

MOTOCRANE RADICAL

MotoCrane RADICAL Troubleshooting Guide v4.0
JUN 2023

This guide helps users diagnose and repair issues in the field.
It should be used in conjunction with the RADICAL Operation Manual.

If a quick fix is available, one is prescribed. If a quick fix is not possible, we give a service procedure for repair using spare or replacement parts.

Via MotoCrane Academy, Certified Technicians and Operators are trained on how to perform these more common service procedures. Find more information at www.motocrane.com/academy.

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Understanding System Feedback

RADICAL provides system feedback using two primary methods: LEDs and GUI Messages.

COM and Power LEDs

The PSU, Cortex, and COMMAND Console all contain LEDs to help quickly identify problems with electrical connections.

The COM LED on the Cortex will turn on when the system is successfully communicating on the CAN-bus. If this LED turns off, this indicates that either the electronics in the Cortex have stopped functioning properly, a wiring issue has developed that prevents normal communication to occur, or in an extremely rare case that the COM LED has burned out.

Similarly, the Power LEDs indicate the presence of the 48V system power in their respective locations. Power LEDs are also present in the PSU, to provide a visual confirmation that the system power is connected and switched on. The RADICAL PSU also contains a 24V Power LED between the AUX and COM ports, to indicate that 24V power is available at those locations.

A red Fault LED near the SYSTEM POWER INPUT port indicates a problem with the power source connected to the PSU (e.g. reverse polarity was applied).

*** Please note: Due to inherent properties of the power management system, the Power LEDs may remain dimly lit for a short while after the system power is turned off.*

GUI Warning and Error Messages

RADICAL has multiple internal sensors and an error reporting system built into the GUI.

If an active error or warning is present, the respective red or yellow icon will be displayed. A yellow icon indicates a warning, and the controller will beep once to alert the user. A red icon indicates an error, and the controller will beep repeatedly until the icon is touched or the DISARM physical switch is pressed by the user.

Touching the error or warning icon will bring you to the Status Control Panel, where you can see a list of active errors and warnings. If you are experiencing an intermittent issue, and the warning or error is not currently active, you can review events by navigating to the System Log. The System Log will also provide a list of errors and warnings that have occurred, along with the time since the event occurred. Note that the System Log will only hold the most recent 10 events.

From either the Status or System Log, you can access the Code Lookup Table, which will provide you with a short description of the error or warning and a recommended first step for troubleshooting and clearing the issue.

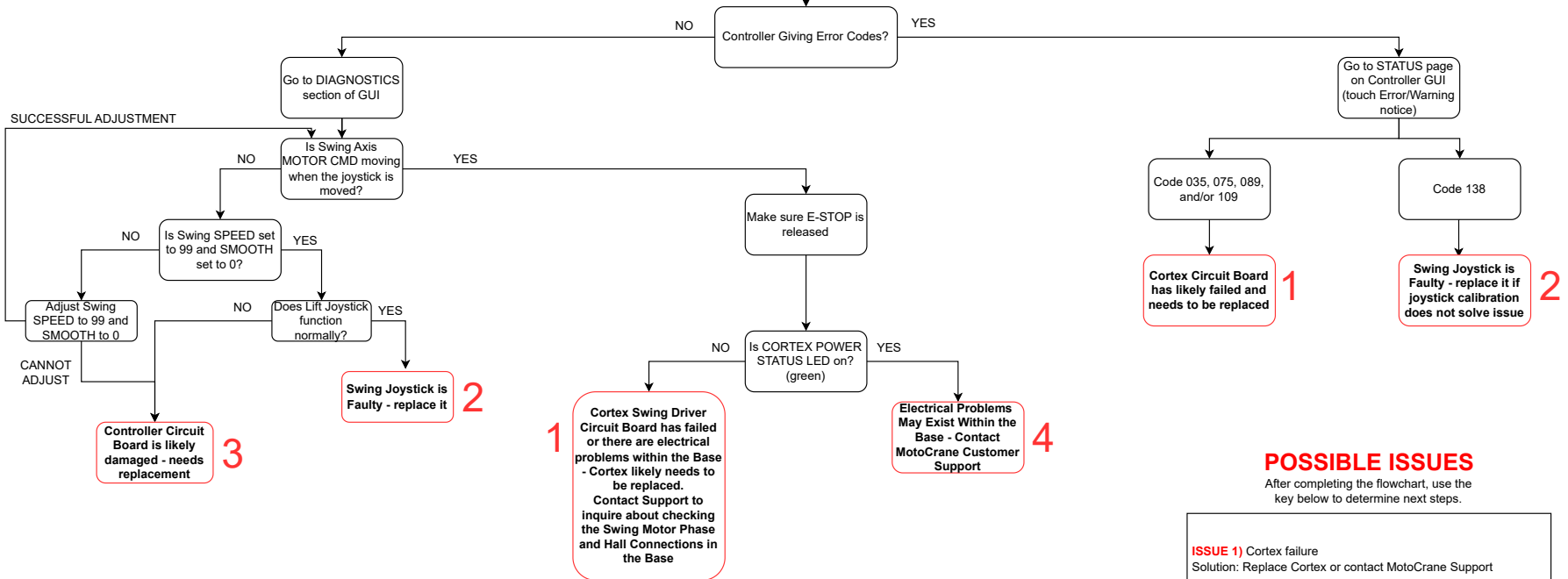
More detail is given below about each error message along with a description of what to try if the first step does not work.

***When debugging any error or warning, first ensure that all cables are properly connected and check the status of the COM and Power LEDs on all modules.*

Diagnosing Common Issues

"SWING IS NOT WORKING"

*Assumes PSU Main Power ON/OFF Switch is already "ON"
 * Try different or new cables, if possible, before moving to troubleshooting steps



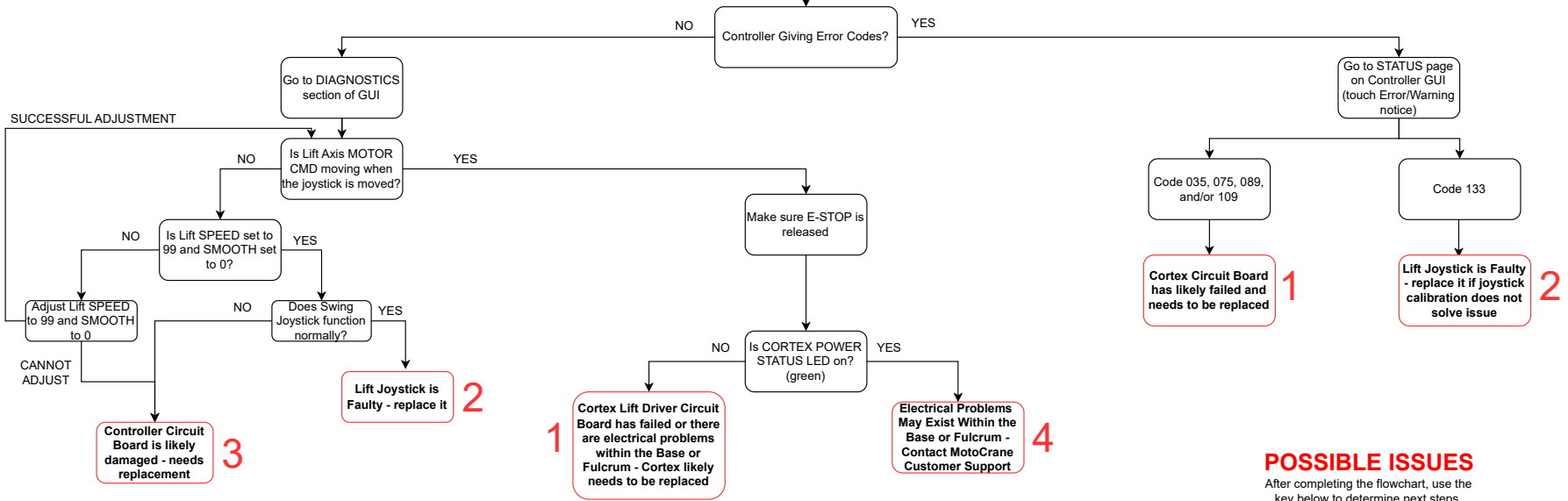
POSSIBLE ISSUES

After completing the flowchart, use the key below to determine next steps.

