MOTOCRANE

ULTRA

ULTRA Operation Manual v1.3
JULY 2019

⚠WARNING

To minimize risk of serious injury, death or damage, before using MotoCrane ULTRA, all drivers and operators must read this Operation Manual and all on-product labels.

All practices and procedures stated herein are required for the proper and safe operation of ULTRA.

If there are any questions, please contact MotoCrane Support at support@motocrane.com.

Keep this Operation Manual near your ULTRA for future reference.

Safety Signal Words

This manual and the safety labels attached to this equipment utilize signal words that signify safety hazards with different levels of severity. The words are preceded by a triangle signifying that these are safety related. Below are the words used and the definitions for these words:

- **⚠WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury or damage
- **⚠CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or damage
- ***NOTICE*** is used to address practices not related to physical injury

The terms IMPORTANT and NOTE are also used to describe ideas for better and more efficient use of ULTRA.

Contents

Safety Signal Words 3
Contents 4
Before the First Drive 6

IMPORTANT PRODUCT AND SAFETY INSTRUCTIONS 7
Safety 7
IMPORTANT: Restricted Use Statement 7
Disclaimer and Limitations of Liability 8
Limited Warranty 8
Intellectual Property 8

Parts of ULTRA 9
System Overview 10
Components 11

Setting up ULTRA 17
ULTRA Setup at a Glance 17
Setup Process 18
Motor Vehicle Requirements 18
Suction Speedrail Grid (SSG) Kit Setup 19
ULTRABase Setup 20
ULTRA Turret Setup 20
ULTRA Boom + Isolator Setup 20
MotoCrane Power Supply Unit (PSU) Setup 22
MotoCrane Controller Setup 23
MotoCrane Controller 25
Controller Touchscreen 27
Known Hazards 32
Terminology 33
Pre-Flight Checklist 34

Troubleshooting and Maintenance 35
Troubleshooting 35
Diagnosing with COM and Power LEDs 35
Diagnosing with GUI Warning and Error Messages 35
External Deactivation of Lift Drive Brake 47
Maintenance 48

Weather & Water 49
Specifications 50
Revision History 52

Before the First Drive

Do the following before using ULTRA for the first time.

1. Read this Operation Manual
2. Read the Warranty in the Terms of Sale
3. Watch the Video Tutorials at www.motocrane.com/support
4. Recommended: Attend MotoCrane Training for in-person demonstration

IMPORTANT PRODUCT AND SAFETY INSTRUCTIONS

Safety

MotoCrane ULTRA is not a toy and can cause serious injury, death or damage if not used properly. You must exercise caution during use of the ULTRA to ensure a safe filming environment for everyone. This Operation Manual describes safe operation and should be read in conjunction with the online training videos or additional in-person training.

IMPORTANT: Restricted Use Statement

ULTRA is intended to produce world-class imagery with safe and comfortable operating conditions for everyone at or near the filming location.

ULTRA must only be used by trained drivers and operators 18 years of age or older when properly mounted on an appropriate motor vehicle driven on a closed course with paved or finished surfaces (for example, asphalt, concrete, or tarmac) or moderate off-road (for example, gravel or dirt roads) conditions. In addition, the speed and acceleration of the motor vehicle must not exceed system ratings for ULTRA as set forth in this Operation Manual.

Using ULTRA requires at least two persons - one driver and one operator. In addition, shoots will require a head operator. Drivers and operators must obey and observe all traffic rules and regulations and operate ULTRA in a safe manner and ensure that all personnel within the vicinity of ULTRA understand and abide by all safety precautions. It is the responsibility of the driver and operator to understand how ULTRA changes a motor vehicle's safety, performance and handling dynamics. Drivers and operators must not be under the influence of alcohol, drugs, or any substance, whether legal or illegal, that may affect the driver’s or operator’s ability to use ULTRA.

Check weather conditions before using ULTRA. Do not use ULTRA in high winds or harsh weather conditions such as fog, snow, rain, hail, lightning, tornadoes, dust, sand storms, hurricanes, or any other adverse weather condition or storm. Only use ULTRA under safe conditions, and within the weather ratings set forth in this Operation Manual.

Do not modify or adjust ULTRA. ULTRA has been calibrated before it is shipped to you. No modification or adjustment to ULTRA is allowed without the express written approval of MotoCrane, LLC.

Disclaimer and Limitations of Liability

You agree that you are responsible for your own conduct and any content created while using ULTRA, and for any consequence thereof. You agree to use this product only for purposes that are proper and in accordance with local laws, regulations or other legal requirements.

You also agree:

1. Any part of this disclaimer is subject to change without prior notice. Refer to www.motocrane.com/support for the latest version.

2. MotoCrane, LLC reserves the right of final interpretation of this disclaimer.

3. MotoCrane, LLC has no control over the use, setup, assembly, modification or misuse of ULTRA, and therefore no liability shall be assumed or accepted by MotoCrane, LLC for any resulting damage, death, or injury incurred directly or indirectly from the use of ULTRA. By the act of use, setup or assembly, the user accepts all resulting liability.

Limited Warranty

ULTRA has a limited manufacturer's warranty on parts and assembly. See the Terms and Conditions of Sale for your ULTRA for a complete description of this limited warranty. This Limited Warranty is incorporated by reference into this Operation Manual.

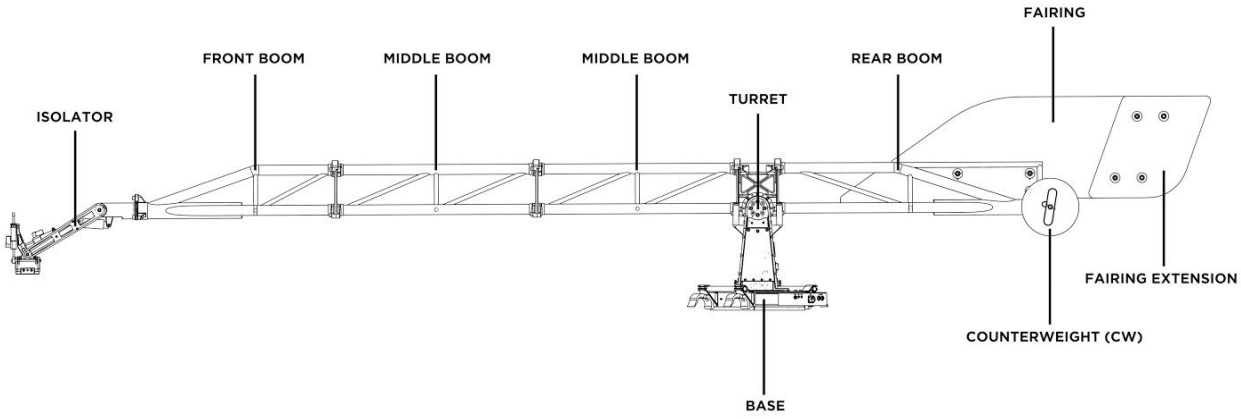
Intellectual Property

Parts of ULTRA

- Base
- Turret
- Booms
    - Front Boom
    - (2) Middle Booms
    - Rear Boom
- Isolator
- Fairing + Fairing Extension
- Counterweight
- Controller
- Power Supply Unit (PSU)
- Cables:
    - (1) 10’ Main Power Input Cable
    - (1) 10’ Controller COM Cable
    - (1) 12’ PSU to Base Main Power Cable
    - (1) 1.5’ Base to Turret Main Power Cable
    - (1) 2’ Power Input Flying Leads
- Miscellaneous: Fasteners, safety pins, hex wrench
- Accessories (not included)
    - Suction Speedrail Grid [SSG]
    - More coming soon.

