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# Owner's Manual SPIDER<sup>®</sup> Smart Carousel System


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Applicable Equipment Part Numbers

200-420-00  
200-421-00  
200-422-00  
210-275-00

**[Please check our web site www.onboardsystems.com](http://www.onboardsystems.com)**  
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### RECORD OF REVISIONS

Revision	Date	Page(s)	Reason for Revision
0	2/21/14	All	Initial release
1	06/05/14	40, 48, 51	Added washers 510-095-00 to controller hardware.
2	09/06/16	7, 8, 31, 32, 50, & 51	Replaced 528-044-10 with 528-044-11. 528-044-10 may be used in place of 528-044-11.

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## 1.0 Introduction

### 1.1 Scope

This owner's manual contains instructions for installation, operation, and maintenance of Onboard Systems SPIDER® Smart Carousel Systems (P/N's 200-420-00, 200-421-00, and 200-422-00) and Carousel Controller (P/N 210-275-00).

### 1.2 Capability

The instructions contained in this document are provided for the benefit of experienced aircraft maintenance personnel and facilities that are capable of carrying out the procedures.

### 1.3 Safety labels

The following definitions apply to safety labels used in this manual.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.




Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Draws the reader's attention to important or unusual information not directly related to safety.



Used to address practices not related to personal injury.

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## 2.0 Referenced Documents

120-213-00 Owner's Manual, Talon Carousel Hook

## 3.0 System Overview

### 3.1 General Description

The SPIDER<sup>®</sup> Smart Carousel System provides the means for helicopter transport and delivery of multiple loads without returning to the staging area. Typical application of this equipment is in support of seismic land survey. The Carousel System is intended to be suspended via long line from the primary Cargo Hook and serves as a secondary release means.

The Carousel System is available as a 4-hook (P/N 200-422-00), 6-hook (P/N 200-421-00) or 8-hook system (P/N 200-420-00) and is designed to be easily converted between these configurations.

The Carousel System is made up of a structural frame, support cables, Cargo Hooks and Controller. See Figure 3.1 for a general overview. The structural frame is constructed of two weldments which are connected by aluminum spokes. The spokes serve as the mounting points for the Cargo Hooks. The support cable assembly attaches to the individual spokes and then to the long line. A plate mounted to the top of the structural frame provides protection for the system from the rigging when the system is set on the ground. The Controller is housed within an enclosure mounted on the underside of the spokes.

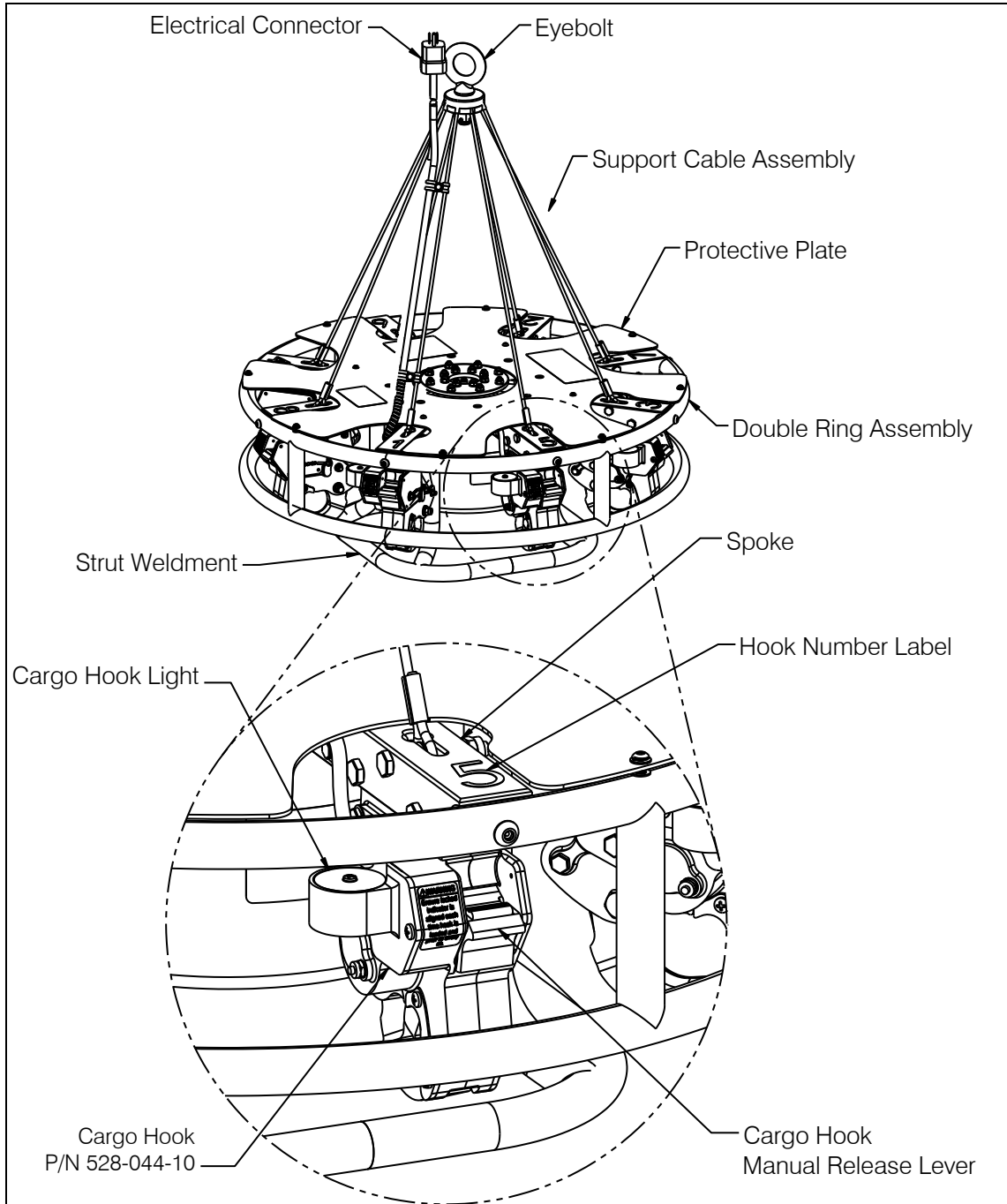
## NOTICE


*The aircraft side electrical components and wiring required for operation of the Carousel System are not included. See section 5 for additional detail including recommended parts and possible aircraft installation.*

## NOTICE

*The aircraft wiring arrangement to support this Carousel System is not interchangeable with legacy Carousel Systems. See figure 5.1.*

Figure 3.1 SPIDER® Smart Carousel System Overview

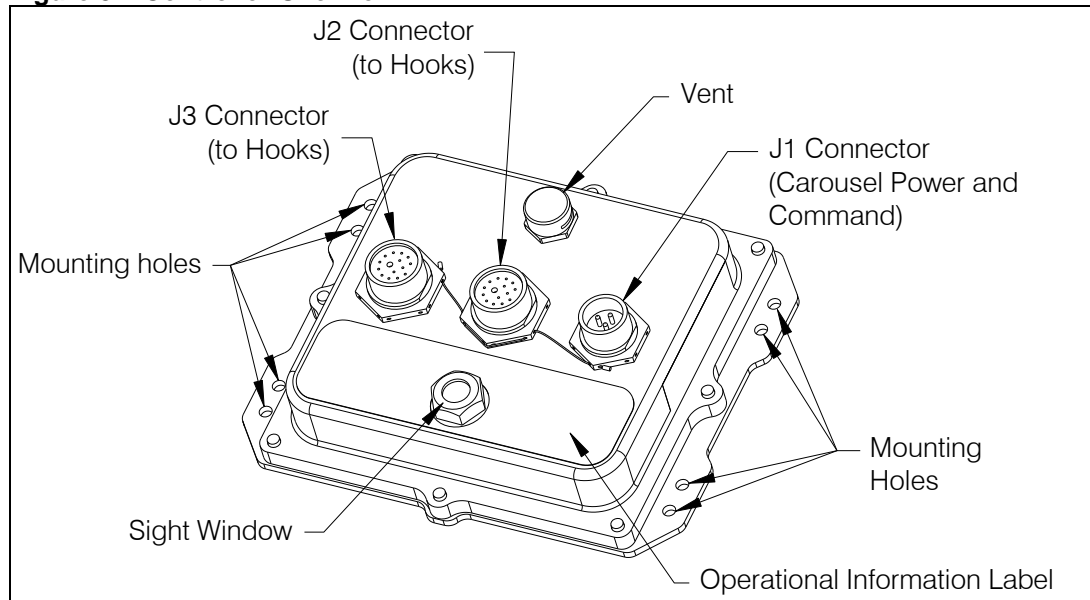


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### 3.2 Controller

The Carousel Controller (210-275-00) is a water-resistant electronic device which is the interface between the cockpit control switch and the Cargo Hooks. Its primary purpose is to track which hook is staged for release and which hooks have already been released. The Controller also displays useful visual information to the pilot via lights on the Cargo Hook. The Controller gives the pilot the opportunity to override the automatic advancement and select a hook out of sequence. The Controller requires a 3-position (neutral center) toggle switch interface for cockpit control.

**Figure 3.2 Controller Overview**

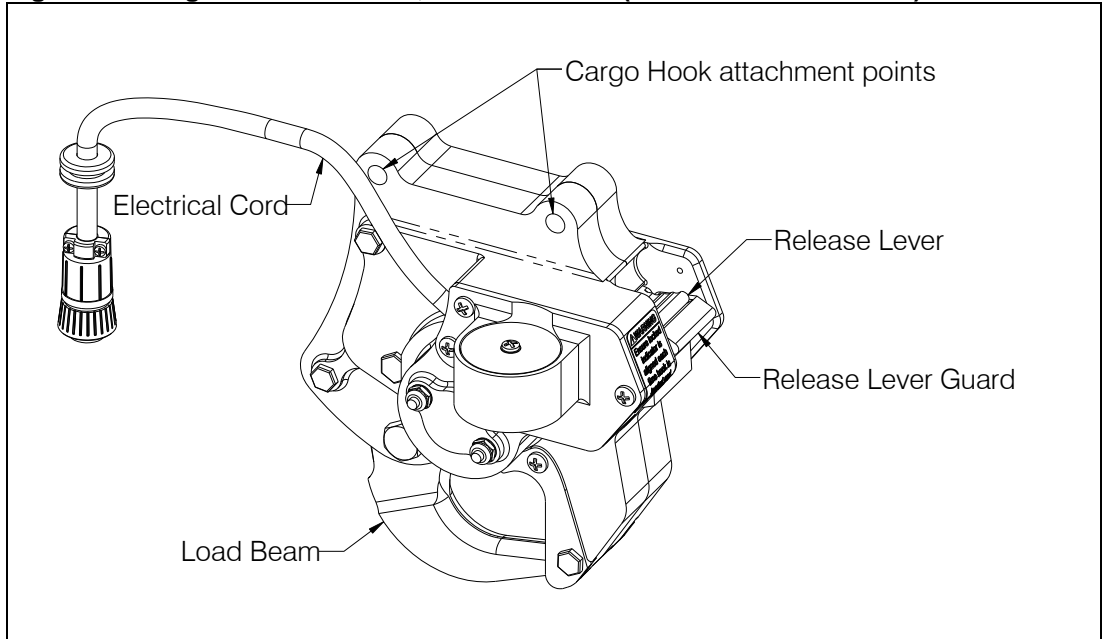


### 3.3 Cargo Hooks

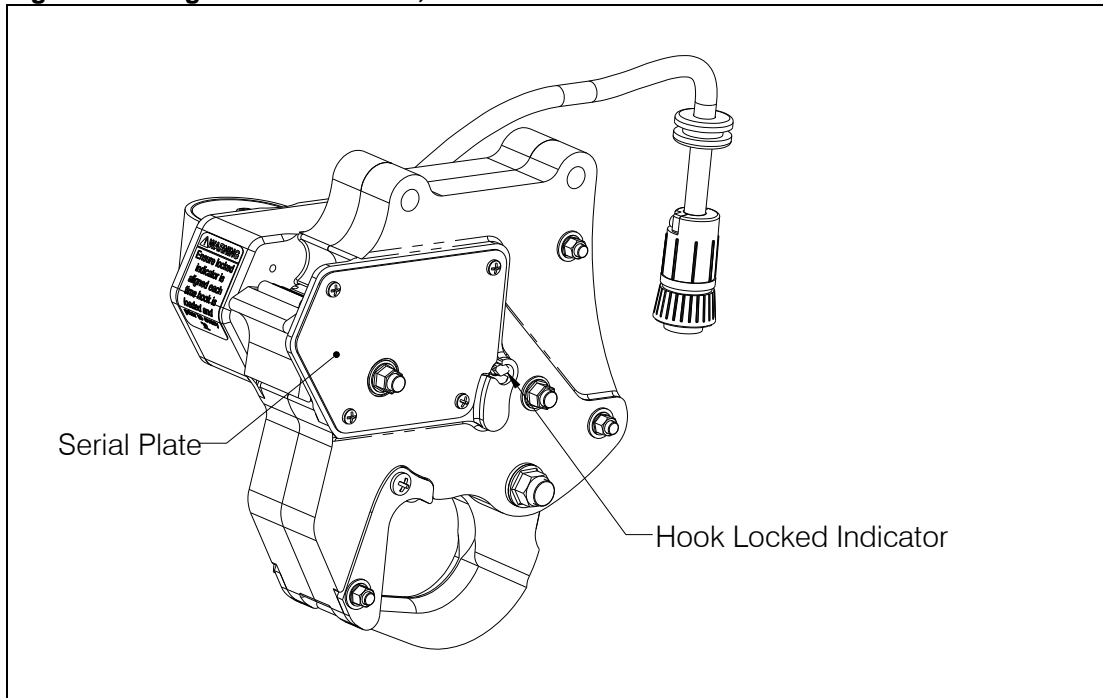
The Cargo Hooks (P/N 528-044-10 or 528-044-11) provide the means to attach an individual load to the Carousel System. The Cargo Hooks are positioned to provide easy access and feature an outward facing release lever. The release lever is guarded with a locking device which prevents inadvertent opening due to contact with tree branches, etc. The Cargo Hooks each include a light module which provides visual feedback to the operator in identifying which hook is next to be released.