- ISSUE 1** Cortex failure
Solution: Replace Cortex or contact MotoCrane Support
- ISSUE 2** Swing joystick failure
Solution: Replace joystick or contact MotoCrane Support
- ISSUE 3** Controller Board failure
Solution: Replace Controller board or contact MotoCrane Support
- ISSUE 4** RADICAL Base Electrical Issue
Solution: Contact MotoCrane Support

"LIFT IS NOT WORKING"

*Assumes PSU Main Power ON/OFF Switch is already "ON"
 * Try different or new cables, if possible, before moving to troubleshooting steps



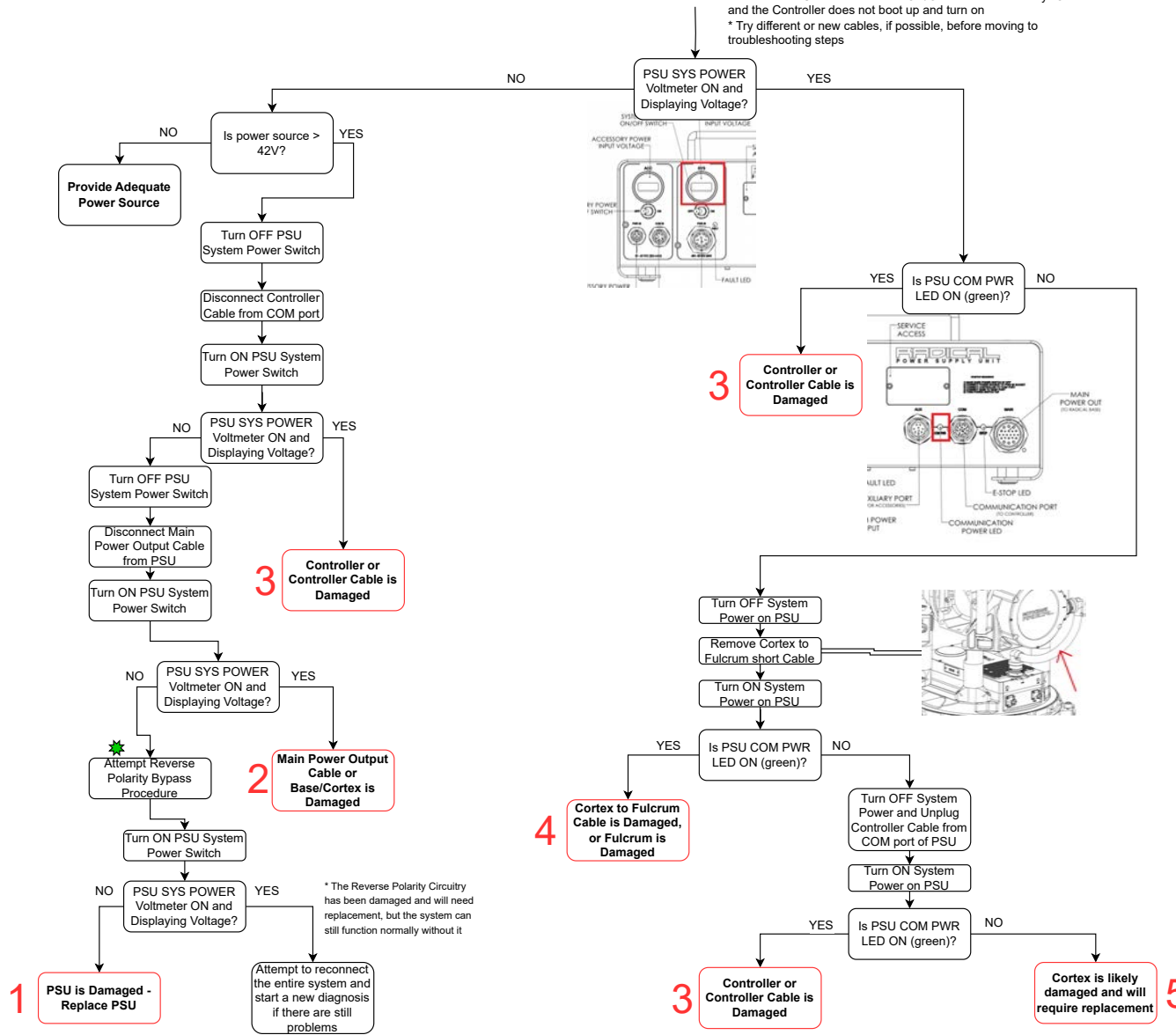
POSSIBLE ISSUES

After completing the flowchart, use the key below to determine next steps.

- ISSUE 1** Cortex failure
Solution: Replace Cortex or contact MotoCrane Support
- ISSUE 2** Lift joystick failure
Solution: Replace joystick or contact MotoCrane Support
- ISSUE 3** Controller Board failure
Solution: Replace Controller board or contact MotoCrane Support
- ISSUE 4** RADICAL Base or Fulcrum Electrical Issue
Solution: Contact MotoCrane Support

"THE SYSTEM WON'T TURN ON"

*Assumes PSU SYSTEM Power ON/OFF Switch is already "ON"
 and the Controller does not boot up and turn on
 * Try different or new cables, if possible, before moving to troubleshooting steps



POSSIBLE ISSUES

After completing the flowchart, use the key below to determine next steps.

- ISSUE 1** PSU failure
Solution: Replace PSU or contact MotoCrane Support
- ISSUE 2** Main Power Output Cable faulty or Base/Cortex Issue
Solution: Attempt Main Power Output Cable replacement first and contact MotoCrane Support
- ISSUE 3** Controller or Controller Cable Damaged
Solution: Attempt Controller Cable replacement first and contact MotoCrane Support
- ISSUE 4** Cortex to Fulcrum Cable Damaged or Fulcrum Issue
Solution: Attempt Cable replacement first and contact MotoCrane Support
- ISSUE 5** Cortex failure
Solution: Replace Cortex or Contact MotoCrane Support

Appendix 1: Field Service Procedures

External Deactivation of Lift and Swing Brakes

In a rare situation, it is possible that the motor driver electronics could fail due to extreme overuse, disregard for system warnings, faulty cables, improper system power supply, among others. Because the nature of the brakes is 'fail-safe', this means that when the system is unpowered (more specifically, the motor driver electronics are not receiving power), the brake is activated and the Axis will not move, except in the case of extreme imbalance between payload and counterweight. In the event that the motor driver electronics stop working, and the Axis is stuck in an undesirable position, the following steps can be taken to manually unlock the Axis (note that the deactivation procedure unlocks BOTH Lift and Swing brakes):