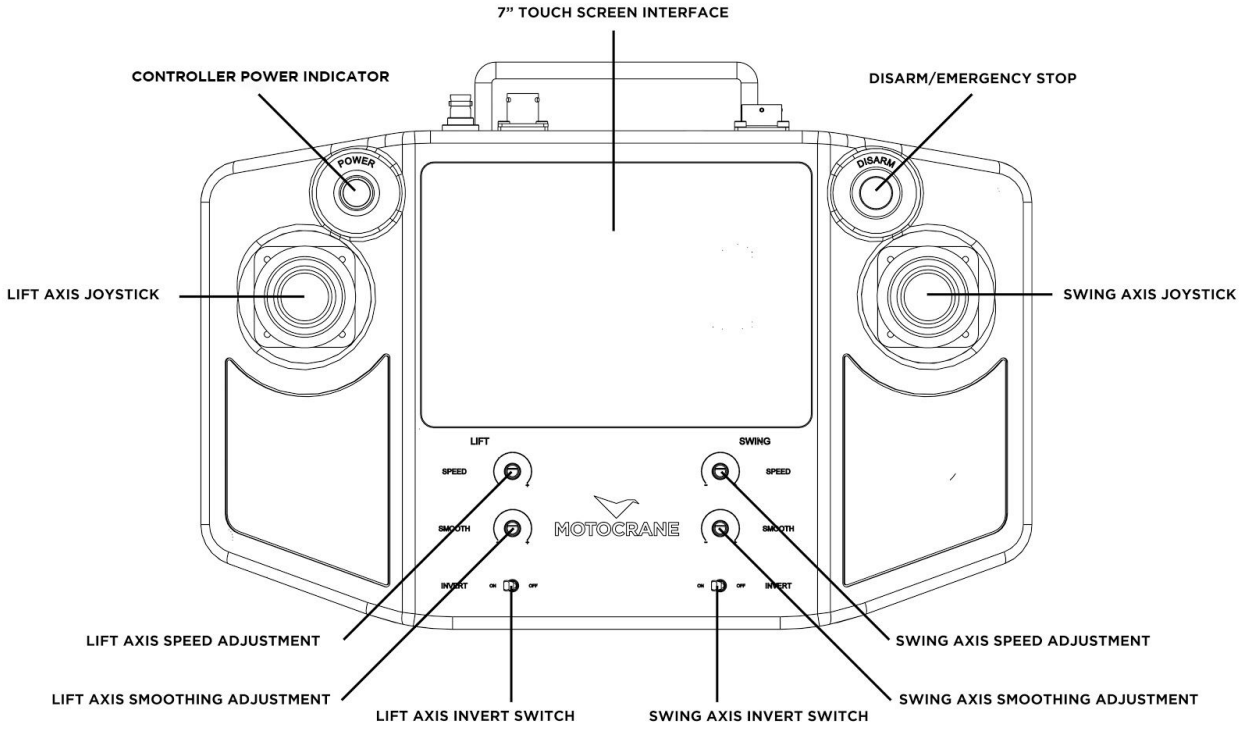
System Overview

ULTRA

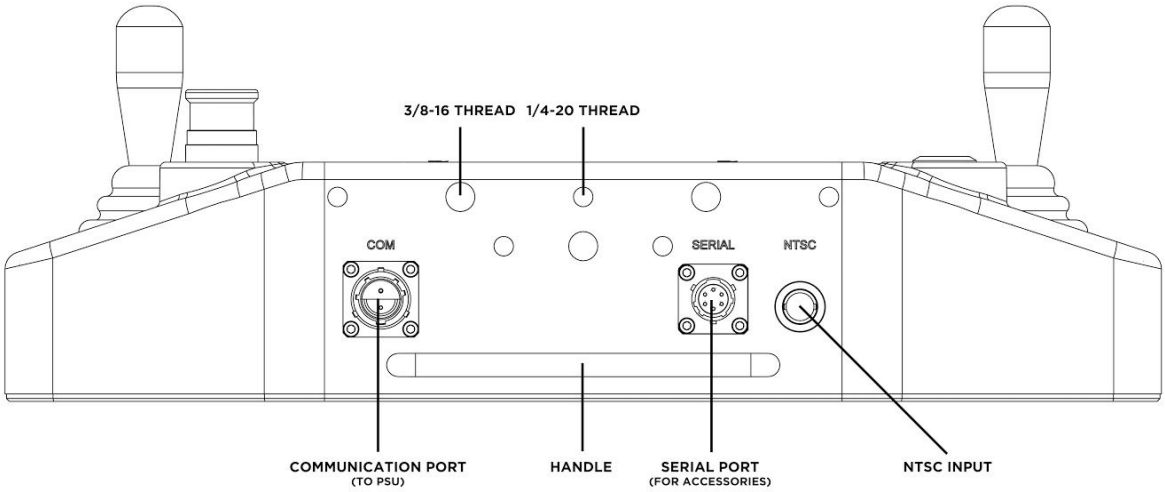


Components

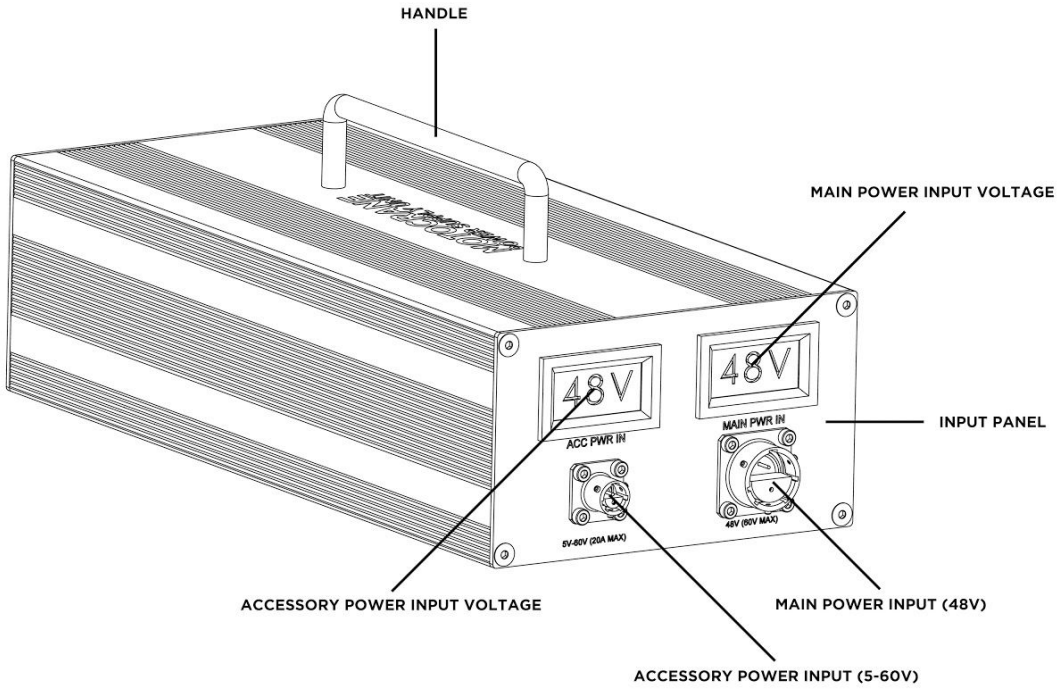
Controller (front view)



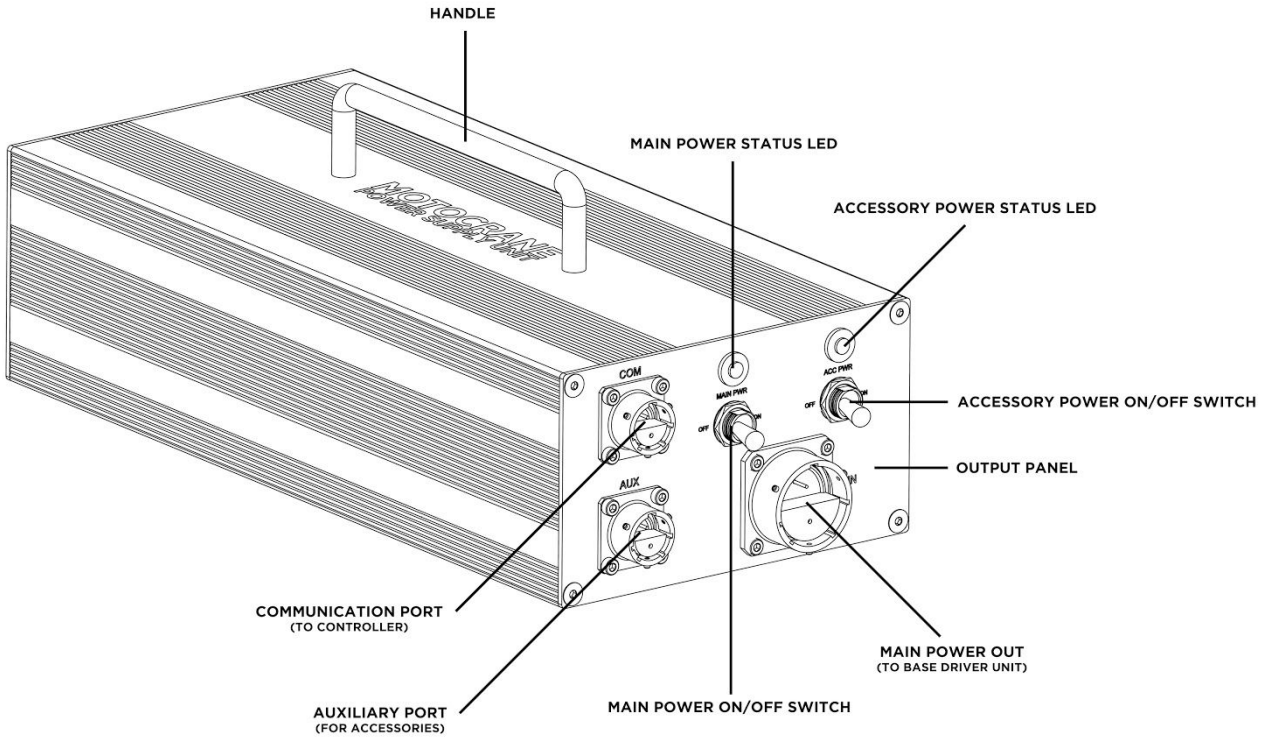
Controller (top panel)