A load is attached to the Cargo Hook by inserting a load ring into the throat of the open load beam and pushing up to close (refer to Figure 3.3 and Figure 3.4 for Cargo Hook overview). On the ground, ground personnel open the hook by actuating the release lever located on the Cargo Hook. Refer to Owner's Manual 120-213-00 for additional information on the Cargo Hook.


**Figure 3.3 Cargo Hook Overview, Electrical Side (P/N 528-044-11 Shown)**



**Figure 3.4 Cargo Hook Overview, Indicator Side**





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### 3.4 Bill of Materials

SPIDER<sup>®</sup> Smart Carousel Systems are supplied mostly assembled, but some final assembly is required before use.

See Table 3.1, Table 3.2, or Table 3.3 for parts included with the particular system purchased. If shortages are found, contact the company from whom the system was purchased. Assembly instructions are located in Section 5.0 of this manual.

**Table 3.1 Bill of Materials, SPIDER<sup>®</sup> Smart 8-Hook Carousel System (200-420-00)**


Part No.	Description	Qty
120-216-00	Owner's Manual	1
210-284-00	8-Hook Carousel System Subassembly	1
232-577-00	8-Hook Cable Assembly	1
510-102-00	Nut	2
510-105-00	Washer	8
510-370-00	Nut	8
510-659-00	Bolt	2
510-953-00	Bolt	8
512-024-00	Adel Clamp	2
512-026-00	Adel Clamp	2

**Table 3.2 Bill of Materials, SPIDER<sup>®</sup> Smart 6-Hook Carousel System (200-421-00)**

Part No.	Description	Qty
120-216-00	Owner's Manual	1
210-285-00	6-Hook Carousel System Subassembly	1
232-578-00	6-Hook Cable Assembly	1
510-102-00	Nut	2
510-105-00	Washer	6
510-370-00	Nut	6
510-659-00	Bolt	2
510-953-00	Bolt	6
512-024-00	Adel Clamp	2
512-026-00	Adel Clamp	2

**Table 3.3 Bill of Materials, SPIDER<sup>®</sup> Smart 4-Hook Carousel System (200-422-00)**

Part No.	Description	Qty
120-216-00	Owner's Manual	1
210-284-00	4-Hook Carousel System Subassembly	1
232-577-00	4-Hook Cable Assembly	1
510-102-00	Nut	2
510-105-00	Washer	4
510-370-00	Nut	4
510-659-00	Bolt	2
510-953-00	Bolt	4
512-024-00	Adel Clamp	2
512-026-00	Adel Clamp	2

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### 3.5 Specifications

Table 3.4 Carousel System Specifications

Specification	4-Hook System (P/N 200-422-00)	6-Hook System (P/N 200-421-00)	8-Hook Systems (P/N 200-420-00)
Max Single Hook Load	650 lbs. (295 kg)	650 lbs. (295 kg)	650 lbs. (295 kg)
Max Combined load*	1,600 lbs. (726 kg)	2,400 lbs. (1,089 kg)	3,200 lbs. (1,452 kg)
Limit Load	4,000 lbs. (1,814 kg)	6,000 lbs. (2,722 kg)	8,000 lbs. (3,629 kg)
Combined Ultimate Strength	6,000 lbs. (2,722 kg)	8,000 lbs. (3,629 kg)	12,000 lbs. (5,443 kg)
Unit weight	53 lbs. (23.9 kg)	65 lbs. (29.3 kg)	76 lbs (34.6 kg)
Power Requirements	28 VDC, 10A		
Operating Temperature Range	-40 °F – 160 °F (-40 °C - 71 °C)*		
Compatible Electrical Connector (long line side):	Leviton 5259-VY or equivalent		

\*Max combined load = 400 lbs x number of hooks




*Icing conditions may cause inadvertent release or failure to release. Always ensure the locked indicator is aligned prior to lifting. Use an anti-icing compound if icing is expected.*



*Although the Cargo Hooks are rated for 1,000 lbs, each is de-rated to 650 lbs when installed in this Carousel System.*



*See Owner's Manual 120-213-00 for complete specifications for the Cargo Hooks included with the Carousel System.*

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## 4.0 SPIDER® Smart Carousel Controller Operation



The Carousel Controller is designed to be operated with a neutral center 3-position toggle switch. Table 4.1 summarizes the inputs for Controller operation with the switch installed as described in Section 5.0.

Toggling the switch to the left is referred to as Switch Position 1. Toggling the switch to the right is referred to as Switch Position 2.

The 'Drop' and 'Drop All' functions are both activated by Switch Position 1. 'Drop' and 'Drop All' are differentiated by the duration of time that Switch Position 1 is held. Holding for ½ second activates the 'Drop' function; holding for 4 seconds activates the 'Drop All' function.

The 'Select' and 'Reset' functions are both activated by Switch Position 2. 'Select' and 'Reset' are differentiated by the duration of time that Switch Position 2 is held. Holding for ½ second activates the 'Select' function; holding for 4 seconds activates the 'Reset' function.


**Table 4.1 Controller Operation**

Input	Command to Controller when Switch Position is held for ½ second.	Command to Controller when Switch Position is held for 4 seconds.
<b>Switch Position 1</b> 	<b>Drop</b>	<b>Drop All</b>
<b>Switch Position 2</b> 	<b>Select</b>	<b>Reset</b>

The Controller can be re-configured in the field to modify some of its operational characteristics depending on operator preferences. Section 6.2 for adjusting settings.

### 4.1 Reset Command

Prior to any new carousel mission, reset the Controller by toggling to position 2 for 4 seconds. The light pattern will march around for a few seconds and then become steady. The system is now reset and all lights are illuminated—indicating the first hook is staged for release.

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## 4.2 Drop Command

To drop a load, toggle the switch to position 1 for ½ seconds.

The hook which is currently staged for release is indicated by a visual pattern of lights. See Table 4.2 for the light patterns. During the drop cycle, the lights will flash several times, and then display the next pattern in the lineup.

If it is necessary that the loads be dropped in a specific sequence, load the Cargo Hooks in the order in which the loads are to be dropped. The default setting counts down from the highest numbered hook to lowest (i.e. – attach the first load to be released to Hook 8, attach the second load to be released to Hook 7, etc.).

### NOTICE









*To reduce the possibility of inadvertent release, the 'Drop' command features a time delay. Hold the switch for approximately one-half second for the command to be completed.*


### NOTICE

*The hook which is currently staged for release is indicated by a visual pattern of lights. See Table 4.2*

The order in which the hooks are released can be reversed from descending to ascending if preferred. See section 6 for instructions for changing this setting.

**Table 4.2 Carousel Light Patterns – Carousel System showing which hook is staged for release**

<p style="text-align: center;"><b>Hook #8</b></p> 	<p style="text-align: center;"><b>Hook #7</b></p> 
<p style="text-align: center;"><b>Hook #6</b></p> 	<p style="text-align: center;"><b>Hook #5</b></p> 
<p style="text-align: center;"><b>Hook #4</b></p> 	<p style="text-align: center;"><b>Hook #3</b></p> 
<p style="text-align: center;"><b>Hook #2</b></p> 	<p style="text-align: center;"><b>Hook #1</b></p> 

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### 4.3 Select Command

The Controller allows the operator to override the automatic advancement with the 'select' command. To skip the current hook in the queue and select the one after it, toggle the switch to position 2 and hold for ½ second. Repeat the command to skip multiple Cargo Hooks until the desired hook is reached.

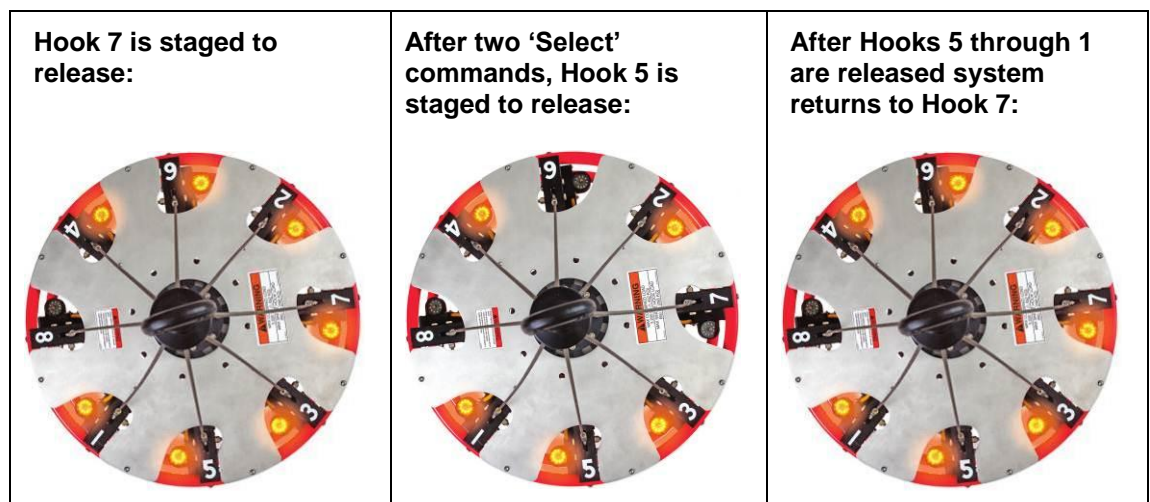



*The hook which is currently staged for release is indicated by a visual pattern of lights. See table 4.2.*

The Controller will automatically return to the hooks that were skipped after all the other Cargo Hooks are released (see following example).

**Example:** (Assume an 8-Hook Carousel System)

- The operator drops the first load, hook 8. The pattern changes to show hook 7 is staged.
- The operator skips to hook 5 using the select command twice. (Hooks 7 and 6 are skipped).
- The remaining hooks 4, 3, 2, and 1 are released by the operator.
- The Controller returns to hook 7 as staged for release. After hook 7 is released, hook 6 is staged. After hook 6 is released, the Carousel System is empty and all the lights are extinguished.



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#### 4.4 Drop All Command


To drop all loads on the Carousel System, toggle the switch to position 1 and hold for 4 seconds. The staged Cargo Hook will release, followed by a brief pause, and then the remaining hooks are released in rapid succession.



*The Drop All feature is disabled when shipped and must be enabled by the customer before use.*

#### 4.5 Carousel System Lights, Dimming

The Carousel System lights on the Cargo Hook have two brightness settings to accommodate different ambient conditions. The lower brightness setting works well for overcast conditions and the higher brightness setting provides greater visibility in full sun. To change from one setting to the other toggle the switch to position 2 in a double-click manner.

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## 5.0 Installation

### 5.1 Recommended Aircraft Electrical Installation

To operate the Carousel System, several supporting provisions will need to be installed on the aircraft. See Figure 5.2 for a recommended aircraft side wiring schematic. If the rotorcraft is wired for operation of a typical remote Cargo Hook, the wiring will need to be modified to accommodate the Carousel System.



*The customer is responsible for the appropriate civil aviation authority approval of the installation of these components on the aircraft.*


The aircraft-side components are not included with the Carousel System (200-420-00, 200-421-00, or 200-422-00) but some of the necessary components can be purchased as a non-certified kit (P/N 200-423-00).

The 200-423-00 kit includes several components which may be used to assist the customer in retrofitting their particular aircraft, although more components may be needed depending on the specific method of installation. Table 5.1 lists all the parts included with this kit. See Figure 5.1 for overview of the primary kit components.

**Table 5.1 Bill of Materials for Kit P/N 200-423-00**

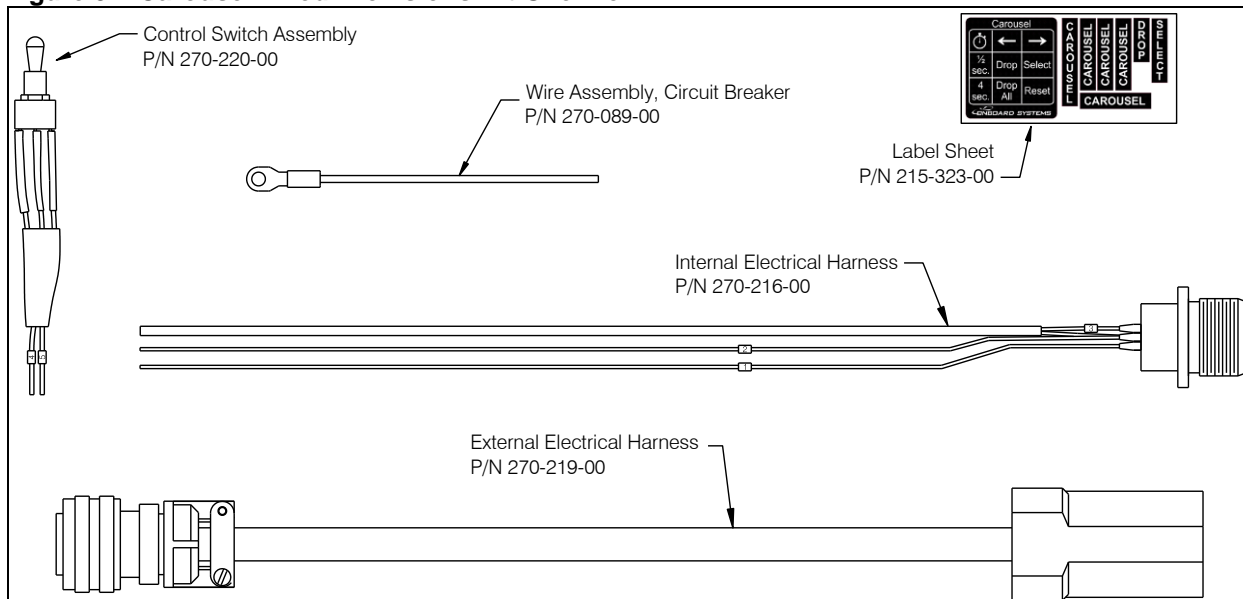
Part No.	Description	Qty
270-089-00	Wire Assembly, Circuit Breaker	1
270-216-00	Carousel Internal Electrical Harness	1
270-219-00	Carousel External Electrical Harness	1
270-220-00	Control Switch Assembly	1
215-323-00	Decal Sheet	1
410-162-00	Ring Terminal	2
440-007-00	Circuit Breaker, 10 Amp	1
510-029-00	Nut	4
510-062-00	Washer	4
510-481-00	Screw	4



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**Recommended Aircraft Electrical Installation** continued

**Figure 5.1 Carousel Fixed Provisions Kit Overview**



The P/N 200-423-00 kit includes a pre-wired toggle switch assembly (P/N 270-220-00) with resistor pre-installed. If installing the 270-220-00 switch assembly, connect wire no. 4 from the switch through the internal harness to pin B of the belly connector and connect wire no. 5 through to 28 VDC. Otherwise, wire a 3 position, neutral center toggle switch per the complete schematic shown in Figure 5.1.

