers.
(Refer to Figure 4-30)

Figure 4-30

Step 7. Obtain the new LMM and record the bias voltage listed on this LMM's Setup sheet which is attached to the new LMM.
This value will be typed into the Quick Setup screen of the Knight Servo Studio during Step #12.

Step 8. Move the new LMM into place and line up with the load pin. Ensure that one of the urethane washers is in place between the carriage and the NEW LMM. Knight recommends the use of a smaller diameter rod to line up the LMM, washer and carriage hole. (Refer to Figure 4-31)

Figure 4-31

Step 9. Push the load pin entirely through the second hole in the carriage ensuring to include the 2nd urethane washer. If the load pin does not smoothly move into place, it is recommended to use a small amount of chain grease on the load pin. (Refer to Figure 4-32)

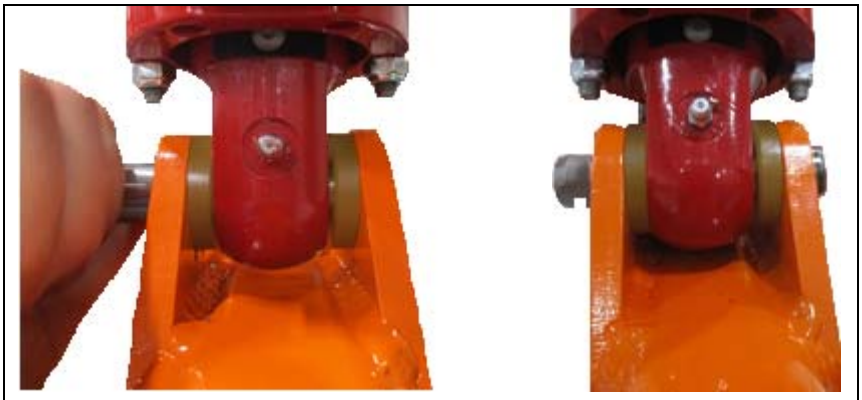


Figure 4-32

Step 10. Line up the recess in the load pin and reinstall the load pin keeper plate with all of its hardware. (Refer to Figure 4-33)

Figure 4-33

Step 11. Reinstall the 8-pin cable and repower the system. Release the Run-Stop button.

Step 12. Boot up the Knight Servo Software and follow the steps in section 5.E. to open the Quick Setup screen. On Row #1, replace the number listed under “Float LC Bias” with the new number for THIS NEW LMM that is listed on this LMM’s Setup sheet. Press the “Re-Zero Float LC” button and then press the “Commit” button on the bottom left-hand side of the Quick Setup Screen. (Refer to Figure 4-34)

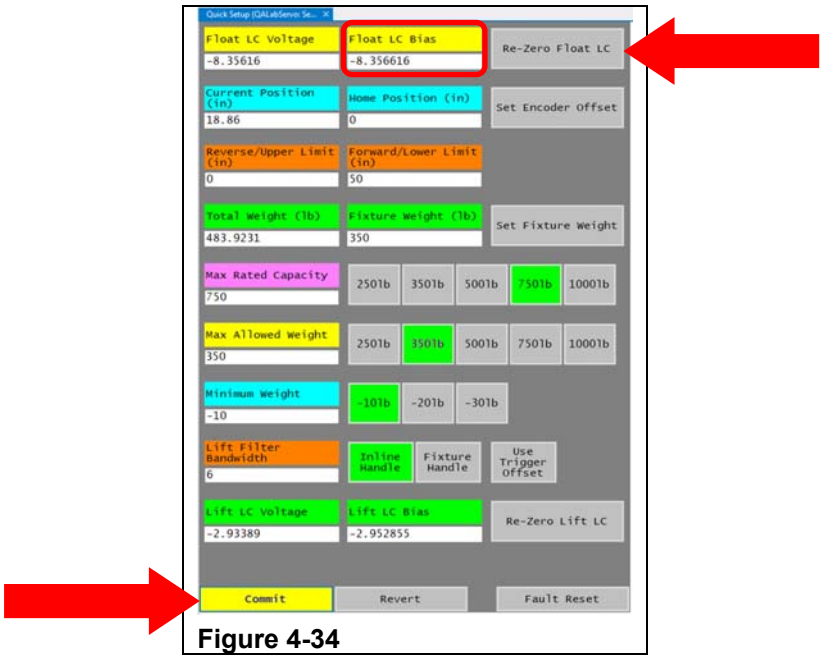


Figure 4-34

Step 13. After the roller chain is reinstalled and is fully hung, following all federal, local and factory safety regulations, use the alternative lifting method in Step 4 and lower the fixture boom.

Step 14. Use the handle controls and move the roller chain into the vertical mast and lift the fixture boom.

Step 15. Ensure the “Part Steady Weight” listed on the Quick View screen of the KSS matches the previously recorded value from Step 2.

Step 16. Lubricate the spherical bearing at the bottom of the LMM. (Refer to Figure 4-35)

Figure 4-35

Step 17. Ensure that the roller chain is lubricated correctly. See section 4.4.3 “Chain Lubrication” for details.

Step 18. The system is now ready to be put back in service.

5. SOFTWARE

There are several subjects related to the Servo Hoist's software that will be reviewed here:

5.A.) Getting Started
5.B.) Connecting to a Servo Hoist
5.C.) Backing up the Knight Servo Hoist Software
5.D.) Load a New Drive with Existing Software
5.E.) Check or Change Setup Values
5.F.) Encoder Offset Setup Procedure
5.G.) Operating Chain Payout Mode
5.H.) Operating Test Mode
5.I.) Accessing the Servo Hoist's Fault Log

In the next few sections of the manual a shorthand is used to point to a particular screen in the Knight Servo Studio (KSS) program. The shorthand that explains how to find each screen or parameter in the KSS is explained below:

KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \ System Status Bits
This means that the Knight Servo Studio's 'User Level' dropdown located on the top menu must be set to the 'Advanced' option. Next, in the 'Workspace' panel on the left-hand side of the screen, the '+' sign next to the Knight Work Order number needs to be pressed. This will expand the selection tree. Mouse down and press the '+' sign next to the 'Status' option and double-click on the 'System Status Bits' screen. This will open that screen and any specific parameters can be inspected.

KSS Home screen location: Quick View panel \ Row 6 (Lower right-hand portion of the screen)
This means that on the Knight Servo Studio's home screen there is a panel located in the lower right-hand portion of the screen labeled 'Quick View'. The parameter in question is located on 'Row 6' of that panel.

If the Servo Hoist is being set up for the first-time, here is a list of functions to initially verify. The functions can be accessed from the 'Quick Setup' screen located here:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup

1) The hoist's maximum allowed weight: This can be verified by following the instructions in section 5.E. 'Check or Change Setup Values' on 'Row #6'.
2) The hoist's set down weight: This can be verified by following the instructions in section 5.E. 'Check or Change Setup Values' on 'Row #7'.
3) The hoist's fixture weight is correct: This can be verified by following the instructions in section 5.E. 'Check or Change Setup Values' on 'Row #4'.
4) The analog handle is balanced: This can be verified by following the instructions in section 5.E. 'Check or Change Setup Values' on 'Row #9'.
5) The encoder offset procedure: This can be verified by following the instructions in section 5.F. 'Encoder Offset Setup Procedure'.

A. Getting Started

Listed below are the hardware and software items needed to connect to a Knight Servo Hoist:
(Refer to Figure 5-1)

- Laptop running Microsoft Windows 7 or above. (Customer Supplied)
- Ethernet Cable with (1) RJ45 connector and (1) M12 4-pin connector.
- The Knight Servo Studio software package.

Note: The Knight Servo Studio software and an Ethernet Cable can be ordered from Knight: P/N EBA1395.

Figure 5-1

B. Connecting to a Servo Hoist

The Knight Servo Studio Servo software is used to configure and troubleshoot the Knight Servo Hoist. The following steps are required to initiate a connection between a computer running the Knight Servo Studio software and the Knight Servo Hoist:

Knight Servo Studio Software Package Setup:

Step 1. Setup the Ethernet communication settings for your laptop.

a. Using a Microsoft Windows based PC open the **Network and Sharing Center**.
b. Right click on **Local Area Connections**. Select **Properties**. (Refer to Figure 5-2)

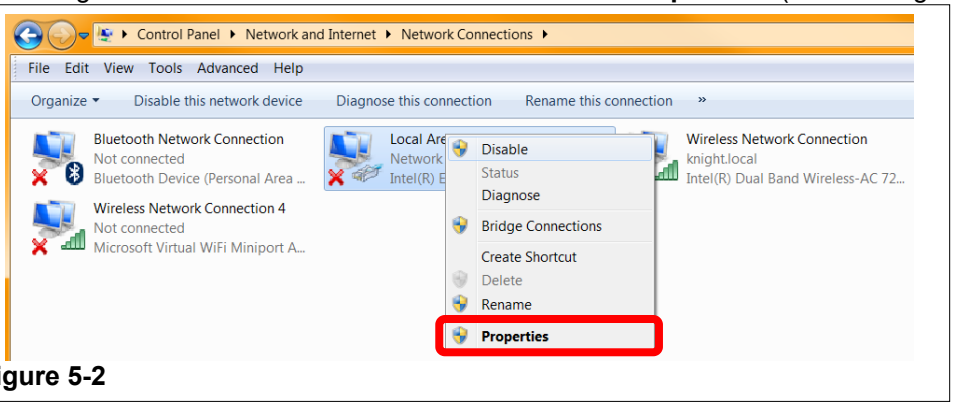


Figure 5-2

c. Select **Internet Protocol Version 4 (TCP/IPv4)**. Select **Properties**.
d. Select **Use the following IP address:**
In most cases the laptop's IP Address should be: 196.168.2.250
Type the correct IP address and Subnet mask into the spaces provided and press the 'OK' button. (Refer to Figure 5-3)

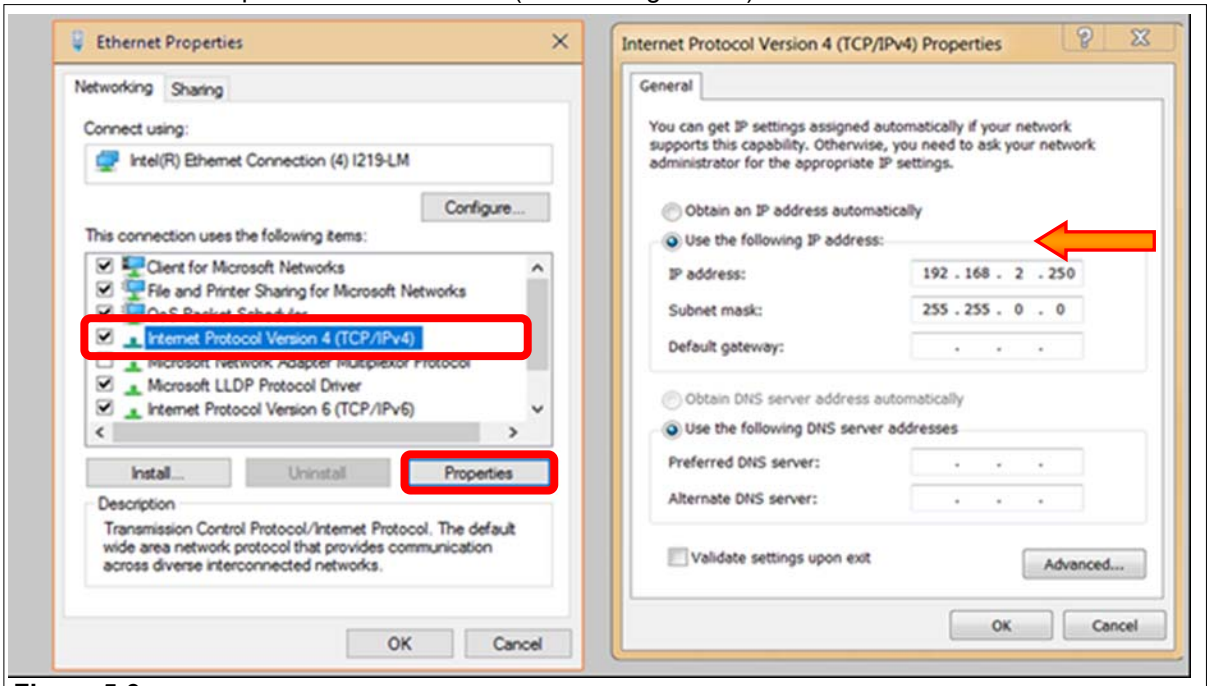


Figure 5-3

Step 2. Insert the USB card that was supplied with Servo Hoist into the laptop.
Double-click on the “ksh_sm_user.exe” icon to launch the Knight Servo Studio installation software. (Refer to Figure 5-4)

Figure 5-4

Step 3. Double click on the blue Knight Servo Studio software icon located on the desktop and allow the Knight Servo Studio software to load. (Refer to Figure 5-5)

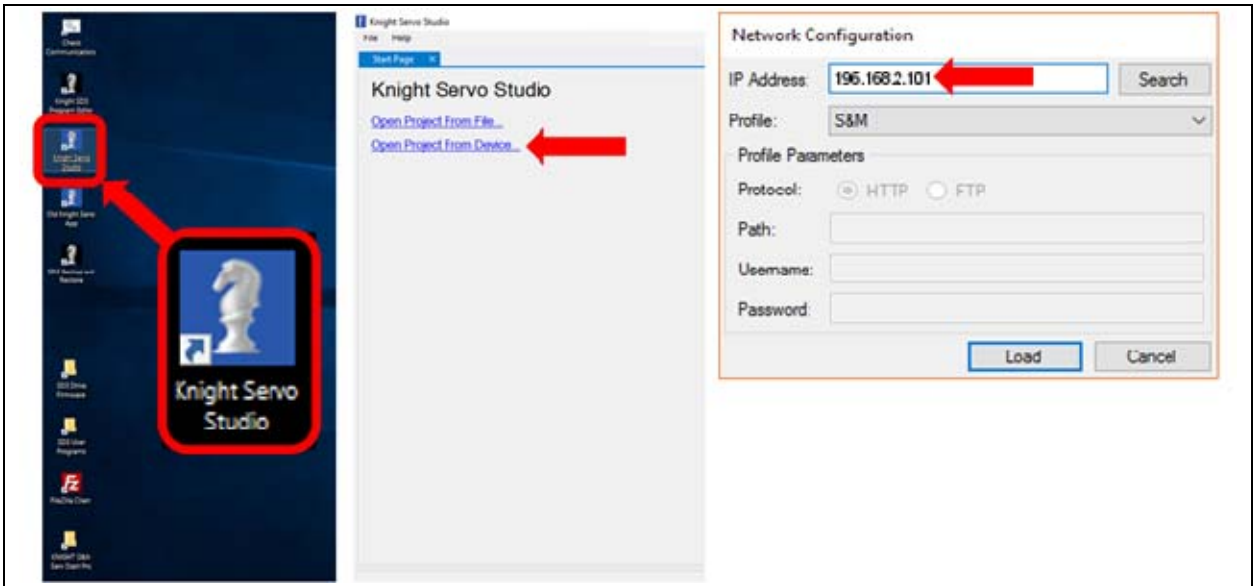


Figure 5-5

Step 4. When the software loads, choose the ‘Open Project from Device’ option.
Input the correct IP Address into the Network Configuration box.
The IP Address for the hoist will be located next to the M12 ENET receptacle located on the Load Monitoring Module or the Inline Handle, but in most cases is: 192.168.2.101
(Refer to Figure 5-5)

Step 5. Move the mouse to the right side of the screen and select the ‘Connect’ button. If the communications are operating correctly the red ‘Disconnected’ box will turn to a green ‘Connected’ box. (Refer to Figure 5-6)

If the Knight Servo Studio software does not connect to the hoist, recheck all of the connections and ensure that the hoist has its 240VAC power connected.

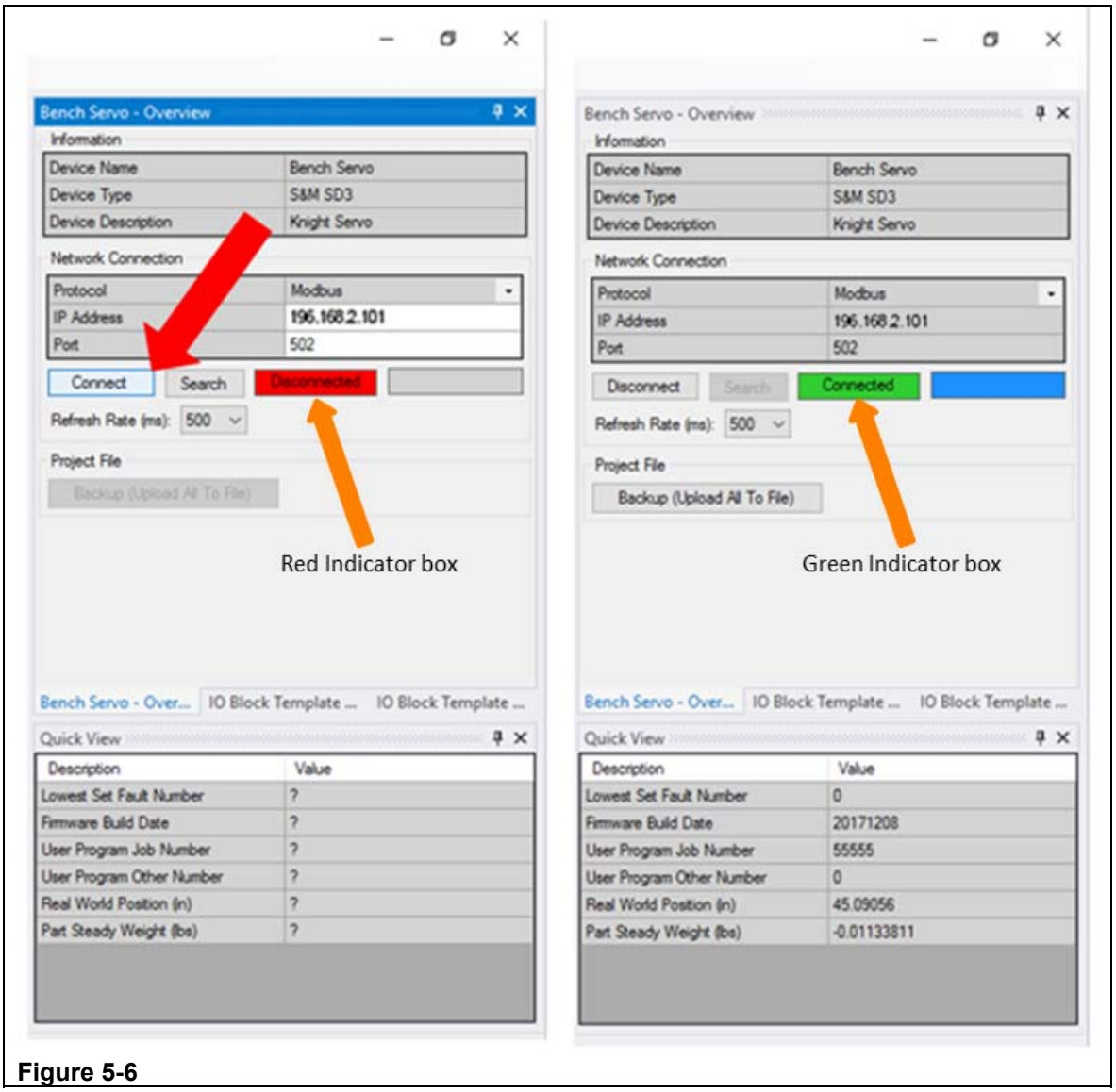


Figure 5-6

C. Backing up the Knight Servo Hoist Software

The section will explain how to save a backup copy of the 'Knight Servo Studio' (a .KSP file) and the 'Knight SD3 Program Editor' (a .PRJ file).

Save a copy of the Knight Servo Studio's .KSP file:

Step 1. Mouse up to the top menu bar located on the left-hand side of the screen and select 'File'. Highlight the 'Save To File' option and select it. (Refer to Figure 5-7)

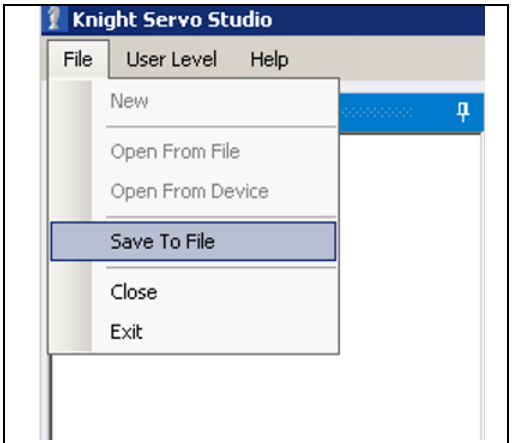


Figure 5-7

Step 2. Select the folder where to save the backup copy of the file. Ensure the Knight Work Order number is included in the filename. (Refer to Figure 5-8)

Knight suggests that a 'Controls' folder be created as well as subdirectories for each servo. The hoist's Work Order number should be used as the name for these new subdirectories.
i.e. \Controls\123748.