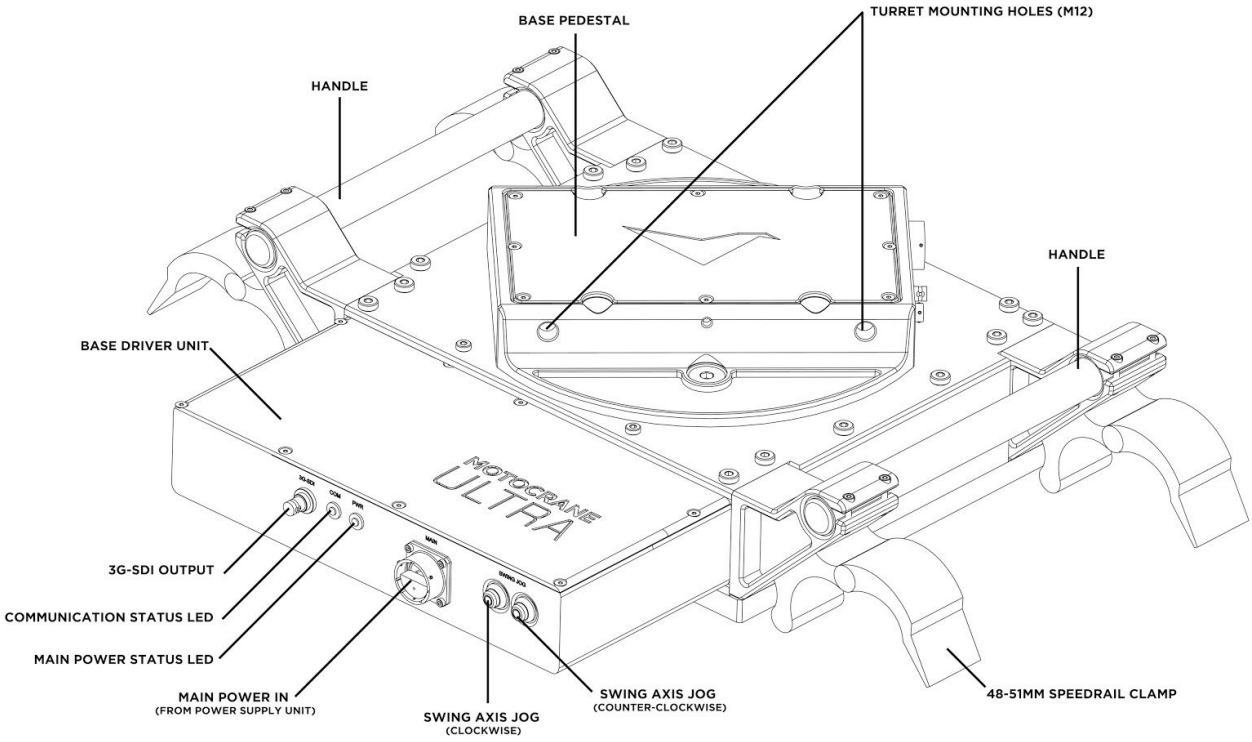
Power Supply Unit (PSU) Input Side

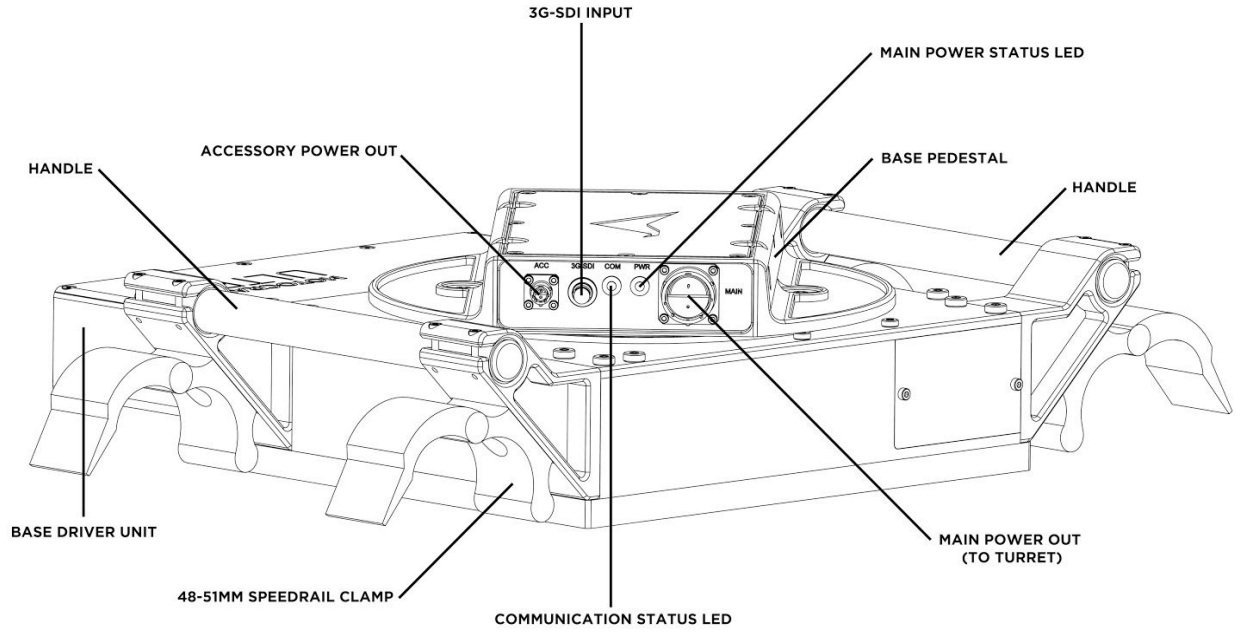


Power Supply Unit (PSU) Output Side

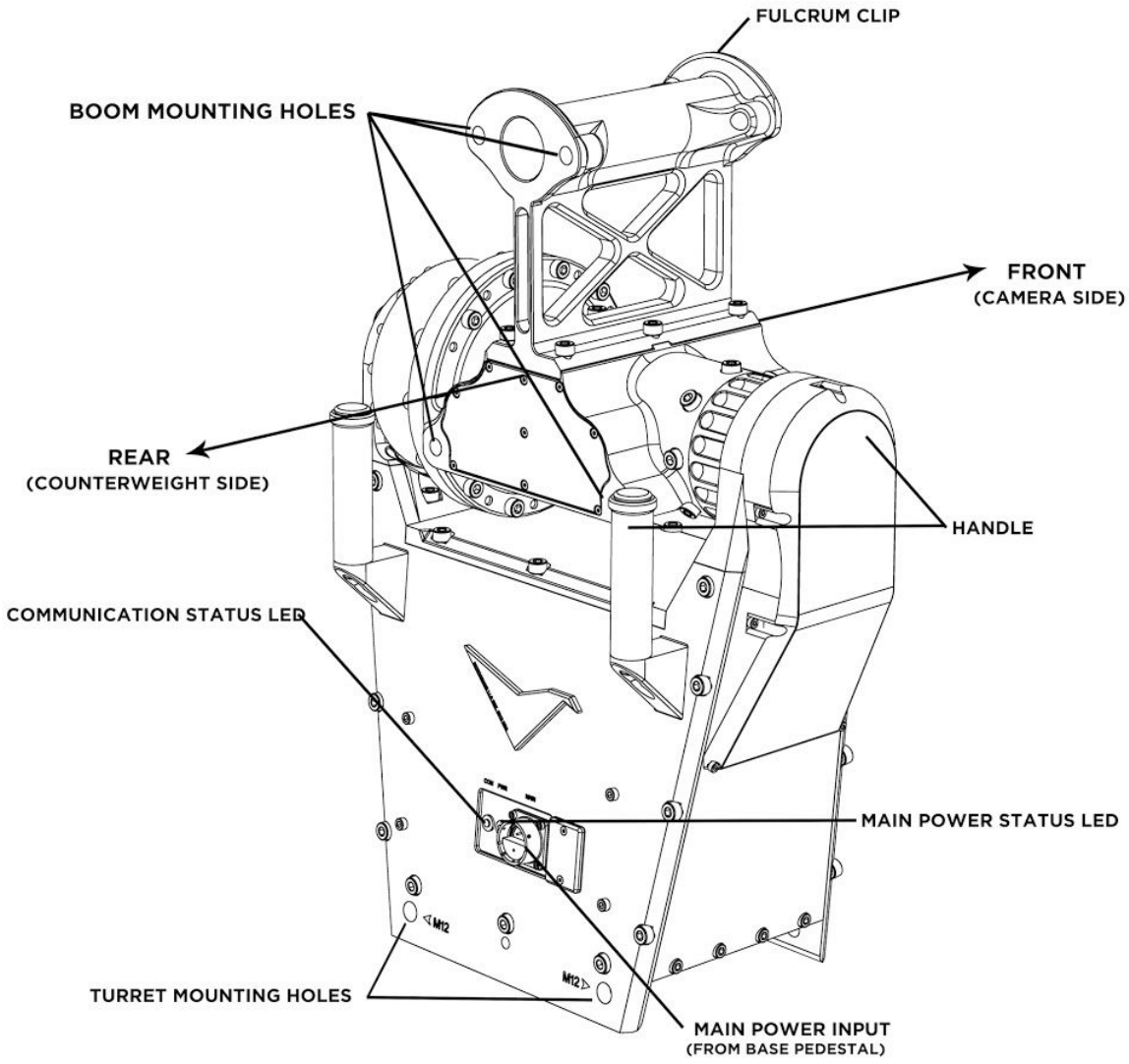


Base

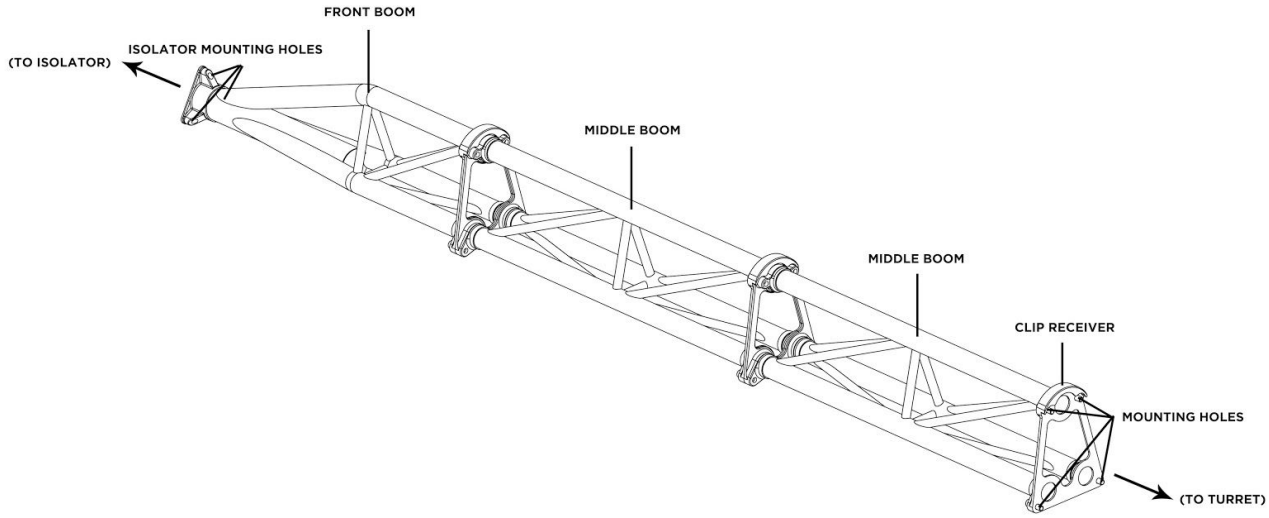

BASE PEDESTAL
TURRET MOUNTING HOLES (M12)
HANDLE
HANDLE
BASE DRIVER UNIT
MOTOCRANE ULTRA
3G-SDI OUTPUT
COMMUNICATION STATUS LED
MAIN POWER STATUS LED
MAIN POWER IN
(FROM POWER SUPPLY UNIT)
SWING AXIS JOG
(CLOCKWISE)
SWING AXIS JOG