Configure and label the switch as described in Table 4.1 (i.e. – toggling to the left is Switch Position 1 and toggling to the right is Switch Position 2).

**NOTICE**

*The schematic shown below is specific to SPIDER® Smart Carousel System operation and is not compatible with a prior carousel installation.*

**NOTICE**

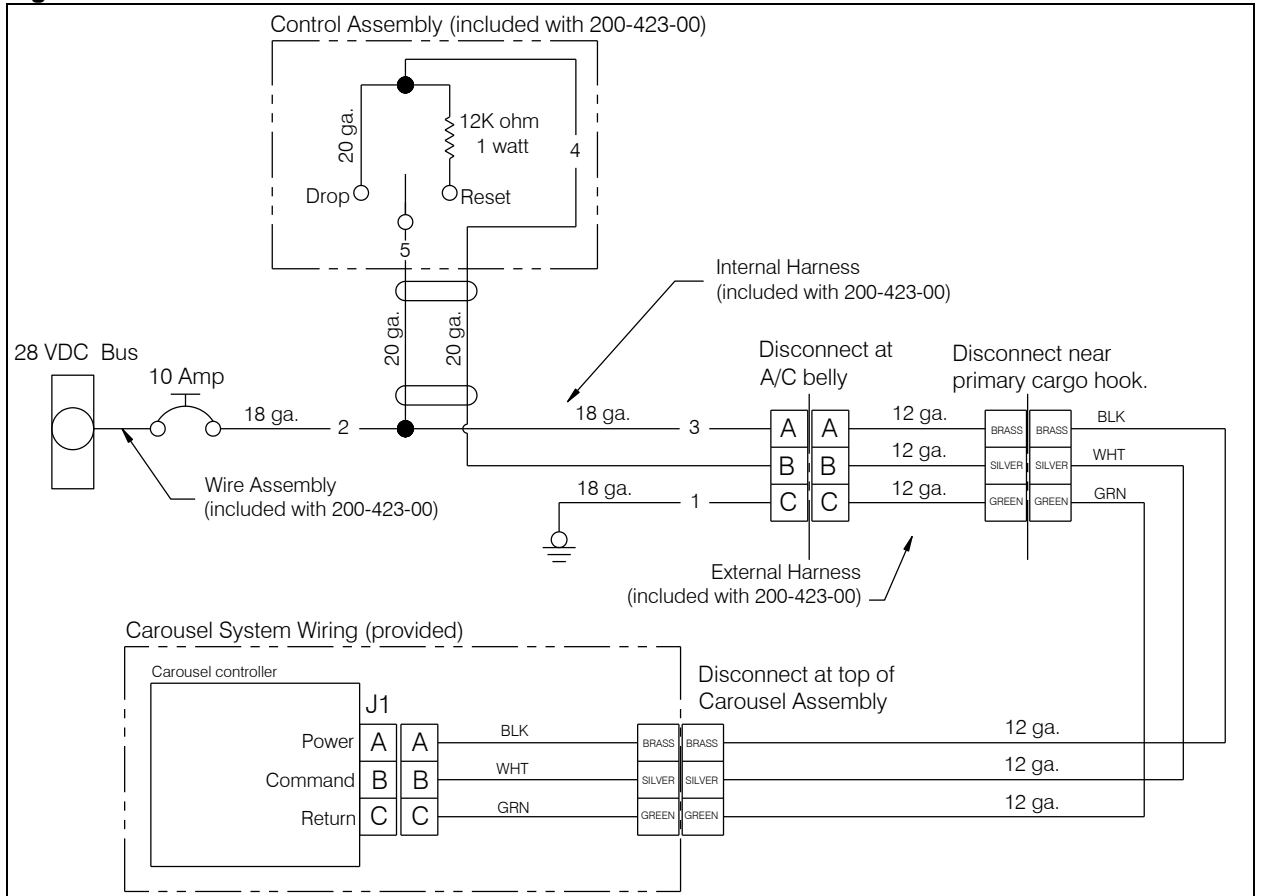
*A long line hook will need a separate wiring configuration as power is always applied to one of the pins of the belly disconnect in the Carousel System.*


Recommended Aircraft Electrical Installation continued

# NOTICE

*The Carousel Controller requires that a 12K ohm 1 watt resistor be installed at one side of the three position switch (as shown in Figure 5.2). This is the 'Reset' side of the switch.*

**Figure 5.2 Recommended Aircraft Side Schematic**



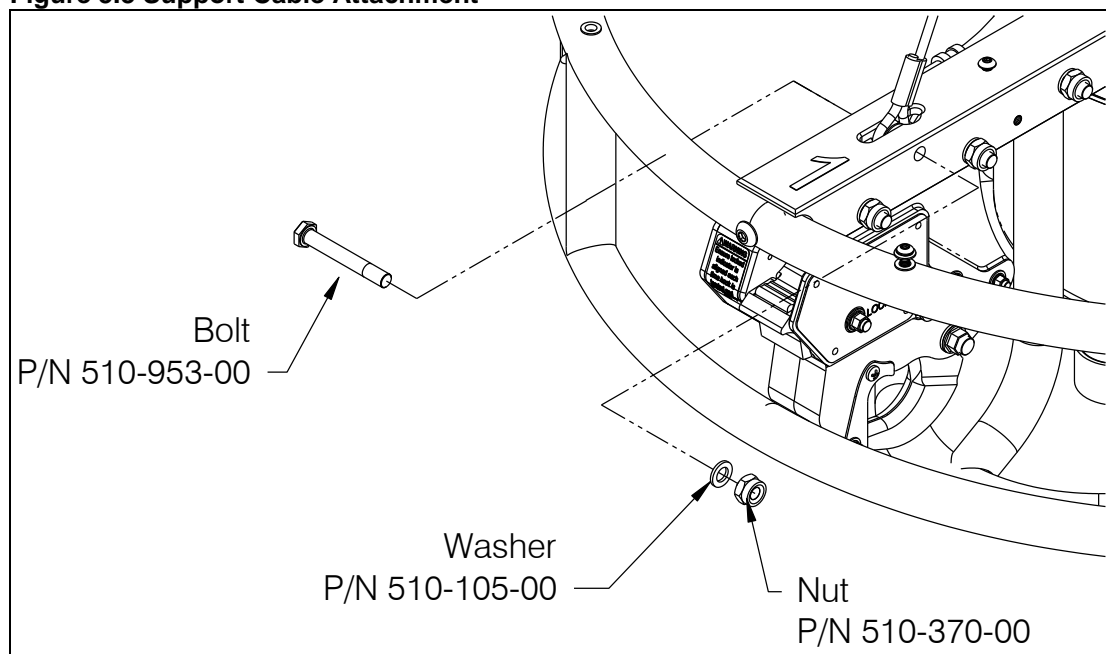
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## 5.2 SPIDER® Smart Carousel System Assembly

SPIDER® Smart Carousel Systems are shipped with the support cables detached from the frame assembly. The support cables are supplied as a sub-assembly. It is necessary to install this sub-assembly onto the carousel frame before putting to the system into operation. The necessary hardware and fasteners used to install the support cables are supplied (see Bill of Materials in section 3 for list of supplied parts).

To install the support cables. Place the thimble end of a support cable in the slot in one of the spokes and secure with the provided bolt, washer and nut (see Figure 5.3). Torque nut to 60-85 in-lbs (7-9.5 Nm). Repeat for each support cable.

**Figure 5.3 Support Cable Attachment**



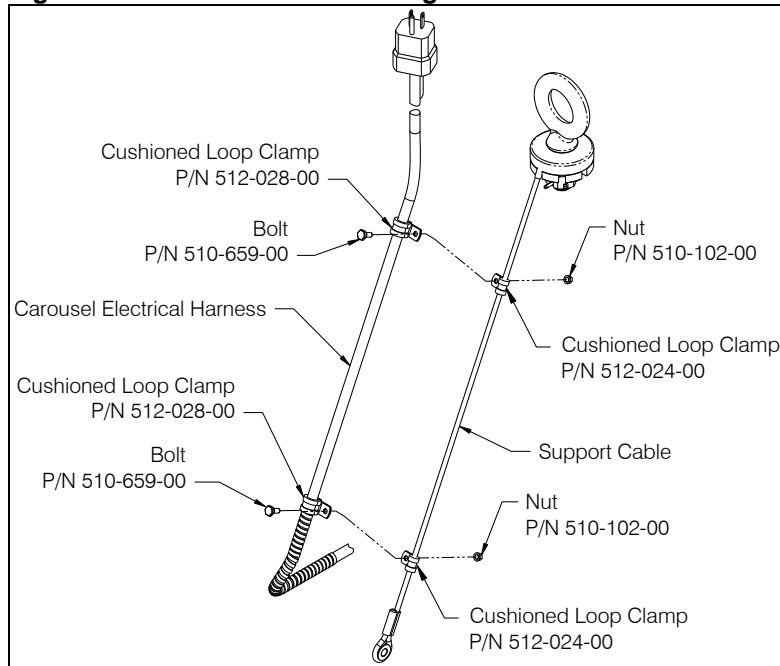
# NOTICE

*If the bolt does not pass through the attach hole in the spoke it may be necessary to loosen the attach bolts securing the Cargo Hook to the spoke. Loosen as needed and re-torque when the cable thimble is installed.*

**SPIDER® Smart Carousel System Assembly** continued

After the support cables are assembled onto the spokes, route the electrical cord along the nearest support cable using the supplied cushioned loop clamps and hardware as shown in Figure 5.4.

**Figure 5.4 Electrical Cord Routing**



Ensure that the electrical cord has sufficient slack below the lower cushioned loop clamp so that it does not rub or chafe on the edges of the Protective Plate or adjacent Spoke.

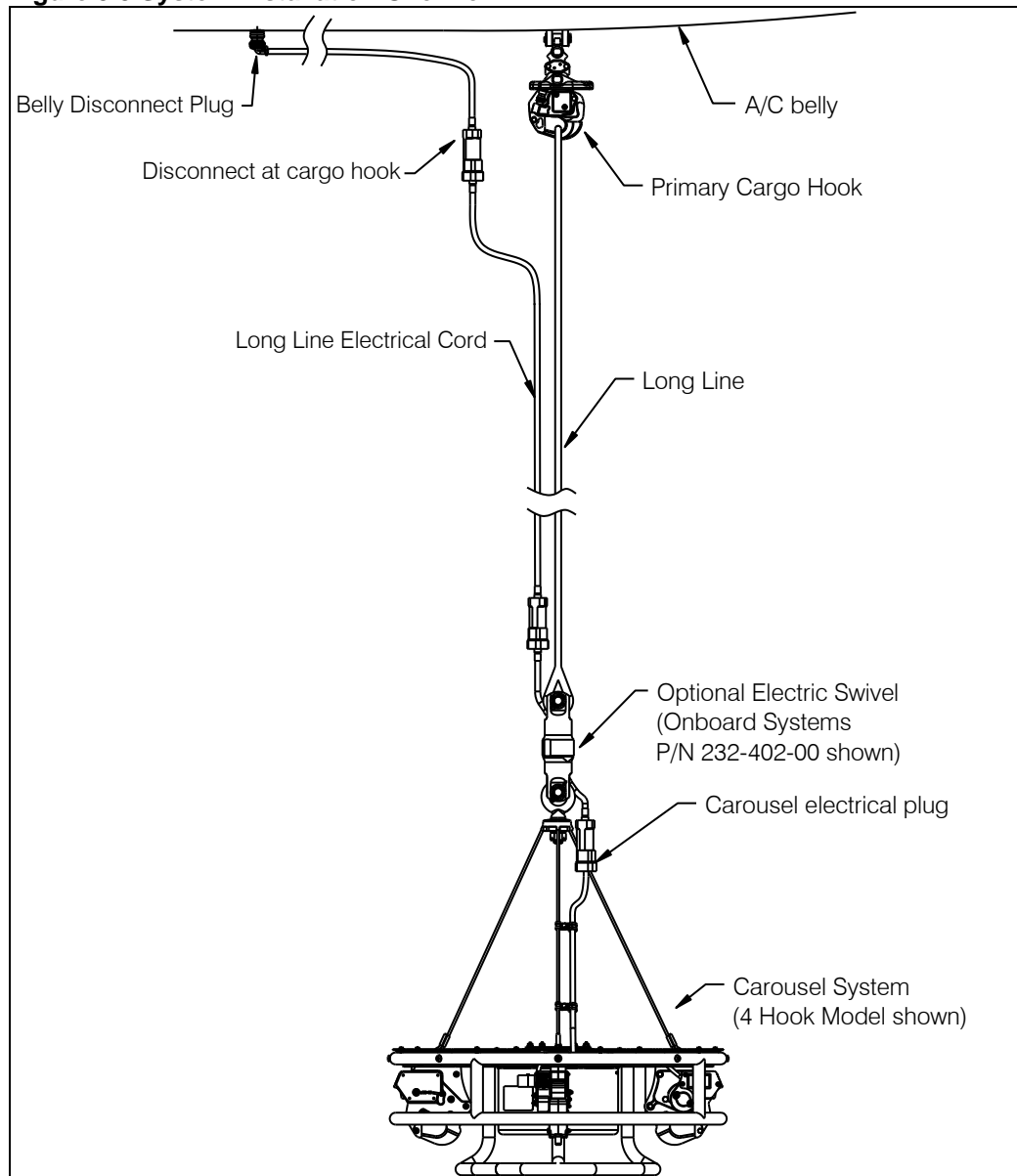


Adjust loop length and clamp orientation to protect cord from chafing in this area.