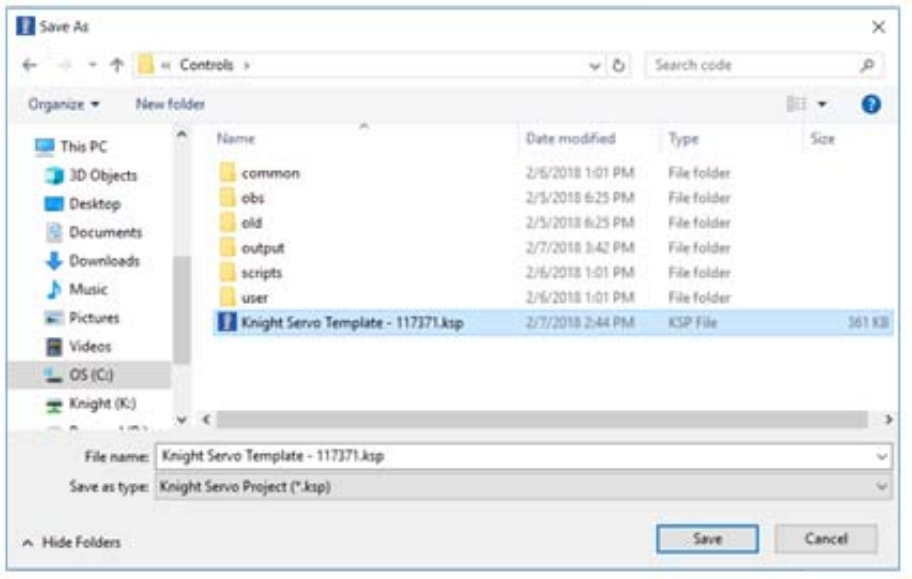


Figure 5-8

Step 3. Send a copy of the newly saved file to Knight's Servo Team at servos@knightglobal.com.

Save a copy of the Knight SD3 Program Editor's .PRJ file:

Step 1. Open the 'Knight SD3 Program Editor' by clicking on the appropriate Knight Icon. (Refer to Figure 5-9)

Figure 5-9

Step 2. After the program loads, mouse to the top menu, select the 'Project' Tab, then mouse down and select 'Upload…'. (Refer to Figure 5-10)

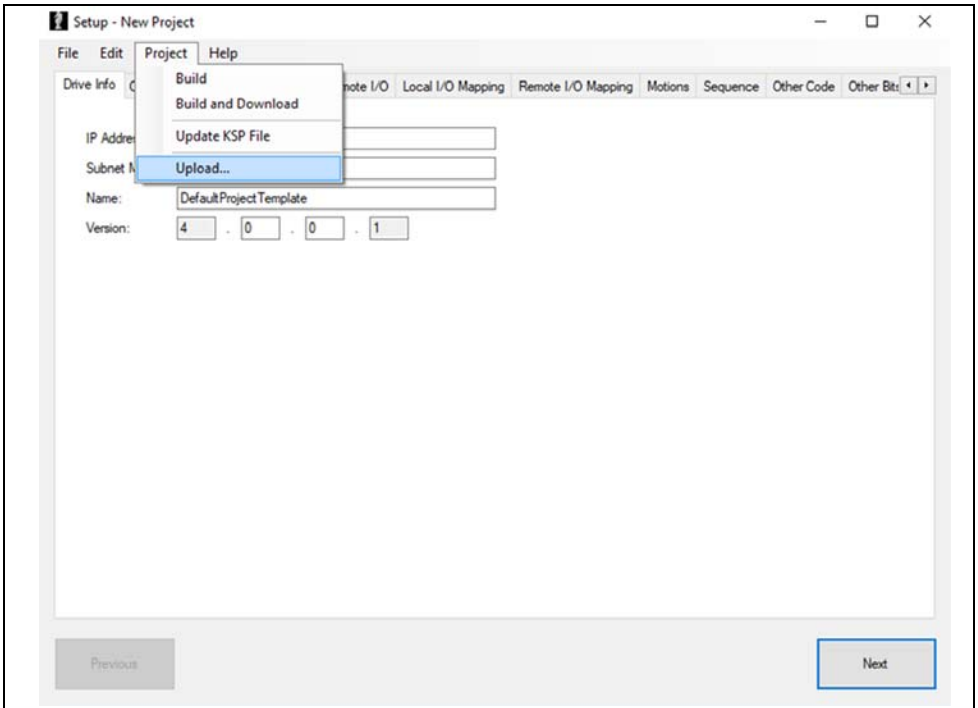


Figure 5-10

Step 3. Input the IP Address into the selection box that appears. In most cases the IP Address will be: 192.168.2.101 (Refer to Figure 5-11)

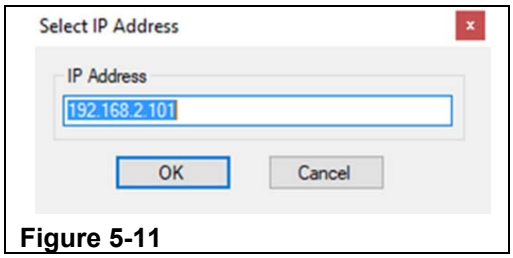


Figure 5-11

Step 4. The program will examine the servo drive and display the programs that are held within it. Highlight the latest one and press the 'Open' button. (Refer to Figure 5-12)

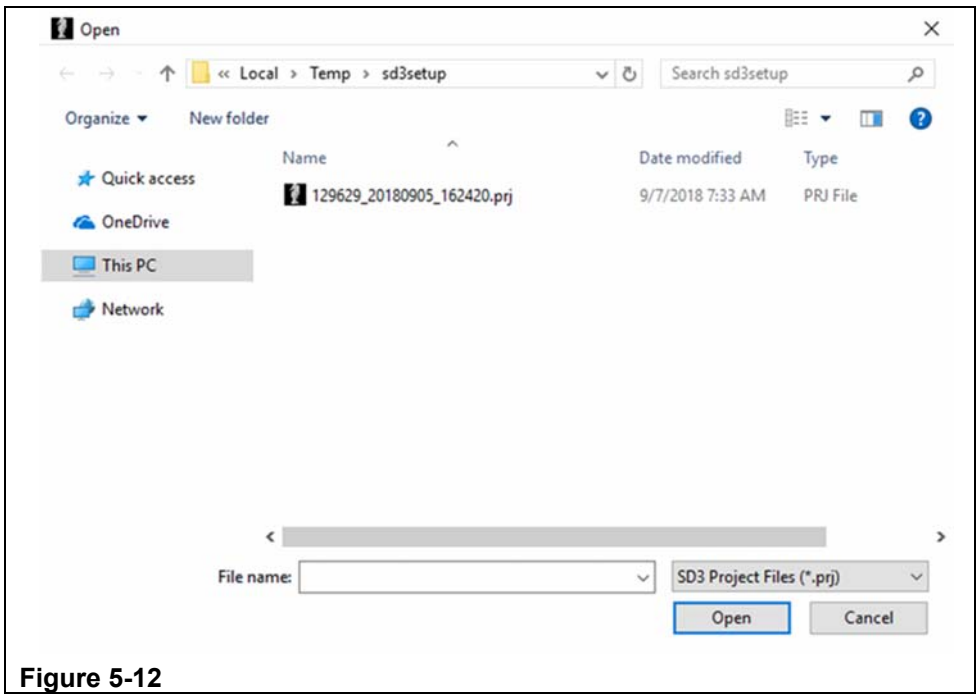


Figure 5-12

Step 5. After the program data is downloaded to the laptop, the program will display this new information inside the ‘Knight SD3 Program Editor’ on the ‘Drive Info’ Tab. (Refer to Figure 5-13)

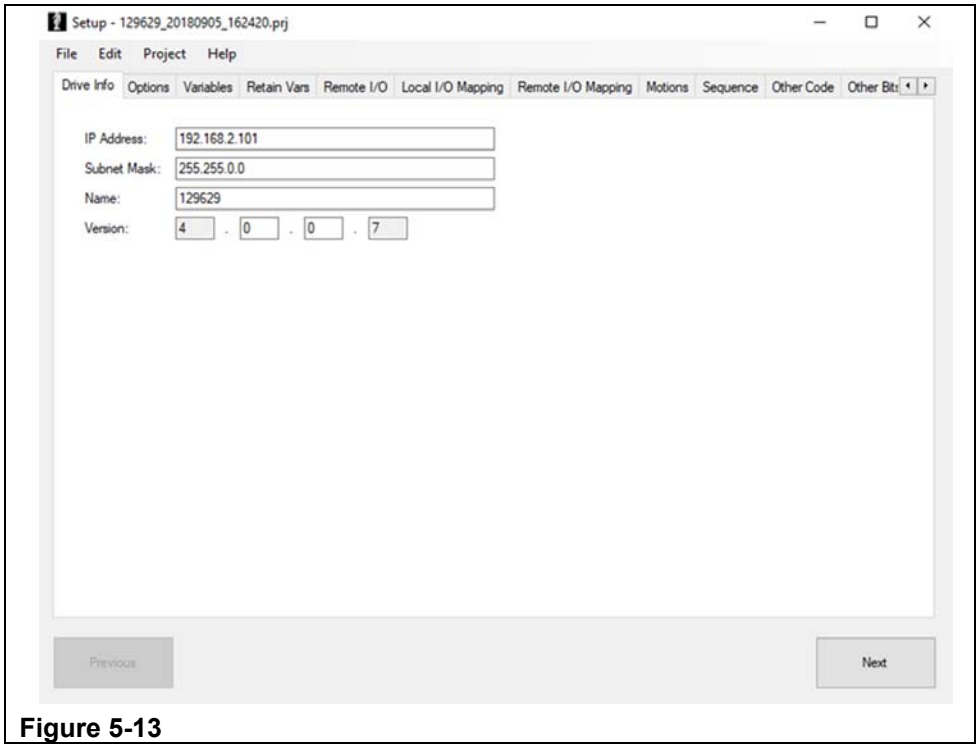


Figure 5-13

Step 6. The ‘Other Code’ Tab can be selected to review application specific code. (Refer to Figure 5-14)

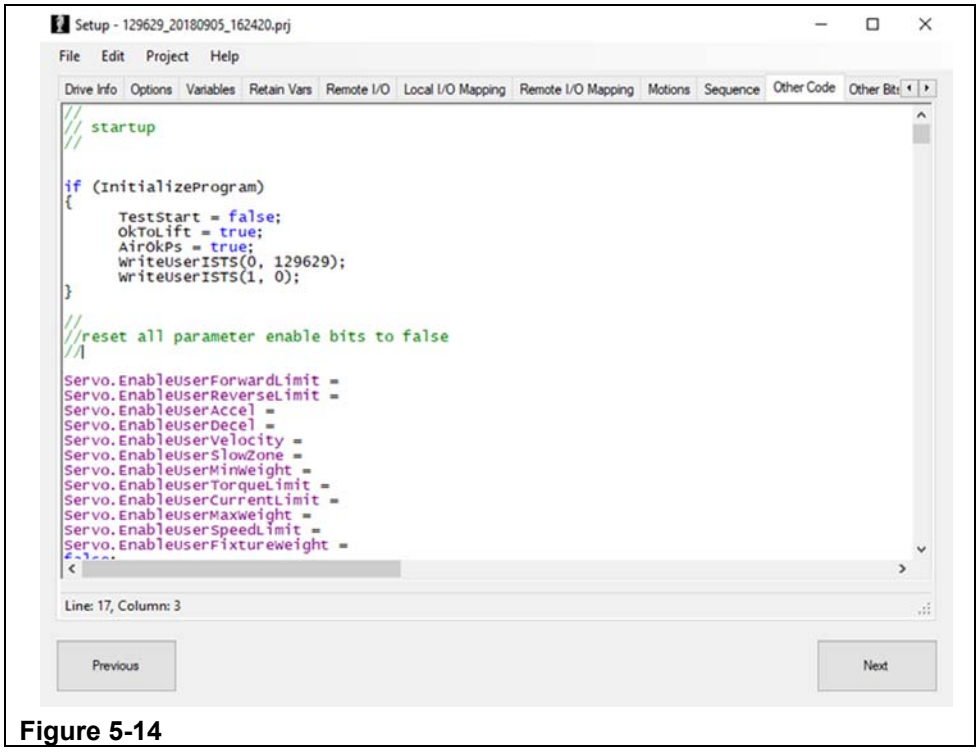


Figure 5-14

D. Load a New Drive with Existing Software

This section of the manual explains how to copy the Knight drive files from an old drive to a new drive.

Step 1. Lower the hoist's support fixture and part so that no load is suspended from the hoist.

WARNING

There can be NO load suspended from the hoist prior to replacing a drive.

Step 2. Press the Run-Stop button.

Step 3. Remove the 240VAC power from the system.

Step 4. In order to remove the old Drive from the Enclosure, remove the two #3 Phillips screws and then the cover from the top of the hoist's enclosure. (Refer to Figure 5-15)

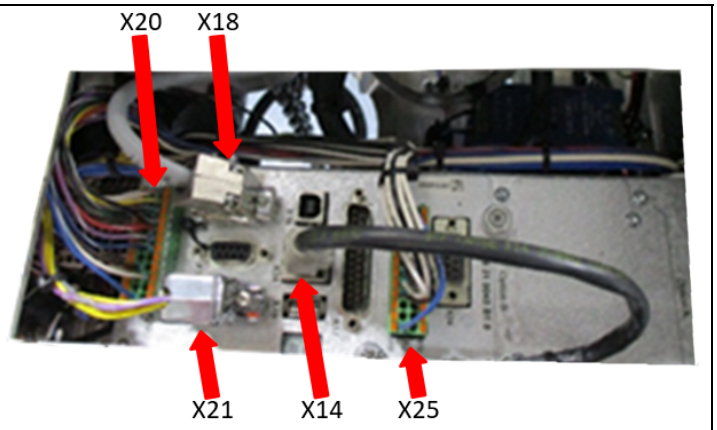


Figure 5-15

Step 5. Remove all of the connectors attached to the servo drive:

- X20: 24-pin connector.
- X18: Encoder cable.
- X21: D-sub connector.
- X14: Ethernet connector.
- X25: 24-pin connector.

Step 6. Remove the (2) two 10mm nuts that secure the servo to the bottom plate using a metric deep well socket wrench. The (2) two button head bolts that the nuts thread onto are 6mm and if they back out use a 4mm Allen wrench to secure them.

Step 7. Remove the I/O Modules from both of the old and new drives. This is accomplished by loosening the thumbscrews (use a #1 Philips if necessary) and then carefully lifting the I/O Module up off the top of the servo. (Refer to Figures 5-16)

Step 8. The SD card is now accessible and can be seen in the old drive. (Refer to Figures 5-17)

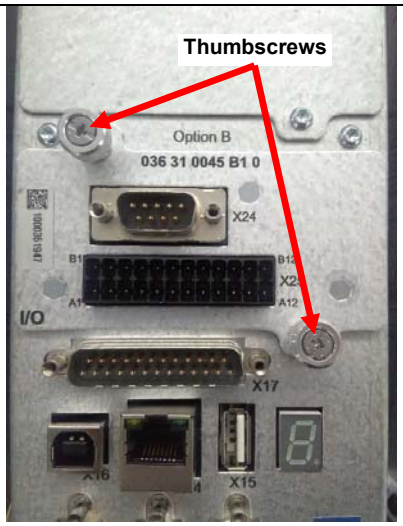


Figure 5-16

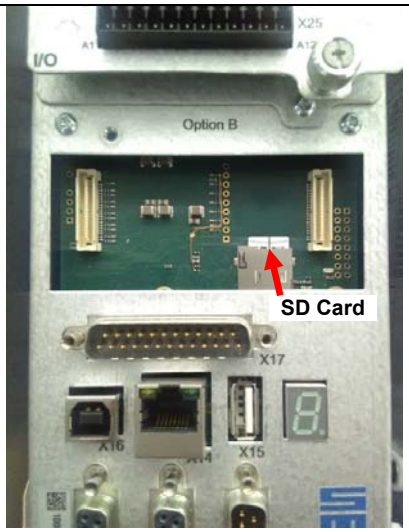


Figure 5-17

Step 9. Place you finger on the circuit board in front of the SD card. When the SD card is released it will spring back with enough force to move several inches. See Note below. (Refer to Figure 5-18)

Step 10. Eject the SD card by pressing it in with your other index finger and then allowing it to spring back. (Refer to Figure 5-19)

Figure 5-18

Figure 5-19

NOTE

When released, the SD card may spring out of the slot quickly. If there is nothing in front of the SD card, it may be ejected with enough force to move several inches and possibly drop down inside the servo.

After the SD Card is released, if it doesn't move forward far enough to be removed from the slot, you may need to move your finger off of the card more quickly.

Step 11. Label the SD card and keep it safe and accessible for replacement.

Step 12. Prepare the new Sieb and Meyer servo drive obtained from Knight Global for installation.

Step 13. Install the SD card into the new drive. This will guarantee that all of the parameters that depict the functionality of the system will be maintained.

Step 14. Re-install the I/O module into the new drive. Do not apply an excessive amount of force. The I/O module should easily slide into place if it is lined up correctly. Tighten the thumbscrews fully by hand, before using a #1 Philips screwdriver; Ensure the screws don't strip when tightening.

Step 15. Re-secure the new drive to the bottom plate of the hoist's enclosure and reattach all of the cable connectors:

- X20: 24-pin connector.
- X18: Encoder cable.
- X21: D-sub connector.
- X14: Ethernet connector.
- X25: 24-pin connector.

Step 16. Reinstall the cover on top of the hoist's enclosure. (Refer to Figure 5-15)

Step 17. Re-connect the 240VAC power to the drive.

Step 18. The Run-Stop red light and the green light will flash on and off briefly when the Servo Hoist has reinitialized. This will take 1-2 minutes after the unit has been powered up.

Step 19. Connect to the Servo Hoist by following the 5.B. "Connecting to a Servo Hoist" procedure.

Step 20. Check for any Drive Faults. A fault will be designated by an illuminated red box next to the fault's description on the Active Fault screen. See Chapter 7.B. for details. (Refer to Figure 5-20)

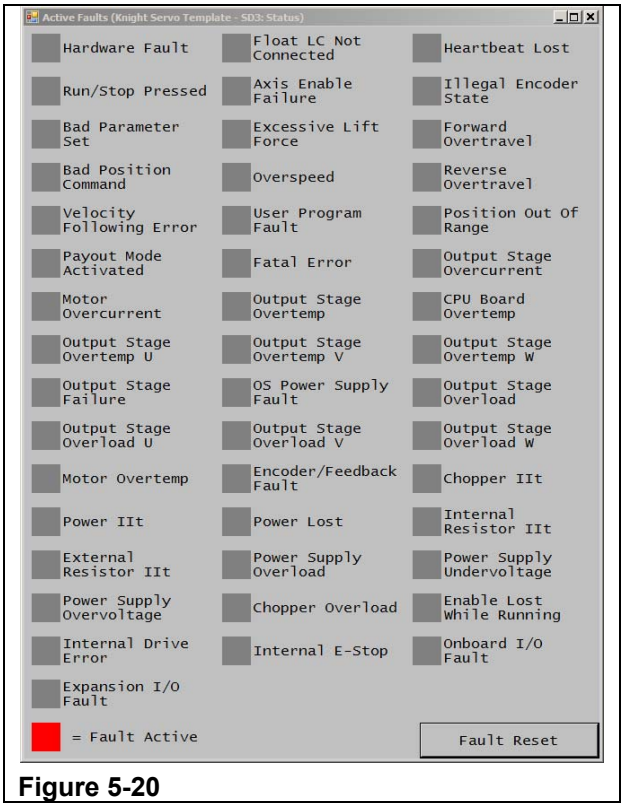


Figure 5-20

KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \ Active Faults

Step 21. Check for any Drive Warnings. A warning will be designated by an illuminated yellow box next to the warning's description on the Active Warnings screen. See Chapter 7.B. for details. (Refer to Figure 5-21)

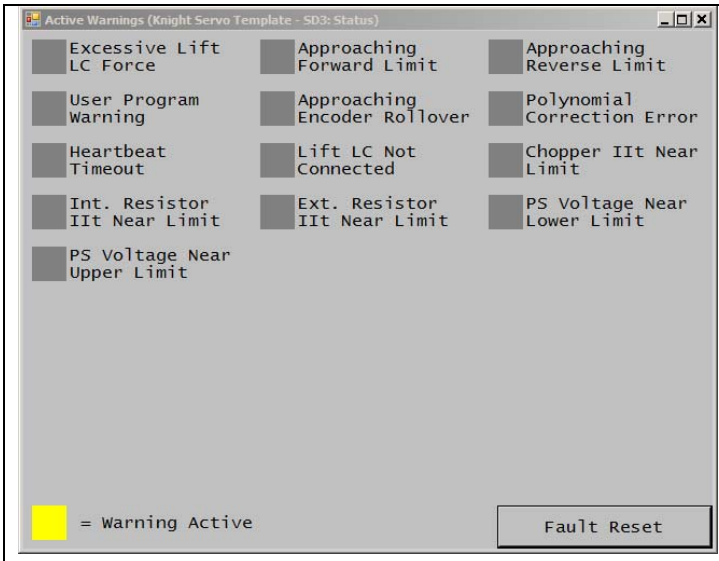


Figure 5-21

KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \ Active Warnings

Step 22. If the I/O devices connected to the I/O module are not working, verify that the green terminal block is correctly seated into the Remote I/O Module and that the module is installed properly into the servo drive.

Step 23. If the unit doesn't work properly, follow the troubleshooting screens located inside the Knight Servo Studio under the Troubleshooting branch of Workspace directory tree. (Refer to Figure 5-22)

Refer to Chapter 7 for a complete description of each screen listed on the directory tree below.