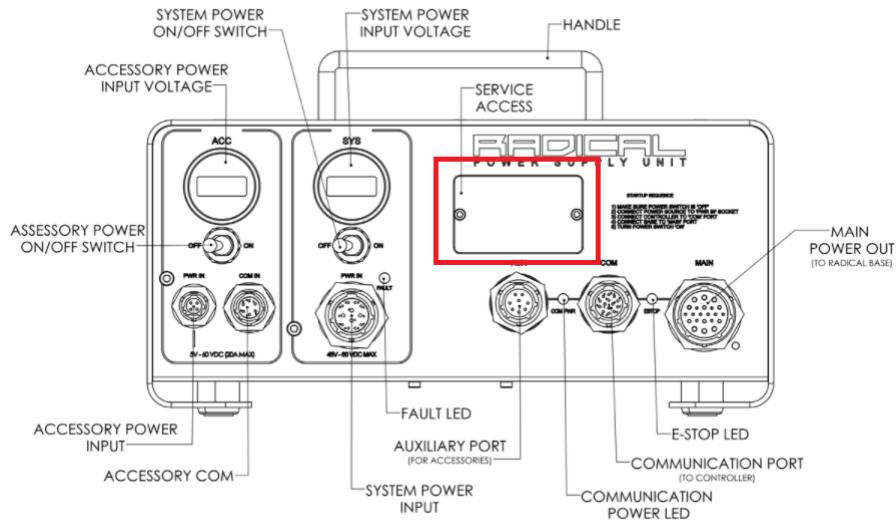
1. Turn OFF System Power and ensure the DISARM/E-STOP button is pressed down
2. Remove the small brake cover panel on the RADICAL Cortex, using a 2mm hex key
3. Move the switch to the (-) position
4. Turn ON System Power - you should immediately hear a click indicating that the brakes have been released
5. Manually move the Swing and/or Lift Axis to the desired position.
6. Turn OFF System Power
7. Move the switch back to the (o) position
8. Replace the brake cover on the RADICAL Cortex

Note that this feature is an immediate solution for re-positioning the Axis, in the event that the system cannot otherwise be transported or disassembled normally. Service will still be required to repair the electronics and return the system to normal operating conditions.

PSU Snubber Circuit Diagnosis and Replacement

The RADICAL PSU contains electronics that prevent dangerously high levels of voltage to the system. This is referred to as the "snubber" circuit. The snubber circuit bleeds this excess energy using a power resistor. In an abnormal situation, such as a system malfunction or applying too high of an input voltage, the snubber circuit may get damaged or the fuse may blow. To access and check the snubber circuit, follow these steps:

1. Make sure System Power is turned OFF
2. Remove the small access panel on the front face of the RADICAL PSU, using a 2.5mm hex key



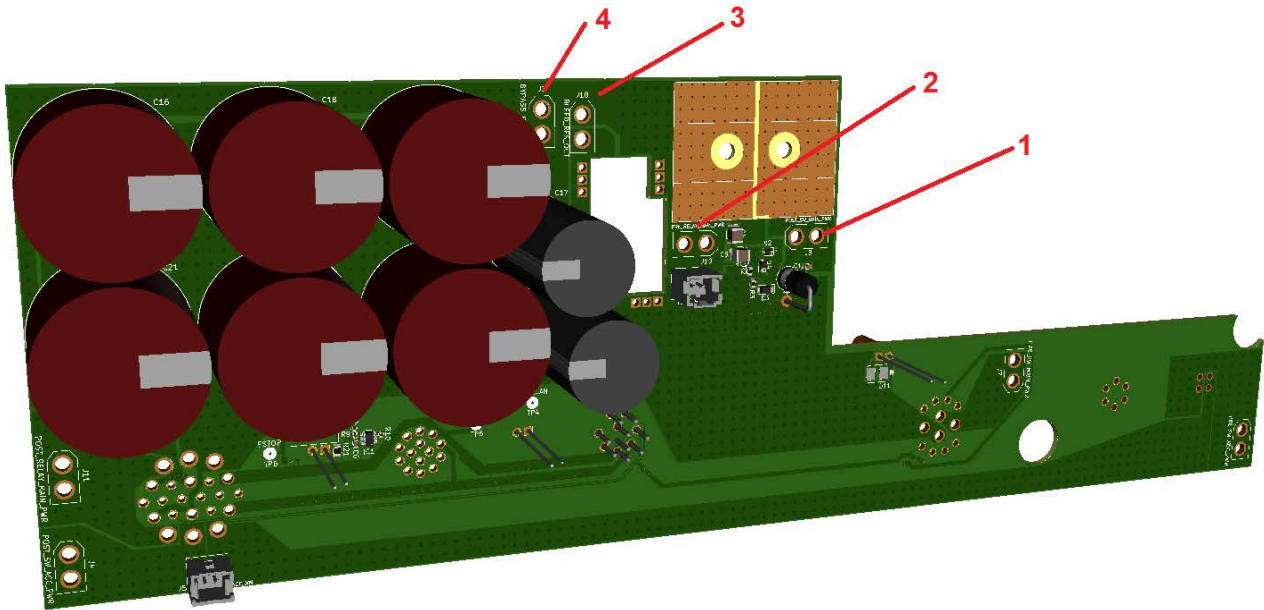
3. Gently pull out the small snubber circuit PCB (wiggling slightly side to side if needed)
4. Remove the fuse from the back side of the PCB
5. Using a multimeter, check for continuity across the fuse
 - a. If there is continuity, the fuse is GOOD and can be replaced
 - b. If there is no continuity, the fuse is BAD and there is likely a problem with the snubber PCB - contact MotoCrane Support for determining a final diagnosis, and the steps for replacement or repair

PSU Reverse Polarity Protection Bypass

The RADICAL PSU contains electronics that prevent reverse polarity conditions from damaging the rest of the system. This circuit essentially blocks the flow of power if a reverse polarity input is detected. However, all system power must flow through this circuit in normal operation. If the reverse polarity circuit has stopped working, the system may not turn on. This is extremely unlikely, but if this is suspected, or if you are directed to attempt this bypass procedure, follow these steps:

1. Remove the cover of the PSU module
 - a. Remove the rubber pads covering the bottom "feet"
 - b. Use a 2mm hex key to remove the 4 fasteners holding the "feet" together
 - c. Use a 2mm hex key to remove the 6 fasteners holding the top cover to the side panels
 - d. Carefully slide the top panel over the side panels and move it out of the way
2. Move the connector from J10 (item 2 in the annotation below) to J2 (item 4 in the annotation below)

3. Move the connector from J8 (item 1 in the annotation below) to J10 (item 2 in the annotation below)

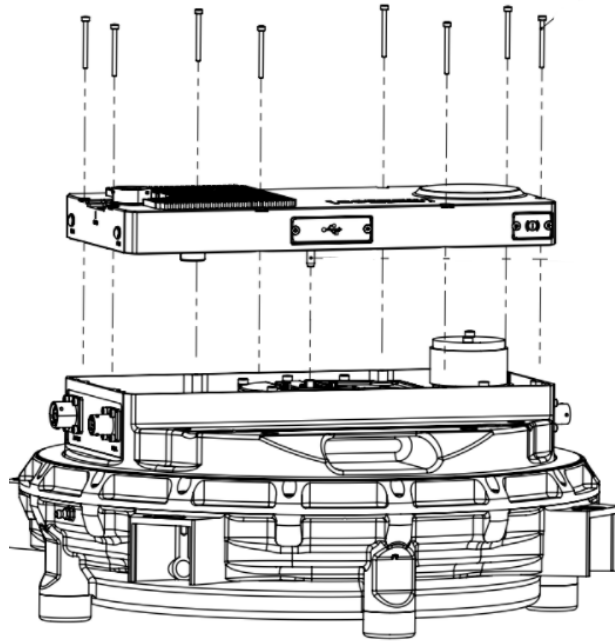


PSU Circuit Board Annotation for Reference (back side)