### 5.3 SPIDER® Smart Carousel System Attachment to Long Line

The Carousel System is intended for attachment at the end of a long line and is equipped with an eyebolt for simple structural connection to the long line and is equipped with a standard NEMA 5-15P duplex connector for electrical connection. It is recommended that an electric swivel be used between the system and the helicopter's primary Cargo Hook to prevent twisting of the long line and/or the system support cables.

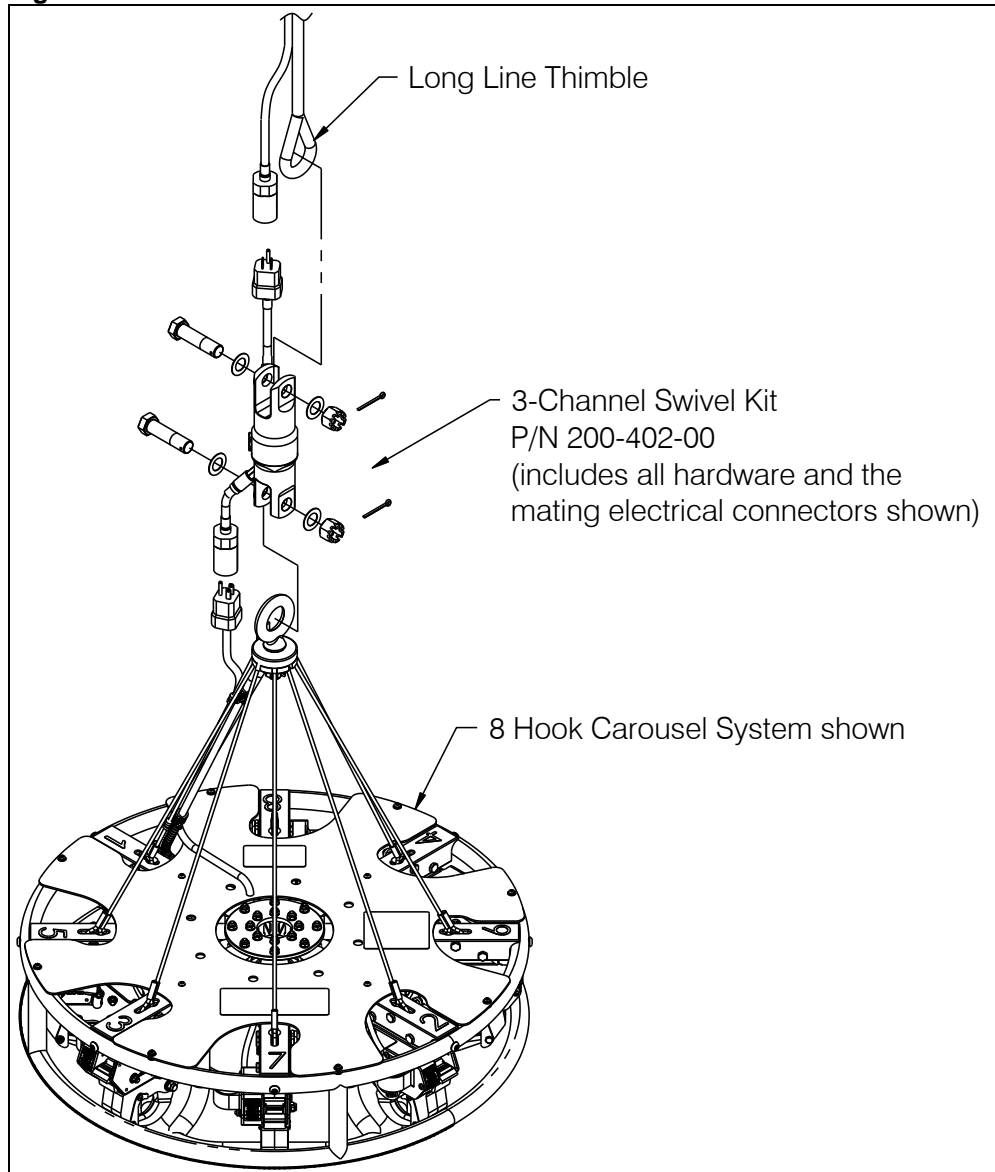
**Figure 5.5 System Installation Overview**




**SPIDER® Smart Carousel System Attachment to Long Line** continued

An optional Electric Swivel Kit, P/N 200-402-00, is available for use with the Carousel System. This 3-Channel Electrical Swivel provides a rotating electrical connection between the helicopter long line and the Carousel System.

**Figure 5.6 Installation with 3-Channel Electric Swivel Kit**



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#### 5.4 Post-Installation Check-Out

After installation of the Carousel System, perform the following functional checks.

1. Ensure that the electrical cord has enough slack to accommodate movement of the system and is protected from chafing and snagging.
2. Test the functionality of the system with the aircraft electrical system per steps 3 through 10 following.

(The functional checks below reflect an 8 hook system with the default factory settings. If a 6 hook system is being used, hook 8 becomes hook 6, hook 7 becomes hook 5, etc. in the instructions below).

3. Close all Cargo Hooks and apply power to the system.
4. Reset the Controller by toggling the switch to position 2 on the aircraft control and holding for 4 seconds. The lights will march around for a few seconds and all lights should be steadily illuminated upon completion.
5. Toggle the switch to position 1 on the aircraft control and hold for ½ second to activate the 'Drop' function. Hook 8 will release, the light pattern will flash, and the light pattern will change to show Hook 7 is staged for release.
6. Actuate the 'Drop' function again and Cargo Hook 7 will release, the light pattern will flash and then change to show Hook 6 is staged for release. Repeat until all Cargo Hooks are released in order (all lights should be extinguished after the last hook is released).
7. Reset the Controller. Hook 8 is now staged for release.
8. Exercise the 'Select' function by toggling the switch to position 2 for ½ second. The light pattern should change from showing hook 8 to hook 7. Repeat the 'Select' command and the light pattern should change to hook 6. Continue through the pattern. Note, none of the Cargo Hooks open during this exercise.
9. Reset the Controller.
10. Double click the switch to position 2 and verify the hook lights change intensity. Repeat the double click and verify the intensity changes back to the original setting.

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## 6.0 Operation Instructions

### 6.1 Pre-Flight Functional Checks

Prior to external load operations perform the following functional checks of the Carousel System. If these procedures are not successful, do not use the Carousel System until the problem is resolved.

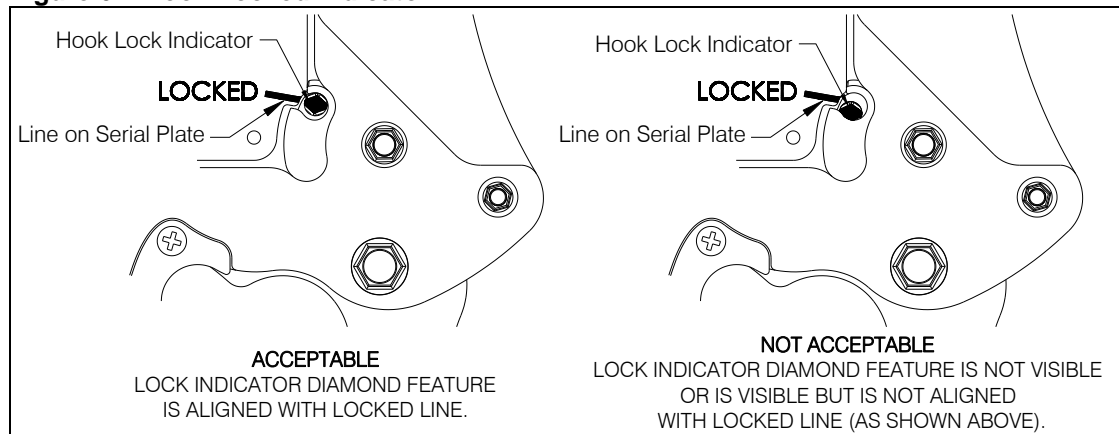
(The functional checks below reflect an 8 hook system with the default factory settings. If a 6 hook system is being used, hook 8 becomes hook 6, hook 7 becomes hook 5, etc. in the instructions below.)

1. Before operating the Carousel System be completely familiar with the Rotorcraft Flight Manual Supplement for External Cargo Operation for your helicopter.
2. Check all fasteners to ensure that they are in place and secure. Check the electrical cord and its connections for damage and security. Check the support cables for damage and fraying.
3. Verify Controller operation per Section 5.4, steps 3 through 9.
4. Return the Cargo Hooks to the closed position by manually closing each load beam. The load beams should snap shut. Verify that the hook lock indicator on the side of the Cargo Hook returns to the fully locked position (see Figure 6.1). The diamond shaped feature must be aligned with the line on the serial plate.




*Ensure the Cargo Hook is in the locked position by checking that the diamond shaped indicator is aligned with the LOCKED line (see Figure 6.1). If they are not aligned, the hook is not locked and an inadvertent load release can occur.*

**Figure 6.1 Hook Locked Indicator**



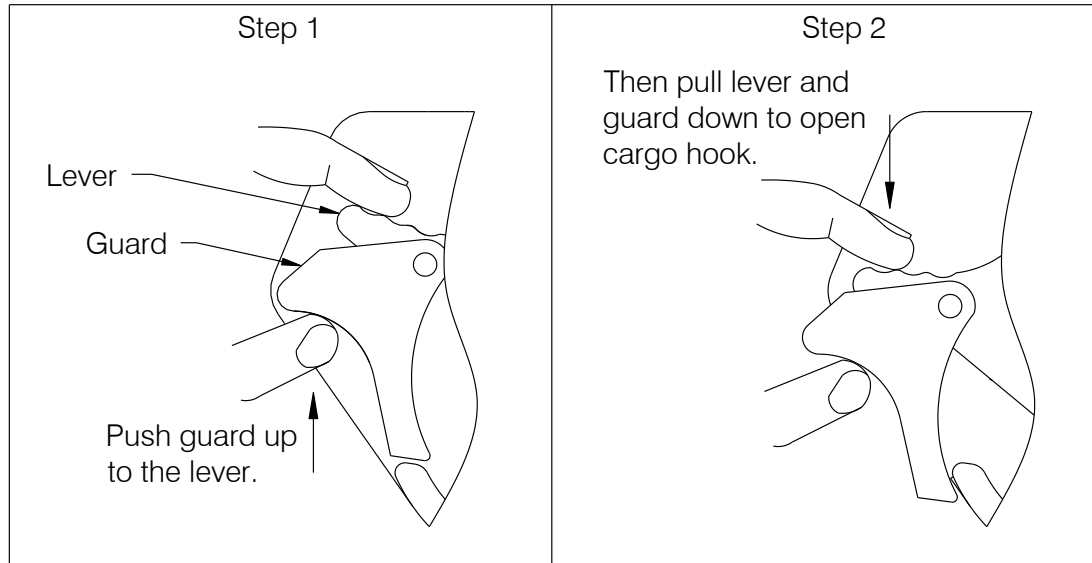



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**Pre-Flight Functional Checks** continued

5. Check the release function of the Cargo Hooks using the manual release lever. To operate the release lever, push the guard up to the lever and then pull the lever and guard down together (see Figure 6.2). The mechanism should operate smoothly and the load beam should open.

**Figure 6.2 Release Lever Operation (hook side plate not shown for clarity)**



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## 6.2 Changing Carousel Controller Settings

The Carousel Controller has features that can be disabled or enabled depending on operator preferences. These functions and the DIP switches on the Controller that enable or disable them are as follows. Note, most of the instructions in this manual are written around the default configuration of the Controller.

**Table 6.1 DIP Switch Settings**


DIP Switch	Function	Switch Off	Switch On
1	<b>Mode</b>	Basic	<b>Advanced*</b>
2	<b>Drop All</b>	<b>Disabled*</b>	Enabled
3	<b>Select Hook</b>	Disabled	<b>Enabled*</b>
4	<b>Auto Advance</b>	Disabled	<b>Enabled*</b>
5	<b>Count</b>	<b>Count Down*</b>	Count Up
6	Not Used		

\*Factory default setting.

- **DIP switch 1** is the mode setting for the Controller and is shipped from the factory in Advanced mode. Do not change this mode to Basic mode unless replacing a legacy Controller. Contact Onboard Systems for more information regarding Basic mode prior to attempting.
- **DIP switch 2** is used to turn the Drop All function on and off. The default factory setting is OFF but if is desired to be able to release all loads with a single command, move this switch to the ON position.
- **DIP switch 3** is used to turn the 'Select' function on and off, the default factory setting is ON. The Select feature enables the operator to skip and move to the next hook in the sequence without dropping. If this feature is not desired move this switch to the OFF position.
- **DIP switch 4** is used to turn the Auto Advance function on and off. The default factory setting is ON, which enables this feature. If Auto Advance is ON then the Controller automatically advances to the next Hook in the sequence after a hook is released. If it is turned off, the operator must manually actuate the 'Select' function on the aircraft control to advance to the next hook. Think of this as a completely manual mode of operation.
- **DIP switch 5** is used to adjust the Count function on the Controller, Count Down is the default factory setting, thus the highest numbered hook (i.e. - hook 8 in the 8 hook system) is the first hook to be staged for release followed by hook 7, hook 6, etc. In the Count Up setting, hook 1 is the first hook to be staged for release followed by hook 2, hook 3, etc. To change to the Count Up setting, move DIP switch 5 to on.