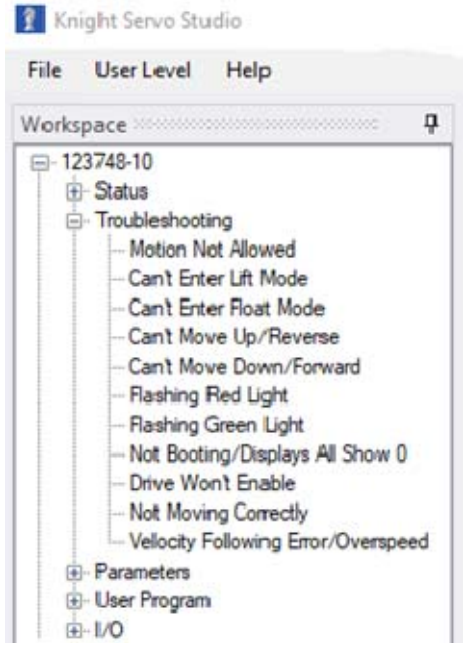


Figure 5-22

E. Check or Change Setup Values

The Knight Servo Studio Servo software can be used to setup the Knight servo drive. Follow these steps to configure the servo drive after a laptop has been connected to the system.
Refer to section 5.B. “Connecting to a Servo Hoist”.

Step 1. Mouse up to the top menu bar located on the left-hand side of the screen and select ‘User Level’. Highlight the ‘Advanced’ option and select it.

Step 2. Just below the top menu bar is a window named ‘Workspace’. There will be a ‘+’ sign next to the Job Number of the Knight servo you are doing maintenance on.
Press this ‘+’ button and a selection tree will appear.

Step 3. Mouse down the selection tree to ‘Setup’. Press the ‘+’ sign next to the ‘Setup’ selection. Double-click on the ‘Quick Setup’ option.

Step 4. This will display a screen labeled ‘Quick Setup (Job Number: Setup)’.

Quick Setup screen: (Refer to Figure 5-23)

Row #1) Float Load Cell setup: The ‘Re-Zero Float LC’ button should only be pressed if there is nothing hanging from the bottom of the Load Monitoring Module (LMM). This button is usually only pressed when the LMM has been replaced.

Row #2) Encoder Offset set-up: Inputting a number into the ‘Home Position’ box and pressing the ‘Set Encoder Offset’ button will equate the ‘Current Position’ of the hoist to that number.
The hoist is usually moved to its top position, a zero is entered into the ‘Home Position’ display, and the ‘Set Encoder Offset’ button is pressed equating this top position to zero inches.

Row #3) Upper / Lower limits: This Row displays the absolute Upper and Lower Limits of the Servo Hoist.

Row #4) Fixture Weight setup: If the weight of the fixture changes, ensure that the fixture is hanging free without a part or any extra weight hanging from it and press the ‘Set Fixture weight’ button to change the ‘Fixture Weight (lb)’ to the current ‘Total Weight (lb)’ displayed.

Row #5) Maximum rated capacity of the servo: This value should not be changed.

Row #6) Maximum allowed weight: This is the total amount of weight that the servo will lift. If this value is exceeded the servo will stop moving upward. I.e. an Up Stop Fault will be generated and processed.

Row #7) Minimum weight: This is the amount of weight that the servo will set down on a surface. This can be set to ensure that only a specific amount of weight is set down on a pallet or surface. Also, it ensures that the servo will not pay-out additional chain when the part is set down.

Row #8) Handle selection: This value should not be changed.

Row #9) Lift Load Cell setup: If the hoist has an analog handle this function is active.
The ‘Re-Zero Lift LC’ button can be pressed to equate the ‘Lift LC Bias’ to the ‘Lift LC Voltage’.
This function may also be used to stop the fixture from ‘drifting’ up or down. Ensure there is no external force affecting the handle and press the ‘Re-Zero Lift LC’ button.

Row #10) Commit Row: If ANY of the Rows above are changed, the ‘Commit’ button will turn yellow and must be pressed for that change to be processed by the servo.

NOTE: If any values are changed, ensure that the Servo Hoist program is backed up to the PC. See Chapter 5.C. ‘Backing up the Knight Servo Hoist Software’ for details.

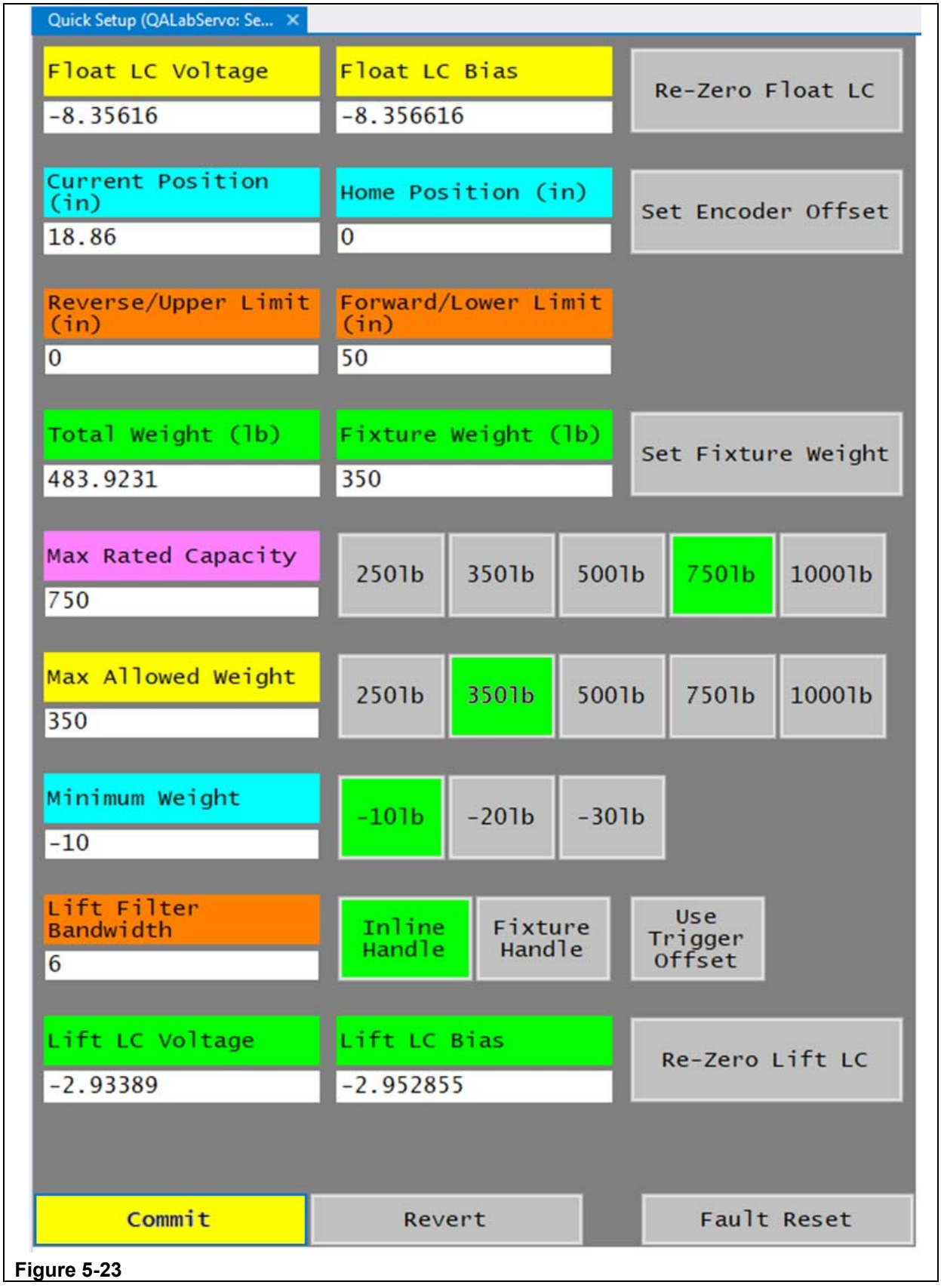

Quick Setup (QALabServo: Se...
Float LC Voltage
-8.35616
Float LC Bias
-8.356616
Re-Zero Float LC
Current Position (in)
18.86
Home Position (in)
0
Set Encoder Offset
Reverse/Upper Limit (in)
0
Forward/Lower Limit (in)
50
Total Weight (lb)
483.9231
Fixture Weight (lb)
350
Set Fixture Weight
Max Rated Capacity
750
250lb
350lb
500lb
750lb
1000lb
Max Allowed Weight
350
250lb
350lb
500lb
750lb
1000lb
Minimum Weight
-10
-10lb
-20lb
-30lb
Lift Filter Bandwidth
6
Inline Handle
Fixture Handle
Use Trigger Offset
Lift LC Voltage
-2.93389
Lift LC Bias
-2.952855
Re-Zero Lift LC
Commit
Revert
Fault Reset

Figure 5-23

F. Encoder Offset Setup Procedure

The Knight Servo Studio Servo software can be used to setup the Encoder Offset position of the servo. Refer to section 5.B. “Connecting to a Servo Hoist”.

Step 1. Follow the steps in the previous section to display the ‘Quick Setup’ screen.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 2.

Step 2. Use the fixture handle or digital controls to move the carriage to its overall top position.
This should be the maximum top point that the fixture will have to travel up to.

Step 3. Set the ‘Home Position (in)’ input box to a value of zero (0).

Step 4. Press the ‘Set Encoder Offset’ button. This will set the ‘Current Position (in)’ of the hoist to the ‘Home Position (in)’.
The ‘Commit’ button located on the bottom left-hand side of the panel will turn yellow.

Step 5. Press the ‘Commit’ button.
This will equate the current position of the hoist to its upper most or zero location.

G. Operating Chain Payout Mode

The ‘Chain Payout’ mode can be initiated from the Knight Servo Software.

Step 1. Mouse to the ‘Workspace’ panel and select the ‘+’ next to the Knight Work Order Number.
Step 2. Next, mouse to and select the ‘+’ next to ‘Motion’ and then double-click on ‘Chain Payout’.
Step 3. This will display a screen labeled ‘Chain Payout (Job Number: Motion)’.

Chain Payout screen: (Refer to Figure 5-24)

Row #1) Set the ‘Payout Mode Speed’. This should be set between 2 to 5.
The ‘Stop’ button will stop the movement of the hoist.

Row #2) Set the ‘Payout Mode Current Limit (A)’. This should be set to 3 for most applications.
Caution MUST be taken as damage may be caused to the servo or personnel if this value is set too high for a particular system.

WARNING

The ‘Payout Mode Current Limit (A)’ should be set to 3 for most applications. Caution MUST be taken as damage may be caused to the servo or personnel if this value is set too high for a particular system.

The ‘Pay In’ button will start Paying IN the chain.
The chain will move up toward the top limit of the servo.

Row #3) The ‘Payout Mode Backoff Distance (in)’ is for Knight internal use only and should be set to ZERO while Payout Mode is being used.
The ‘Pay Out’ button will start Paying OUT the chain.
The chain will move down toward the bottom limit of the servo.

Row #4) The ‘Payout mode Max Travel Distance’ is for Knight internal use only and should be set to ZERO while Payout Mode is being used.

Row #5) Commit Row: If ANY of the Rows above are changed, the ‘Commit’ button will turn yellow and must be pressed for that change to be processed by the servo.

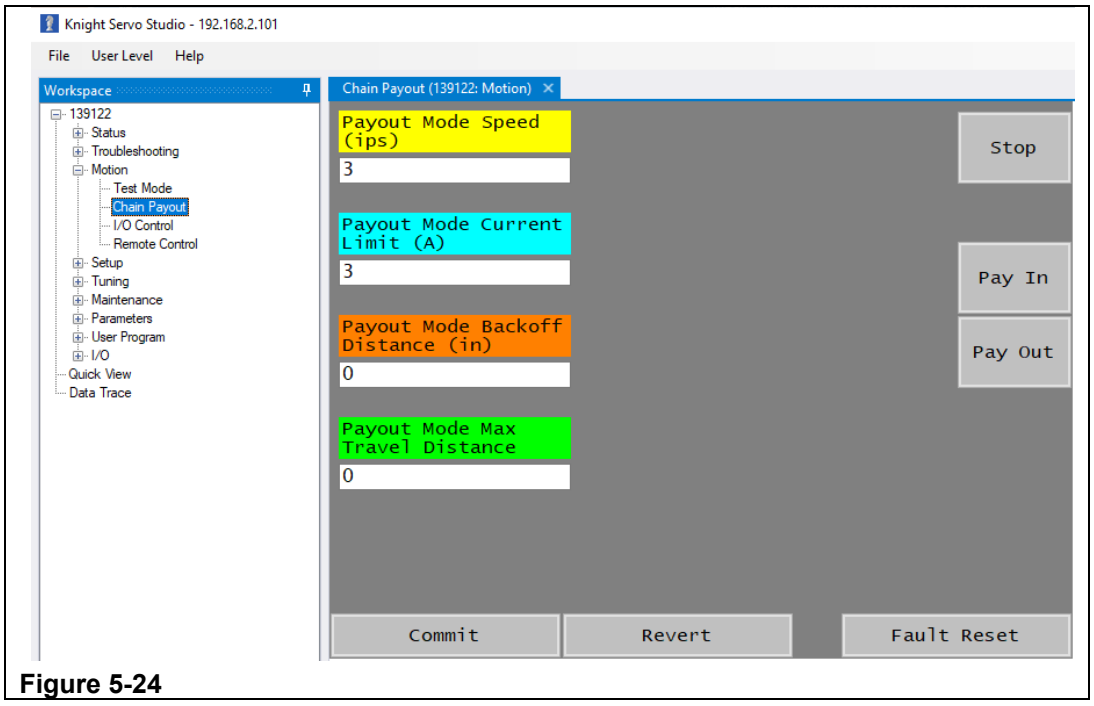


Figure 5-24

H. Operating Test Mode

The ‘Test Mode’ can be initiated from the Knight Servo Software.

Step 1. Mouse to the ‘Workspace’ panel and select the ‘+’ next to the Knight Work Order Number.
Step 2. Next, mouse to and select the ‘+’ next to ‘Motion’ and then double-click on ‘Test Mode’.
Step 3. This will display a screen labeled ‘Test Mode (Job Number: Motion)’.

Test Mode screen: (Refer to Figure 5-25)

Row #1) Upper and Lower limit setup: The hoist’s movement in the reverse direction will stop at the upper limit and its forward movement will stop at the lower limit.
Note: When the ‘Start’ button is pressed, the servo will move to the upper limit and then continue the test cycle.

Row #2) The ‘Velocity (ips)’ value should be set between 3 to 10.
The ‘Accel (ips^2)’ value should be set between 2 to 10.
The ‘Decel (ips^2)’ value should be set between 2 to 10.

Row #3) The ‘Delay (ms)’ value should equal the time it takes for the servo to move from the upper limit to the lower limit during the cycle. If using the settings on the screen below, the delay should be set to 6000ms or a six second delay.
The ‘Max Moves’ box displays the total number of cycles that the servo will perform in test mode.

Row #4) The ‘Move Count’ box will display the current number of cycles the hoist has performed.
Press the ‘Reset Counter’ button if the current number of cycles needs to be reset to zero.

Row #5) Press the ‘Start’ button once to start the test cycle. The button will turn green and the test will start within a few seconds.
Press the ‘Start’ button again to stop the test cycle. The button will turn grey and the hoist’s movement will immediately stop.

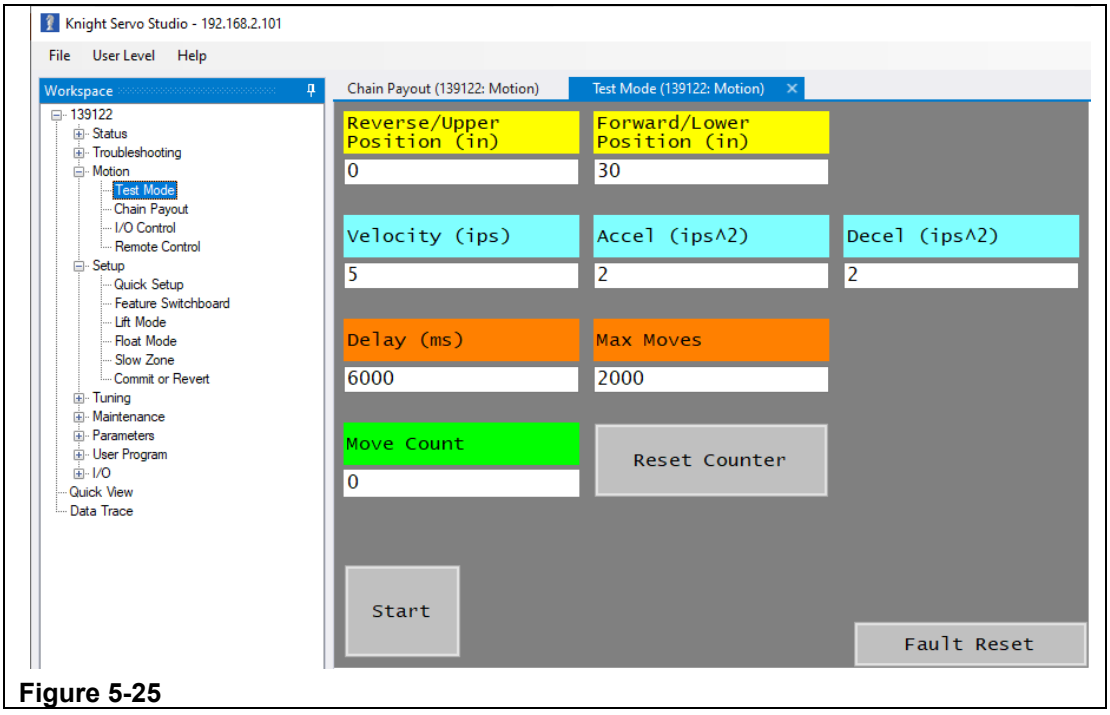


Figure 5-25

I. Accessing the Servo Hoist's Fault Log

The servo drive's Fault Log is accessible from its web page.

Step 1. Open your web browser and enter on the hoist's IP Address in the address bar. This will be 192.168.2.101 in most cases.

Step 2. The web page will be similar to what is shown in Figure 5-26.

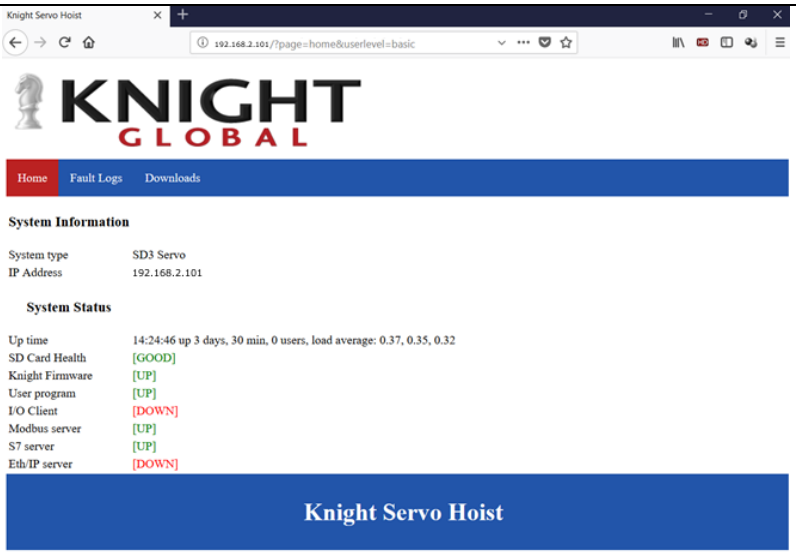


Figure 5-26

Step 3. Select the 'Fault Logs' button to see a list of all of the faults recorded by the servo. Each fault will have a 'Fault ID', a 'Description', the time the fault occurred and the duration the fault lasted. (Refer to Figure 5-27)

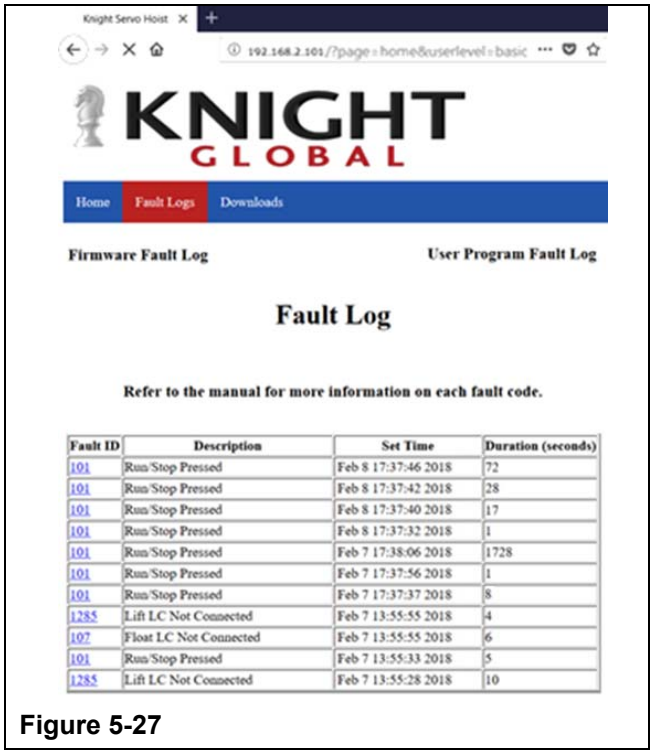


Figure 5-27

6. PARAMETER DESCRIPTIONS

There are several parameter status arrays described in this section:

6.A.) iSTS Status Array
6.B.) fSTS Status Array
6.C.) F8L1 Parameter Array
6.D.) User Retained Variables Parameter Array
6.E.) F8L2 Parameter Array
6.F.) F8L3 Parameter Array

A. iSTS Status Array

This complete array is reserved for internal use.