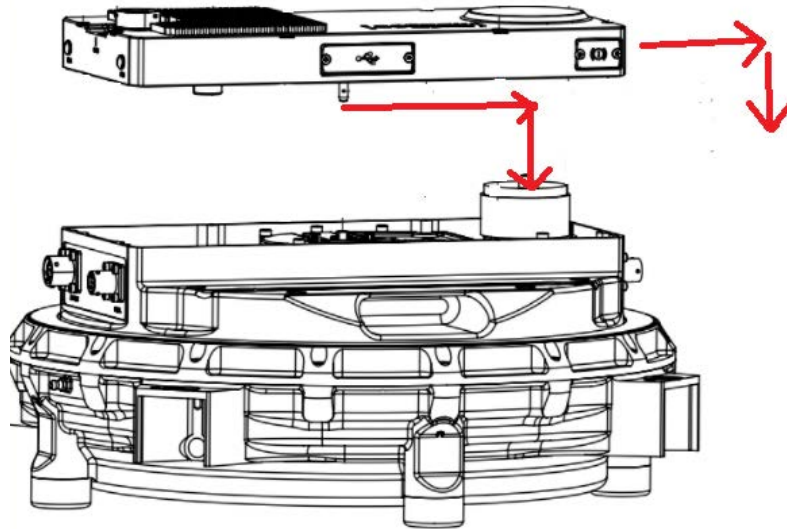
Radical Cortex Replacement

To replace the Radical Cortex, follow these steps:

1. Remove the 8 M3 fasteners holding the Radical Cortex to the Base, using a 2.5mm hex key



2. Carefully lift the Cortex up vertically, about 1 inch (25mm) - make sure the Swing encoder drive shaft is clear of the mating part that it slides into
3. Carefully move the cortex laterally, in the direction of the ACC PWR and ACC COM sockets
4. Rest the Swing encoder drive shaft in the center hole of the Swing brake (the shiny metal cylinder)



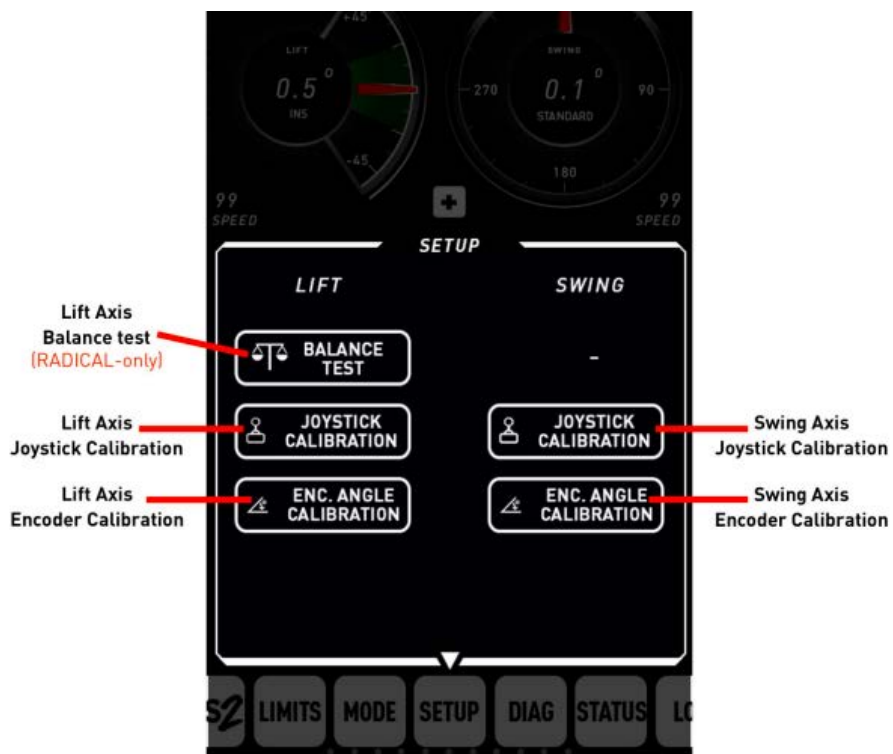
Steps 2,3,4

5. Unplug the two twist-lock connectors from the Cortex signal and power connector panel (inside the Base)(refer to below figure)



6. Remove the Cortex entirely from the system
7. Place the replacement Cortex in the same position (Swing encoder drive shaft resting in the middle of the Swing brake)
8. Plug in the two twist-lock connectors to the Cortex signal and power connector panel (inside the Base)
9. Make sure the wires are not being pinched as you reposition the Cortex over the Swing encoder drive shaft mating part
10. Slowly lower the Cortex, making sure the Swing encoder drive shaft mates with the hollow central shaft
11. Replace the 8 M3 fasteners and tighten securely using a 2.5mm hex key

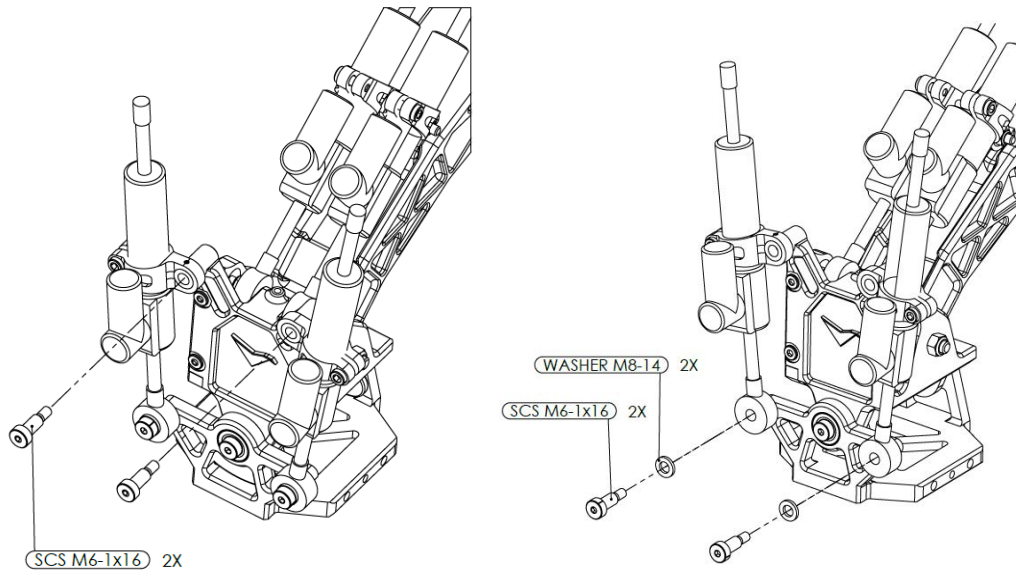
** NOTE: Upon turning on the system again, you will need to perform an Encoder Angle Calibration for BOTH the Lift and the Swing axis. This is accessed in the SETUP control panel of the Command Console:



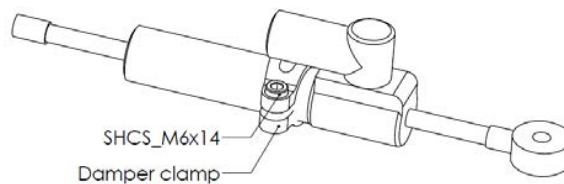
Radical Isolator Damper Replacement

To replace the Radical roll dampers, follow these steps:

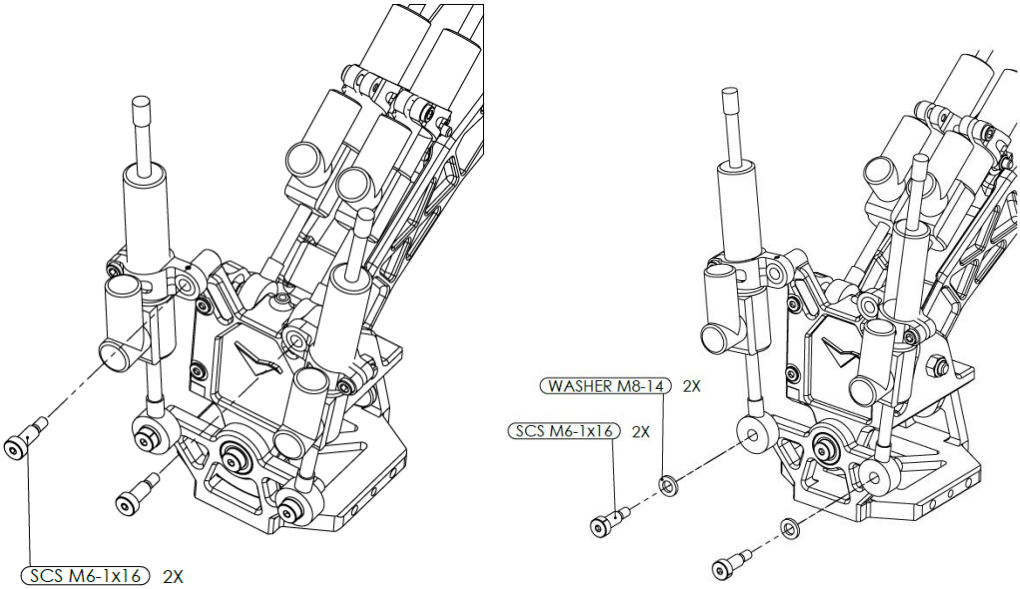
1. Remove the M6 shoulder bolts (Be cautious not to lose the shims when removing the shoulder bolts, keep the shims for shoulder bolt adjustment if needed)



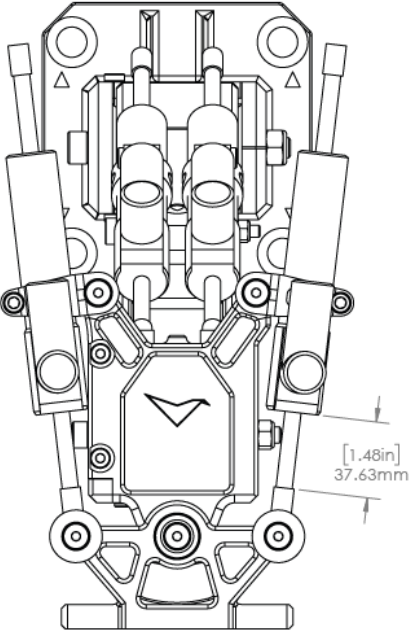
2. Remove the damper mount from the used damper and install it to the new damper. Keep the SHCS M6x14 loose for adjustment in step 5.



3. Install the new dampers to the Isolator as shown.

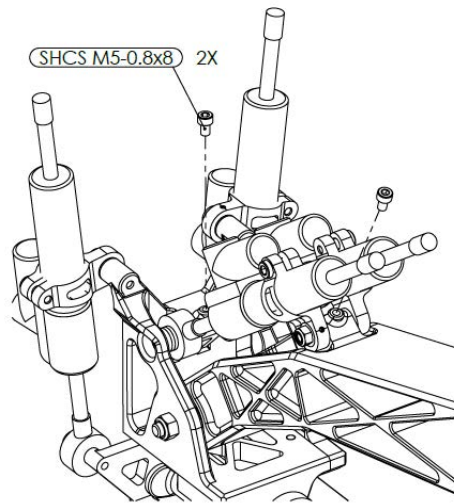


4. Adjust the dampers position by sliding the housing up or down. This step is to ensure the travel length is equal in both directions. Torque the SHCS M6x14 to specification once both dampers are adjusted.

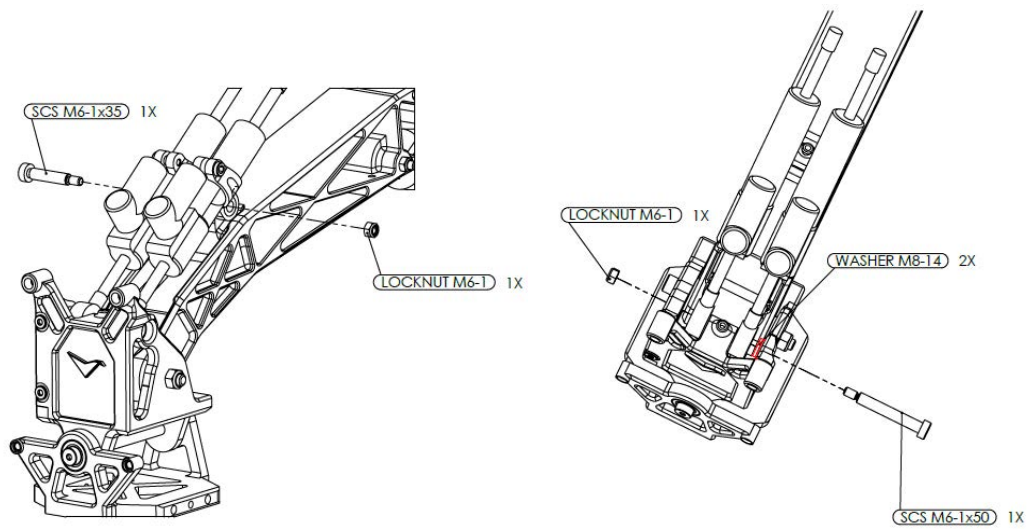


To replace the Radical pitch dampers, follow these steps:

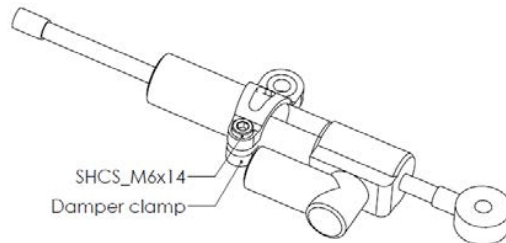
1. Remove SHCS M5x8 as shown.



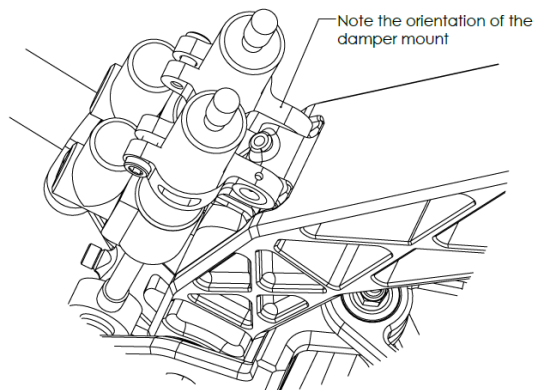
2. Remove the shoulder bolts from the isolator.