**NOTICE**

*After changes to DIP switch settings, the Controller must be reset (using the 'Reset' command) before the new settings take effect.*

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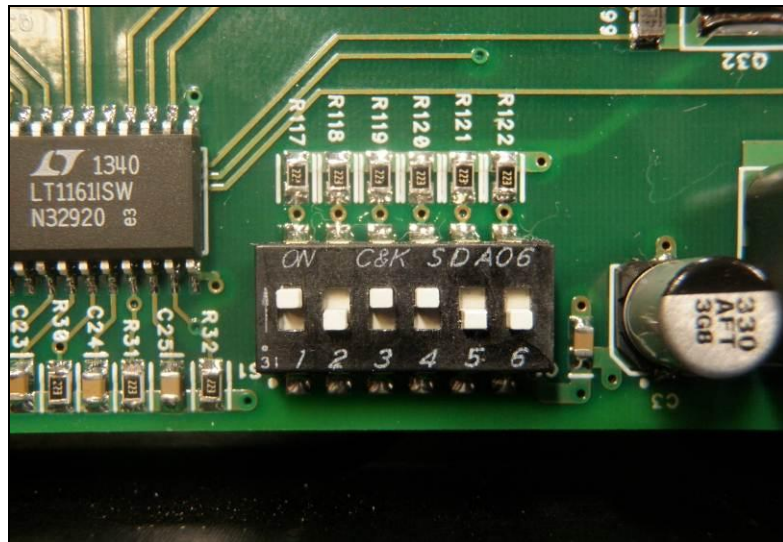
**Changing Carousel Controller Settings** continued


To change the default factory settings the Controller must be removed from the Carousel System. To remove the Controller from the Carousel System reference disassembly steps in Section 10.0.

Once the Controller is removed, remove the cover from the Controller by removing eight screws and locate the DIP switch at the edge of the circuit board (see photo below). The DIP switch shown below is configured in the factory default settings: switch 1, 3 and 4 are on and switches 2 and 5 are off. Switch 6 is not used.



*When working with the Carousel Controller observe precautions for handling electrostatic sensitive devices.*



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### Changing Carousel Controller Settings continued

Re-assemble the cover onto the Controller with the eight screws removed previously and re-assemble the Carousel per assembly instructions in Section 12.0.



Perform the post-installation check-out to verify expected operation. Note the new settings on the information label.

## NOTICE

*After changing the settings, record the new settings on the information label (see following example) on top of the carousel and in another convenient location or annotate in this manual.*

## NOTICE


**Controller Operation**

Input	 ½ sec	 4 sec
Switch 1	Drop	Drop All*
Switch 2	Select	Reset

**Controller Options**

Mode	<input type="checkbox"/> Basic	<input checked="" type="checkbox"/> Advanced <sup>†</sup>
Drop All	<input type="checkbox"/> Disabled <sup>†</sup>	<input checked="" type="checkbox"/> Enabled
Select Hook	<input type="checkbox"/> Disabled	<input checked="" type="checkbox"/> Enabled <sup>†</sup>
Auto Advance	<input type="checkbox"/> Disabled	<input checked="" type="checkbox"/> Enabled <sup>†</sup>
Count	<input checked="" type="checkbox"/> Count Down <sup>†</sup>	<input type="checkbox"/> Count Up

<sup>\*</sup>Drop all function must be enabled before use.  
<sup>†</sup>Factory default setting. See owner's manual.

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### 6.3 Carousel System Rigging

When loading the Carousel System, load the Cargo Hooks evenly by following the numbering scheme labeled on the top of the Carousel System (i.e. load the Cargo Hooks in order 1, 2, 3, 4 etc...). Other rigging order may result in uneven loading of the Carousel System.



*If slinging a single load from multiple Cargo Hooks, it is recommended that it be released only when the load is on the ground.*

Extreme care must be exercised in rigging a load to the Carousel System Cargo Hooks. Steel load rings are recommended to provide consistent release performance and resistance to fouling.




*It is the responsibility of the operator to assure the Cargo Hooks will function properly with each rigging configuration.*

If nylon straps or ropes are used, verify that they slide freely from the load beam when the Cargo Hook is opened. Extremely thin straps (less than a 1/16" thickness) may be capable of sliding off the tip of the load beam even when closed & latched. If very thin straps are to be used they must first be attached to a steel primary ring. When using steel load rings, verify that the ring will freely slide off the load beam when it is opened.



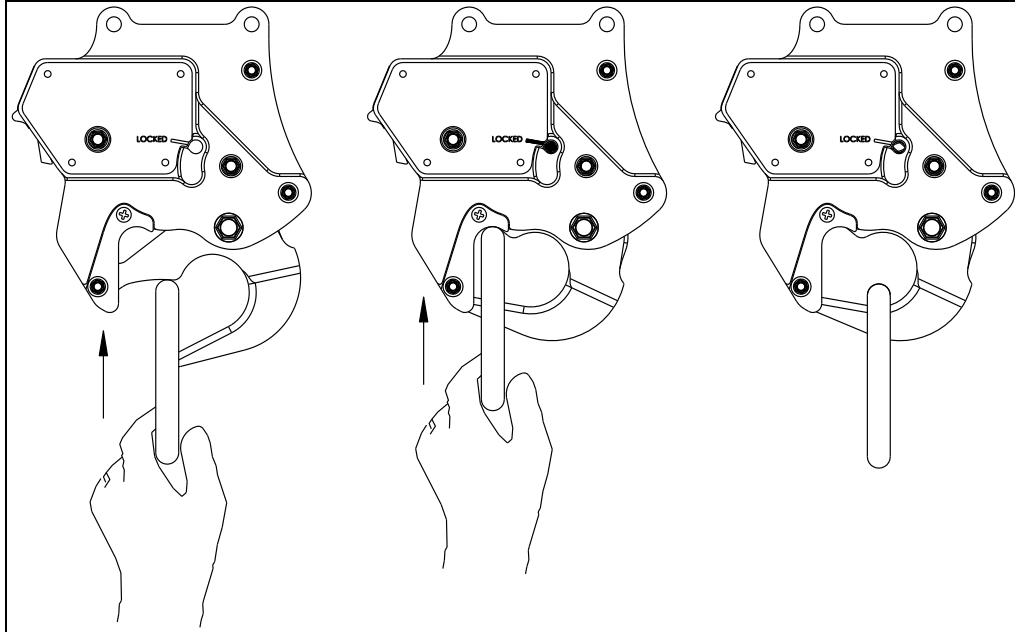
*Very thin nylon straps (less than a 1/16" thick) must not be used directly on the load beam as they may be capable of working themselves around the tip of the load beam when it is latched.*

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## 6.4 Cargo Hook Loading

The Cargo Hooks can be easily loaded with one hand. A load is attached by pushing a ring upward against the upper portion of the load beam throat, as illustrated in Figure 6.3, until an internal latch engages the load beam and latches it in the closed position.

**Figure 6.3 Cargo Hook Loading**



The Cargo Hooks may be flown in the open position to facilitate loading by a ground crew. See Owner's Manual 120-213-00 for complete instructions regarding operation of the 528-044 series Cargo Hook.

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## 7.0 Maintenance

Refer to Owner's Manual 120-213-00 for maintenance instructions for the Cargo Hooks (P/N 528-044-10 and 528-044-11) included with the Carousel System.



*Failure to follow all equipment maintenance instructions and component inspection criteria may result in serious injury, death or loss of flight safety.*




*It is not recommended to repair the Carousel Controller in the field, see troubleshooting in section 13.0 in the event of system malfunction and if problem cannot be corrected then return the Controller to the factory (see Section 15.0 for instructions for return). Do not open Controller except to change DIP switch settings (see Section 6.2).*

### 7.1 Monthly Preventive Maintenance

1. Remove accumulated soils from the exterior with a soft bristle brush and mild solvent/cleaner. In corrosive environments, apply a corrosion preventative compound such as ACF-50 to exterior surfaces of Cargo Hooks.

### 7.2 Annual Inspection

1. Annually or 100 hours of external load operations, whichever comes first, thoroughly clean the exterior with a soft bristle brush and mild solvent/cleaner and visually inspect for cracks, gouges, dents, nicks, corrosion, and missing or loose fasteners.

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### **7.3 Five Year/1000 Hour Inspection**

1. The remainder of the Carousel System, not including the Cargo Hooks, is on-condition, every 1000 hours of external load operations or 5 years, whichever comes first, inspect the Carousel System per the instructions contained here-in. This interval is the same as the overhaul interval for the Carousel System Cargo Hooks (Onboard Systems P/N's 528-044-10 and 528-044-11). Overhaul the Cargo Hooks per the instructions contained within Owner's Manual 120-213-00.
2. Hours of external load operations should be interpreted to be (1) anything is attached to the system (whether or not a useful load is being transported) and (2) the aircraft is flying. If these conditions are not met, time does not need to be tracked.

### **7.4 Repair**

1. Repair the Carousel System in accordance with the repair instructions contained here-in.




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## 8.0 Repair Instructions

- 8.1 It is recommended that only minor repairs be attempted by anyone other than the factory. The following procedures and information are provided for the benefit of experienced aircraft maintenance facilities and trained maintenance and inspection personnel capable of carrying out the procedures. They must not be attempted by those lacking the necessary expertise. See Section 15.0 for instructions for returning equipment to the factory.
- 8.2 Reference numbers throughout this manual shown in parentheses ( ) refer to Table 14.1 and Figure 14.1 through Figure 14.4.
- 8.3 Follow these steps to repair the Carousel System, referring to the applicable sections in this manual.
1. Disassemble as required.
  2. Inspect disassembled parts.
  3. Obtain required replacement parts.
  4. Re-assemble.
  5. Inspect for return to service.

## 9.0 Inspection Instructions

- 9.1 It is recommended that only minor repairs be attempted by anyone other than the factory. The following procedures and information are provided for the benefit of experienced aircraft maintenance facilities and trained maintenance and inspection personnel capable of carrying out the procedures. They must not be attempted by those lacking the necessary expertise and suitable equipment to acceptance test the Cargo Hook after overhaul. See Section 15.0 for instructions for returning equipment to the factory.
- 9.2 Follow these steps to inspect the SPIDER<sup>®</sup> Smart Carousel System, referring to the applicable sections in this manual:
1. Inspect the system per Table 11.1.
  2. If a part (or parts) requires replacement, disassemble system as required.
  3. Obtain required replacement parts.
  4. Re-assemble.
  5. Inspect for return to service.

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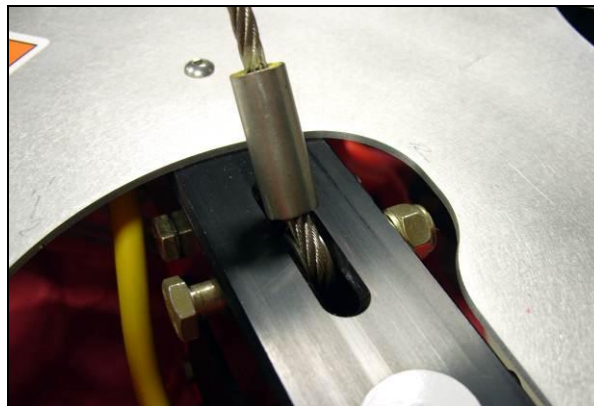
## 10.0 Disassembly Instructions

Reference numbers throughout this manual shown in parentheses ( ) refer to Table 14.1 and Figure 14.1 through Figure 14.4.




*Failure to follow all equipment maintenance instructions and component inspection criteria may result in serious injury, death or immediate loss of flight safety.*

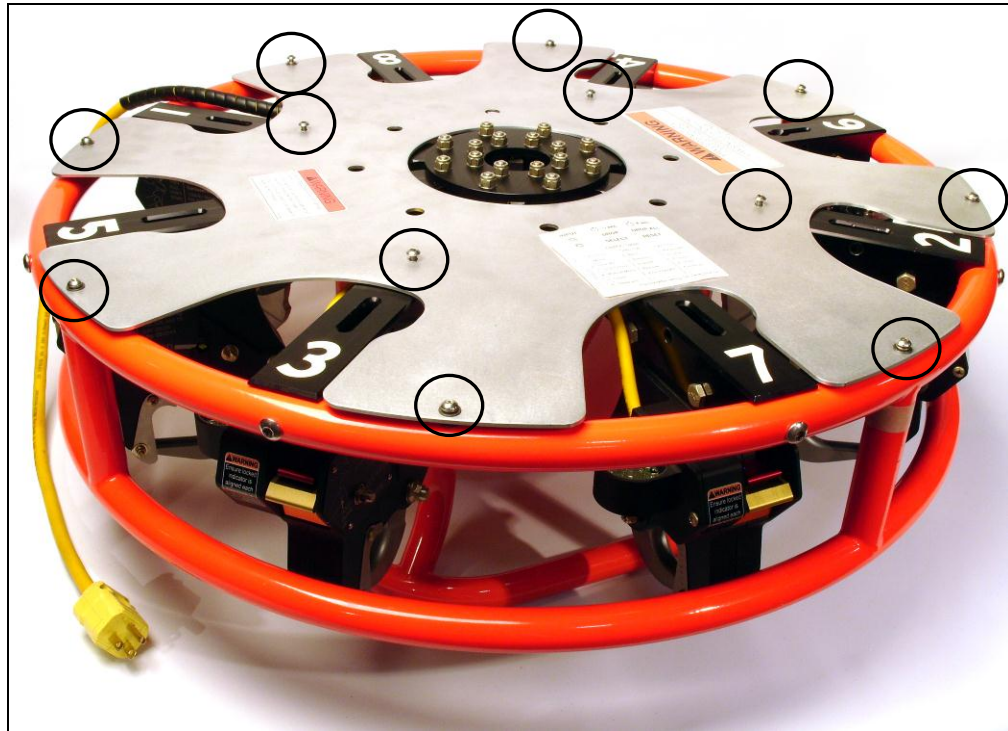
- 10.1 Remove the cushioned loop clamps (46 and 47) that attach the electrical cord (7) to the support cable (42.1).
- 10.2 Remove the bolts (43), washers (44) and nuts (45) securing the Support Cable Assembly to the Spokes (6.1).



- 10.3 To separate the Support Cable Assembly from the Cable Hub (42.2) remove the cotter pin (42.5) securing the castellated nut (42.6). The Cable Hub, Cable Hub Cap (42.3), eyebolt (42.4) and Support Cable Assembly can now be disassembled.