(COUNTER-CLOCKWISE)
48-51MM SPEEDRAIL CLAMP


3G-SDI INPUT
MAIN POWER STATUS LED
ACCESSORY POWER OUT
HANDLE
BASE PEDESTAL
HANDLE
ACC
3GSDI
COM
PWR
MAIN
BASE DRIVER UNIT
MAIN POWER OUT
(TO TURRET)
48-51MM SPEEDRAIL CLAMP
COMMUNICATION STATUS LED

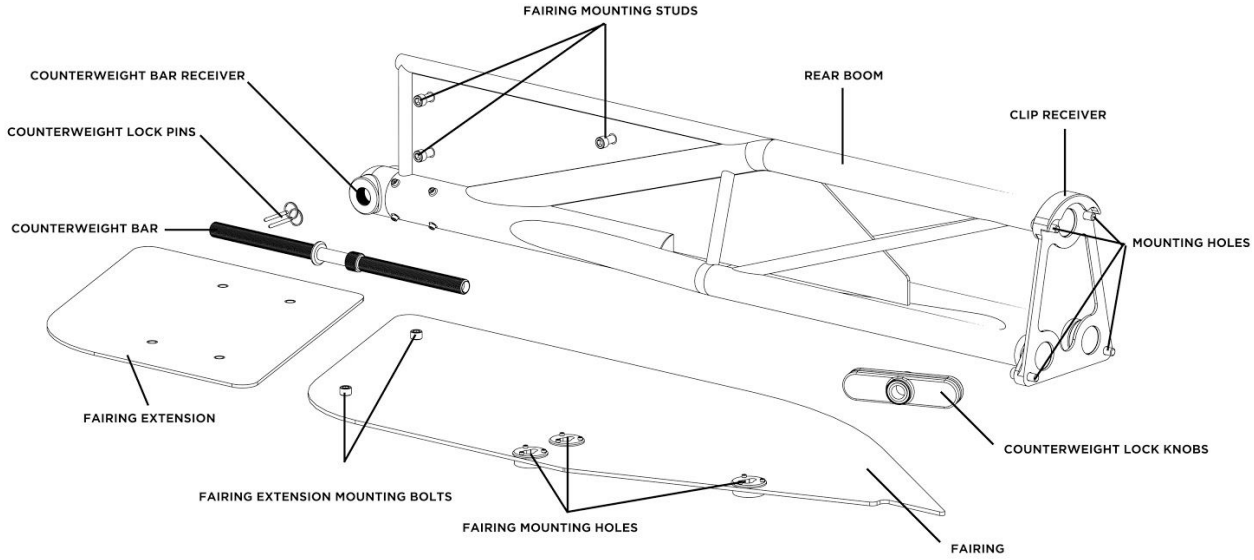
Turret


FULCRUM CLIP
BOOM MOUNTING HOLES
FRONT
(CAMERA SIDE)
REAR
(COUNTERWEIGHT SIDE)
HANDLE
COMMUNICATION STATUS LED
MAIN POWER STATUS LED
M12
M12
TURRET MOUNTING HOLES
MAIN POWER INPUT
(FROM BASE PEDESTAL)