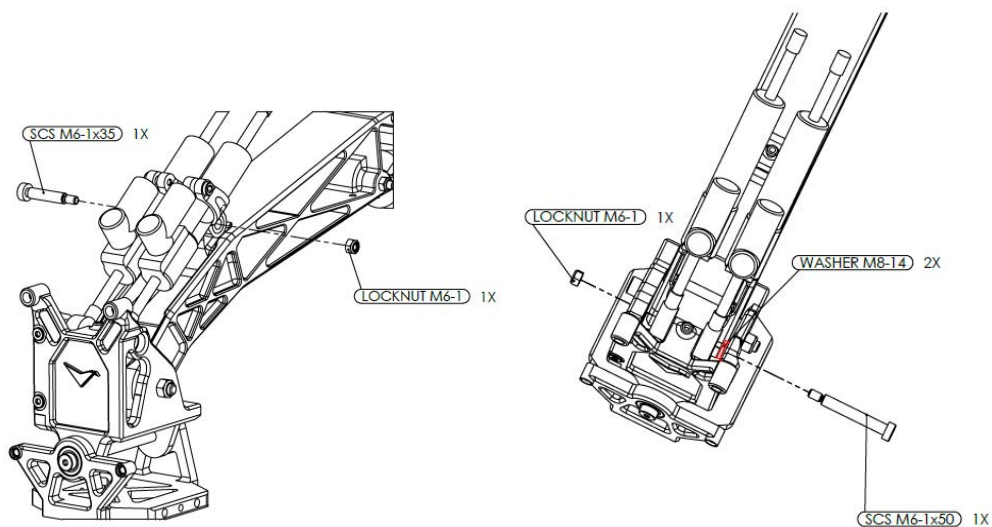
3. Remove the damper mount from the used damper and install it to the new damper. Keep the SHCS M6 loose for adjustment in step 6.



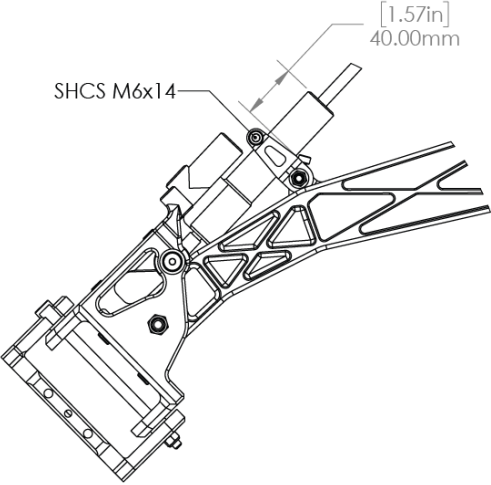
4. Check and make sure the damper clamps are installed correctly onto the dampers.



5. Secure the new dampers to the Isolator as shown.



6. Adjust the dampers position by sliding the housing up or down. This step is to ensure the travel length is equal in both directions. Torque the SHCS M6x14 to specification once both dampers are adjusted.



Appendix 2: Error Codes Lookup Table

Code	Description	Service	Details
002	Lift Motor Temp Warning	<ul style="list-style-type: none"> ● Use caution and watch motor temp ● Make sure payload and counterweight are properly balanced ● Make sure there are no obstructions preventing the boom from raising or lowering ● Keep system 'DISARMED' during periods of inactivity 	<p>The lift motor temperature has risen to a level that is higher than expected, under normal use. This can be caused by excessive load and higher than normal current passing through the motor.</p> <p>Under very high ambient temperatures and with the Fulcrum in direct sunlight, this warning can appear from time to time and is not a concern. Keeping the system 'DISARMED' during periods of inactivity, and keeping the system covered or in shade will help prevent this warning from happening</p>
003	Lift Motor Temp Error	<ul style="list-style-type: none"> ● Discontinue use until temp is reduced ● Make sure payload and counterweight are properly balanced ● Make sure there are no obstructions preventing the boom from raising or lowering 	<p>The lift motor temperature has risen to a level that is potentially dangerous to the system. This could be caused by extreme overuse, high ambient temperatures, imbalanced load, obstruction of lift movement, or some combination of these events. Allow the system to cool down below the error threshold before continuing major lift-axis movements.</p>
004	Lift Motor Temp Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid heavy use of lift moves in high ambient temperatures 	<p>The lift motor temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Fulcrum internal wiring or electronics. Service on the system by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.</p>
007	Lift Motor Driver Temp Warning	<ul style="list-style-type: none"> ● Use caution and watch driver temp ● Make sure payload and counterweight are 	<p>The temperature of the lift motor driver electronics has risen to a level that is higher than expected, under normal use. This is generally caused by excessive load</p>

		<p>properly balanced</p> <ul style="list-style-type: none"> ● Make sure there are no obstructions preventing the boom from raising or lowering 	<p>and higher than normal current being used by the motor. If the problem is persistent, contact MotoCrane Support.</p>
008	Lift Motor Driver Temp Error	<ul style="list-style-type: none"> ● Discontinue use until temp is reduced ● Make sure payload and counterweight are properly balanced ● Make sure there are no obstructions preventing the boom from raising or lowering 	<p>The temperature of the lift motor driver electronics has risen to a level that is potentially dangerous to the system. This could be caused by extreme overuse, high ambient temperatures, imbalanced load, obstruction of lift movement, or some combination of these events. If the problem is persistent, contact MotoCrane Support.</p>
009	Lift Motor Driver Temp Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid heavy use of lift moves in high ambient temperatures 	<p>The lift motor driver temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.</p>
012	Lift Over-Current Warning	<ul style="list-style-type: none"> ● Use caution and observe current and temps ● Make sure payload and counterweight are properly balanced ● Make sure there are no obstructions preventing the boom from raising or lowering 	<p>The lift motor current has risen to a level that is higher than expected, under normal use. This is generally caused by excessive load and higher than normal current passing through the motor.</p>
013	Lift Over-Current Error	<ul style="list-style-type: none"> ● Discontinue use while error is active ● Make sure payload and counterweight are properly balanced ● Make sure there are no obstructions preventing the boom from raising or lowering 	<p>The lift motor current has risen to a level that is potentially dangerous to the system. This could be caused by extreme movements, imbalanced load, obstruction of lift movement, or some combination of these events.</p>

014	Lift Current Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid extreme movements of lift axis and make sure payload and counterweight are balanced 	The lift motor current sensor reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
017	Lift Motor Current Warning	<ul style="list-style-type: none"> ● Make sure there are no obstructions preventing the boom from raising or lowering ● Reduce intensity of terrain if warning is persistent 	Stall conditions are detected to prevent excessive current and temperature from damaging the motor and the power electronics. If the average motor current is above a certain threshold for a period of time, a current warning is detected and the operator is notified via this warning. If the overuse continues, the warning may eventually turn into an error (Lift Motor Stall - 018). This may often happen when operating in Standard Mode and driving over very rough terrain.
018	Lift Motor Stall	<ul style="list-style-type: none"> ● Disarm, power cycle, and check functionality ● Make sure there are no obstructions preventing the boom from raising or lowering 	Stall conditions are detected to prevent excessive current and temperature from damaging the motor. If the motor current is above a certain threshold for a period of time, without any movement of the motor, a stall is detected and the power to the motor is shut off. In order to attempt movement again, the joystick has to be returned to a neutral position first. If there are no obstructions preventing the boom from moving up and down, and this error continues to occur, this likely means there is an issue with the lift drive mechanism and the Fulcrum or Cortex needs to be serviced by MotoCrane. If the problem is persistent, contact MotoCrane Support.
020	Lift IMU Warning	<ul style="list-style-type: none"> ● Do not subject the system to higher forces 	This warning indicates that the G-forces experienced by the unit are slightly higher than normal. Do not attempt to subject the system to more extreme conditions than those that triggered the warning.