B. fSTS Status Array

This Global Array is used as a status file to review the current state of the Servo Hoist.

These parameters are listed in the fSTS array and can be displayed at:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Parameters \ fSTS \ Row xx.

Many of these parameters have equivalent displays located on various Knight Servo Studio (KSS) screens.
The location of these screens is listed at the end of each parameter's description.
See section 5. 'Software' for an explanation of the shorthand used.

fSTS:00 – Run-Stop
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter displays a '1' if the Run-Stop button is in the run position and the 19-pin straight cable is connected to the Servo Hoist. It will be a '0' if the Run-Stop button is in the opened condition or if the 19-pin straight cable is disconnected.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \ System Status Bits

fSTS:01 – Lowest Set Fault Number
Variable Units: Fault #
Description: This parameter displays the current drive fault if one exists. If the number is between 1 and 310 then a drive fault has occurred and will be displayed on the Knight Servo Studio Active Fault screen.
A complete list of faults is listed in this manual in section 7 under the heading 'Error Codes'.
KSS Home screen location: Quick View panel \ Row 1 (Lower right-hand portion of the screen).
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \ Active Faults

fSTS:02 and fSTS:03 – Spare

fSTS:04 – Current Mode (0=none, 1=Lift, 2=Float, 3=Position, 4=Payout)
Variable Units: Choice (0 = No Mode/Sleep, 1=Lift Mode, 2=Float Mode, 3=Test Mode)
Description: This parameter displays the current operating mode of the hoist.

fSTS:05 – Current Motion Time (s)
Variable Units: Seconds
Description: This parameter displays the time it took to complete the last cycle.

fSTS:06 through fSTS:09 – Spare

fSTS:10 – Float Load Cell Raw Voltage
Variable Units: Volts
Description: This parameter displays the analog voltage from the float load cell.

fSTS:11 – Float Load Cell Filtered Voltage
Variable Units: Volts
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:12 – Float Load Cell Bias Voltage
Variable Units: Volts
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:13 – Float Load Cell Raw Weight Reading (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:14 – Zeroed and Filtered Weight Reading (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:15 – Total Filtered and Compensated Weight (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:16 – Floating Weight (lb)
Variable Units: Pounds
Description: This parameter displays the weight used by the hoist while it is in Float Mode.

fSTS:17 – Steady Part Weight (lb)
Variable Units: Pounds
Description: This parameter displays the weight of the part hanging from the fixture or inline handle.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 4.
KSS Home screen location: Quick View panel \ Row 6 (Lower right-hand portion of the screen).

fSTS:18 – Float Load Cell Weight - Fixture Weight (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:19 – Float Load Cell Scaled Value (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the float load cell.

fSTS:20 – Lift Load Cell Raw Voltage
Variable Units: Volts
Description: Analog voltage from the lift load cell.

fSTS:21 – Lift Load Cell Filtered Voltage
Variable Units: Volts
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:22 – Lift Load Cell Bias Voltage
Variable Units: Volts
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:23 – Lift Load Cell Raw Weight Reading (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:24 – Lift Load Cell Adjusted Weight (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:25 – Lift Load Cell Weight (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:26 – Lift Load Cell Weight, Filtered (lb)
Variable Units: Pounds
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:27 – Lift Weight - Adjusted, Zeroed, Filtered (lb)
Variable Units: Pounds
Description: This parameter displays the force applied to the fixture or inline handle.

fSTS:28 – Spare

fSTS:29 – Motor Encoder Raw Position (in)
Variable Units: Inches
Description: This parameter displays the encoder information directly from the motor.

fSTS:30 – Motor Encoder Real World Position (in)
Variable Units: Inches
Description: This parameter displays the normalized encoder information.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 2.
KSS Home screen location: Quick View panel \ Row 5 (Lower right-hand portion of the screen).

fSTS:31 – Command Velocity (ips)
Variable Units: Inches per second
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:32 – Feedback Velocity (ips)
Variable Units: Inches per second
Description: This parameter displays an intermediate calculation of the force exerted on the lift load cell.

fSTS:33 – 2nd Float Load Cell Raw Voltage
Variable Units: Volts
Description: This parameter displays information relating to a second float load cell.

fSTS:34 – 2nd Float Load Cell Filtered Voltage
Variable Units: Volts
Description: This parameter displays information relating to a second float load cell.

fSTS:35 – 2nd Float Load Cell Bias Voltage
Variable Units: Volts
Description: This parameter displays information relating to a second float load cell.

fSTS:36 – Feedback Acceleration (ips^2)
Variable Units: Inches per second^2
Description: This parameter displays the feedback acceleration of the hoist.

fSTS:37 and fSTS:38 – Spare

fSTS:39 – Lift Mode Max Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum speed of the hoist when in Lift Mode.

fSTS:40 – Float Mode Max Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum speed of the hoist when in Float Mode.

fSTS:41 – Max Motor Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum speed the hoist can move.

fSTS:42 – Max Command Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum command speed the hoist will accept.

fSTS:43 – Command Current
Variable Units: Amps
Description: This parameter displays the instantaneous command current of the hoist.

fSTS:44 and fSTS:45 – Spare

fSTS:46 – Total Distance (in)
Variable Units: Inches
Description: This parameter displays the overall distance the servo has traveled since delivery.

fSTS:47 – Lift Mode Distance (in)
Variable Units: Inches
Description: This parameter displays the total distance the servo has traveled while in Lift Mode.

fSTS:48 – Float Mode Distance (in)
Variable Units: Inches
Description: This parameter displays the total distance the servo has traveled while in Float Mode.

fSTS:49 – Position Mode Distance (in)
Variable Units: Inches
Description: This parameter displays the total distance the servo has traveled while in position mode.

fSTS:50 through fSTS:127 are reserved for User Program code located in the Knight SD3 Program Editor's .PRJ file under the 'Other Code' Tab.

C. F8L1 Parameter Array

This array stores the parameters that are most frequently adjusted by the end user. This list contains parameters used to fine tune the hoist's performance. It also contains configuration parameters that must be adjusted after maintenance to the servo, motor or gearbox or after modification of the fixture or lift handle.

These parameters are listed in the F8L1 array and can be displayed at:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Parameters \ F8L1 \ Row xx.

Many of these parameters have equivalent displays located on various Knight Servo Studio (KSS) screens. The location of these screens is listed at the end of each parameter's description.
See section 5. 'Software' for an explanation of the shorthand used.

F8L1:00 – Initial Settings
Variable Units: Various
Description: *Reserved for internal use only.*

F8L1:01 – Calibration Weight
Variable Units: Pounds
Description: *Reserved for internal use only.*

F8L1:02 – Voltage Difference
Variable Units: Volts
Description: *Reserved for internal use only.*

F8L1:03 and F8L1:04 – Spare

F8L1:05 – Reverse/Upper Limit (in)
Variable Units: Inches
Description: This parameter sets the upper travel limit for the hoist. This value should be set to a number greater than or equal to zero. The home position or absolute physical top limit of the hoist's movement is set to zero inches.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 3.

F8L1:06 – Forward/Lower Limit (in)
Variable Units: Inches
Description: This parameter sets the lower travel limit for the hoist. This value should be set to the physical lowest limit of the hoist.
NOTE: All measurements increase in value as the fixture moves downward towards the ground.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 3.

F8L1:07 – Spare

F8L1:08 – Handle Weight (lb)
Variable Units: Pounds
Description: This parameter is not currently used for software calculations.

F8L1:09 – Fixture Weight (lb)
Variable Units: Pounds
Description: This parameter is used to show the static weight of all equipment hanging below the hoist's Load Monitoring Module (LMM). This equipment includes the hook, shackle and fixture. This parameter must be adjusted if the fixture is modified or replaced.
See section 5.D. 'Check or Change Setup Values' to modify this parameter.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 4.

F8L1:10 – Spare

F8L1:11 – Encoder Offset (in)
Variable Units: Inches
Description: This parameter sets the offset that the hoist uses to compute its home position. It offsets the absolute encoder's zero position so the hoist's zero position becomes the position at the physical upper limit of its travel. A setting of zero indicates a non-absolute incremental motor and is only for compatibility with legacy systems. This parameter must be adjusted when the motor, gearbox or chain are replaced.
See section 5.D. 'Check or Change Setup Values' to modify this parameter.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 2.

F8L1:12 – Decel Rate at Limits (ips^2)
Variable Units: Inches per second^2
Description: This parameter sets the rate of deceleration when the hoist reaches its top and bottom limits. These limits are typically F8L1:5 'Reverse/Upper Limit (in)' and F8L1:6 'Forward/Lower Limit (in)'. The greater the number the quicker the hoist slows down when it approaches a limit.

F8L1:13 through F8L1:20 – Spare

F8L1:21 – Max Weight (lb)
Variable Units: Pounds
Description: This parameter sets the maximum load that the Servo Hoist will lift. This includes the weight of the fixture and the part.
NOTE: F8L2:21 'Max Weight Override (lb)' also restricts the maximum load that the hoist will lift. F8L1:21 must be set to a value less than or equal to the value of F8L2:21.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 6.

F8L1:22 – Min Weight (lb)
Variable Units: Pounds
Description: This parameter limits the load that the Servo Hoist will set down on a surface. In other words, once the weight supported by the hoist measures below this value, the Servo Hoist will not set down any more weight and hence will not pay out any more chain.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Quick Setup \ Row 7.

F8L1:23 – Lift Mode Timeout (minutes)
Variable Units: Minutes
Description: This parameter sets the length of time that the hoist will stay in Lift Mode unattended. When idle for longer than this specified time, the hoist will disable itself and revert to No Mode. If this variable is set to zero, the hoist will not switch from Lift Mode to No Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 1.

F8L1:24 – Lift Mode Speed Limit (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum lift velocity for the Servo Hoist while in Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 1.

F8L1:25 through F8L1:28 – Spare

F8L1:29 – Lift Handle Force Sense (Float) (lb)
Variable Units: Pounds
Description: Before the hoist switches from Float Mode to Lift Mode, this amount of force is required to be registered on a fixture or inline handle. This parameter only applies to systems that do not have a trigger that enables Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 2.

F8L1:30 – Lift Handle Force Sense (not Float) (lb)
Variable Units: Pounds
Description: Before the hoist switches from No Mode to Lift Mode, this amount of force is required to be registered on a fixture or inline handle. This parameter only applies to systems that do not have a trigger that enables Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 2.

F8L1:31 – Lift Handle Force Deadband (lb)
Variable Units: Pounds
Description: This parameter sets the amount of input force that is required to be registered on a fixture or inline handle to start motion.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 3.

F8L1:32 through F8L1:35 – Spare

F8L1:36 – Digital Lift Fast Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum velocity for a hoist with discrete up/down controls. This parameter is used by the software when a digital lever is fully depressed.
Note: Applies to systems with up/down pendants or wireless transmitters only.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 4.

F8L1:37 – Digital Lift Normal Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the minimum velocity for a hoist with discrete up/down controls. This parameter is used by the software when a digital lever is only depressed half way.
Note: Applies to systems with up/down pendants or wireless transmitters only.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 4.

F8L1:38 – Digital Lift Accel (ips^2)
Variable Units: Inches per second^2
Description: This parameter sets the acceleration for hoists with discrete up/down controls.
Note: Applies to systems with up/down pendants or wireless transmitters only.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 5.

F8L1:39 – Digital Lift Decel (ips^2)
Variable Units: Inches per second^2
Description: This parameter sets the deceleration for hoists with discrete up/down controls.
Note: Applies to systems with up/down pendants or wireless transmitters only.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Lift Mode \ Row 5.

F8L1:40 – Spare

F8L1:41 – Float Mode Top Limit (in)
Variable Units: Inches
Description: This parameter sets the upper travel limit for the hoist when it is in Float Mode. This is used to restrict the Float Mode travel to a position greater than the overall upper limit set in F8L1:5 'Reverse/Upper Limit (in)'.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Float Mode \ Row 2.

F8L1:42 – Float Mode Bottom Limit (in)
Variable Units: Inches
Description: This parameter sets the lower travel limit for the hoist when it is in Float Mode. This is used to restrict the Float Mode travel to a position less than the overall lower limit set in F8L1:6 'Forward/Lower Limit (in)'.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Float Mode \ Row 2.

F8L1:43 – Float Mode Timeout (minutes)
Variable Units: Minutes
Description: This parameter sets the length of time that the hoist will stay in Float Mode unattended. When idle for longer than this specified time the hoist will disable and revert to No Mode. If this variable is set to zero, the hoist will not switch from Float Mode to No Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Float Mode \ Row 1.

F8L1:44 – Float Mode Speed Limit (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum velocity of the Servo Hoist when it is in Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Float Mode \ Row 1.

F8L1:45 – Float Force Deadband (lb)
Variable Units: Pounds
Description: This parameter sets the minimum amount of force that is required to be exerted on the fixture or part hanging from the bottom of the Load Monitoring Module to start motion while the hoist is in Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Float Mode \ Row 3.

F8L1:46 through F8L1:77 – Spare

F8L1:78 – Slow Zone Mode (0 = off, 1 = down, 2 = up, 3 = both)
Variable Units: Choice (0=off, 1=down, 2=up, 3=up and down)
Description: This parameter configures the hoist's automatic slow zone. This parameter works with the variables F8L1:79 to F8L1:84 to configure the automatic slow zone.
0 = Slow Zone feature is disabled.
1 = Program will automatically decrease the speed of the hoist only when moving down.
2 = Program will automatically decrease the speed of the hoist only when moving up.
3 = Program will automatically decrease the speed of the hoist when moving up or down.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 1.
NOTE: If using this function, all parameters (F8L1:79 to F8L1:84) must be non-zero for the Slow Zone to function correctly.

F8L1:79 – Slow Zone Part Loaded Weight (lb)
Variable Units: Pounds
Description: This parameter sets the number of pounds that the hoist needs to register in order to indicate that a part is loaded on the fixture.
This parameter is only processed if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 2.

F8L1:80 – Slow Zone Part Loaded Position (in)
Variable Units: Inches
Description: This parameter sets the height that the hoist will start to run at a reduced speed when a part is loaded.
This parameter is only processed if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
NOTE: The current position of the hoist is visible in fSTS: 30 "Real World Position" or on the KSS Home screen location: Quick View panel \ Row 5 (Lower right-hand portion of the screen).
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 2.

F8L1:81 – Slow Zone Part Loaded Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the reduced speed that the hoist runs at when a part is loaded and it is below the F8L1:80 'Slow Zone Part Loaded Position' parameter.
This parameter is only processed if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 2.

F8L1:82 – Slow Zone Part Unloaded Position (in)
Variable Units: Inches
Description: This parameter sets the height that the hoist will start to run at a reduced speed when a part is not loaded. This is only valid if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 3.

F8L1:83 – Slow Zone Part Unloaded Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the reduced speed that the hoist runs at when a part is not loaded and it is below the F8L1:82 'Slow Zone Part Unloaded Position' parameter.
This parameter is only processed if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 3.

F8L1:84 – Slow Zone Max Decel (ips^2)
Variable Units: Inches per second^2
Description: This parameter sets the deceleration constant when the hoist approaches the slow zone and transitions from the normal speed to the reduced speed.
This parameter is only processed if the Slow Zone is turned on. i.e. F8L1:78 'Slow Zone Mode' is not zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 4.

F8L1:85 – Slow Zone Invert
Variable Units: Boolean (0=Off, 1=On)
Description: The slow zone usually is only initiated when the hoist is Below the slow zone heights. This parameter changes the functionality of the slow zone so that it initiates when the hoist is Above the stated heights.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Setup \ Slow Zone \ Row 1.

F8L1:86 through F8L1:255 – Spare

D. User Retained Variables Parameter Array

This array displays all of the user retained variables for the hoist.

These parameters are listed in the User Retained Variables array and can be displayed at:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ User Program \ UserRetainVars \ Row xx

UserRetainVars:00 – Test Mode Upper Position
Variable Units: Inches
Description: This parameter sets the upper travel limit for the hoist while it is in Test Mode. This value should be set to a number greater than or equal to zero and should not be less than F8L1:05 'Reverse/Upper Limit (in)'.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 1

UserRetainVars:01 – Test Mode Lower Position
Variable Units: Inches
Description: This parameter sets the lower travel limit for the hoist while it is in Test Mode. This value should be set to a number greater than the UserRetainVars:00 'Test Mode Upper Position' parameter.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 1

UserRetainVars:02 – Test Mode Target Velocity
Variable Units: Inches per second
Description: This parameter sets the speed of the hoist while it is in Test Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 2

UserRetainVars:03 – Test Mode Target Acceleration
Variable Units: Inches per second^2
Description: This parameter sets the acceleration of the hoist while it is in Test Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 2

UserRetainVars:04 – Test Mode Target Deceleration
Variable Units: Inches per second^2
Description: This parameter sets the deceleration of the hoist while it is in Test Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 2

UserRetainVars:05 – Test Mode Delay Between Moves
Variable Units: Milliseconds
Description: This parameter sets the time delay between upward and downward cycles of the hoist while it is in Test Mode. The hoist will move up, delay at its upper position, move down and then delay at its lower position.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 3

UserRetainVars:06 – Test Mode Target Move Count
Variable Units: Count
Description: This parameter sets number of movements the hoist will perform while it is in Test Mode. This count will be increased for every move up and move down the hoist completes. i.e. A complete up and down cycle of the hoist will count as TWO movements.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 3

UserRetainVars:07 – Test Mode Start Test Cycle
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter starts the Test Mode if it is a One and stops Test Mode if it is a Zero.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 5

UserRetainVars:08 – Test Mode Current Movement Count
Variable Units: Count
Description: This parameter sets displays the current movement count of the hoist while it is in Test Mode.
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ Test Mode \ Row 4

UserRetainVars:09 through UserRetainVars:11 – Spare

UserRetainVars:12 – Part Loaded Weight (lb)
Variable Units: Pounds
Description: This is a weight in pounds that triggers the part loaded bit On. If the current weight hanging from the fixture is greater than this parameter, then the part loaded bit is On. If the current weight hanging from the fixture is less than this parameter, then the part loaded bit is Off.

UserRetainVars:13 – Clear to Rotate Position (in)
Variable Units: Inches
Description: This parameter sets a height that the hoist must be above to allow the Rotate function to execute.

UserRetainVars:14 – Fixture Down Force (lb)
Variable Units: Pounds
Description: This parameter controls the amount of weight that the hoist has to set down before permitting the clamp open motion to execute. This ensures that the operator places at least a portion of the part's weight down on a surface before allowing the part clamp to open.

UserRetainVars:15 – Tilt Window Upper Position, Loaded (in)
Variable Units: Inches
Description: This parameter sets the upper limit of the window that allows the Tilt function to execute while the hoist is loaded. i.e. The Part Weight (fSTS:17 'Steady Part Weight') is greater than the value in UserRetainVar:12 'Part Loaded Weight (lb)'.

UserRetainVars:16 – Tilt Window Lower Position, Loaded (in)
Variable Units: Inches
Description: This parameter sets the lower limit of the window that allows the Tilt function to execute while the hoist is loaded. i.e. The Part Weight (fSTS:17 'Steady Part Weight') is greater than the value in UserRetainVar:12 'Part Loaded Weight (lb)'.

UserRetainVars:17 – Tilt Window Upper Position, Unloaded (in)
Variable Units: Inches
Description: This parameter sets the upper limit of the window that allows the Tilt function to execute while the hoist is unloaded. i.e. The Part Weight (fSTS:17 'Steady Part Weight') is less than the value in UserRetainVar:12 'Part Loaded Weight (lb)'.

UserRetainVars:18 – Tilt Window Lower Position, Unloaded (in)
Variable Units: Inches
Description: This parameter sets the lower limit of the window that allows the Tilt function to execute while the hoist is unloaded. i.e. The Part Weight (fSTS:17 'Steady Part Weight') is less than the value in UserRetainVar:12 'Part Loaded Weight (lb)'.

UserRetainVars:19 and UserRetainVars:20 – Spare

UserRetainVars:21 – Fixture Disconnected Maximum Lift Weight (lb)
Variable Units: Pounds
Description: This parameter sets the maximum weight that the hoist is allowed to lift when the fixture is not connected to the Load Monitoring Module (LMM).

UserRetainVars:22 – Parameter Set 1 Target Velocity (ips)
Variable Units: Inches per second
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the velocity during an automatic move function.

UserRetainVars:23 – Parameter Set 1 Target Acceleration (ips^2)
Variable Units: Inches per second^2
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the acceleration during an automatic move function.

UserRetainVars:24 – Parameter Set 1 Target Deceleration (ips^2)
Variable Units: Inches per second^2
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the deceleration during an automatic move function.

UserRetainVars:25 – Parameter Set 1 Target Position (in)
Variable Units: Inches
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the destination for an automatic move function.

UserRetainVars:26 – Parameter Set 1 Float Weight (lb)
Variable Units: Pounds
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the weight used by Float Mode instead of using the normal instantaneous weight obtained when Float Mode is initiated.

UserRetainVars:27 – Parameter Set 1 Forward/Lower Limit (in)
Variable Units: Inches
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the lower travel limit for the hoist.