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- 10.4 Remove the Protective Plate (27) by removing the eight screws (30), lock washers (31), and washers (32) at the outer ring of the Double Ring Assembly (33) and the four screws (11) into the Spokes.



- 10.5 Remove the Controller Enclosure (5) by removing four screws (15) and washers (23). The Cargo Hook and main electrical connections can now be separated and the cords and grommets (10) slid out from the slots in the Enclosure Cap (8).




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- 10.6 Separate the electrical cord from each Cargo Hook at the spoke by removing the screw (38) attaching the cushioned loop clamp (37) to the Spoke.
- 10.7 Disconnect each Cargo Hook electrical cord's Molex connector from the mating connector on the harness from the Controller.
- 10.8 Remove Cargo Hooks (36) from each Spoke by removing the two nuts (41) and washers (40) from the bolts (39).
- 10.9 Separate the Enclosure Cap with Controller from the Spokes by removing the four bolts (24), washers (18), and urethane spring (12).
- 10.10 Separate the Double Ring Assembly from the Spokes by removing the screws (14) along the perimeter.
- 10.11 Separate the Strut Weldment (4) from the Spokes by removing the nuts (20), washers (16) and bolts (22) at the top of each vertical leg.



- 10.12 Separate the Spokes from the two Hubs (9) by removing the two nuts (17), washers (21), and bolts (19) at each Spoke.


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## 11.0 Inspection Instructions

- 11.1 Thoroughly clean all parts to be inspected using a soft bristle brush and mild solvent/cleaner.
- 11.2 Carefully inspect detail parts in accordance with the instructions in Table 11.1. Inspect the parts in a clean, well-lighted room using standard dimensional measuring tools and visual methods. Repair parts found within inspection limits. Replace any part found beyond limits.

**Table 11.1 Carousel System Inspection Criteria**

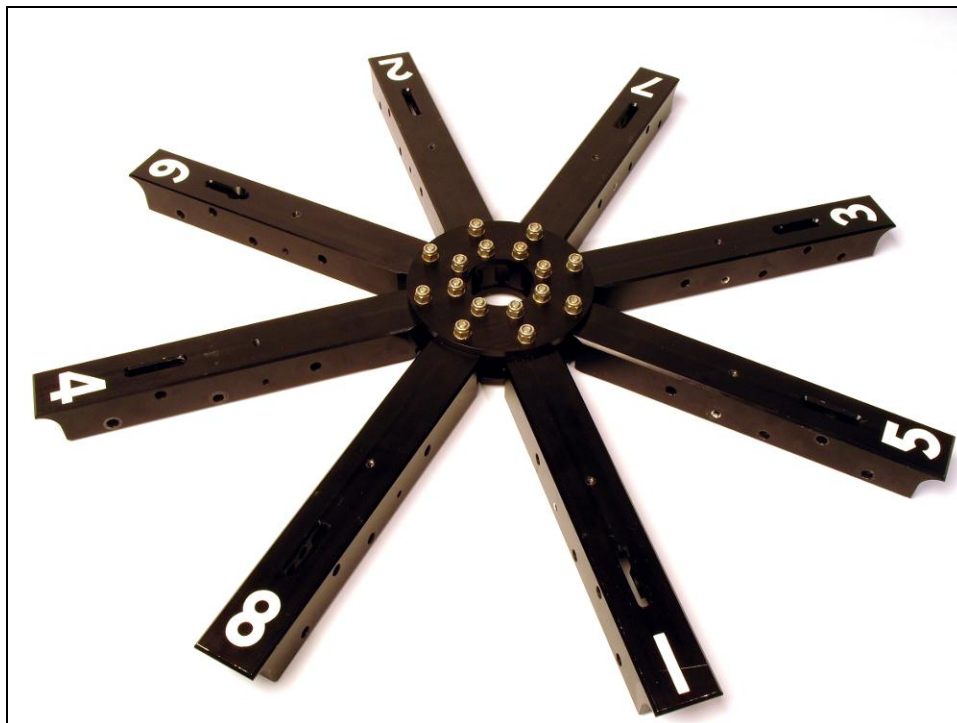
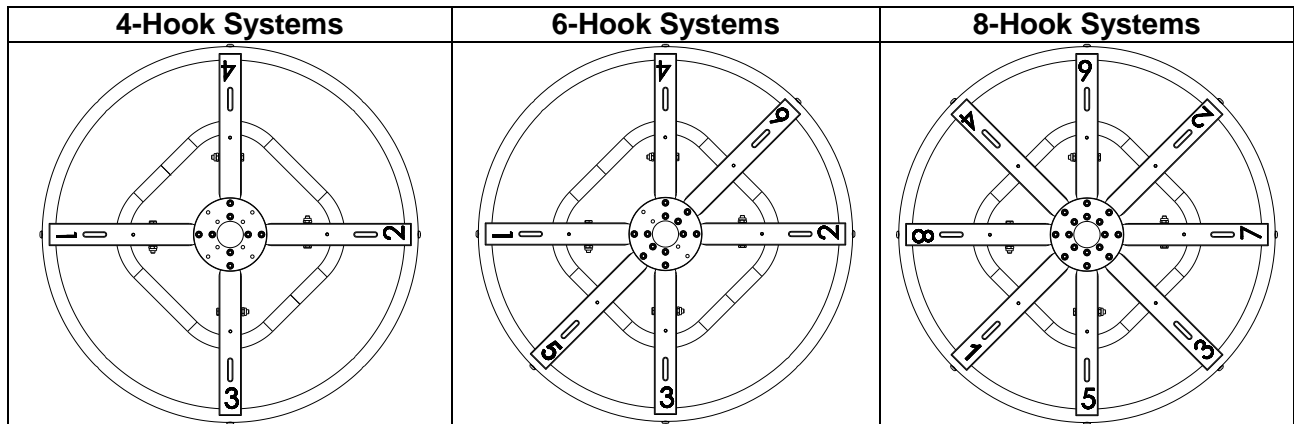
Seq	Component	Inspection Criteria & Limit	Repair Action	Finish
1.	Spoke (6.1)	Dents, nicks, cracks, gouges, scratches and corrosion – 0.060 in. (1.52 mm) deep.	Glass bead blast at less than 30 PSI (2.11 KGF/CM <sup>2</sup> ) to remove corrosion. Blend at 10:1 ratio as required to provide smooth transitions.	Apply Alodine (MIL-DTL-5541) and zinc chromate primer (MIL-PRF-23377 or similar) to affected surfaces.
2.	Spokes (6.1)	Slots which retain support cable thimbles are worn, width greater than .32 in. (8.1 mm).	None. Replace.	N/A
3.	Cable Hub (42.2)	Slots which retain support cables are worn, width greater than 0.30 in (7.6 mm).	None. Replace.	N/A
4.	Eyebolt (42.4)	Wear on inside of ring from long line or swivel connection, diameter of cross section less than .53 in (13.5 mm).	None. Replace.	N/A
5.	Strut Weldment (4), Ring Weldment (33)	Separated weld joints, cracks in tubes. Bent tubes interfering with full travel of Cargo Hook load beam or obstructing access for attaching load to Cargo Hook.	None. Replace. Touch up worn finish w/ paint.	N/A
6.	Electrical wiring (7, 29)	Worn or missing insulation, exposed conductors.	None. Replace.	N/A
7.	Cable Assembly (42.1)	Kinks, broken cable strands - ten randomly distributed broken strands in one cable lay (one complete rotation around the cable) or five broken wires in one strand in one cable lay.	None. Replace	N/A
8.	Placards, Decals (1, 2, 3, 35)	Damaged or illegible.	None. Replace	N/A
9.	Protective Plate (27)	Cracks.	None. Replace	N/A

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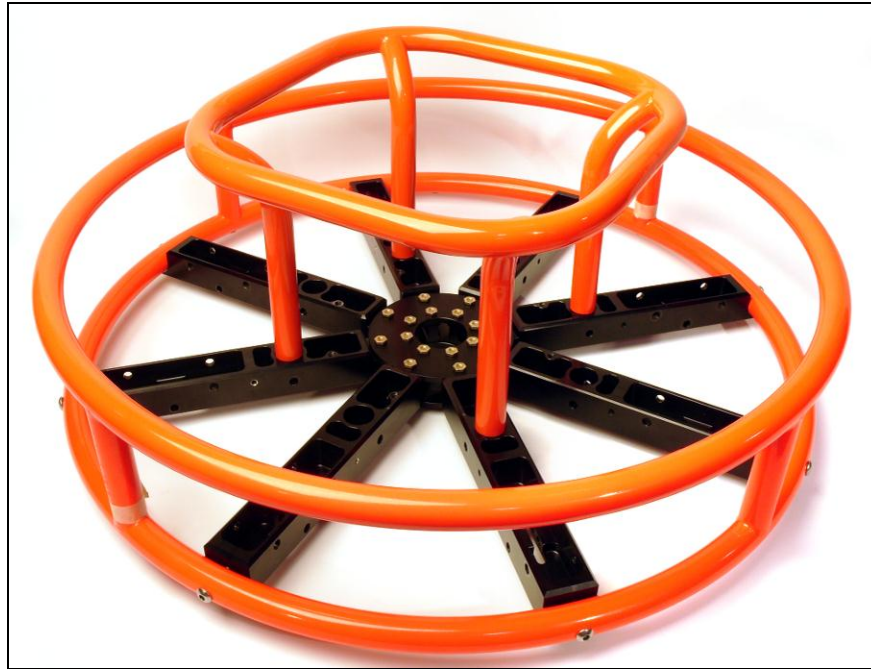
## 12.0 Re-assembly Instructions

- 12.1 Replace all parts found to be damaged with serviceable parts.
- 12.2 Position the Spokes (6.1) between the two Hubs (9) and align each Spoke with a pair of holes in the hubs. Follow the numbered Spoke pattern layouts shown in Figure 12.1. Insert two bolts (19) per Spoke from underneath (see photo for Spoke orientation) and retain with washers (21) and nuts (17) but do not tighten nuts at this stage.

**Figure 12.1 Spoke Assembly Pattern**




- 12.3 Flip assembly over and align vertical tubes of Strut Weldment (4) with holes in four Spokes and insert. Set Double Ring Assembly (33) in position over the outer ends of the Spokes and align the holes in the ring with each tapped hole in the strut and thread in button head screws (14).



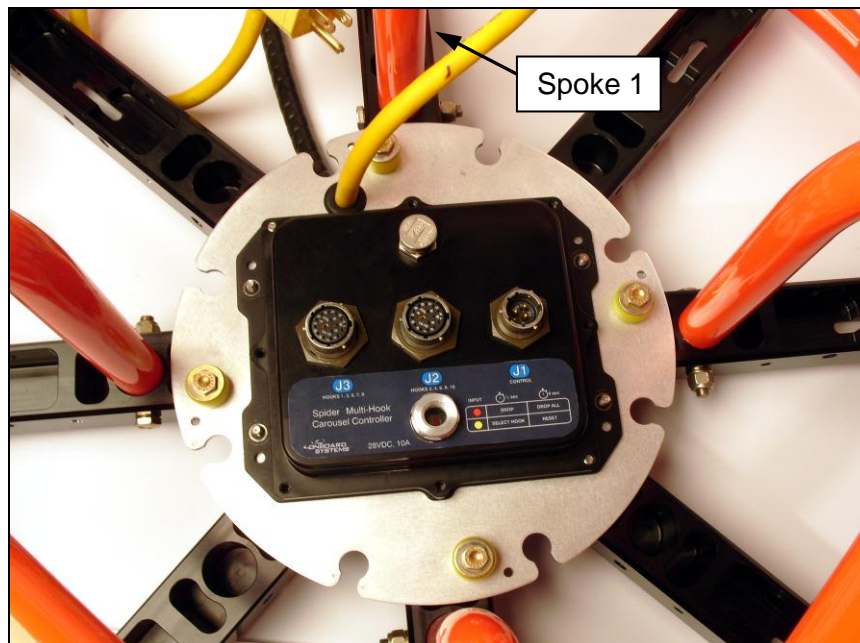
- 12.4 To secure each vertical tube of the Strut Weldment to the mating Spoke insert a bolt (22) through and retain with washer (16) and nut (20). Tighten nuts to 60-85 in-lbs (6.8 – 9.6 N-m).



- 12.5 Tighten the nuts on the bolts securing the Spokes (6.1) to the Hubs (9) to 50-70 in-lbs (5.6 – 7.9 N-m).


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- 12.6 If the electrical cord was replaced, install the grommet (10) in the hole in the Enclosure Cap (8) and slide the cord through and attach connector.
- 12.7 Orient the Enclosure Cap over the Spokes such that the electrical cord is adjacent and to the left of Spoke 1 as shown. Attach the Enclosure Cap to the threaded holes in the underside of the Spokes using four bolts (24), washers (18) and urethane bumpers (12). Tighten the bolts to 10 – 15 in-lbs (1.1 – 1.7 N-m).
- 12.8 Position the Controller (26) over four the threaded studs of the Enclosure Cap and secure washers (50) and with nuts (28). Tighten nuts to 20 – 25 in-lbs (2.3 – 2.8 N-m).



- 12.9 Connect the wire harness to their respective connectors on the Controller.



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- 12.10 Attach each Cargo Hooks (36) to a Spoke with two bolts (39), washers (40) and nuts (41). Tighten nuts to 60-85 in-lbs (6.8 – 9.6 N-m).



- 12.11 Route each electrical cord from the Cargo Hook along the Spoke and secure to the strut with cushioned loop clamp (37) and bolt (38). Slide the grommet along the cord to a position where it can be slid into the slot of the Enclosure Cap.




- 12.12 Connect the electrical connectors from the Cargo Hook to the connectors from the Controller.