021	Lift IMU Error	<ul style="list-style-type: none"> ● Reduce intensity of use to acceptable level 	This error indicates that the G-forces experienced by the unit are much higher than normal. Do not continue operating the unit in these extreme conditions.
022	Lift IMU Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support 	The lift IMU reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
029	Lift Motor Command Timeout	<ul style="list-style-type: none"> ● Power cycle system to reset ● Double check all cable connections ● With system Disarmed, enter the Diagnostics page of the GUI and move the lift joystick to check for motor commands 	This error indicates that the Cortex is not receiving commands from the Controller. The most likely cause of this error is an issue with the Controller, which may be solved with a simple power cycle. If this does not resolve the issue, the Controller may have sustained damage and has stopped generating the appropriate motor commands. If the problem is persistent, contact MotoCrane Support.
031	Boom Imbalance - Front Heavy	<ul style="list-style-type: none"> ● Ensure Payload and CW are properly balanced, in accordance with the Operation Manual instructions 	The system can generally detect situations where the Payload is more than +/- 5 lbs heavy/light.
032	Lift Limits Disabled From Error	<ul style="list-style-type: none"> ● Power cycle and calibrate lift angle 	This error occurs if limits are enabled, and an encoder error or failure is triggered. Because lack of reliable encoder data prevents limits from being trusted, limits are disabled and cannot be enabled again while the error persists. If power cycling the system does not eliminate the encoder error, limits will not be available until the encoder can be repaired.
033	Boom Imbalance - Back Heavy	<ul style="list-style-type: none"> ● Ensure Payload and CW are properly balanced, in accordance with the Operation Manual instructions 	The system can generally detect situations where the Payload is more than +/- 5 lbs heavy/light.

035	Central Heartbeat Timeout	<ul style="list-style-type: none"> ● Power cycle system to reset ● Double check all cable connections 	This error occurs if the lift motor driver electronics are not detected in the system. Typically seen along with code 075, 089, and 109. If this issue cannot be solved by power cycling or replacing cables, a field repair can be achieved by replacing the Cortex.
042	Swing Motor Temp Warning	<ul style="list-style-type: none"> ● Use caution and watch motor temp ● Make sure there are no obstructions preventing the boom from swinging 	The swing motor temperature has risen to a level that is higher than expected, under normal use. This is generally caused by excessive load and higher than normal current passing through the motor. If the swing motor is experiencing low to moderate use, but high ambient temperatures and direct sunlight are a factor, there is no need for concern. Do not push the system past the swing motor temp error threshold.
043	Swing Motor Temp Error	<ul style="list-style-type: none"> ● Discontinue use until temp is reduced ● Make sure there are no obstructions preventing the boom from swinging 	The swing motor temperature has risen to a level that is potentially dangerous to the system. This could be caused by extreme overuse, high ambient temperatures, obstruction of swing movement, or some combination of these events. Wait until the temperature has dropped below the error threshold to attempt movement again.
044	Swing Motor Temp Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid heavy use of swing moves in high ambient temperatures 	The swing motor temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Base internal wiring or electronics. Service on the Base by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
047	Swing Motor Driver Temp Warning	<ul style="list-style-type: none"> ● Use caution and watch driver temp ● Make sure there are no obstructions preventing the boom from swinging 	The temperature of the swing motor driver electronics has risen to a level that is higher than expected, under normal use. This is generally caused by excessive load and higher than normal current being used by the motor.

048	Swing Motor Driver Temp Error	<ul style="list-style-type: none"> ● Discontinue use until temp is reduced ● Make sure there are no obstructions preventing the boom from swinging 	The temperature of the swing motor driver electronics has risen to a level that is potentially dangerous to the system. This could be caused by extreme overuse, high ambient temperatures, obstruction of swing movement, or some combination of these events.
049	Swing Motor Driver Temp Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid heavy use of swing moves in high ambient temperatures 	The swing motor driver temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
052	Swing Over-Current Warning	<ul style="list-style-type: none"> ● Use caution and observe current and temps ● Make sure there are no obstructions preventing the boom from swinging 	The swing motor current has risen to a level that is higher than expected, under normal use. This is generally caused by excessive load and higher than normal current passing through the motor.
053	Swing Over-Current Error	<ul style="list-style-type: none"> ● Discontinue use while error is active ● Make sure there are no obstructions preventing the boom from swinging 	The swing motor current has risen to a level that is potentially dangerous to the system. This could be caused by extreme movements, obstruction of swing movement, or some combination of these events.
054	Swing Current Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support ● Avoid extreme movements of swing axis under high load 	The swing motor current sensor reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
057	Swing Motor Current Warning	<ul style="list-style-type: none"> ● Make sure there are no obstructions preventing the boom from swinging ● Reduce intensity of movements if 	Stall conditions are detected to prevent excessive current and temperature from damaging the motor and the power electronics. If the average motor current is above a certain threshold for a period of time, a current warning is detected and the

		warning is persistent	operator is notified via this warning. If the overuse continues, the warning may eventually turn into an error (Swing Motor Stall - 058). This may happen when operating swing movements in high speed conditions.
058	Swing Motor Stall	<ul style="list-style-type: none"> ● Disarm, power cycle, and check functionality ● Make sure there are no obstructions preventing the boom from swinging 	Stall conditions are detected to prevent excessive current and temperature from damaging the motor. If the motor current is above a certain threshold for a period of time, without any movement of the motor, a stall is detected and the power to the motor is shut off. In order to attempt movement again, the joystick has to be returned to a neutral position first. If there are no obstructions preventing the boom from swinging, and this error continues to occur, this likely means there is an issue with the swing drive mechanism and the Base needs to be serviced by MotoCrane.
060	Swing IMU Warning	<ul style="list-style-type: none"> ● Do not subject the system to higher forces 	This warning indicates that the G-forces experienced by the unit are slightly higher than normal. Do not attempt to subject the system to more extreme conditions than those that triggered the warning.
061	Swing IMU Error	<ul style="list-style-type: none"> ● Reduce intensity of use to acceptable level 	This error indicates that the G-forces experienced by the unit are much higher than normal. Do not continue operating the unit in these extreme conditions.
062	Swing IMU Sensor Failure	<ul style="list-style-type: none"> ● Use caution and contact MotoCrane Support 	The swing IMU reading has been lost by the system. The most likely cause of this failure is damage to the Cortex electronics. Service on the Cortex by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
069	Swing Motor Command Timeout	<ul style="list-style-type: none"> ● Power cycle system to reset ● Double check all cable connections 	This error indicates that the swing driver board is not receiving commands from the Controller. The most likely cause of this error is an issue with the Controller, which

		<ul style="list-style-type: none"> • With system Disarmed, enter the Diagnostics page of the GUI and move the swing joystick to check for motor commands 	<p>may be solved with a simple power cycle. If this does not resolve the issue, the Controller may have sustained damage and has stopped generating the appropriate motor commands.</p>
072	Swing Limits Disabled From Error	<ul style="list-style-type: none"> • Power cycle and calibrate swing orientation 	<p>This error occurs if limits are enabled, and an encoder error or failure is triggered. Because lack of reliable encoder data prevents limits from being trusted, limits are disabled and cannot be enabled again while the error persists. If power cycling the system does not eliminate the encoder error, limits will not be available until the encoder can be repaired.</p>
075	Swing Driver Heartbeat Timeout	<ul style="list-style-type: none"> • Power cycle system to reset • Double check all cable connections 	<p>This error occurs if the swing motor driver electronics are not detected in the system. Typically seen along with code 035, 089, and 109. If this issue cannot be solved by power cycling or replacing cables, a field repair can be achieved by replacing the Cortex.</p>
081	Swing Encoder Data Suspect	<ul style="list-style-type: none"> • Power cycle system to reset 	<p>This warning indicates some inconsistency in the angular position readings from the swing encoder. If the condition gets worse, the encoder will go into an error state. Limits are not allowed while this condition is active, to ensure that bad encoder values do not cause limits to fail.</p>
082	Swing Encoder Data Invalid	<ul style="list-style-type: none"> • Use caution and contact MotoCrane Support • Try power cycling the system to reset the board 	<p>This warning indicates that valid data is not being received from the swing encoder. Limits are not allowed while this condition is active, to ensure that bad encoder values do not cause limits to fail. The swing position gauge on the Operate page of the GUI may also be non-functional. If this error persists after multiple attempts at power cycling, the encoder electronics in the Base need to be serviced.</p>
089	Swing Encoder	<ul style="list-style-type: none"> • Power cycle system to 	<p>This error occurs if the swing encoder</p>