UserRetainVars:28 – Parameter Set 1 Reverse/Upper Limit (in)
Variable Units: Inches
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the upper travel limit for the hoist.

UserRetainVars:29 – Parameter Set 1 Minimum Part Weight (lb)
Variable Units: Pounds
Description: This Parameter Set 1 variable must be enabled. If enabled, it limits the load that the Servo Hoist will set down on a surface.

UserRetainVars:30 – Parameter Set 1 Maximum Total Weight (lb)
Variable Units: Pounds
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the maximum load that the Servo Hoist will lift.

UserRetainVars:31 – Parameter Set 1 Maximum Torque (Nm)
Variable Units: Newton meters
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the maximum motor feedback torque allowed.

UserRetainVars:32 – Parameter Set 1 Maximum Motor Current (A)
Variable Units: Amps
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the maximum current sent to the motor.

UserRetainVars:33 – Parameter Set 1 Maximum Velocity (ips)
Variable Units: Inches per second
Description: This Parameter Set 1 variable must be enabled. If enabled, it sets the maximum speed that the Servo Hoist may travel.

UserRetainVars:34 – Parameter Set 1 Fixture Weight (lb)
Variable Units: Pounds
Description: This Parameter Set 1 variable must be enabled. If enabled, it shows the static weight of all equipment hanging below the hoist's Load Monitoring Module (LMM).

UserRetainVars:35 – Parameter Set 1 Invert Slow Zone
Variable Units: Boolean (0=Off, 1=On)
Description: The Parameter Set 1slow zone usually is only initiated when the hoist is Below the Parameter Set 1slow zone heights. This parameter changes the functionality of the Parameter Set 1slow zone so that it initiates when the hoist is Above the stated Parameter Set 1 heights.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:36 – Parameter Set 1 Slow Zone Mode
Variable Units: Choice (0=off, 1=down, 2=up, 3=up and down)
Description: This Parameter Set 1 variable must be enabled. If enabled, the hoist's automatic slow zone will be active.
This parameter works with the User Retained Variables 37 - 42 to configure the Parameter Set 1 slow zone.
0 = Parameter Set 1 Slow Zone feature is disabled.
1 = Program will automatically decrease the speed of the hoist only when moving down.
2 = Program will automatically decrease the speed of the hoist only when moving up.
3 = Program will automatically decrease the speed of the hoist when moving up or down.
NOTE: If using this function, all parameters (37 to 42) must be non-zero for the Slow Zone to function correctly.

UserRetainVars:37 – Parameter Set 1 Slow Zone Part Loaded Sense Weight (lb)
Variable Units: Pounds
Description: This parameter sets the number of pounds that the hoist needs to register in order to indicate that a part is loaded on the fixture.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:38 – Parameter Set 1 Slow Zone Part Loaded Max Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the reduced speed that the hoist moves at when a part is loaded and it is below the UserRetainVar:39 'Parameter Set 1 Slow Zone Part Loaded Position (in)' parameter.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:39 – Parameter Set 1 Slow Zone Part Loaded Position (in)
Variable Units: Inches
Description: This parameter sets the height that the hoist will start to move at a reduced speed when a part is loaded.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.
NOTE: The current position of the hoist is visible in fSTS: 30 "Real World Position" or on the KSS Home screen location: Quick View panel \ Row 5 (Lower right-hand portion of the screen).

UserRetainVars:40 – Parameter Set 1 Slow Zone Part Unloaded Max Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the reduced speed that the hoist moves at when a part is unloaded and it is below the UserRetainVar:41 'Parameter Set 1 Slow Zone Part Unloaded Position (in)' parameter.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:41 – Parameter Set 1 Slow Zone Part Unloaded Position (in)
Variable Units: Inches
Description: This parameter sets the height that the hoist will start to move at a reduced speed when a part is unloaded.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:42 – Parameter Set 1 Slow Zone Entry Decel Rate
Variable Units: Inches per second^2
Description: This parameter sets the deceleration rate of the hoist as it transitions from its normal speed to its slow zone speed.
This parameter is only processed if the Parameter Set 1 Slow Zone is turned on:
i.e. UserRetainVar:36 'Parameter Set 1 Slow Zone Mode' is not zero.

UserRetainVars:43 through UserRetainVars:63 – Parameter Set 2
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:64 through UserRetainVars:84 – Parameter Set 3
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:85 through UserRetainVars:105 – Parameter Set 4
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:106 through UserRetainVars:126 – Parameter Set 5
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:127 through UserRetainVars:147 – Parameter Set 6
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:148 through UserRetainVars:168 – Parameter Set 7
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:169 through UserRetainVars:189 – Parameter Set 8
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:190 through UserRetainVars:210 – Parameter Set 9
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:211 through UserRetainVars:231 – Parameter Set 10
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:232 through UserRetainVars:252 – Parameter Set 11
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:253 through UserRetainVars:273 – Parameter Set 12
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:274 through UserRetainVars:294 – Parameter Set 13
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:295 through UserRetainVars:315 – Parameter Set 14
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

UserRetainVars:316 through UserRetainVars:336 – Parameter Set 15
Variable Units: See above
Description: These parameters are described in the Parameter Set 1 section: UserRetainVars:22 to 42.

E. F8L2 Parameter Array

This array stores advanced parameters that affect the performance of the hoist. These parameters should only be adjusted with the aid of a Knight Representative.

These parameters are listed in the F8L2 array and can be displayed at:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Parameters \ F8L2 \ Row xx.

Many of these parameters have equivalent displays located on various Knight Servo Studio (KSS) screens. The location of these screens is listed at the end of each parameter's description.
See section 5. 'Software' for an explanation of the shorthand used.

WARNING

ALL variables in the **F8L2** parameter list should **NOT** be manipulated without the aid of a Knight representative.

F8L2:00 – Spare

F8L2:01 – Inline Handle Trigger Bias (V)
Variable Units: Volts
Description: *Reserved for internal use only.*

F8L2:02 – Spare

F8L2:03 – Reverse Encoder Direction
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter sets the forward direction of the encoder. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 1½.

F8L2:04 – Spare

F8L2:05 – Gear Ratio
Variable Units: Integer
Description: This parameter states the gear ratio of the gear reducer. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 4.

F8L2:06 – Max Motor Speed (RPM)
Variable Units: RPM
Description: This parameter states the maximum revolutions per minute of the servo motor. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 1.

F8L2:07 – Lift Load Cell Gain (lb/V)
Variable Units: Pounds per Volt
Description: This parameter states the gain of the lift load cell. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Analog Calibration \ Row 3.

F8L2:08 – Float Load Cell Gain (lb/V)
Variable Units: Pounds per Volt
Description: This parameter states the gain of the float load cell. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Analog Calibration \ Row 2.

F8L2:09 – Lift Load Cell Bias (V)
Variable Units: Volts
Description: This parameter states the value of the lift load cell's analog input when there is no external force exerted on the handle. This is a physical property and should not be modified unless the fixture or inline handle is replaced.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Analog Calibration \ Row 3.

F8L2:10 – Float Load Cell Bias (V)
Variable Units: Volts
Description: This parameter states the value of the float load cell's analog input when there is no external weight hanging from the Load Monitoring Module (LMM). This is a physical property and should not be modified unless the LMM is replaced.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Analog Calibration \ Row 2.

F8L2:11 – Reverse Motor Direction
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter sets the direction of the servo motor. This is a physical property of the servo motor and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 1.

F8L2:12 – Spare

F8L2:13 – Max Velocity Following Error (ips)
Variable Units: Inches per second
Description: This parameter sets the maximum acceptable amount of following error allowable by the hoist. This is used by the controller for detecting a velocity following error which generates a fault number of 104.

F8L2:14 – Chain Pitch (mm)
Variable Units: Millimeters
Description: This parameter states the pitch or length of each chain link. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 2.

F8L2:15 – Chain Links per Revolution
Variable Units: Number of Chain Links Per Rev
Description: This parameter states the size of the drive sprocket. This is a physical property and should not be modified.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Motor and Gearbox \ Row 3.

F8L2:16 – Fault Decel Rate (ips^2)
Variable Units: Inches per second^2
Description: This parameter sets the deceleration rate of the hoist when a fault occurs. The minimum setting for this is 50in/s^2.

F8L2:17 – Lift Mode Allow Down Full Speed
Variable Units: Boolean (0=Off, 1=On)
Description: Setting this parameter to a 1 (or On) allows the hoist to travel at its maximum speed when lowering its load in Lift Mode. This speed is dynamically limited by the load weight when moving upwards in Lift Mode. Setting this to a 0 (or Off) dynamically limits the speed when lifting and lowering in Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Lift Mode \ Row 4.

F8L2:18 – Hard Stop Home Position (in)
Variable Units: Inches
Description: This parameter displays the "real world" position after accepting a value by pressing the 'Set Encoder Offset' button on the 'Quick Setup' screen.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Quick Setup \ Row 2.

F8L2:19 – Spare

F8L2:20 – Lift Mode Enable
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter is used to enable or disable Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Lift Mode \ Row 1.

F8L2:21 – Max Weight Override (lb)
Variable Units: Pounds
Description: This sets the maximum load that the Servo Hoist will lift. This includes the weight of the fixture and the part.
NOTE: Parameter F8L1:21 'Max Weight (lb.)' also restricts the maximum load. F8L1:21 must be set to a value less than or equal to the value of F8L2:21.

F8L2:22 – Up Stop Resume Bandwidth (lb)
Variable Units: Pounds
Description: *Reserved for internal use only.*

F8L2:23 – Down Stop Resume Bandwidth (lb)
Variable Units: Pounds
Description: *Reserved for internal use only.*

F8L2:24 – Up/Down Stop Resume Time (ms)
Variable Units: Milliseconds
Description: *Reserved for internal use only.*

F8L2:25 – Lift Mode Max Speed Scale Factor
Variable Units: Factor
Description: This factor is multiplied by F8L1:24 'Lift Mode Speed Limit (ips)' to obtain the maximum lift speed of the hoist. This value is normally a one. Any value above one will increase the hoist's maximum speed and any value below one will reduce the hoist's maximum speed.

F8L2:26 – Spare

F8L2:27 – Impulse Limiting Enable
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter is used to enable the hoist's impulse limiting code. When this code is enabled, the hoist will sense an instantaneous increase in weight registered by the float load cell and slow the hoist to reduce the impact on the system. Instead of suddenly moving the load upwards, the hoist senses the impulse and automatically slows down to a controlled speed.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Impulse Limiting \ Row 1.

F8L2:28 – Impulse Limiting Max Speed (ips)
Variable Units: Inches per second
Description: This parameter sets the speed that the hoist will slow to when impulse limiting is enabled and a sudden movement is detected.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Impulse Limiting \ Row 2.

F8L2:29 – Impulse Limiting Max Speed Time (ms)
Variable Units: Seconds
Description: This parameter sets the duration that the slow speed will be active when impulse limiting is enabled and a sudden movement is detected.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Impulse Limiting \ Row 2.

F8L2:30 – Lift Analog Handle Enable
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter is used to enable an analog handle. This parameter is enabled for systems that have an inline or fixture handle.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Lift Mode \ Row 2.

F8L2:31 – Lift Filter Bandwidth
Variable Units: Frequency
Description: This parameter controls how quickly the hoist responds to force changes on the lift load cell. The larger the number the faster the hoist reacts to changes in force applied to the analog handle.

F8L2:32 – Lift Analog Decel on Trigger Release (ips^2)
Variable Units: Inches per second^2
Description: *Reserved for internal use only.*

F8L2:33 – Lift Proportional Accel (ips^2)
Variable Units: Inches per second^2
Description: *Reserved for internal use only.*

F8L2:34 – Lift Proportional Decel (ips^2)
Variable Units: Inches per second^2
Description: *Reserved for internal use only.*

F8L2:35 – Lift Command Force Limit (lb)
Variable Units: Pounds
Description: This parameter sets the maximum lift command that can be given to the hoist via an analog handle without generating a fault. For example, if this parameter is set to 100lbs and a force of more than 100lbs is applied to the handle while the hoist is in Lift Mode then the software will generate a fault.

F8L2:36 – Lift Cancel Gain
Variable Units: Real Number
Description: This parameter controls how much of the force registered on the lift load cell is subtracted from the force seen on the float load cell when using a fixture handle.

F8L2:37 – Spare

F8L2:38 – Lift Digital PB Enable
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter is used to enable a digital handle. This parameter is enabled for systems that have a single-speed or two-speed pushbutton control handle or a wireless transmitter pendant.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Lift Mode \ Row 3.

F8L2:39 – Spare

F8L2:40 – Float Mode Enable
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter is used to enable or disable Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Float Mode \ Row 1.

F8L2:41 through F8L2:44 – Spare

F8L2:45 – Float Mode Max Speed Scale Factor
Variable Units: Factor
Description: This factor is multiplied by F8L1:44 'Float Mode Speed Limit (ips)' to obtain the maximum speed of the hoist while it is in Float Mode. This value is normally a one. Any value above one will increase the hoist's maximum speed and any value below one will reduce the hoist's maximum speed.

F8L2:46 through F8L2:50 – Spare

F8L2:51 – "In Position" Velocity Window
Variable Units: Inches
Description: *Reserved for internal use only.*

F8L2:52 – Spare

F8L2:53 – Float Proportional Accel (ips^2)
Variable Units: Inches per second^2
Description: *Reserved for internal use only.*

F8L2:54 – Float Proportional Decel (ips^2)
Variable Units: Inches per second^2
Description: *Reserved for internal use only.*

F8L2:55 – Float Command Force Limit (lb)
Variable Units: Pounds
Description: This parameter sets the maximum float command that can be given to the hoist without generating a fault. For example, if this parameter is set to 100lbs and a force of more than 100lbs is applied to the fixture or part while the hoist is in Float Mode then the software will generate a fault.

F8L2:56 through F8L2:59 – Spare

F8L2:60 – Float Proportional Gain
Variable Units: Real Number
Description: This parameter sets the target velocity per unit of force exerted on the float load cell while the hoist is in Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Float Mode \ Row 4.

F8L2:61 – Float Filter Scale Factor
Variable Units: Real Number
Description: This parameter sets how quickly the force applied to the load suspended from the Load Monitoring Module changes the float command velocity.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Float Mode \ Row 4.

F8L2:62 – Spare

F8L2:63 – Float Force Filter Trim Scale Factor
Variable Units: Real Number
Description: This parameter allows the hoist to respond quicker to a float motion input command. The higher the value, the easier it is to begin movement of the hoist while it is in Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Setup \ Float Mode \ Row 5.

F8L2:64 – Max Speed for Jerk Limiting (ips)
Variable Units: Inches per second
Description: This parameter controls the maximum velocity the hoist can be travelling at and still reset the "Hit Ground" bit while it is in Float Mode.

F8L2:65 – Disable Gear Unlock Code
Variable Units: Real Number
Description: When this parameter is enabled, it limits the initial maximum velocity of Float Mode. When the hoist slows below the speed listed in F8L3[68] 'Gear Unlock Feedback Velocity (ips)', then the software will prevent any increase in speed over F8L3[67] 'Gear Unlock Command Velocity (ips)' for the amount of time in F8L3[69] 'Gear Unlock Time (ms)'. After this delay, the hoist is allowed to ramp up towards its commanded velocity.

F8L2:66 – Spare

F8L2:67 – Enable Accelerometer
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:68 – Accelerometer Gain (G/V)
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*
F8L2:69 and F8L2:70 – Spare

F8L2:71 – Enable Stress Relief Logic
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:72 – Spare

F8L2:73 – Polynomial Weight Correction Factor 6
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:74 – Polynomial Weight Correction Factor 5
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:75 – Polynomial Weight Correction Factor 4
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:76 – Polynomial Weight Correction Factor 3
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:77 – Polynomial Weight Correction Factor 2
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:78 – Polynomial Weight Correction Factor 1
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:79 – Polynomial Weight Correction Factor 0
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:80 – Touch Filter Bandwidth
Variable Units: Real Number
Description: This parameter controls how quickly the system triggers a Down Stop or Up Stop in response to exceeding the minimum or maximum weight. The larger the number the more quickly the hoist responds.

F8L2:81 – Steady Weight Filter Constant
Variable Units: Real Number
Description: This parameter controls how quickly the "Steady Part Weight" value changes in response to changes in float load cell force. The larger the number the more quickly the hoist responds.

F8L2:82 – Spare

F8L2:83 – Active Damping Filter Constant (LF)
Variable Units: Real Number
Description: This parameter is used in conjunction with F8L2:86 'Active Damping Gain (LF)' to prevent low frequency oscillations occurring at the control handle.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 1.

F8L2:84 – Spare

F8L2:85 – Active Damping Filter Constant (HF)
Variable Units: Real Number
Description: This parameter is used in conjunction with F8L2:87 'Active Damping Gain (HF)' to prevent high frequency oscillations occurring at the control handle.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 2.

F8L2:86 – Active Damping Gain (LF)
Variable Units: Real Number
Description: This parameter is used in conjunction with F8L2:83 'Active Damping Filter Constant (LF)' to prevent low frequency oscillations occurring at the control handle.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 1.

F8L2:87 – Active Damping Gain (HF)
Variable Units: Real Number
Description: This parameter is used in conjunction with F8L2:85 'Active Damping Filter Constant (HF)' to prevent high frequency oscillations occurring at the control handle.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 2.

F8L2:88 and F8L2:89 – Spare

F8L2:90 – Active Damping Min Gain (Lift)
Variable Units: Real Number
Description: This parameter sets the lowest point the velocity-based ramp-down multiplier can reach. This is only valid for Lift Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 3.

F8L2:91 – Active Damping Min Gain (Float)
Variable Units: Real Number
Description: This parameter sets the lowest point the velocity-based ramp-down multiplier can reach. This is only valid for Float Mode.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 3.

F8L2:92 – Active Damping Always On
Variable Units: Boolean (0=Off, 1=On)
Description: This parameter controls whether or not the low frequency Active Damping velocity is ramped down based on velocity. If the value is a one (or On), the hoist will only control the ramp function while it is moving down towards the ground. If the value is a zero (or Off), it will control the velocity in both directions.

F8L2:93 – Active Damping Ramp Down Start Position (in)
Variable Units: Inches
Description: This parameter sets the point at which the active damping velocity starts to ramp down based on position.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 4.

F8L2:94 – Active Damping Ramp Down Min Gain Position (in)
Variable Units: Inches
Description: This parameter sets the point at which the position-based ramp reaches its minimum multiplier value.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 4.

F8L2:95 – Active Damping Ramp Down Min Gain
Variable Units: Real Number
Description: This parameter sets the lowest point the position-based ramp-down multiplier can reach.
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Tuning \ Active Dampening Filters \ Row 4.

F8L2:96 – Enable LF AD Notch Filter
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:97 – Enable HF AD Notch Filter
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:98 – 2nd Float LC Gain (lb/V)
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:99 – 2nd Float LC Bias (V)
Variable Units: *Reserved for internal use only.*
Description: *Reserved for internal use only.*

F8L2:100 through F8L2:255 – Spare

WARNING

ALL variables in the **F8L2** parameter list should **NOT** be manipulated without the aid of a Knight representative.

F. F8L3 Parameter Array

This entire array is reserved for internal use.

7. TROUBLESHOOTING

There are several troubleshooting screens described in this section:

7.A.) Troubleshooting Screens
7.B.) System Activity screens including Faults, Warnings and Error Codes
7.C.) Troubleshooting Inputs and Outputs
7.D.) Troubleshooting Chart

A. Troubleshooting Screens

There are several Troubleshooting screens covered in this section. Each of these screens is listed below and can be accessed inside the Knight Servo Studio (KSS) software from:

KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Troubleshooting \ …

7a) Motion Not Allowed screen
7b) Can't Enter Lift Mode screen
7c) Can't Enter Float Mode screen
7d) Can't Move Up/Reverse screen
7e) Can't Move Down/Forward screen
7f) Flashing Red Light screen
7g) Flashing Green Light screen
7h) Not Booting/Displays All Show 0 screen
7i) Drive Won't Enable screen
7j) Not Moving Correctly screen
7k) Velocity Following Error / Overspeed screen

See section 5. ‘Software’ for an explanation of the shorthand used.

7a) Motion Not Allowed screen

This screen lists the steps to trace down the reason why the hoist's motion is not allowed.

In section (I), if the indicator box is green then the hoist's motion is allowed, but if the indicator box is red then the hoist's motion is restricted.