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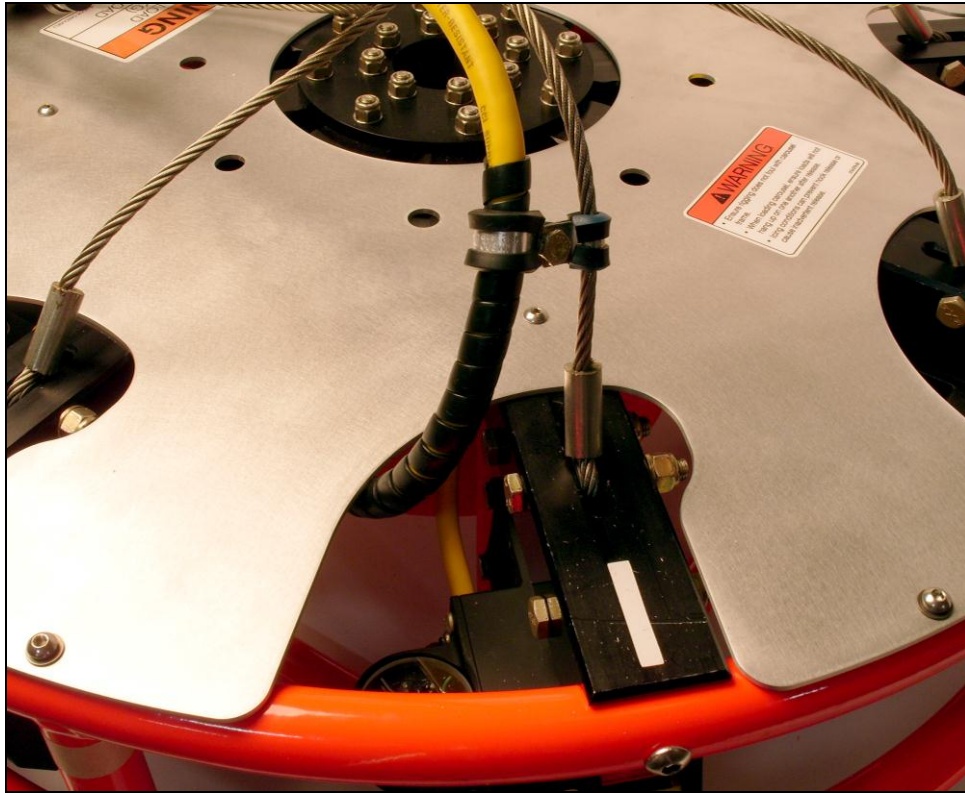
- 12.13 Assemble the Enclosure from underneath and secure to Enclosure Cap with four lock washers (23) and screws (15). Use Loctite 242 Threadlocker on the screw threads.




- 12.14 Attach Protective Plate to top of carousel with eight screws (30), lock washers (31), and washers (32) into the outer ring and four screws (11) into the Spokes.
- 12.15 Attach each cable thimble end of the suspension cable assembly (42) to a strut using a bolt (43), washer (44) and nut (45). Tighten nuts to 60 – 85 in-lbs (6.8 – 9.6 N-m).

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- 12.16 Route the electrical cord along the adjacent suspension cable and secure at a location approximately 3" up from the top of the strut with two cushioned loop clamps (46 and 47), bolt (48) and nut (49).



- 12.17 Secure the electrical cord at a second location along the suspension cable with a second set of cushioned loop clamps (46 and 47), bolt (48) and nut (49) at a location approximately 12" from the first attachment location.


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### 13.0 Troubleshooting

Most Carousel System anomalies will be the result of a wiring problem. The Controller has a built in troubleshooting system using a set of status LEDs visible from the top of the Controller housing through a sight window. If everything is hooked up correctly, the "Drop" command will cause the red status LED to illuminate and the "Select" command will cause the amber status LED to illuminate.

**Table 13.1 Troubleshooting**

<b>Symptom</b>	<b>Probable Cause</b>	<b>Remedy</b>
Carousel lights do not illuminate. No response when commanded.	Power or wiring problem	<p>Ensure circuit breaker is not tripped.</p> <p>Ensure long line has three continuous wires and that a three channel swivel is being used, if applicable.</p> <p>Ensure correct pinout of J1 plug (see Section 12.0 for dis-assembly and Table 13.2 for pinout and recommended aircraft wiring schematic in Section 5).</p>
I've checked the wiring but nothing happens to the carousel when I activate the switch.	Operator is pushing buttons too fast.	Hold switch for at least 1/2 second to initiate drop and select events. This delay is intentional to avoid accidental releases.
Carousel is dropping highest number hooks first (or lowest number hooks first). I want it the other way.	Count Up / Count Down feature is set incorrectly.	Reconfigure Count Up/Count Down feature (see section 6.2).
Both "Drop" and "Select" switch cause hook to drop.	J1 pins A-B are swapped.	Inspect switch, relay, belly and long line connections. It is likely the white and black wires are swapped (see Section 12.0 for dis-assembly and Table 13.2 for connector pin-outs).
Carousel won't "Drop All"	Controller is configured with this feature disabled.	Reconfigure Controller to enable Drop All feature (see section 6.2 in manual)
Hook(s) drop once and "stick" open then shut down.	Input voltage too low.	Ensure long line wires are of sufficient size to provide >20VDC at the Controller.
Not all hooks drop when performing function test.	One or more hooks disconnected from Controller	Inspect connections from individual hooks to Controller
Carousel drops hooks out of order (7-8-5-6-3-4-1-2).	J2 and J3 are swapped	Reverse the splitter cables plugged into J2 and J3 (see Table 13.2 for connector pin-outs).
Active hook does not advance to the next number after drop.	Auto-advance feature is disabled	Reconfigure Controller to enable auto-advance (see section 6.2)
Hook releases when power is applied.	Operator is providing "Advanced" power to Controller configured in Basic mode.	Reconfigure Controller in Advanced mode. (see Section 6.2).
Only lights 1 and 2 are working.	Carousel is configured in Basic mode.	Reconfigure Controller in Advanced mode (see section 6.2 in manual)

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**Table 13.2 Carousel Controller Connector Pin Outs**

<b>Connector J1: Control</b>			
<b>Pin</b>	<b>Function</b>	<b>Notes</b>	<b>Power</b>
A	Power	Continuous	28 VDC power, 10A
B	Command	Momentary	28 VDC = Drop 14 VDC = Select / Reset
C	Return	Continuous	28 VDC return, 10A
<b>Connector J2: Hooks 2, 4, 6, 8, 10</b>			
A	Not Used		
B	Hook 10 Light	Continuous	5 VDC power, 0.3 A
C	Hook 10 Solenoid	Momentary	28 VDC power, 10A
D	Hook 8 Light	Continuous	5 VDC power, 0.3 A
E	Hook 8 Solenoid	Momentary	28 VDC power, 10A
F	Hook 6 Light	Continuous	5 VDC power, 0.3 A
G	Hook 6 Solenoid	Momentary	28 VDC power, 10A
H	Hook 4 Light	Continuous	5 VDC power, 0.3 A
J	Hook 4 Solenoid	Momentary	28 VDC power, 10A
K	Hook 2 Light	Continuous	5 VDC power, 0.3 A
L	Hook 2 Solenoid	Momentary	28 VDC power, 10A
M	Not Used		
N	Not Used		
R	Not Used		
P	Return	Continuous	28 VDC return, 10A
<b>J3: Hooks 1, 3, 5, 7, 9</b>			
A	Not Used		
B	Hook 9 light	Continuous	5 VDC power, 0.3 A
C	Hook 9 solenoid	Momentary	28 VDC power, 10A
D	Hook 7 light	Continuous	5 VDC power, 0.3 A
E	Hook 7 solenoid	Momentary	28 VDC power, 10A
F	Hook 5 light	Continuous	5 VDC power, 0.3 A
G	Hook 5 solenoid	Momentary	28 VDC power, 10A
H	Hook 3 light	Continuous	5 VDC power, 0.3 A
J	Hook 3 solenoid	Momentary	28 VDC power, 10A
K	Hook 1 light	Continuous	5 VDC power, 0.3 A
L	Hook 1 solenoid	Momentary	28 VDC power, 10A
M	Not Used		
N	Not Used		
R	Not Used		
P	Return	Continuous	28 VDC return, 10A