	Heartbeat Timeout	<ul style="list-style-type: none"> reset ● Double check all cable connections 	electronics are not detected in the system. Typically seen along with code 035, 075, and 109. If this issue cannot be solved by power cycling or replacing cables, a field repair can be achieved by replacing the Cortex.
101	Lift Encoder Data Suspect	<ul style="list-style-type: none"> ● Power cycle system to reset 	This warning indicates some inconsistency in the angular position readings from the lift encoder. If the condition gets worse, the encoder will go into an error state. Limits are not allowed while this condition is active, to ensure that bad encoder values do not cause limits to fail.
102	Lift Encoder Data Invalid	<ul style="list-style-type: none"> ● Attempt to Lift Encoder Calibration and power cycling ● Contact Customer Support if error persists 	This warning indicates that valid data is not being received from the lift encoder. Limits are not allowed while this condition is active, to ensure that bad encoder values do not cause limits to fail. The lift position gauge on the Operate page of the GUI may also be non-functional. If this error persists after multiple attempts of Lift Encoder Calibration and power cycling, the encoder electronics in the Fulcrum need to be serviced.
109	Lift Encoder Heartbeat Timeout	<ul style="list-style-type: none"> ● Power cycle system to reset ● Double check all cable connections 	This error occurs if the lift encoder electronics are not detected in the system. Typically seen along with code 035, 075, and 089. If this issue cannot be solved by power cycling or replacing cables, a field repair can be achieved by replacing the Cortex.
122	System Over-Voltage Warning	<ul style="list-style-type: none"> ● Ensure correct voltage of power source 	This warning will be triggered if the system voltage is above 59V. Applying voltage higher than this can potentially cause system damage.
123	System Over-Voltage Error	<ul style="list-style-type: none"> ● Disarm system and remove power source ● Ensure the proper power source is being connected 	This error will be triggered if the system voltage is above 60V. Applying a voltage higher than this will likely cause system damage or failure. This can also be caused by rapid deceleration of the Swing or Lift

		<ul style="list-style-type: none"> ● Check PSU Snubber Circuit (Appendix 3) 	Axis.
125	System Under-Voltage Warning	<ul style="list-style-type: none"> ● Ensure correct voltage of power source 	This warning will be triggered if the system voltage is below 46V. Applying voltage lower than this can potentially disable the system and prevent normal operation.
126	System Under-Voltage Error	<ul style="list-style-type: none"> ● Move system to safe position and disarm 	This error will be triggered if the system voltage is below 45V. Applying voltage lower than this will likely cause the system to shut down and become inoperational.
128	System Over-Current Warning	<ul style="list-style-type: none"> ● Use caution and observe current draw ● Ensure the boom is free and clear of obstructions ● Ensure payload and counterweight are balanced 	If the system current remains higher than normal for an extended period of time, this warning will become active. This is generally caused by excessive load on the system and higher than normal current passing through the motors.
129	System Over-Current Error	<ul style="list-style-type: none"> ● Discontinue use while error is active ● Ensure the boom is free and clear of obstructions ● Ensure payload and counterweight are balanced 	The system current has risen to a level that is potentially dangerous to the system. This could be caused by extreme movements, imbalanced load, obstruction of swing or lift movement, or some combination of these events. If intense movement was not the trigger of this event, there may be a short circuit in the system and further diagnosis and service will be required.
130	System Current Sensor Failure	<ul style="list-style-type: none"> ● Contact MotoCrane Support 	The system current sensor reading has been lost. The most likely cause of this failure is damage to the Cortex electronics. Service on the unit by MotoCrane or replacement is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
133	Lift Joystick Failure	<ul style="list-style-type: none"> ● Power cycle system with joysticks neutral and then re-calibrate joystick ● Contact MotoCrane Support if the problem 	If the joystick output goes beyond the maximum or minimum expected value, the Controller will take action to prevent unintended movement of the system, as it assumes that there is a physical problem

		persists	with the joystick. A power cycle will be required after this error, to reset the system. If the error persists, the joystick or Controller internal wiring may be faulty and require service by MotoCrane.
135	Lift Joystick Initialization Failure	<ul style="list-style-type: none"> • Power cycle system with joysticks neutral 	If the joysticks are not in the neutral position when the system is initialized, the Controller will take action to prevent unintended movement of the system. A power cycle will be required after this error, to reset the system. If the error persists, the joystick or Controller internal wiring may be faulty and require service by MotoCrane.
138	Swing Joystick Failure	<ul style="list-style-type: none"> • Power cycle system with joysticks neutral and then re-calibrate joystick • Contact MotoCrane Support if the problem persists 	If the joystick output goes beyond the maximum or minimum expected value, the Controller will take action to prevent unintended movement of the system, as it assumes that there is a physical problem with the joystick. A power cycle will be required after this error, to reset the system. If the error persists, the joystick or Controller internal wiring may be faulty and require service by MotoCrane.
140	Swing Joystick Initialization Error	<ul style="list-style-type: none"> • Power cycle system with joysticks neutral 	If the joysticks are not in the neutral position when the system is initialized, the Controller will take action to prevent unintended movement of the system. A power cycle will be required after this error, to reset the system. If the error persists, the joystick or Controller internal wiring may be faulty and require service by MotoCrane.
233	Lift Control Mode Disabled From Error	<ul style="list-style-type: none"> • Look at STATUS and LOG to determine cause of the issue • Power cycle system and attempt re-enable 	Each control mode requires specific hardware functionality to be able to safely function. For example, STANDARD mode on the Lift Axis requires good, stable data from the Lift Encoder. If this data is compromised, and the sensor goes offline, STANDARD mode must be exited, and will

			be accompanied by this error message. Similarly, if the mechanical limit switch is activated by too much movement on the Lift Axis, this error will happen
236	Swing Control Mode Disabled From Error	<ul style="list-style-type: none"> ● Look at STATUS and LOG to determine cause of the issue ● Power cycle system and attempt re-enable 	Each control mode requires specific hardware functionality to be able to safely function. For example, STANDARD mode on the Swing Axis requires good, stable data from the Swing Encoder. If this data is compromised, and the sensor goes offline, STANDARD mode must be exited, and will be accompanied by this error message.
239	Lift Limit Switch Error	<ul style="list-style-type: none"> ● Move the Lift Axis away from the mechanical limit and power cycle 	This means that the internal range of motion limit switch has been triggered and it is unsafe to try and drive the motor further. Move away from the limit before operating again.

If these steps don't fix your problem, please contact us at support@motocrane.com. We can help troubleshoot and diagnose the issue. If we determine that a manufacturing defect exists in a part and it is covered under the Limited Warranty, we will repair the unit at no cost to you. If your system is experiencing general wear and tear, we can advise what options exist to get your system back to 100%. This includes sub-assembly upgrades, component replacement, or sending your unit back to MotoCrane Headquarters for a tune up.

Revision History

Revision	Date	Description
1.0	Nov 2021	Initial Release
2.0	Jul 2022	Updated CORTEX replacement section
3.0	Nov 2022	Added some additional error codes
4.0	Jun 2023	Removed RADICAL DSK information

MotoCrane Support

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This content is subject to change.

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