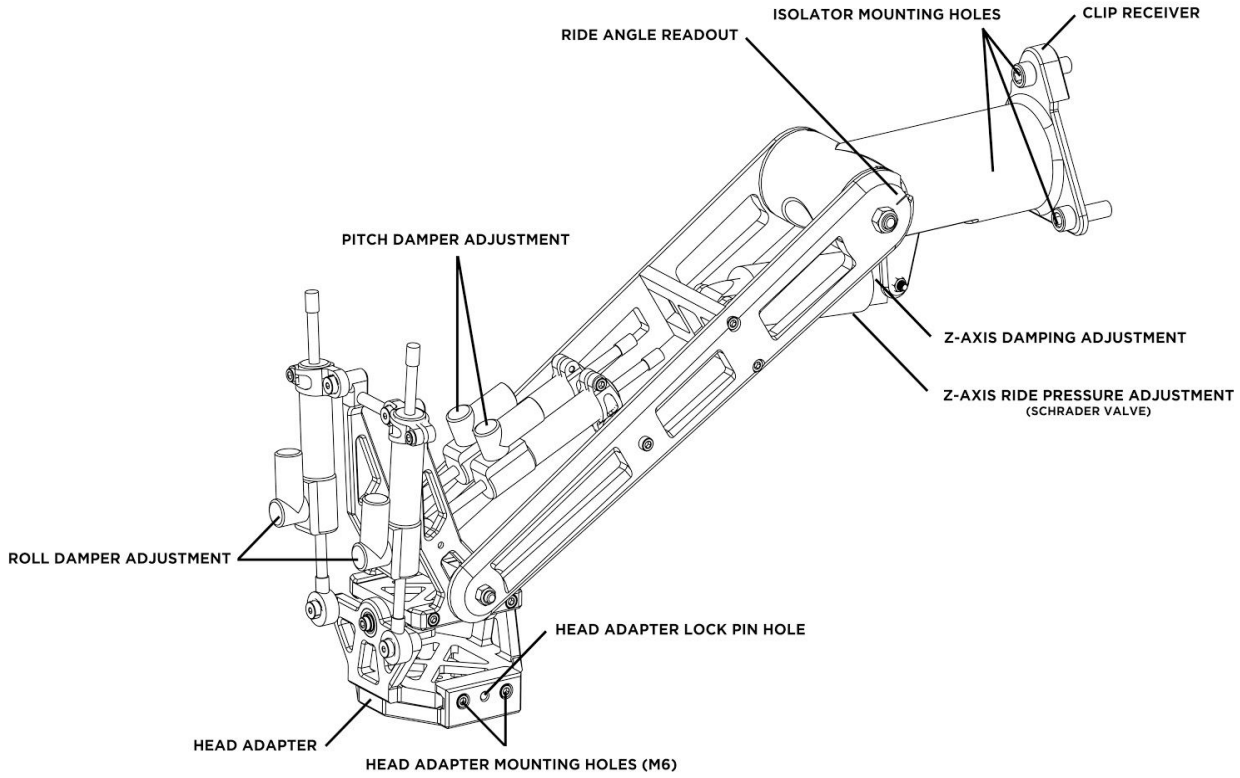
Front Boom



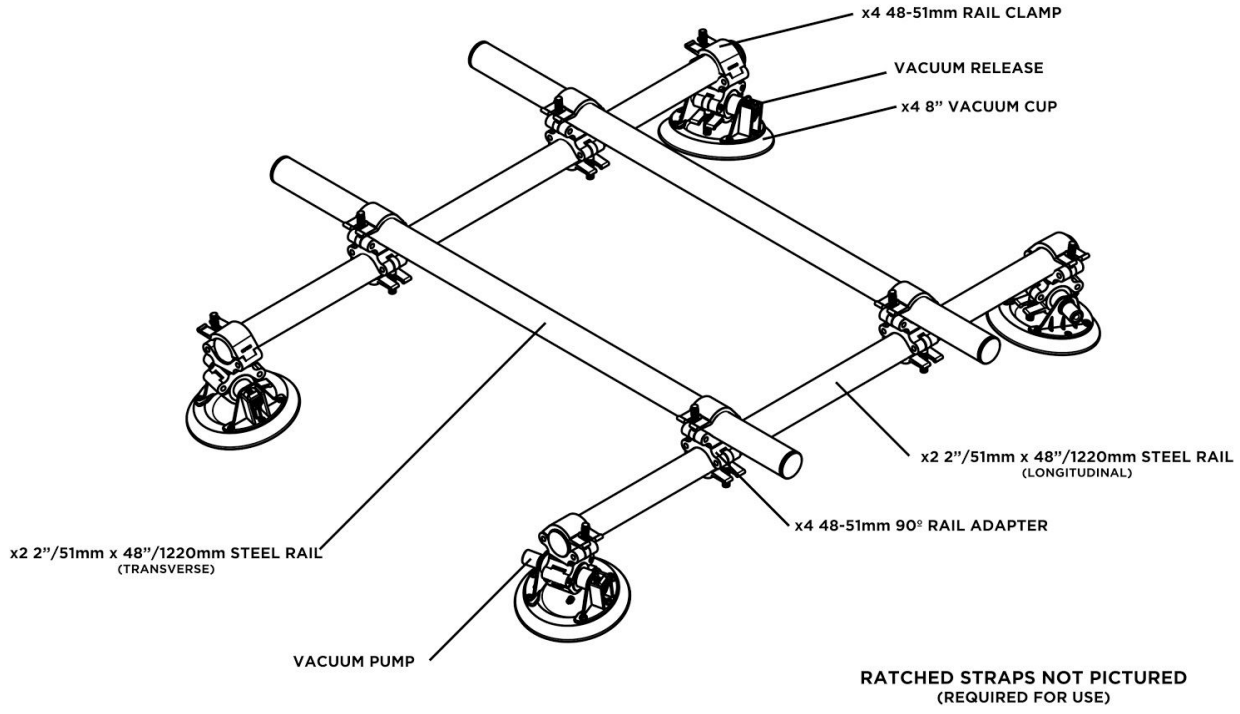
Rear Boom + Fairing



Isolator



Suction Speedrail Grid (SSG) Kit



Setting up ULTRA

ULTRA Setup at a Glance

ULTRA comes in modules that are to be set up piece by piece.

1. Via either your custom mount or Suction Speedrail Grid [SSG], provide a speed rail mount for ULTRA.
2. Place the Base on the Speed Rail and torque the Speed Rail Clamps.
3. Add the Turret and torque Bolts.
4. Add the Front and Rear Booms, torquing bolts as each section is assembled.
5. Add the Isolator.
6. Add the Fairing and Counterweights to balance the arm.
7. Attach and balance your head and camera rig.
8. Add Counterweights to balance your rig.
9. Adjust the Isolator as desired.
10. Ensure all knobs are tight, safety pins inserted, and safety lanyards connected.
11. Connect system cables, make sure controller 'DISARM' button is depressed, and turn on PSU.
12. Tune to desired speeds on the Controller before driving.
13. Release the 'DISARM' button to enable arm control via the joysticks.
14. Operate in a safe manner as described in the manual and obey all laws.

⚠WARNING: Failure to follow these instructions and those below can result in serious injury, death or damage.

These instructions are demonstrated in our training videos and found online at www.motocrane.com/support. All terminology is referred to in the above diagrams.

Setup Process

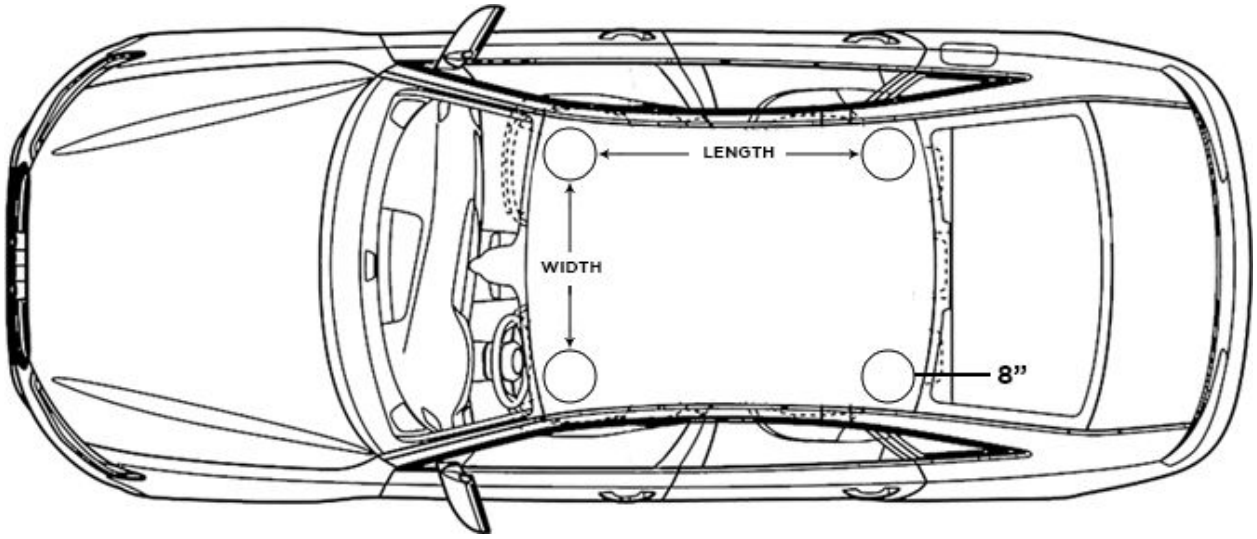
Motor Vehicle Requirements

ULTRA is designed to work on a motor vehicle that meets the following criteria:

1. Roof constructed of metal or other material suitable for bearing 350 lbs load.
2. If using the Suction Speed Rail Grid;
    a. Roof must be in "like-new" condition with non-porous, glossy surface finish suitable for mounting vacuum cups. Can have no blemishes to paint or exterior finish.

The roof of the car must meet the following minimum dimensions in order to support the smallest configuration of the Base.

Minimum Roof Dimensions:
Minimum Width: 30"
Minimum Length: 45"



⚠WARNING The use of ULTRA on any vehicle not meeting the required criteria may cause serious injury, death or damage. Operator is responsible for ensuring all rigging meets the requirements of the shoot.

Suction Speedrail Grid (SSG) Kit Setup

1. Position each 9" Cup at the 4 corners of the roof. Rotate cup so that the Speedrail starter clamps are aligned with it's longitudinal pair on each side of the vehicle (e.g. Driver's side suction cups should be aligned as a pair, and passenger side suction cups should be aligned as a pair)
2. Loosen the M12 adjustment bolt to rotate the Speedrail starter clamp about the handle axis, once level and aligned with the mating pair, tighten the bolt.
3. Open Speedrail starter clamps and lay 48-51mm (2") Speedrail tube in the clamps running from the front to the back of the vehicle. Measure distance between the rails at the front and rear, and adjust either end to make parallel.
4. Close the Speedrail starter clamps, and tighten the M12 wingnut with adequate torque to safely secure the Speedrail within the clamp.
5. Open the 90° Speedrail adapter clamps, and secure loosely on the Speedrail. To ensure proper fitment of the base, front and rear clamps should be spaced 18" apart from each other at the point that contacts the Speedrail
6. Confirm 90° adapter clamps are mirrored from Driver's side to Passenger side.
7. Open the top section of the 90° adapter clamps, and lay 48-51mm (2") Speedrail tube in the clamps running from driver's side to passenger side clamps.
8. Confirm the distance between the rails is 18", making adjustments to the 90° adapter clamps fore and aft as needed.
9. Confirm the transverse rails are not too far fore or aft for your application. The load should be evenly distributed between the 9" Cups.
10. Close the top section of the adapter clamp around the Speedrail, and tighten the
11. Tighten M12 wingnut with adequate torque to safely secure the Speedrail within the clamp.
12. Extend the adjustable side of the ratchet strap to it's full length, and secure the completed Speedrail grid to the roof, making sure to loop around and capture both the longitudinal and transverse rails. The completed strap harness must loop through the cabin of the vehicle.

⚠WARNING The SSG is secured in two ways; Vacuum Cups and a Strap Harness. ULTRA should never be operated without fully engaged Vacuum Cups and Strap Harness. Without both, ULTRA can fall off the vehicle. If you see the red lines on the Vacuum Pumps, stop operation and reapply vacuum pressure by pumping until they are no longer visible. A clean, glossy finish and proper mounting is essential to maintaining vacuum pressure.

⚠WARNING The Speed Rail provides the connection from your vehicle to MotoCrane. If not mounted properly, the base can fall off the vehicle. Do not skip any steps or deviate from the setup order.