### 14.0 Illustrated Parts List

Figure 14.1 SPIDER® Smart Carousel System Parts

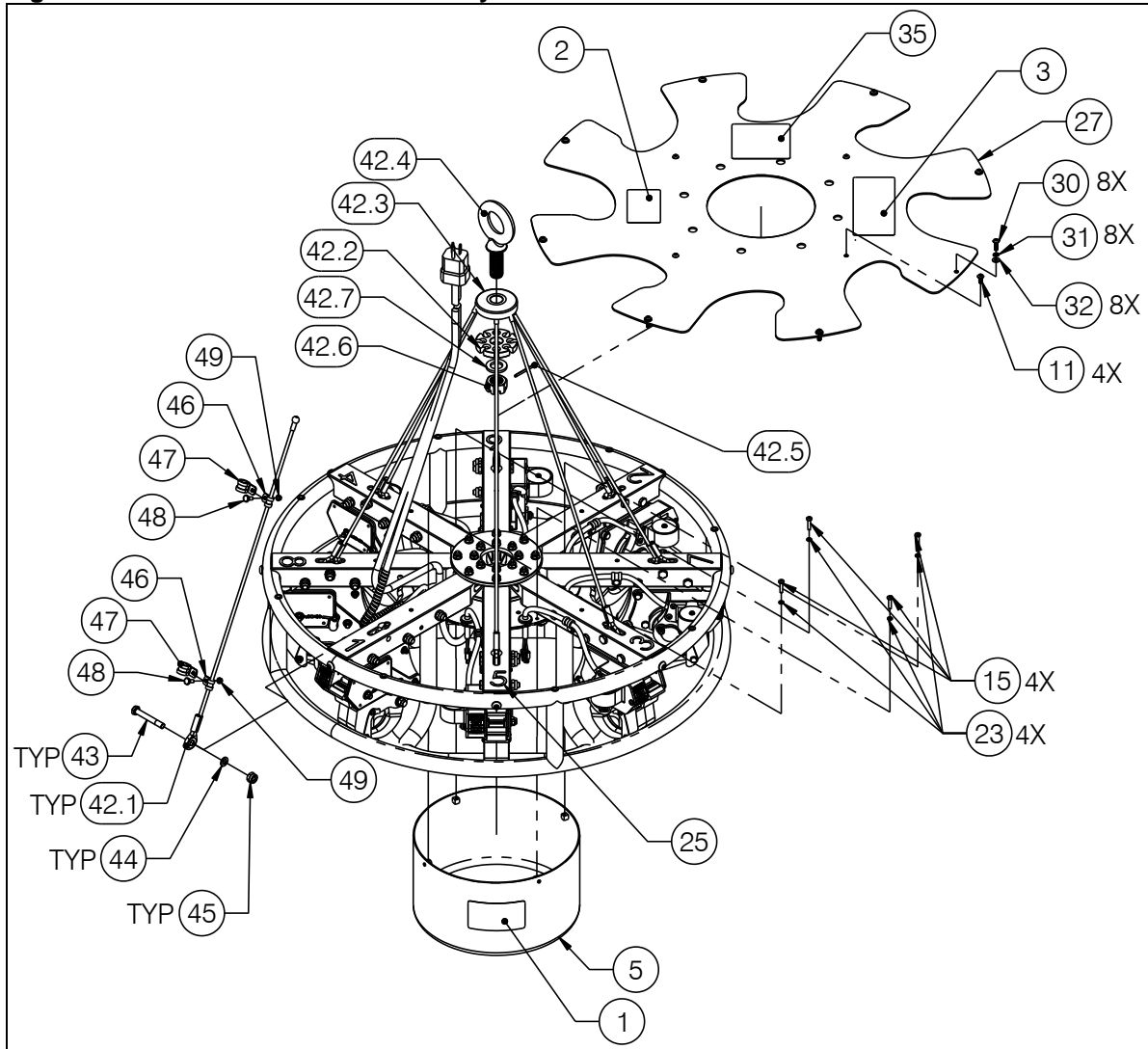


Figure 14.2 SPIDER® Smart Carousel System Parts

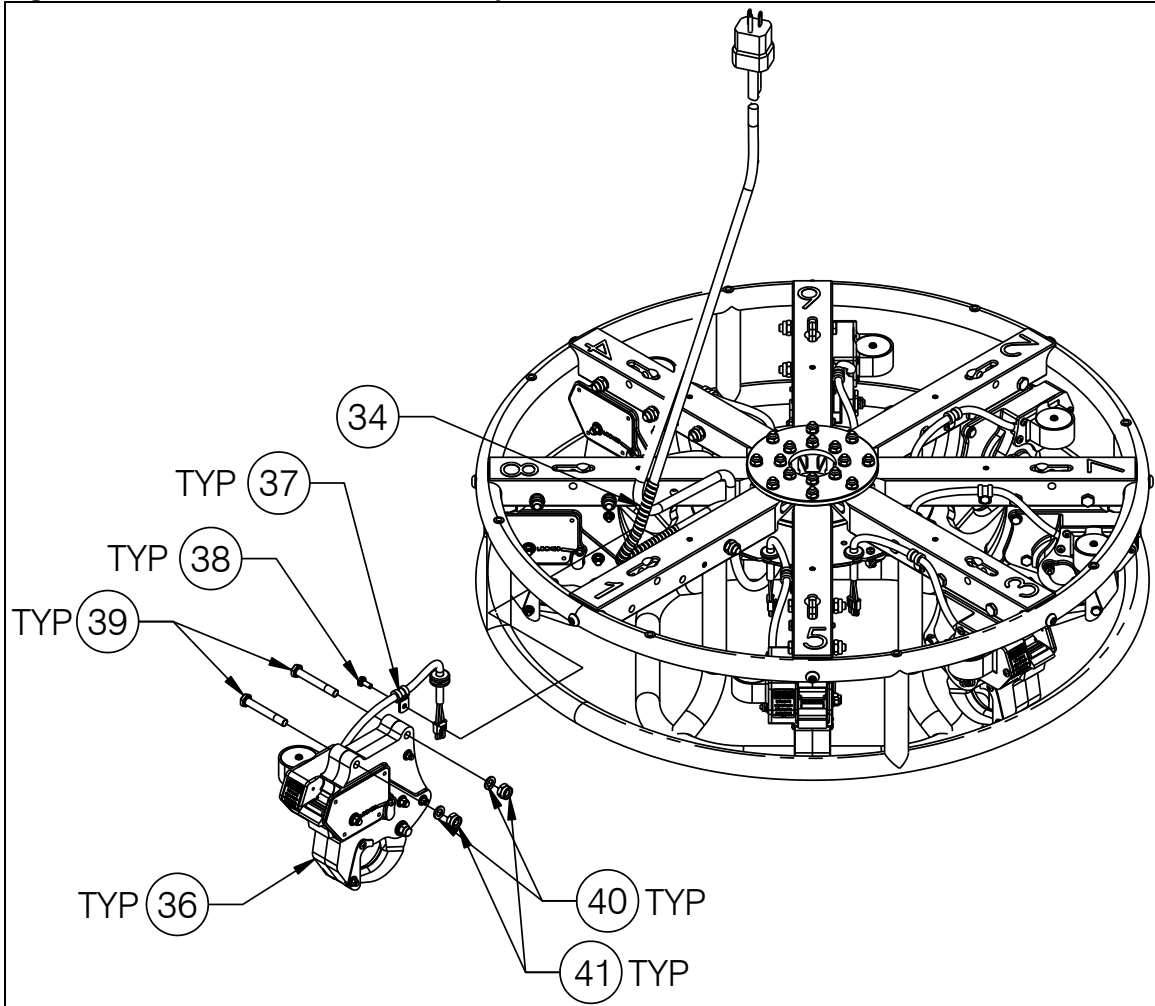


Figure 14.3 SPIDER® Smart Carousel System Parts

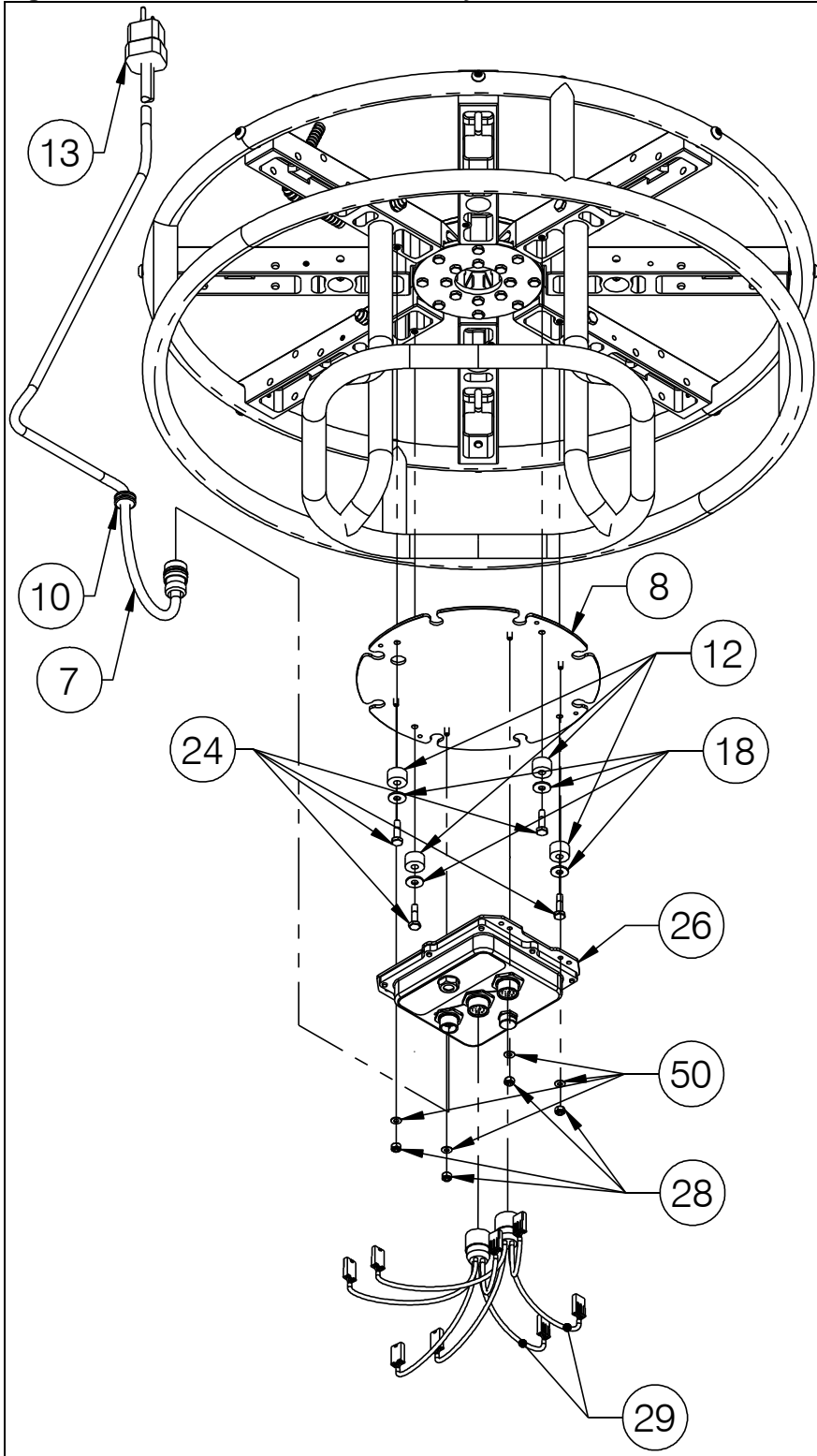
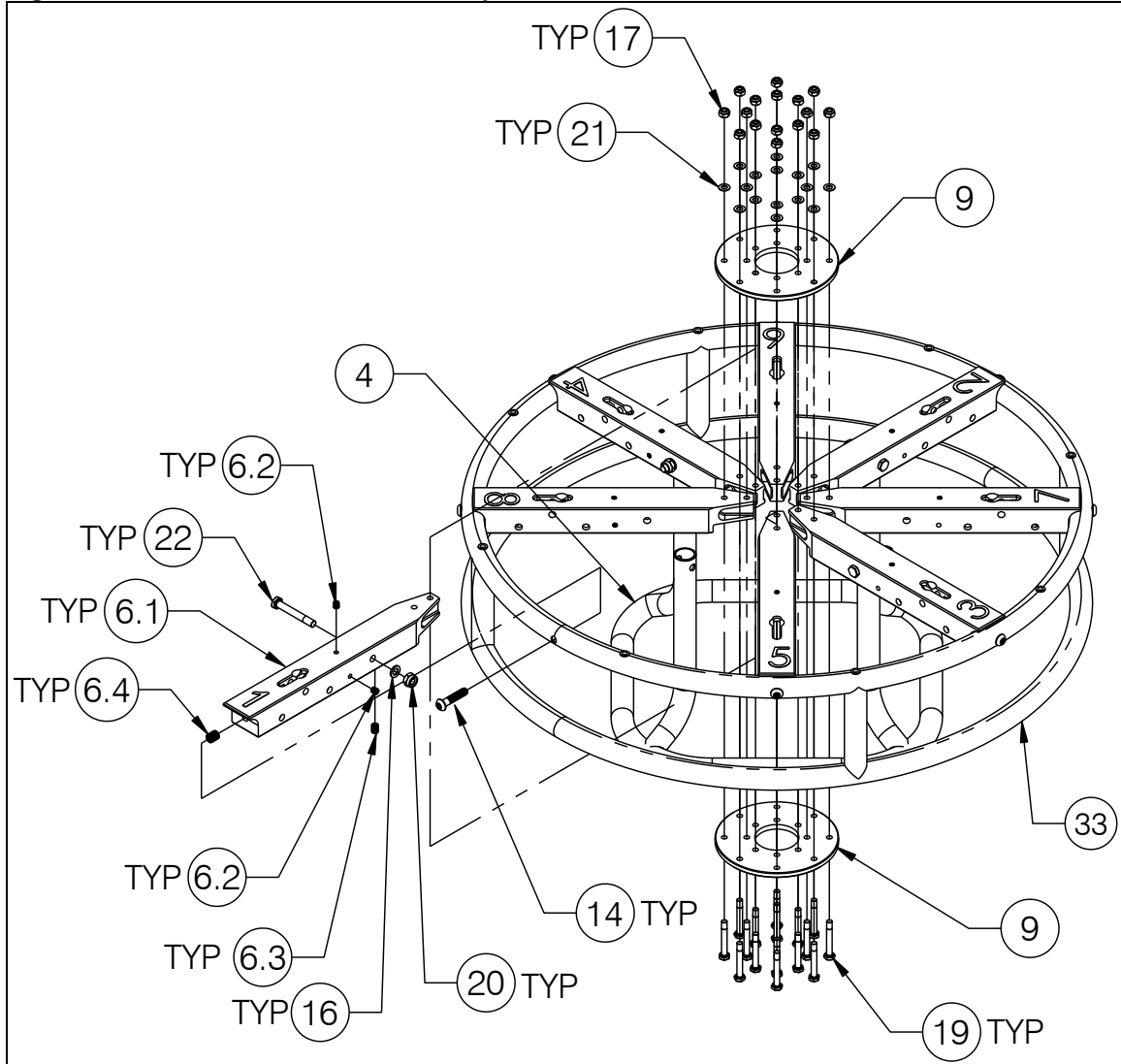





Figure 14.4 SPIDER® Smart Carousel System Parts



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**Table 14.1 SPIDER® Smart Carousel System Parts**

Item	Part No.	Description	Quantity 200-422-00	Quantity 200-421-00	Quantity 200-420-00
1	215-274-00	Serial Number Decal	1	1	1
2	215-275-00	Warning Placard	1	1	1
3	215-287-00	Load Limit Decal	1	1	1
4	235-207-00	Strut Weldment	1	1	1
5	235-208-00	Enclosure Can	1	1	1
6 <sup>1</sup>	232-470-00	Spoke Sub-assembly	4	6	8
6.1	291-587-00	Spoke	1	1	1
6.2	510-248-00	Helicoil	2	2	2
6.3	510-307-00	Helicoil	1	1	1
6.4	510-752-00	Helicoil	1	1	1
7	270-189-00	Carousel Electrical Harness	1	1	1
8	232-644-00	Enclosure Cap Assembly	1	1	1
9	291-599-00	Hub	2	2	2
10	505-018-00	Grommet	1	1	1
11	510-988-00	Screw	4	4	4
12	514-099-00	Spring	4	4	4
13	410-300-00	Plug	1	1	1
14	510-952-00	Screw	4	6	8
15	510-205-00	Screw	4	4	4
16	510-105-00	Washer	4	4	4
17	510-246-00	Nut	16	16	16
18	510-312-00	Washer	4	4	4
19	510-322-00	Bolt	16	16	16
20	510-370-00	Nut	4	4	4
21	510-737-00	Washer	16	16	16
22	510-953-00	Bolt	4	4	4
23	510-955-00	Lock Washer	4	4	4
24	510-977-00	Bolt	4	4	4
25	520-112-00	Numbering Set	1	1	1
26	210-275-00	Carousel Controller	1	1	1
27	291-825-00	Protective Plate	1	1	1
28	510-043-00	Nut	4	4	4
29	270-209-00	Carousel Splitter Harness	2	2	2
30	511-093-00	Screw	8	8	8
31	511-089-00	Lock Washer	8	8	8
32	510-467-00	Washer	8	8	8
33	232-646-00	Double Ring Assembly	1	1	1
34	590-017-00	Spiral Wrap	1	1	1
35	215-320-00	Information Decal	1	1	1
36 <sup>2</sup>	528-044-11	Carousel Hook w/ Indicator Light	4	6	8
37	512-005-00	Cushioned Loop Clamp	4	6	8
38	510-342-00	Bolt	4	6	8
39	510-953-00	Bolt	8	12	16
40	510-105-00	Washer	8	12	16
41	510-370-00	Nut	8	12	16
42 <sup>1</sup>	232-577-00	8-Hook Cable Assembly	-	-	1



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Item	Part No.	Description	Quantity 200-422-00	Quantity 200-421-00	Quantity 200-420-00
	232-578-00	6-Hook Cable Assembly	-	1	-
	232-579-00	4-Hook Cable Assembly	1	-	-
42.1	232-471-00	Carousel Cable Assembly	4	6	8
42.2	291-588-00	Cable Hub	1	1	1
42.3	291-589-00	Cable Hub Cap	1	1	1
42.4	291-598-00	Eyebolt, Modified	1	1	1
42.5	510-098-00	Cotter Pin	1	1	1
42.6	510-956-00	Nut	1	1	1
42.7	510-962-00	Washer	1	1	1
43	510-953-00	Bolt	4	6	8
44	510-105-00	Washer	4	6	8
45	510-370-00	Nut	4	6	8
46	512-024-00	Cushioned Loop Clamp	2	2	2
47	512-026-00	Cushioned Loop Clamp	2	2	2
48	510-659-00	Bolt	2	2	2
49	510-102-00	Nut	2	2	2
50	510-095-00	Washer	4	4	4

<sup>1</sup> Items not illustrated as assemblies

<sup>2</sup> 528-044-11 Cargo Hook supersedes 528-044-10. Optionally use 528-044-10.

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## 15.0 Instructions for Returning Equipment to the Factory

If an Onboard Systems product must be returned to the factory for any reason (including returns, service, repairs, overhaul, etc) obtain an RMA number before shipping your return.



*An RMA number is required for all equipment returns.*

- To obtain an RMA, please use one of the listed methods.
  - Contact Technical Support by phone or e-mail ([Techhelp@OnboardSystems.com](mailto:Techhelp@OnboardSystems.com)).
  - Generate an RMA number at our website: <http://www.onboardsystems.com/rma.php>
- After you have obtained the RMA number, please be sure to:
  - Package the component carefully to ensure safe transit.
  - Write the RMA number on the outside of the box or on the mailing label.
  - Include the RMA number and reason for the return on your purchase or work order.
  - Include your name, address, phone and fax number and email (as applicable).
  - Return the components freight, cartage, insurance and customs prepaid to:

Onboard Systems  
13915 NW 3rd Court  
Vancouver, Washington 98685  
USA  
Phone: 360-546-3072