If the hoist's motion is restricted, follow the steps listed on the screen below. (Refer to Figure 7-1)

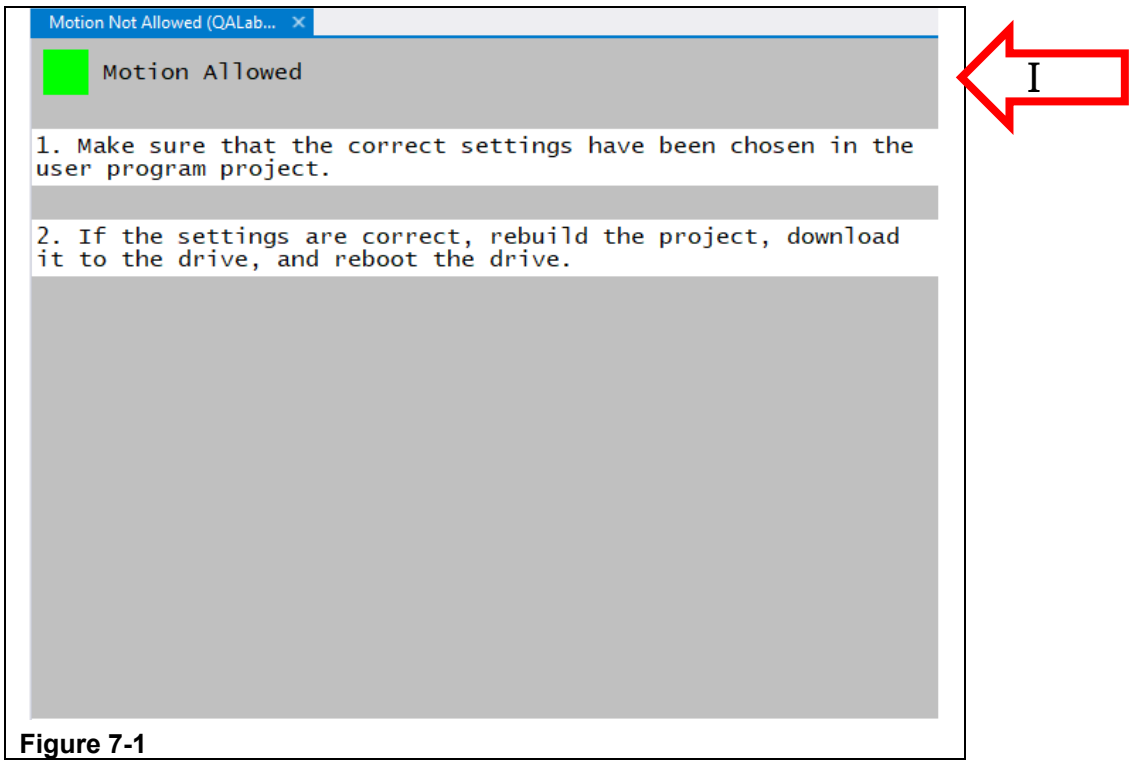


Figure 7-1

7b) Can't Enter Lift Mode screen

This screen lists the steps to trace down the reason why the hoist will not enter Lift Mode.

In section (I), if the indicator box is green then the function is on, but if the indicator box is red then the function is off.
In section (II), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off.
In section (III), if the indicator box is green then the function is on, but if the indicator box is red then the function is off.

If the hoist will not enter Lift Mode, ensure all of the conditions listed on the screen below are met. (Refer to Figure 7-2)

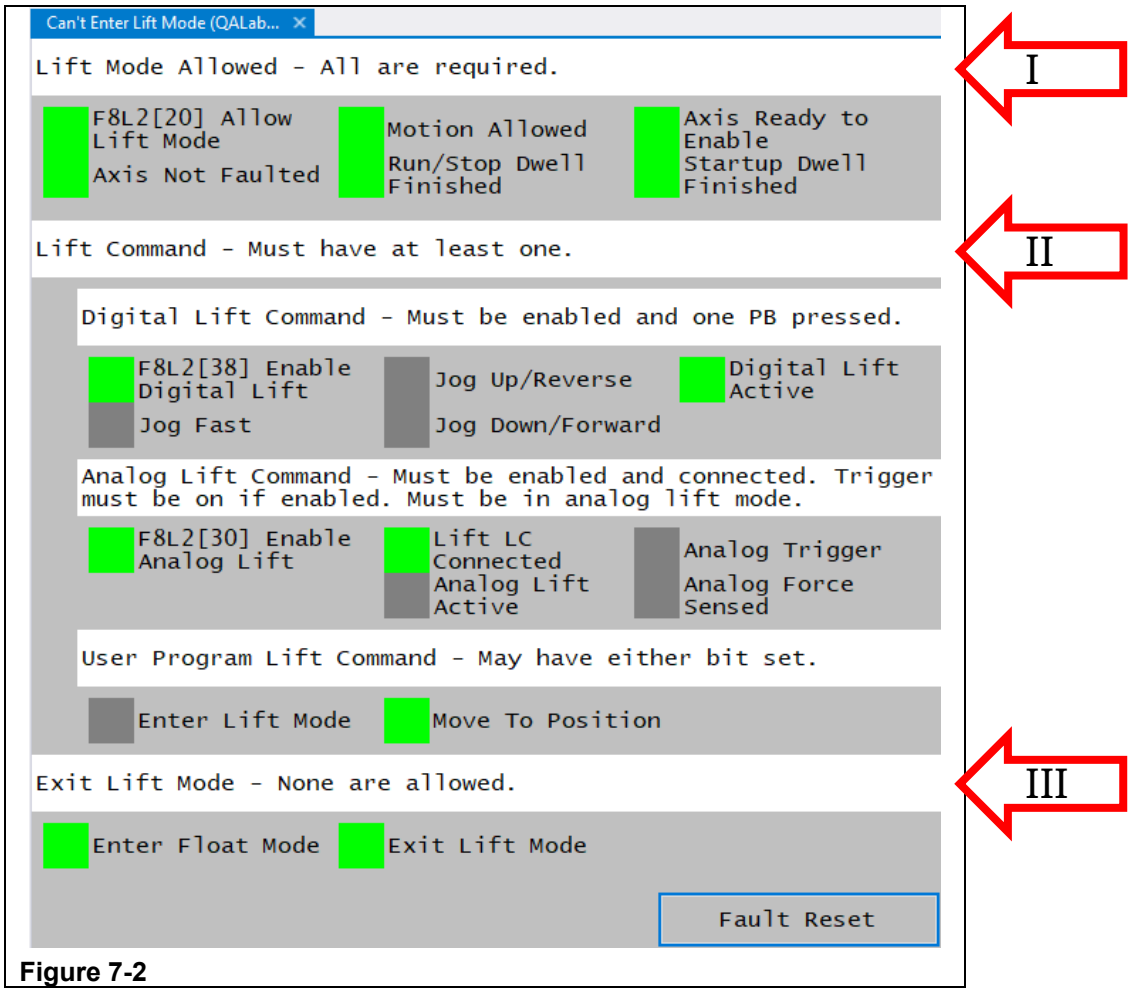


Figure 7-2

7c) Can't Enter Float Mode screen

This screen lists the steps to trace down the reason why the hoist will not enter Float Mode.

In section (I), if the indicator box is green then the function is on, but if the indicator box is red then the function is off.
In section (II), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off.
In section (III), if the indicator box is green then the function is on, but if the indicator box is red then the function is off.

If the hoist will not enter Float Mode, ensure all of the conditions listed on the screen below are met. (Refer to Figure 7-3)

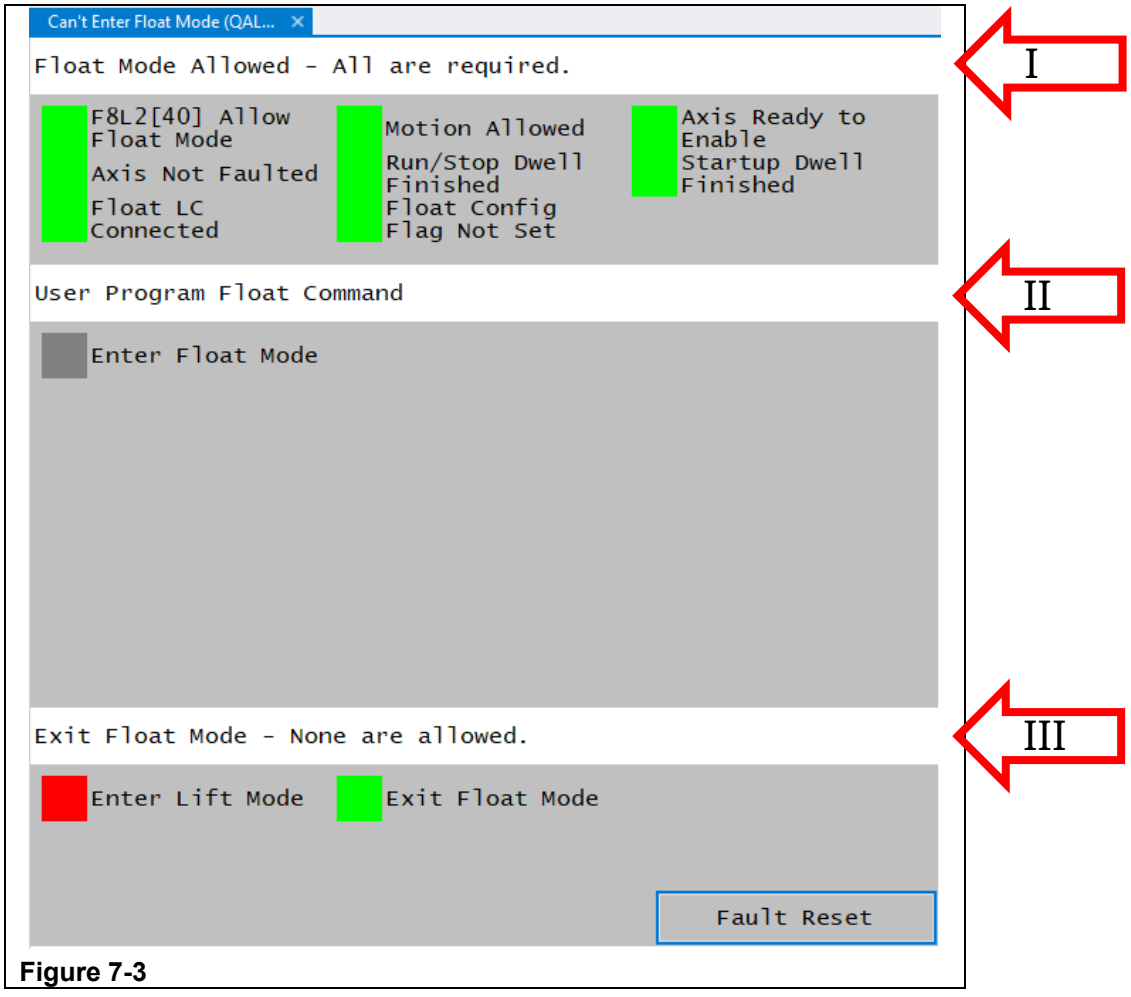


Figure 7-3

7d) Can't Move Up / Reverse screen

This screen lists the steps to trace down the reason why the hoist won't move upwards towards the bottom of the servo.

In section (I), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off.
In section (II), the current measured weight is shown as well as the maximum weight the hoist will lift.
In section (III), the current position is shown as well as the upper limit of the hoist.
In section (IV), both of the load cell voltages are shown in real time.
NOTE: If the hoist only has a digital up/down control handle, the 'Lift LC Voltage' will be zero.
In section (V), if the indicator box is red then the hoist's Up Stop is active, but if it is grey the hoist's Up Stop is off. If the Up Stop is active then the software is preventing the hoist from moving up.

If the hoist won't move up, ensure all of the conditions listed on the screen below are met. (Refer to Figure 7-4)

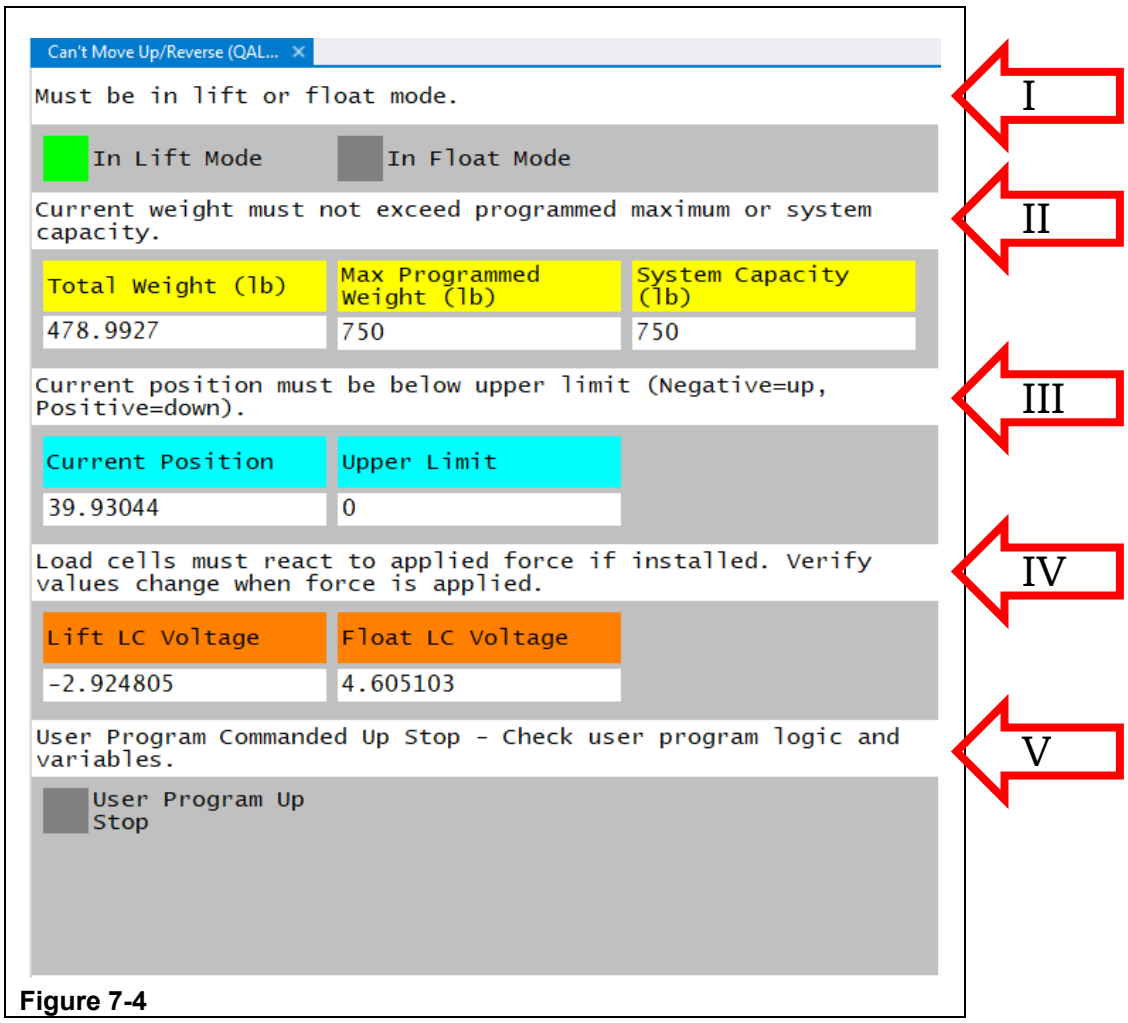


Figure 7-4

7e) Can't Move Down / Forward screen

This screen lists the steps to trace down the reason why the hoist won't move down towards the facilities' floor.

In section (I), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off.
In section (II), the current measured weight is shown as well as the total weight that the hoist will set down on a surface.
In section (III), the current position is shown as well as the lower limit of the hoist.
In section (IV), both of the load cell voltages are shown in real time.
NOTE: If the hoist only has a digital up/down control handle, the 'Lift LC Voltage' will be zero.
In section (V), if the indicator box is red then the hoist's Down Stop is active, but if it is grey the hoist's Down Stop is off. If the Down Stop is active then the software is preventing the hoist from moving down.

If the hoist won't move down, ensure all of the conditions listed on the screen below are met. (Refer to Figure 7-5)

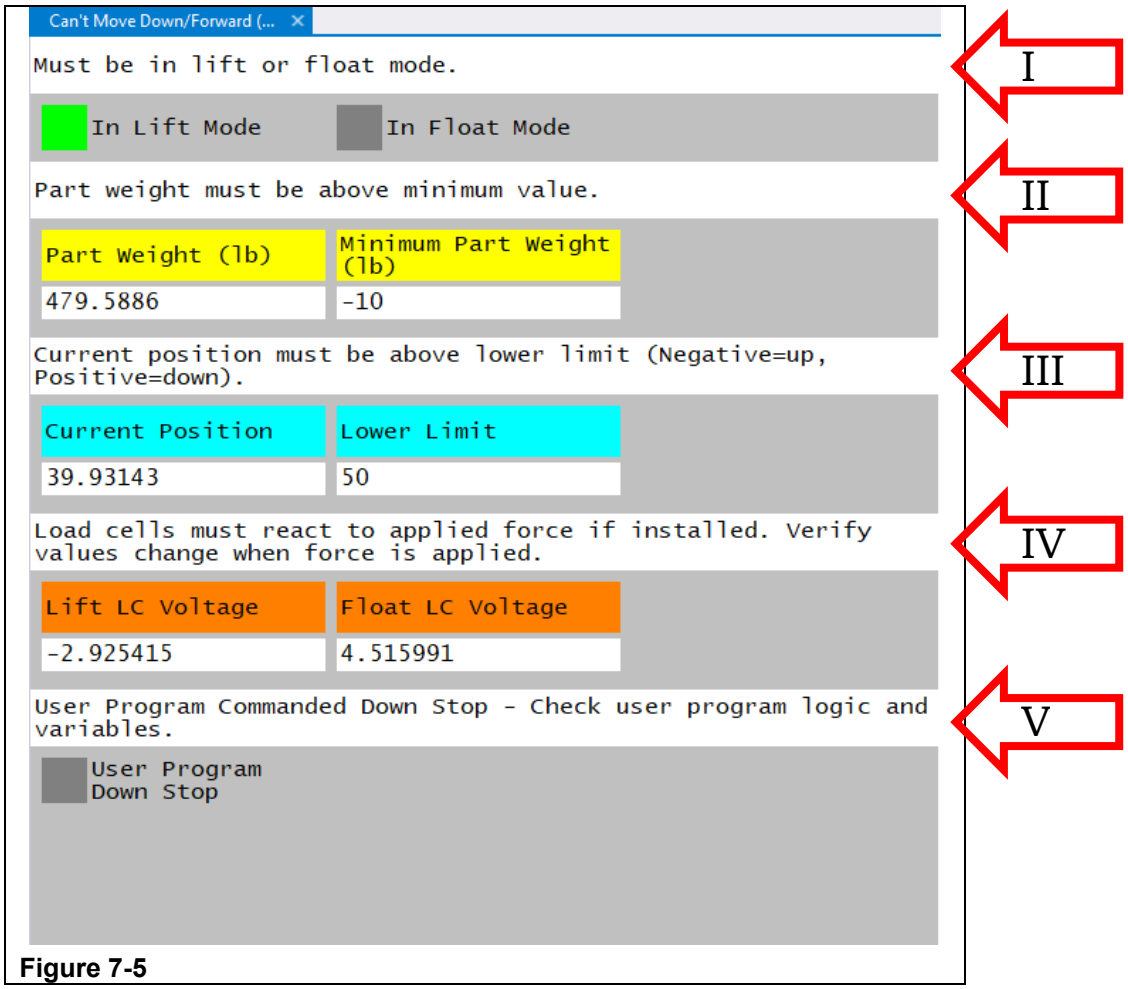


Figure 7-5

7f) Flashing Red Light screen

This screen lists the steps to trace down the reason why the hoist's red fault light is flashing.

In section (I), if the indicator box is red then either a Fault or Warning is Active.

If the hoist's red light is flashing, check the 'Code' display to find out which Fault or Warning is Active. The 'Code' display is located in the left-middle portion of the screen below, and this error code can also be seen at:

KSS Home screen location: Quick View panel \ Row 6 (Lower right-hand portion of the screen). (Refer to Figure 7-6)

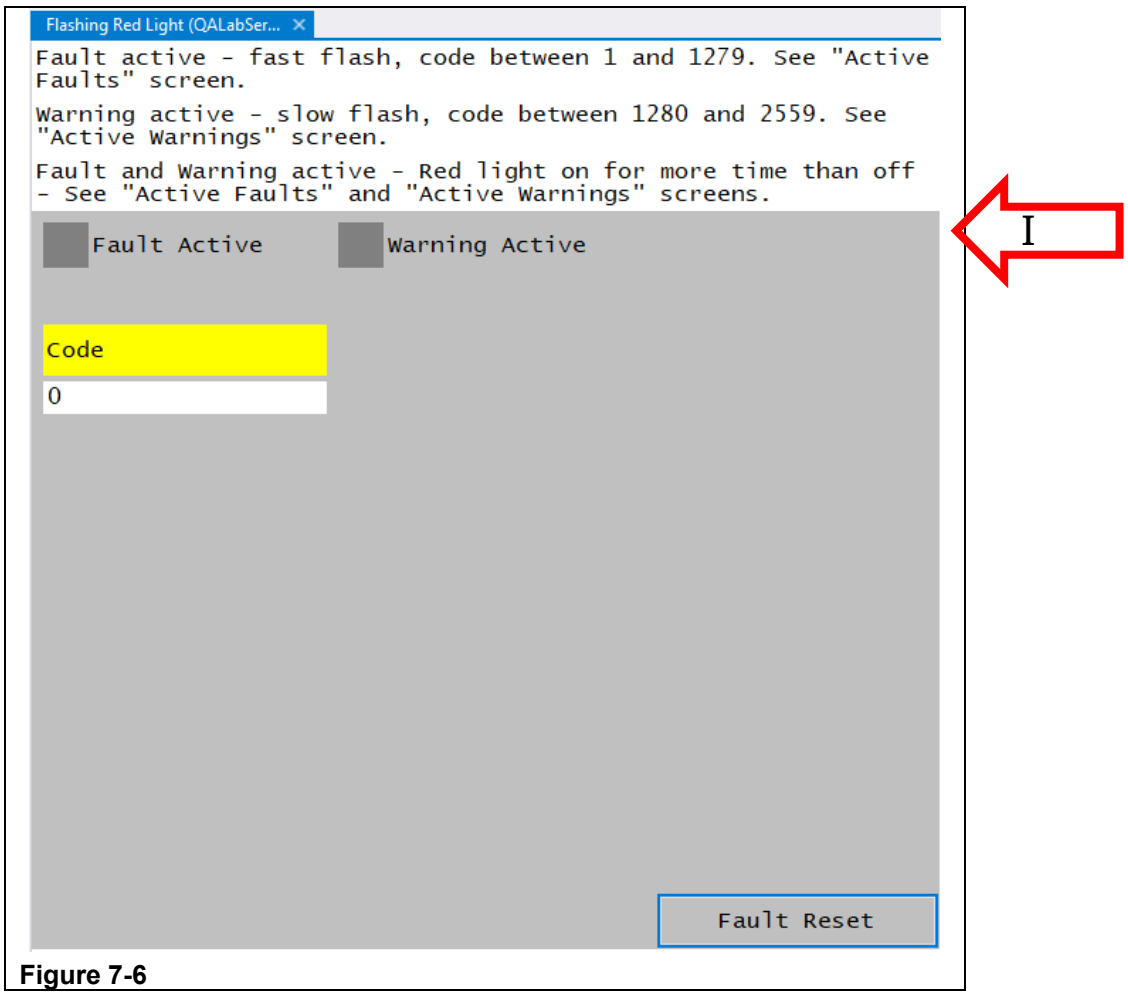


Figure 7-6

7g) Flashing Green Light screen

This screen lists the steps to trace down the reason why the hoist's green light is flashing. This green light is customarily referred to as the 'Lift Mode light' because it is normally illuminated during Lift Mode.