ULTRA Base Setup

1. Prepare the ULTRA Base by opening the 4 Speedrail clamps, and make note which orientation is preferred for the connectors/cables.
2. With a partner, hoist the ULTRA Base onto the Suction Speedrail grid, or equivalent approved rigging.
3. Once safely seated on the rails, slide the ULTRA Base so that the Pedestal is centered side-to-side. *(Alt.- Install Turret, then move to step #4)*
4. Close the Speedrail clamps, and tighten the M12 wingnut with adequate torque to safely secure the Speedrail within the clamp

ULTRA Turret Setup

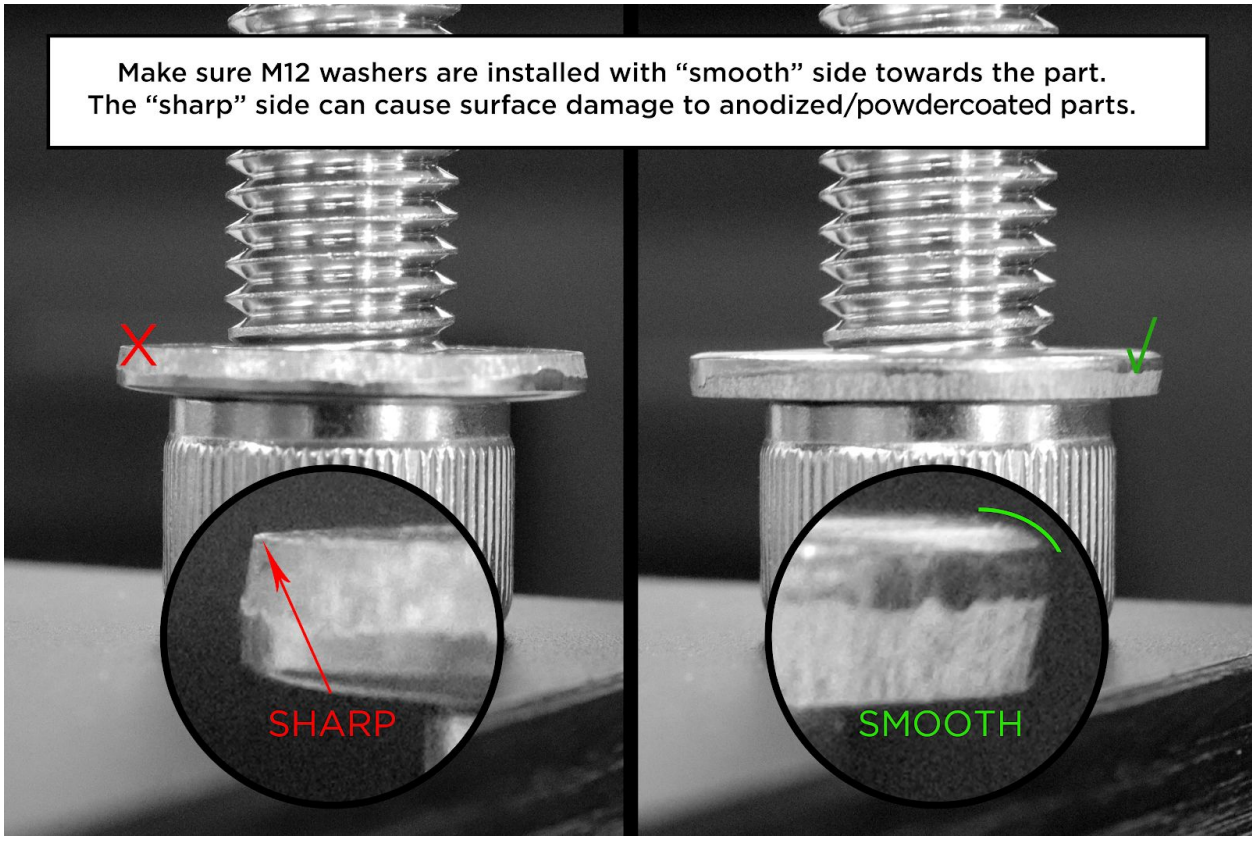
1. Prepare the Turret by confirming the ULTRA Base Pedestal is oriented properly for installation. *(If Pedestal needs orientation adjustment, you may skip to PSU Setup for delivering power to the base and enabling Swing Jog)*
2. With a partner, hoist the Turret onto the ULTRA Base Pedestal.
3. Install the M12 fasteners in the Turret mounting holes, applying appropriate torque to the fasteners.

NOTICE The Turret can only mount on the base in one direction. If aligned incorrectly, the cables will not reach from Base to Turret. See illustration below:

ULTRA Boom + Isolator Setup

1. Prepare for boom installation by noting the front and rear of the Turret.
2. Install the Rear Boom by placing the clip receiver over the fulcrum clip.

NOTICE Do not hang on ULTRA. Only apply force on Lock knobs, spanners, and boom tool in a rotational direction. Hanging on ULTRA can cause damage.



NOTICE When installing M12 fasteners, be sure that the supplied washers are installed with the “smooth” side towards the part. This will help to preserve the finish on your ULTRA Front, Middle, and Rear boom sections, as well as the Turret.

3. Install the x4 M12 fasteners into the mounting holes with adequate torque to safely secure the Rear Boom to the fulcrum.
4. Install the Threaded Bar by sliding it into the Threaded Bar Receiver, then screwing the Threaded bar into the receiver completely.
5. Prepare to install the Fairing by first loosening the M12 mounting studs so that >35mm is exposed of the mounting stud.
6. Install the fairing over the x3 M12 mounting studs so that the head of the studs are seated firmly within the x3 slots of the fairing.
7. Tighten the mounting studs with adequate torque to safely secure the Fairing
8. Install the Middle Boom to the fulcrum by securing the clip receiver over the fulcrum clip. Install the x4 M12 fasteners into the mounting holes with adequate torque to safely secure the Middle Boom to the fulcrum.
9. Repeat step 8 to install the next section of Middle Boom, and the Front Boom
10. Position the Isolator clip receiver over the Front Boom clip, and install the x3 M12 fasteners into the mounting holes with adequate torque to safely secure the Isolator to the Front Boom

11. Measure the All-Up Weight (AUW) of the payload then use the chart below to determine how much counterweight (CW) should first be installed before mounting the payload, and if any is needed after. "Payload" includes everything hanging from ULTRA including AVM's like Tranquilizer, stabilized head, camera and accessories. You must weigh for accuracy. "Tallying" of weight often leads to balancing error.

⚠CAUTION The Lift axis is equipped with a fail-safe brake. Failure to observe the proper counterweighting method will result in excessive imbalance beyond the max permissible limit, and may cause permanent system damage.

All Up Weight [AUW] vs Counterweight [CW] Chart

Payload AUW	Counterweight Pre-load
Empty/No Payload	40lbs/18kg
20lbs/9kg	90lbs CW/41kg, mount Payload
25lbs/11kg	100lbs/45kg CW, mount Payload
30lbs/14kg	115lbs/52kg CW, mount Payload
35lbs/16kg	125lbs/57kg CW, mount Payload
40lbs/18kg	130lbs/59kg CW, mount Payload, Add 10lbs/4.5kg
45lbs/20kg	130lbs/59kg CW, mount Payload, Add 20lbs/9kg
50lbs/22kg	130lbs/59kg CW, mount Payload, Add 35lbs/16kg
55lbs/25kg	130lbs/59kg CW, mount Payload, Add 45lbs/20kg

NOTE: Subtract Counterweight Pre-load by 10lb if Fairing Extension is used.

12. The Fairing Extension provides additional surface area to counterbalance the drag incurred from larger stabilized heads and camera packages. Refer to the following notice to understand when you should install it.

NOTICE

- Compact heads such as the Ronin 2, MoVI Pro, Intuitive Aerial Newton, etc. do not require the Fairing Extension. Only the Carbon Fiber Fairing should be used.
- For Shotover G1, and Arri SRH-3, install the Fairing Extension in the first (smaller) position.
- For MoVI XL or Flighthead Mini, install the Fairing Extension in the second (larger) position.

13. Based on your payload AUW, pre-load the Rear Boom with the appropriate amount of CW and secure the CW Pre-load with the CW Lock Knobs.
14. Remove the x4 M6 Bolts from the Isolator and release the Head Adapter.
15. Install the Head Adapter on to the Payload.

NOTICE Stabilized heads require isolation from high frequency vibrations for optimal tuning. Failure to include an AVM will result in poor pan-axis tuning. MoVI XL users are highly encouraged to review our Advanced Applications Guide [AAG] for MoVI XL.

16. Mount the Payload (55lbs MAX) onto the Isolator so that the Head Adapter can be fastened to the Isolator using the x4 M6 Fasteners. Install Safety Pin.
17. If Payload is between 40-55lbs (18-25kg), add the additional CW as instructed by the AUW vs. CW Chart.
18. Once the additional CW has been added, secure both sides of the Threaded Bar with the Counterweight lock knobs and install the Counterweight Lock Pins at the ends of the Threaded Bar.

ULTRA Isolator Tuning

1. Using the included air pump, increase or decrease the pressure at the rear chamber of the air shock so that the Z-Axis Ride Angle Indicator reads ~20°. *Note: early ULTRA units are equipped with 2 pressure adjustment valves. Do not adjust the front valve (should have 0psi) in the front valve.*
2. Z-Axis damping should be adjusted via the "*Fast-Slow*" dial on the rear of the air shock. Damping should be "fast" enough to account for sudden terrain jolts, but not at the risk of bottoming out the Isolator.

⚠CAUTION Z-Axis damping adjusted too "fast" on rough/off-road terrain can cause the Isolator to bottom out and cause permanent damage.

3. For adjustment of the Pitch and Roll passive damping, manually deflect the stabilized head to 45° and release. If the head swings past the neutral hanging position, the damping should be increased. If the head does not reach the neutral hanging position, the damping should be decreased.

NOTICE Dampers should be acclimated to operating temperature before adjustments.

MotoCrane Power Supply Unit (PSU) Setup

1. Prepare the 48V power source by confirming that it is terminated with the mating Gray Anderson SB50 Connector. DOUBLE CHECK PROPER POLARITY
2. With the PSU Main Power Switch in the "Off" position, connect the 48V power source to the Main Power Input on the Input stage of the PSU.
3. If supplying accessory power, connect the accessory power source to the ACC Power Input on the input stage of the PSU.
4. Connect the 10' MotoCrane Controller Cable to the COM port on the PSU, then to the COM port on the MotoCrane Controller. Make sure the Controller has the DISARM/E-Stop engaged (pressed down).
5. Connect the longer 12' Base Power Cable from the MAIN Port on the output stage of the PSU to the MAIN Port on the ULTRA Base.
6. Connect the shorter 16" Turret Power Cable from the MAIN Port on the ULTRA Base Pedestal to the MAIN Port on the Turret. Be sure that the right angle connector is installed on the Pedestal side, while the straight connector is installed on the Turret side.
7. If supplying accessory power, connect the appropriate ACC Power Adapter cable from the ACC Port on the ULTRA Base Pedestal, to the appropriate port on the corresponding product.
8. Connect the 3G-SDI compatible video signal from the camera to the 3G-SDI Port on the ULTRA Base Pedestal. The 3G-SDI video signal should be passed from the ULTRA Base into the interior of the vehicle to a preferred 3G-SDI monitor (not included).
9. The MotoCrane PSU MAIN and ACC Power Switches can now be turned on.

MotoCrane Controller Setup

1. Make sure the DISARM/E-Stop button is engaged (pressed down) and then turn the PSU Main Power Switch to the "On" position. The controller will power up and boot after ~5 seconds.
2. Press OPERATE from the Home menu, then adjust Speed and Smoothing values to "15" for both Lift and Swing axes. This will ensure slow and controlled arm movement during configuration.
3. To configure Limits for the Lift and/or Swing axes, press SETTINGS from the Home menu, then select "New Limits" from the axis you wish to configure.
4. Confirm that no personnel, including yourself, are within the Swing/Lift radius of ULTRA then release the DISARM/E- Stop button (twist clockwise).
5. Carefully follow the on-screen directions until Limits are configured, then turn Limits to the "ON" position in the SETTINGS Menu.
6. Once Limits are configured, you may proceed to the OPERATE screen for live operation of ULTRA.

7. If desired, additional safeguards in the form of 'Limits Protection' and 'Imbalance Check' can be enabled or disabled (via the SETTINGS page and the SETTINGS+ page, respectively).

   - 'Limits Protection' ensures that even when the boom is slightly imbalanced, due to improper Payload/CW ratios, small corrections will automatically take place to ensure the boom remains within the limits, independent of user input.
   - 'Imbalance Check' monitors the frequency and duration of these small corrections in order to determine if a significant imbalance exists. If so, a warning message will provide information on the appropriate action to take in order to balance the system.

NOTE: Carefully read through the Operation Manual for complete understanding of all Controller features, menus and submenus. Serious injury and/or death can occur from irresponsible use of ULTRA. Always start with slow, controlled operation of ULTRA before attempting arm moves at speed.

⚠CAUTION ULTRA will require fine balancing beyond the 10lbs/4.5kg CW increments offered by the AUW vs. CW Chart. We recommend carrying a 5lbs/2kg weight and 2.5lbs/1kg weight to ensure that proper counterweight can be achieved. With the DISARM/E-Stop released, you can manually back-drive the arm up and down to feel for any imbalance.

If the camera drifts downward during operation, you must increase counterweight.
If the camera drifts upward during operation, you must decrease counterweight.

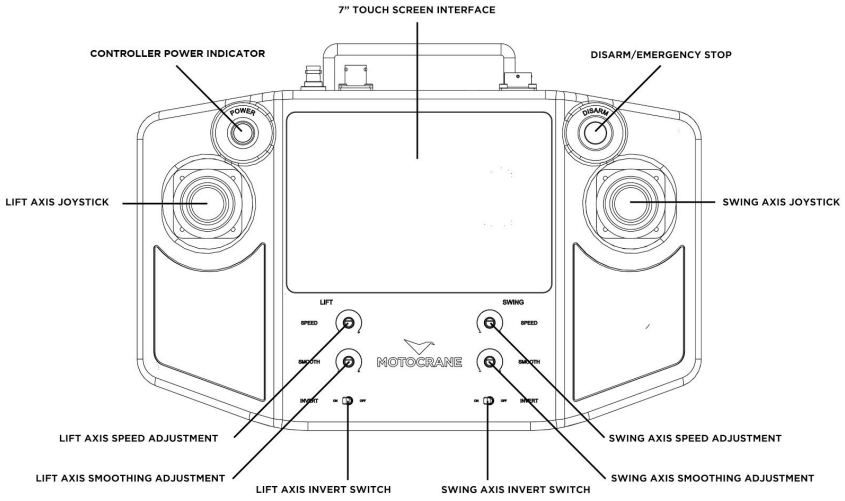
NOTICE The ULTRA Base/swing axis gearing has nominal backlash of .05° resulting in 1-2" of play at the ULTRA Isolator. This does not affect smooth start/stop operation or the ability to tune stabilized heads to optimum levels.

⚠WARNING Do not touch the joysticks on the Controller during boot up. This time is required to calibrate the zero point on the joysticks. Although this startup error should be detected automatically, improper calibration could, in a rare situation, unintentionally set ULTRA in motion.

MotoCrane Controller

The MotoCrane Controller includes two joysticks for individual Swing and Lift axis control, switches for easy user adjustment, and a 7” touchscreen for configuration, monitoring, and advanced settings. The joysticks apply a command proportional to the degree they are pushed. There are 3 manual parameters which should be tested, and configured before operation.

Before operating MotoCrane, consider the configuration most desirable for your operation/application and take time to get comfortable with the controls. Consider changes in focal length, and how these might affect your changing field of view.



SPEED - Adjusts the maximum speed achievable. Turning to “0” disables control.
SMOOTH - Adjusts the rate at which rpms are gained and lost.
INVERT - Inverts the direction of the controls

Examples:

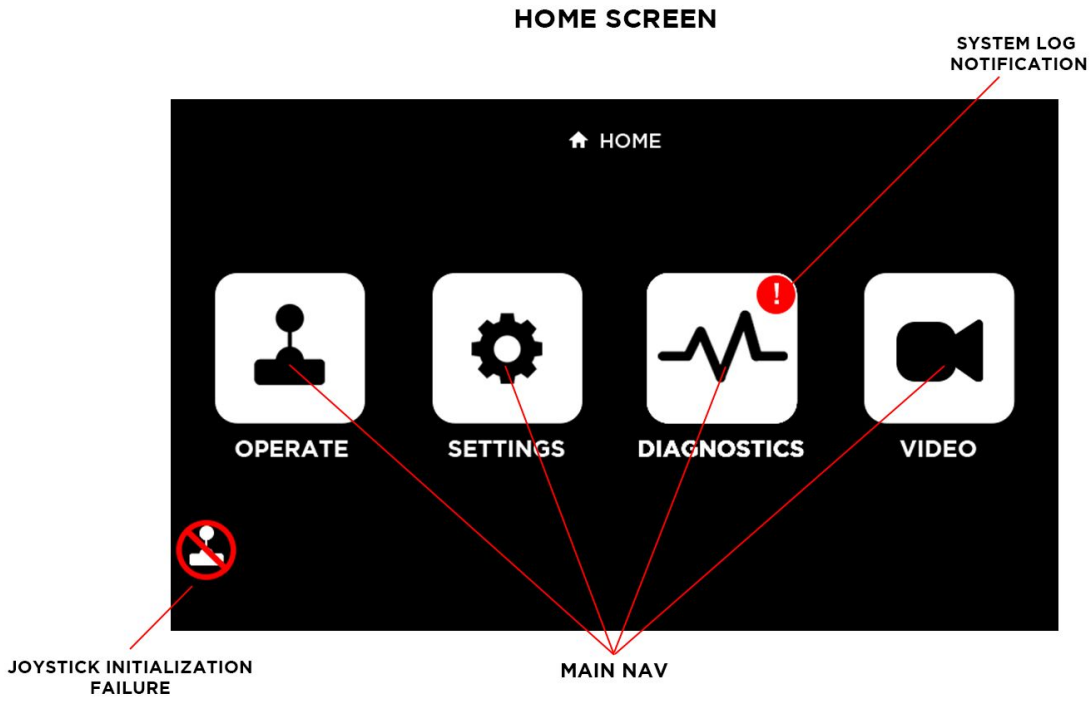
High Speed, Low Smooth: The axis will feel very reactive and touchy. The axis will eventually achieve fastest rotation quickly, and when released will take very little time to come to a stop.