In section (I), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off.

In section (II), if the indicator box is green then the function is on, but if the indicator box is grey then the function is off. This screen lists information generated by both a digital and an analog handle.

In section (III), if the green light is flashing, then usually one of two situations are occurring:

1) The analog handle is being activated with an excessive amount of force influencing the handle.
2) The hoist has application specific code communicating an event to the operator.

If the hoist's green light is flashing, follow the steps listed on the screen below. (Refer to Figure 7-7)

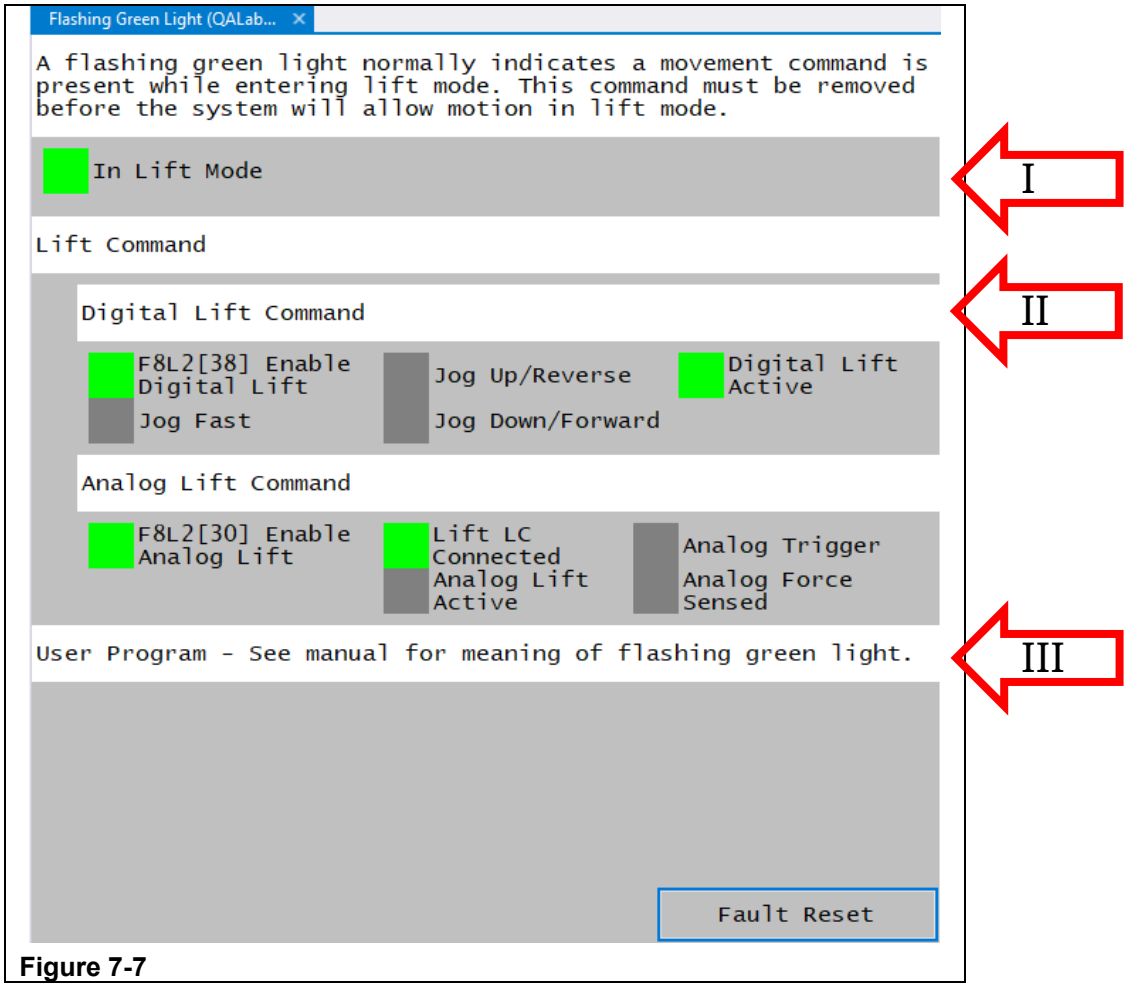


Figure 7-7

7h) Not Booting/Displays All Show 0 screen

This screen lists the steps to trace down the reason why the hoist's Knight Servo Studio is displaying all Zeros on its displays.

If the KSS displays are all showing Zeros, follow the steps listed on the screen below. (Refer to Figure 7-8)

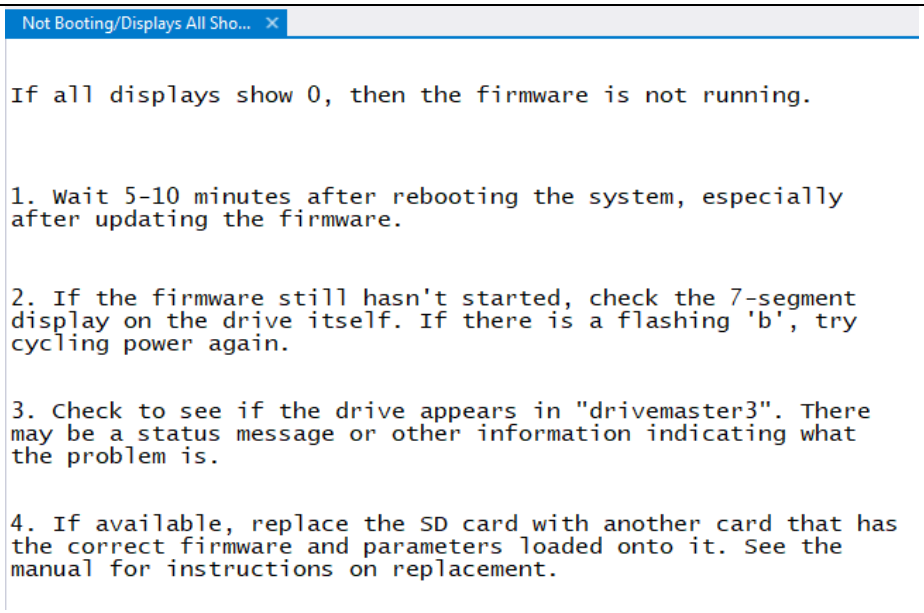


Figure 7-8

7i) Drive Won't Enable screen

This screen lists the steps to trace down the reason why the hoist won't enable.

If the hoist won't enable, follow the steps listed on the screen below. (Refer to Figure 7-9)

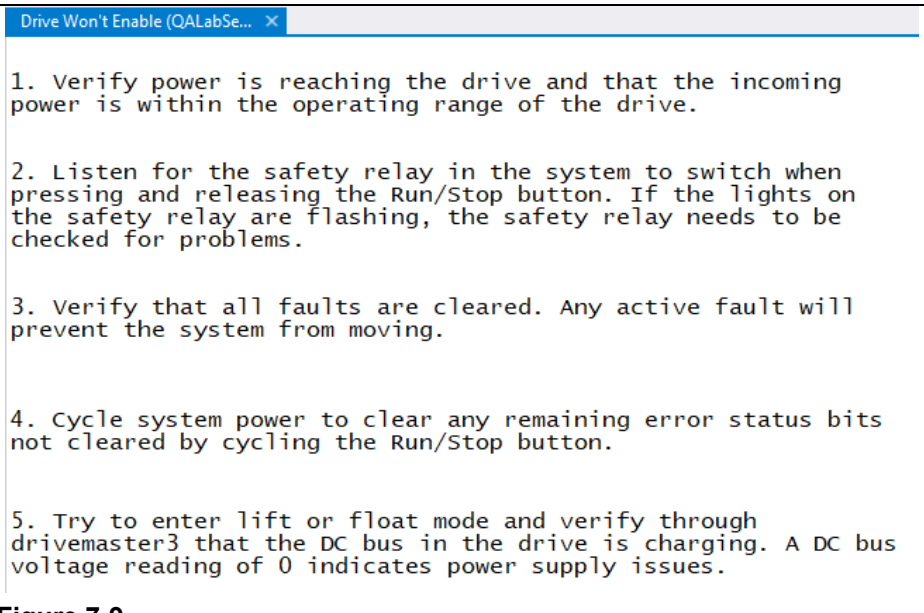


Figure 7-9

7j) Not Moving Correctly screen

This screen lists the steps to trace down the reason why the hoist won't move up and down smoothly.

If the hoist won't move up and down easily, follow the steps listed on the screen below. (Refer to Figure 7-10)

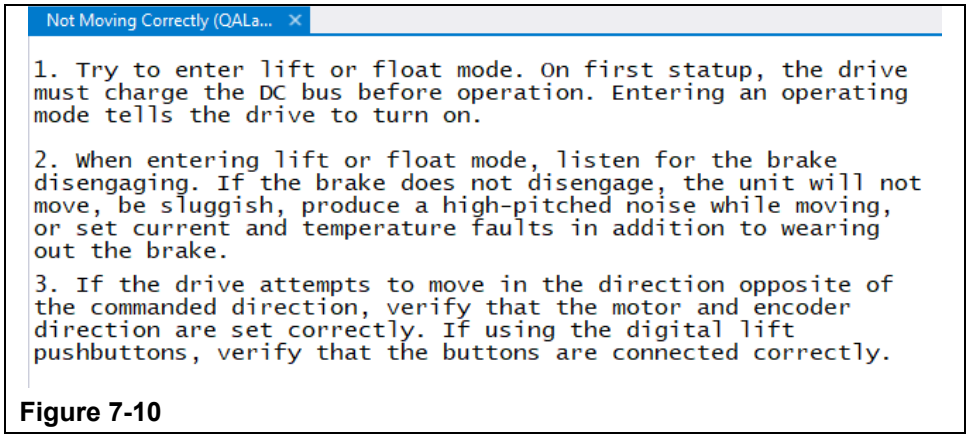


Figure 7-10

7k) Velocity Following Error / Overspeed screen

This screen lists the steps to trace down the reason why the hoist is experiencing multiple Velocity Following errors. The Velocity Follow error will generate a 104 Fault in the software. This fault will be listed on the:

KSS Home screen location: Quick View panel \ Row 1 (Lower right-hand portion of the screen).

If the hoist is experiencing an excessive number of Velocity Following errors, follow the steps listed on the screen below. (Refer to Figure 7-11)

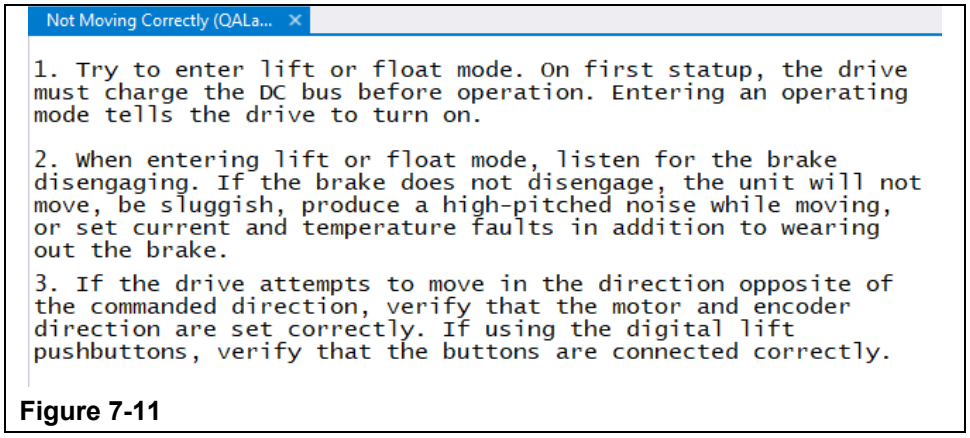


Figure 7-11

B. System Activity screens including Faults, Warnings and Error Codes

There are several System Activity screens covered in this section. Each of these screens is listed below and can be accessed inside the Knight Servo Studio (KSS) software from:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Status \

7l) System Status Bits screen
7m) Active Faults screen
7n) Active Warnings screen
7o) Knight Error Codes - These error codes are displayed in the Knight Servo Studio.
7p) Sieb & Meyer Error Codes - These codes are flashed on the servo's 7-segment display.

7l) System Status Bits screen

This screen shows many aspects of the hoist's systems in real time.

In section (I), if the indicator box is green then that particular hoist's function is on, but if the indicator box is grey then that particular hoist's function is off.

This screen gives an overview of the hoist's readiness. (Refer to Figure 7-12)

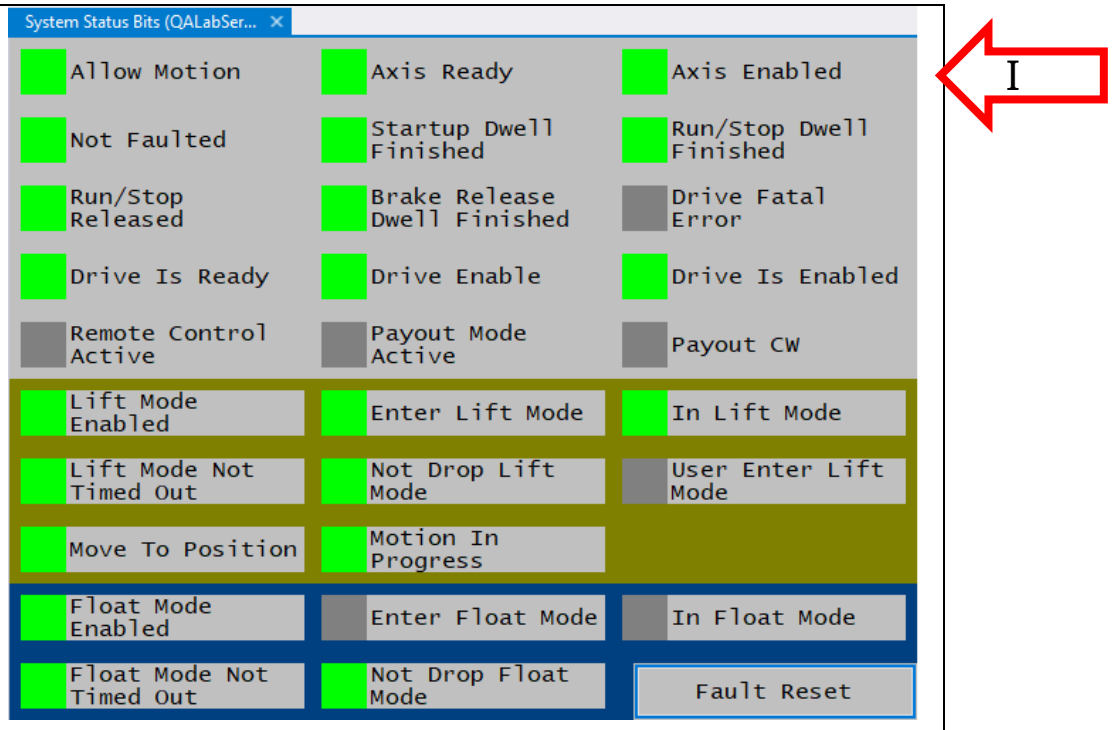


Figure 7-12

7m) Active Faults screen

This screen shows all faults that may be active on the hoist.

In section (I), if the indicator box is red then that fault is active, but if the indicator box is grey then that fault is off.

This screen graphically shows if a fault is active. If a fault is active it will correspond to a particular fault code. This fault code can be easily viewed at:

KSS Home screen location: Quick View panel \ Row 1 (Lower right-hand portion of the screen). (Refer to Figure 7-13)

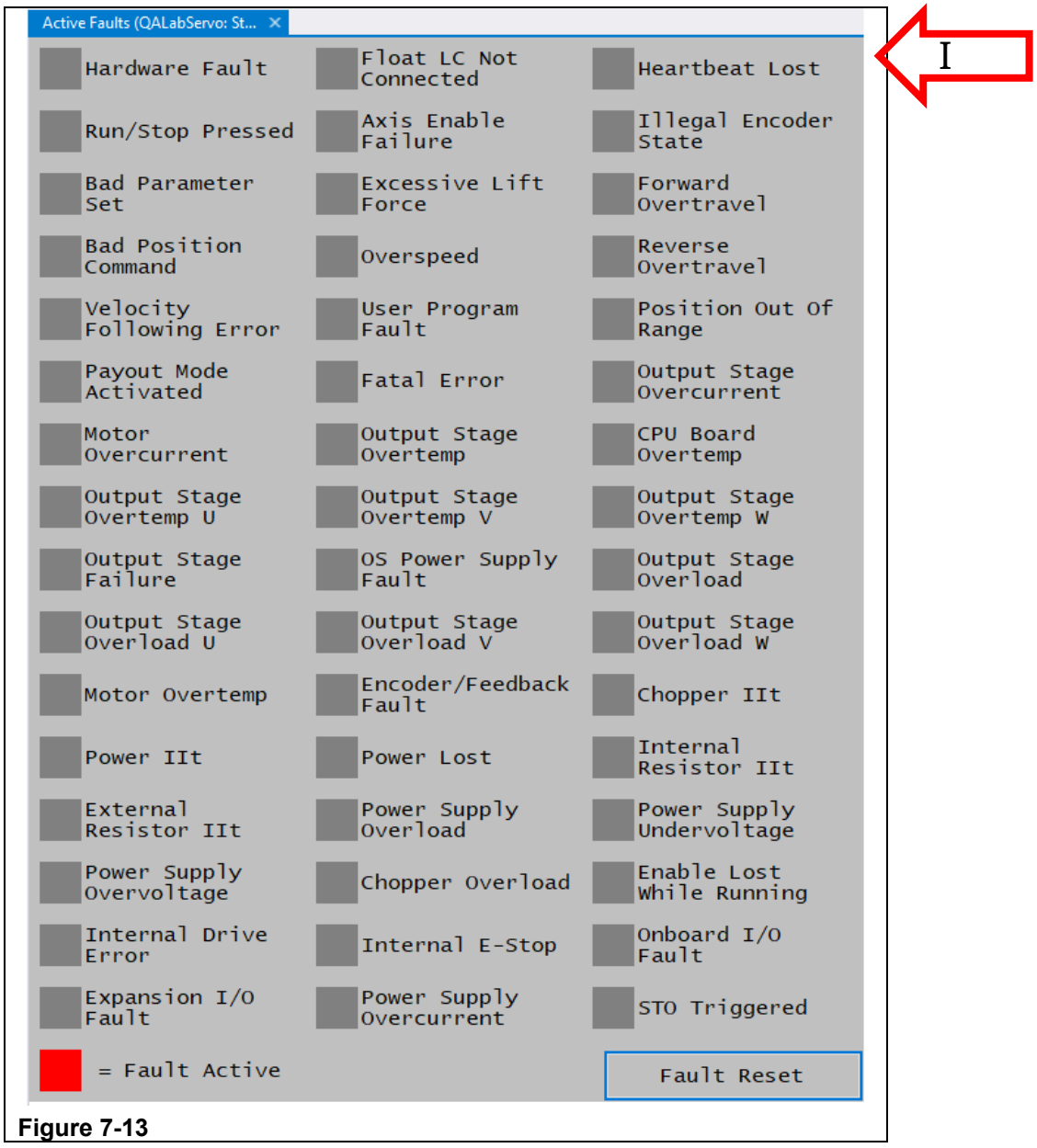


Figure 7-13

7n) Active Warnings screen

This screen shows all warnings that may be active on the hoist.

In section (I), if the indicator box is yellow then that warning is active, but if the indicator box is grey then that warning is off.

This screen graphically shows if a warning is active. If a warning is active it will correspond to a particular warning code. This warning code can be easily viewed at:

KSS Home screen location: Quick View panel \ Row 1 (Lower right-hand portion of the screen). (Refer to Figure 7-14)

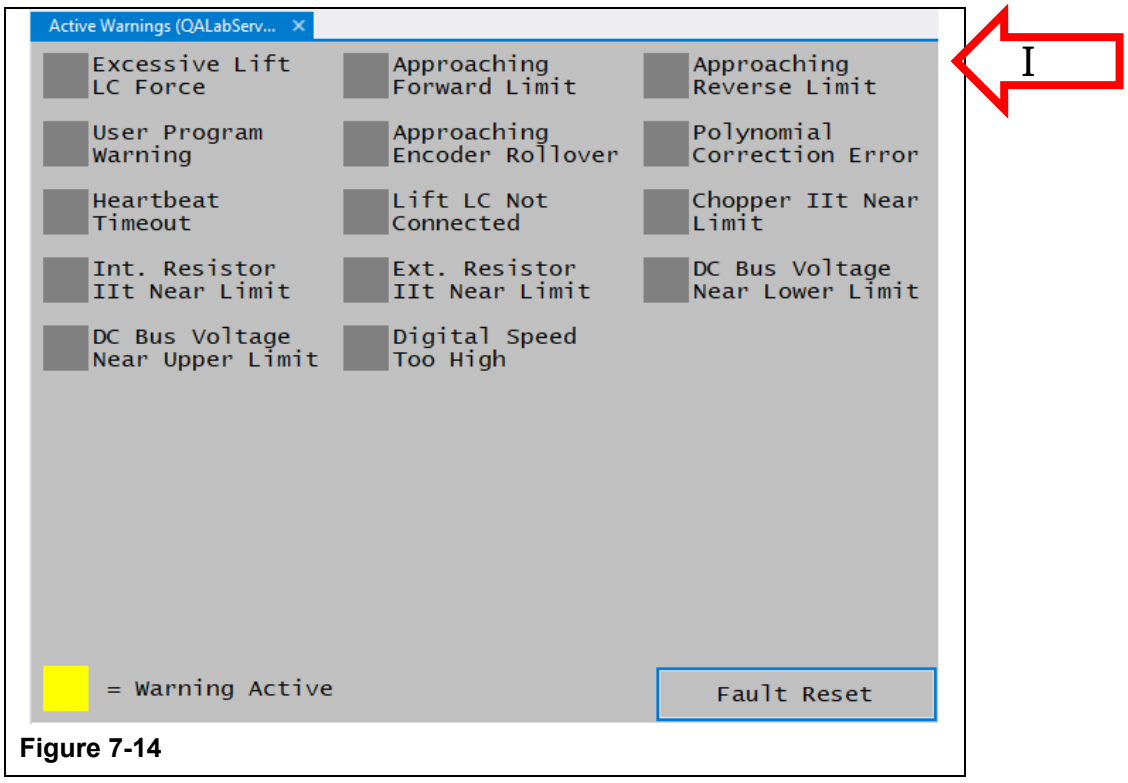


Figure 7-14

7o) Knight Error Codes

These are the error codes that can be generated by the Knight firmware and displayed in the Knight Servo Studio.

Error Code	Description
100	Hardware Fault
101	Run-Stop button pressed
102	Bad Parameters
103	Bad Position Command
104	Velocity Following Error
105	Position Following Error
106	Axis Enable Failure
107	Float Load Cell Not Connected
109	Excessive Lift Force Fault
111	Overspeed Fault
140	User Program Fault
150	Heartbeat Lost Fault
152	Illegal Encoder State
153	Forward Overtravel
154	Reverse Overtravel
250	Position Out Of Range
252	Onboard I/O Fault
253	Addon I/O Fault
254	Payout Mode Active
255	Fatal Error
256	Output Stage Overcurrent Fault
257	Motor Overcurrent Fault
258	Output Overtemperature Fault
259	CPU Overtemperature Fault
260	Output Overtemperature U Fault
261	Output Overtemperature V Fault
262	Output Overtemperature W Fault
263	Output Stage Failure Fault
264	Output Stage Supply Fault
265	Output Stage Overload Fault
266	Output Stage Overload U Fault
267	Output Stage Overload V Fault
268	Output Stage Overload W Fault

Error Code	Description
269	Motor Temperature Fault
270	Feedback Fault
271	Chopper IIT Fault
272	Power IIT Fault
273	Power Lost Fault
274	Rintern IIT Fault
275	Rextern IIT Fault
276	Power Overload Fault
277	Power Undervoltage Fault
278	Power Overvoltage Fault
279	Chopper Overload Fault
280	Power Overcurrent Fault
281	Enable Lost Fault
282	LL EStop Fault
283	LL Error Fault
284	Onboard I/O #4 Fault
285	Onboard I/O #5 Fault
286	Onboard I/O #6 Fault
287	Onboard I/O #7 Fault
288	Onboard I/O #8 Fault
289	Onboard I/O #9 Fault
290	Onboard I/O #10 Fault
291	Onboard I/O #11 Fault
292	Onboard I/O #12 Fault
293	Onboard I/O #13 Fault
294	Onboard I/O #14 Fault
295	Onboard I/O #15 Fault
296	Addon I/O #36 Fault
297	Addon I/O #37 Fault
298	Addon I/O #38 Fault
299	Addon I/O #39 Fault
300	Addon I/O #40 Fault
301	Addon I/O #41 Fault
302	Addon I/O #42 Fault
303	Addon I/O #43 Fault
304	Addon I/O #44 Fault
305	Addon I/O #45 Fault
306	Addon I/O #46 Fault
307	Addon I/O #47 Fault

7p) Sieb & Meyer Error Codes

The 7-segment display located on the front of the Sieb & Meyer SD3 servo drive displays internal error codes programmed by the manufacturer. These error codes are flashed on the display one digit at a time and are preceded by an “E”. For instance, the error “Supply Voltage Too Low” equates to Error Code 0132. The 7-segment display would flash an “E”, then a “0”, then a “1”, then a “3”, then a “2.”. This code will repeat until the error is remedied.

The Knight fault codes displayed in Knight Servo Studio are the primary troubleshooting resource, but the Sieb & Meyer error codes are provided here for reference.

Error Code	Description
0002	Log File
0003	File Not Found
0004	Create XML File
0005	Real Time FIFO
0006	Install ISR
0007	Task Let
0008	ISR Install
0009	Shared Memory Not Found
0010	Undefined State
0011	Wrong Parameter Value
0012	Object Not Found
0013	Wrong Object Size
0014	Parameter File Not Found
0015	Type Plate File Not Found
0016	EEPROM Time Out
0017	EEPROM Check Sum
0018	No Valid Interrupt ID
0019	No Valid Serial Number
0020	Wrong Hardware ID Code
0021	Task Create
0022	Wrong Command
0023	Compensation File Not Found
0024	Command Canceled
0025	Machine Stop
0026	No PCIe Device
0027	FPGA Done Time Out
0028	FPGA Initialization Time Out
0029	Wrong File Format
0030	Mapping
0031	No Shared Memory Block
0032	No Plugin Found
0033	Shared Memory Block Not Found
0034	Shared Memory Block Size
0035	No Response
0036	Buffer Full
0037	Wrong Curve Count
0038	FPGA Wrong Version
0039	Wrong Product Name
0040	Wrong Product ID
0041	Wrong Product Version
0042	Wrong Product ID In Parameter File
0043	Create Object Dictionary File
0044	Create Device Configuration File
0045	Create Parameter Files

Error Code	Description
0046	Hardware File
0047	System Clock Not Set
0073	Quit Reboot
0074	Quit Create Object Dictionary
0075	Quit Create Default Parameter
0076	Quit Program
0077	Quit Restart
0078	Quit IP
0079	Parameter Not Found
0080	Script Execution Fault
0081	Hardware Not Available
0082	FPGA Package File Not Found
0112	IIT Power
0113	IIT Chopper Resistor
0114	Input Lost
0115	Undervoltage
0116	Overvoltage
0117	Chopper Overload
0118	DC-DC Converter Fault
0119	DC-DC Overload
0120	PFC Fault
0121	Preload Time
0122	Power Overload
0123	Preload
0124	Power Off
0125	DCO Voltage
0126	DC1 Voltage
0127	DC2 Voltage
0128	Safety
0129	Chopper Resistor Too Low
0130	Chopper Power Too High
0131	Chopper Resistor Power Too High
0132	Supply Voltage Too Low
0133	Chopper Voltage Too Low
0134	Unknown Supply Type
0135	Supply Voltage Too High
0136	IIT Chopper Resistor 90
0137	Restart Application
0138	Incompatible FPGA File
0139	FPGA File Does Not Exist
0140	Power User Fault
0141	Power Busy

Error Code	Description
0142	IIT Chopper Resistor Internal
0143	IIT Chopper Resistor External
0144	IIT Chopper
0145	Chopper Voltage Level
0146	Power Ok
0147	Module Chopper Temperature
0148	Module Rectifier Temperature
0160	Not Calibrated
0161	Profile
0162	Actual Position Not Destination Position
0163	SG Command Busy
0164	Not Operation Enabled
0165	Illegal Cal Method
0166	Illegal Drive Number
0167	Wrong Drive Type
0168	Not Ready To Switch On
0169	Wrong Start Condition
0170	Drive Parameter Fault
0171	Velocity Out Of Limits
0172	Simulated Error
0173	Change On The Fly
0174	Not In Gantry Mode
0175	Wrong Master
0176	Emergency Stop
0177	Limit Switch P
0178	Limit Switch N
0179	Position Out Of Limits
0180	Parameter Out Of Limits
0181	Motor Temperature
0182	Heat Sink Temperature
0183	Drive Overload
0184	Drive Overvoltage
0185	Drive Undervoltage
0186	Power Stage Off
0187	Gantry Positions Not Equal
0188	Not In Hold Mode
0189	Power Stage On
0190	Acceleration Out Of Limits
0191	Jerk Out Of Limits
0192	Bad Switching
0193	Overload U
0194	Overload V
0195	Overload W
0196	Overload
0197	No Valid Parameter
0198	Output Stage Off
0199	IIT Motor
0200	IIT Output Stage
0201	Module U Temperature
0202	Module V Temperature
0203	Module W Temperature

Error Code	Description
0204	Water Temperature
0205	Ambient Temperature
0206	Feedback
0207	Over Speed
0208	Output Stage Enabled
0209	Limit Switch Input Not Enabled
0210	Brake Output Not Enabled
0211	Function Disabled
0256	NR No Tool
0257	NR Time Out
0258	NR Angle Too Low
0259	NR Angle Too High
0260	NR Torque Out Of Range
0261	NR Friction Torque Too Low
0262	NR Friction Torque Too High
0263	NR Angle Max
0264	NR Current Too Low
0265	NR Current Too High
0266	NR Time Max
0267	NR Illegal Variant
0268	NR Illegal Section
0269	NR Unknown Tool
0270	NR No Transducer
0271	NR No Scanner
0272	NR Start Lost
0273	NR No Valid Section Type
0320	Network Invalid Telegram ID
0321	Network Zero Data
0322	Network CRC
0323	Network Synchronization
0324	Network Configuration
0325	Network NMT
0326	Network Addressing
0327	Network Node Guarding
0328	Network EEPROM
0329	Network Heartbeat
0337	Network Invalid AL Control
0338	Network Unknown AL Control error
0339	Network Boot Not Supported
0340	Network No Valid Firmware
0342	Network Invalid Mbx Configuration
0345	Network No Valid Outputs
0346	Network Sync Error
0347	Network SM Watchdog
0349	Network Invalid SM Out Configuration

Error Code	Description
0351	Network Invalid SM In Configuration
0361	Network Free Run Needs 3 Buffer Mode
0365	Network Fatal Sync Error
0368	Network Invalid Sync Configuration
0374	Network Sync Zero Cycle Time
0377	Network EE Error
0496	OEM
0559	OEM End
0640	TI Base
0641	TI Wrong State
0642	TI Command Not Supported
0643	TI Break Command
0644	TI Wrong Address
0645	TI Config Com Port
0646	TI Device Not Supported
0647	TI No Connection
0650	TI UART Config COM Port
0651	TI UART RX Buffer 0 Overflow
0652	TI UART RX Buffer 1 Overflow
0653	TI UART TX Buffer 0 Overflow
0654	TI UART TX Buffer 1 Overflow
0655	TI UART CRC Error
0656	TI UART Telegram Counter
0660	TI IIC Timeout
0661	TI IIC Wrong Mode
0662	TI IIC Write Data
0663	TI IIC ACK
0664	TI IIC NACK
0665	TI IIC STOP
0666	TI IIC PSR
0667	TI IIC Device
0668	TI IIC res28
0669	TI IIC res29
0670	TI ZMDI IIC
0671	TI ZMDI Measurement
0672	TI ZMDI CRC Error
0673	TI ZMDI Command Not Supported

C. Troubleshooting Inputs and Outputs

This screen can be used to inspect the hoist's Inputs and Outputs. This screen can be accessed inside the Knight Servo Studio (KSS) software from:
KSS Workspace tree location (User Level= Advanced): Knight Work Order # \ Motion \ I/O Control

7q) I/O Control screen

7q) I/O Control screen

This screen shows each of the onboard inputs and outputs.

In section (I), if the indicator box in the 3rd column is green then that I/O point is on, but if that indicator box is grey then it is off.

This screen graphically shows if an Input or Output is On, Forced On, or Forced Off.
In order to Force an I/O point On, mouse to and press the button in the 1st column (labeled 'ON') next to that point. A yellow box in the 1st column indicates that I/O point is Forced On.
NOTE: If the point being Forced On is an Output and that specific Output does not turn on within 25ms, then this will be reflected on the 'I/O Fault' screen. This screen is located at:
KSS Workspace tree location (User Level= Advanced): Knight WO# \ Status \ I/O Fault
In order to Force an I/O point Off, mouse to and press the button in the 2nd column (labeled 'OFF') next to that point. A yellow box in the 2nd column indicates that I/O point is Forced Off.

NOTE: All Forced On or Forced Off I/O points are RESET every time the Run-Stop button is cycled.
(Refer to Figure 7-18)

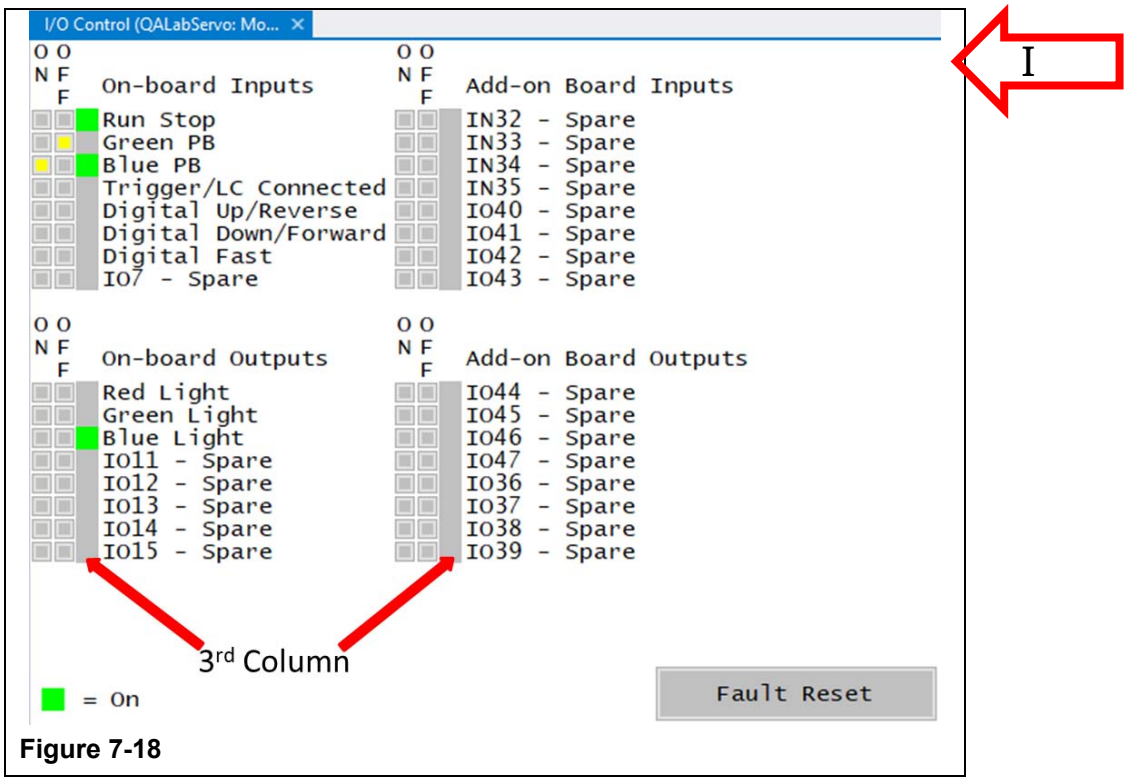


Figure 7-18

D. Troubleshooting Chart

The Servo Hoist operation may be affected by various factors. If your hoist is not performing as well as expected, follow the table below to diagnose the problem. If unable to resolve the issue, contact the Knight Service Department at 248-375-7962 or via e-mail at service@knightglobal.com.

Problem	Cause	Solution
Hoist does not lift or lower	Power loss	Check circuit breaker, switches, and connections of all power lines. Check Run-Stop button, reset if necessary.
	Incorrect voltage	Check supply voltage and frequency of power supply to ensure it is correct for the Servo Hoist.
	Electrical fault	Secure power to the hoist; check all wiring and connections on the Servo Hoist.
	Hoist capacity exceeded	Reduce the weight of the load to within the rated or programmed capacity of the Servo Hoist.
Servo Hoist lifts but does not lower	"Lower Travel Limit" set incorrectly	Check parameter F8L1:06 “Forward / Lower Limit (in)”.
	Damaged pendent cord	Check each conductor in the pendent cable for continuity. Replace damaged cable as required.
Servo Hoist lowers but will not lift	"Upper Travel Limit" set incorrectly	Check parameter F8L1:05 “Reverse / Upper Limit (in)”.
	Damaged pendent cord	Check each conductor in the pendent cable for continuity. Replace damaged cable as required.
	Hoist capacity exceeded	Reduce the weight of the load to within the rated or programmed capacity of the Servo Hoist.
	Low voltage in power supply	Determine the cause of low voltage and restore voltage back to within +/-10% of required voltage supply.
Servo Hoist does not lift at proper speed	Hoist capacity exceeded	Reduce the weight of the load to within the rated or programmed capacity of the Servo Hoist.
	Low voltage in power supply	Determine the cause of low voltage and restore voltage back to within +/-10% of required voltage supply.
Servo Hoist operates intermittently	Open / Short circuit	Check circuit for loose connections or broken conductors. Repair or replace as necessary.
	Damaged pendent cord	Check each conductor in the pendent cable for continuity. Replace damaged cable as required.
	Damaged handle	Check each conductor in the pendent cable for continuity. Replace damaged conductors as required. Check connections and replace if necessary.
Continuously flashing Green light using an Up/Down Pendent	Damaged pendent cord or switch	Check each conductor in the pendent cable for continuity. Check switch for correct functionality. Replace damaged part as required.

8. SPARE PARTS LIST

Because Knight is continuously improving and updating its products, all product drawings and spare parts lists for this Servo Hoist are provided as supporting documentation accompanying this manual and delivered with the system.

9. DECOMMISSIONING OF A SERVO HOIST

Knight Servo Hoists contain various materials which, at the end of the service life, must be disposed of or recycled (where appropriate), in accordance with statutory regulations.

Decommissioning:

WARNING

Knight Servo Hoists must be decommissioned by qualified personnel.

- Ensure there is not a load on the hoist.
- Remove power from hoist.
- Remove hoist from rail or support structure.
- If desired, Knight Global will properly dispose of the hoist. Contact a Knight Global representative to obtain a Return Material Authorization form.

10. KNIGHT'S PERFORMANCE WARRANTY

Knight warrants that its products and parts shall meet all applicable specifications, performance requirements, and be free from defects in material and workmanship for one year, (Servo Systems for (2) two years, Pneumatic Lift Tables for (5) five years), from the date of invoice, unless otherwise noted.

Knight warrants the Servo Hoist, Arms, and Tractors to be free from defects in material or workmanship for a period of two years or 6000 hours use from the date of shipment.

On design and build jobs, the customer is the owner of the equipment once they authorize shipment. The purchased equipment cannot be returned for reimbursement or credit.

Exclusions

This warranty shall not cover the failure or defective operation caused by inadequate training provided by customer regarding the operation and/ or maintenance of the tool, misuse, negligence, misadjustment, or any alteration not approved by Knight Global. Knight's obligation is limited to the replacement or repair of Knight's products at a location designated by Knight Global. Buyer is responsible for all associated internal removal and reinstallation costs as well as freight charges to and from Knight Global. Knight's maximum liability shall not in any case exceed the contract price for the products claimed to be defective.

Any field modification made to Knight Products or Systems without the written authorization by Knight Global shall void Knight's warranty obligation.

Any purchased components not manufactured by Knight Global and their specific individual warranties are not covered. Paint defects, scratches and marring from shipping are also excluded on all Knight Global products and products not manufactured by Knight Global.

Knight Distributors/ Agents are not authorized to circumvent or change any of these terms and/ or conditions of this warranty unless prior approval is received in writing by Knight Global Management. Verbal statements made by Knight Distributors/ Agents do not constitute warranties.

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KNIGHT GLOBAL

KNIGHT GLOBAL
2705 Commerce Parkway
Auburn Hills, MI 48326
Phone 248-377-4950 | Fax 248-377-2135

For additional copies of the literature contact: salesorders@knightglobal.com
For technical questions contact: servos@knightglobal.com
For service-related requests contact: service@knightglobal.com

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