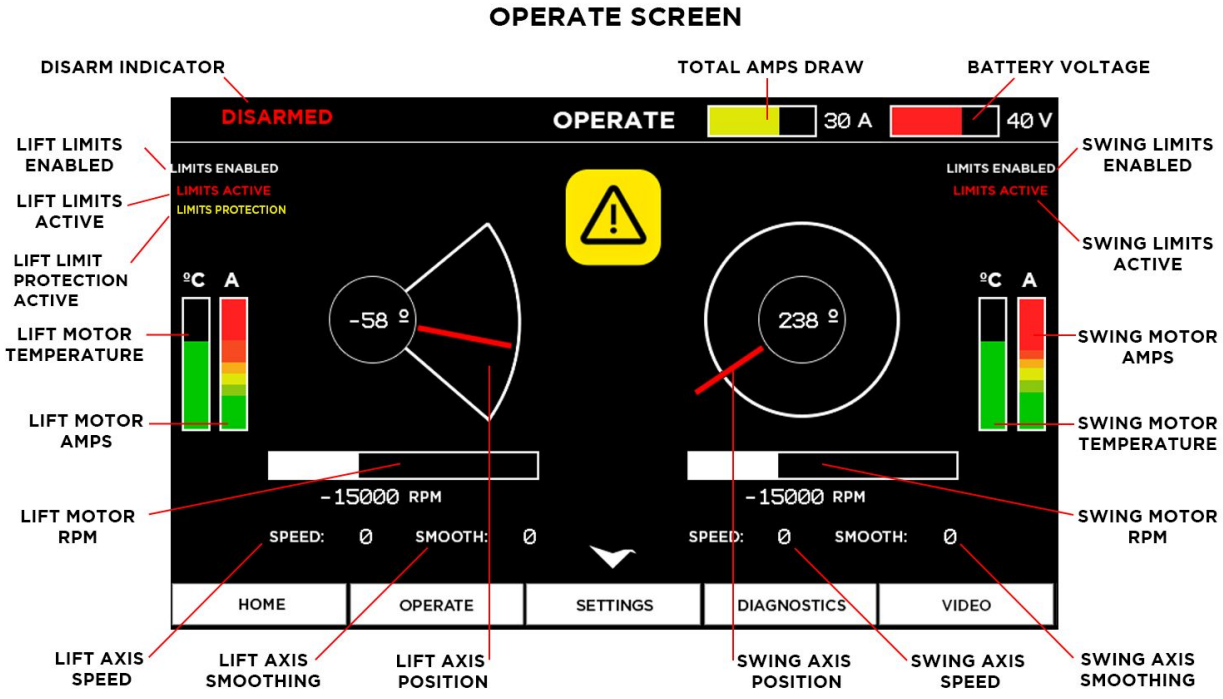
Low Speed, High Smooth: The axis will feel sluggish and dampened. If held, the axis will achieve slow rotation over some time, and when released will stop very smoothly.

⚠WARNING When the DISARM/ EMERGENCY STOP button is engaged (pressed down), all power is cut from the motors, and Lift-axis brake is engaged. ULTRA will not be controllable, which could prevent the operator from moving it into a safe position. It will stop immediately, regardless of the speed or acceleration settings. After releasing this button, it will take a few seconds to regain the ability to move.

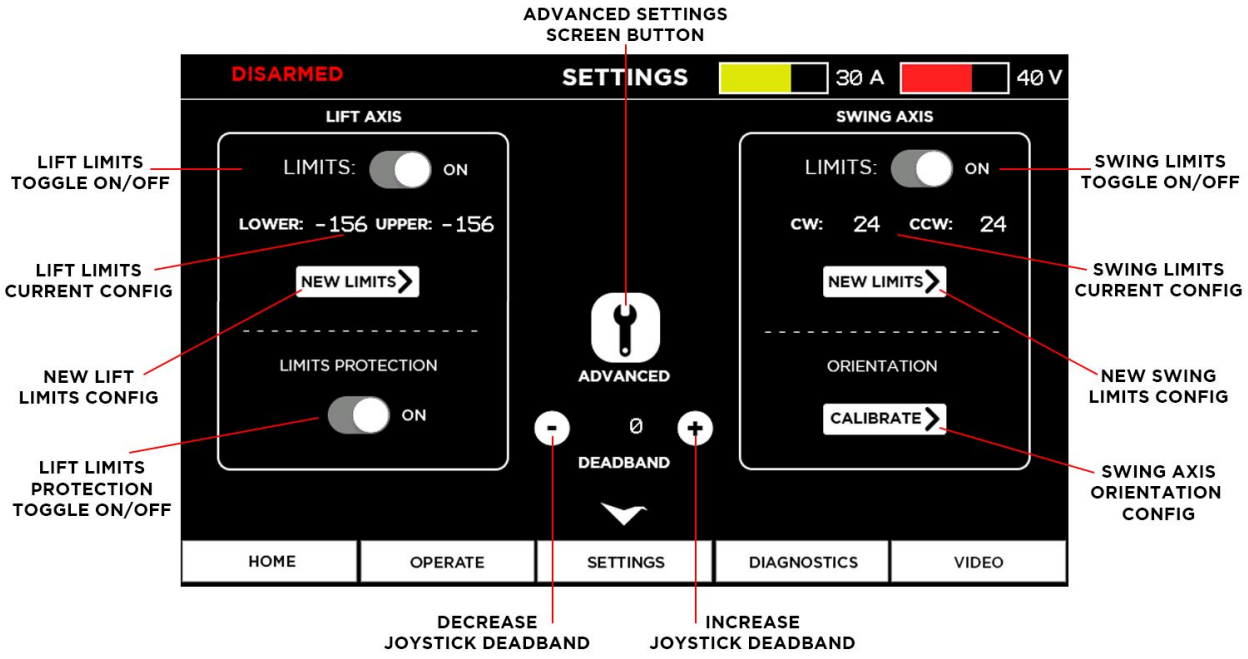
⚠WARNING Do not force the joysticks past their range of motion. This can send erroneous commands causing undesired and potentially hazardous movement.

Controller Interface

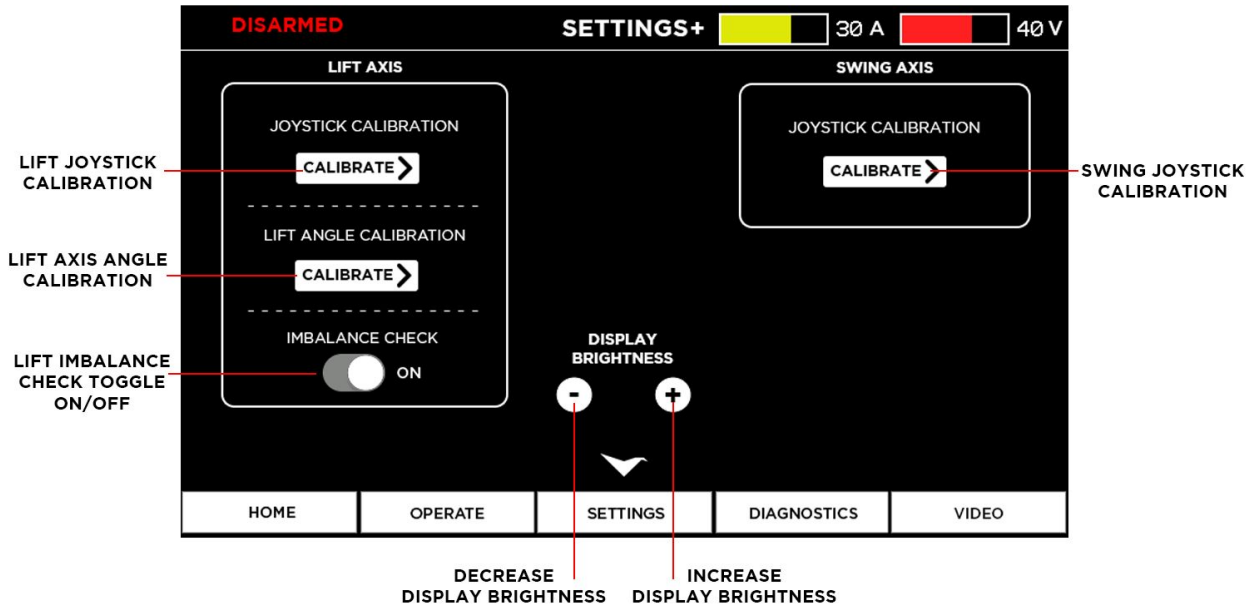




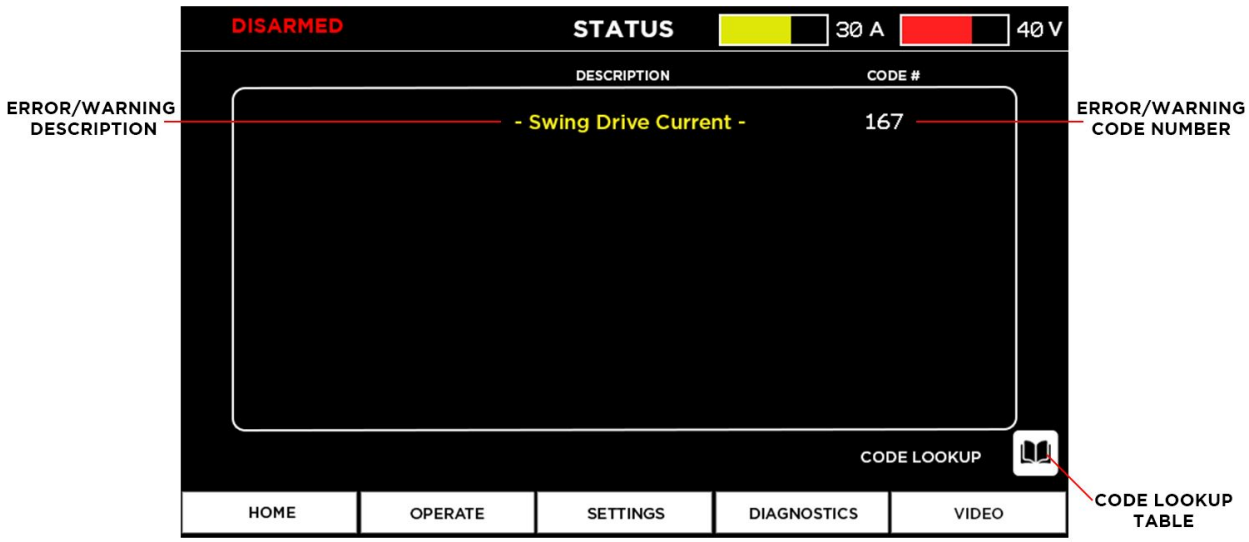
SETTINGS SCREEN



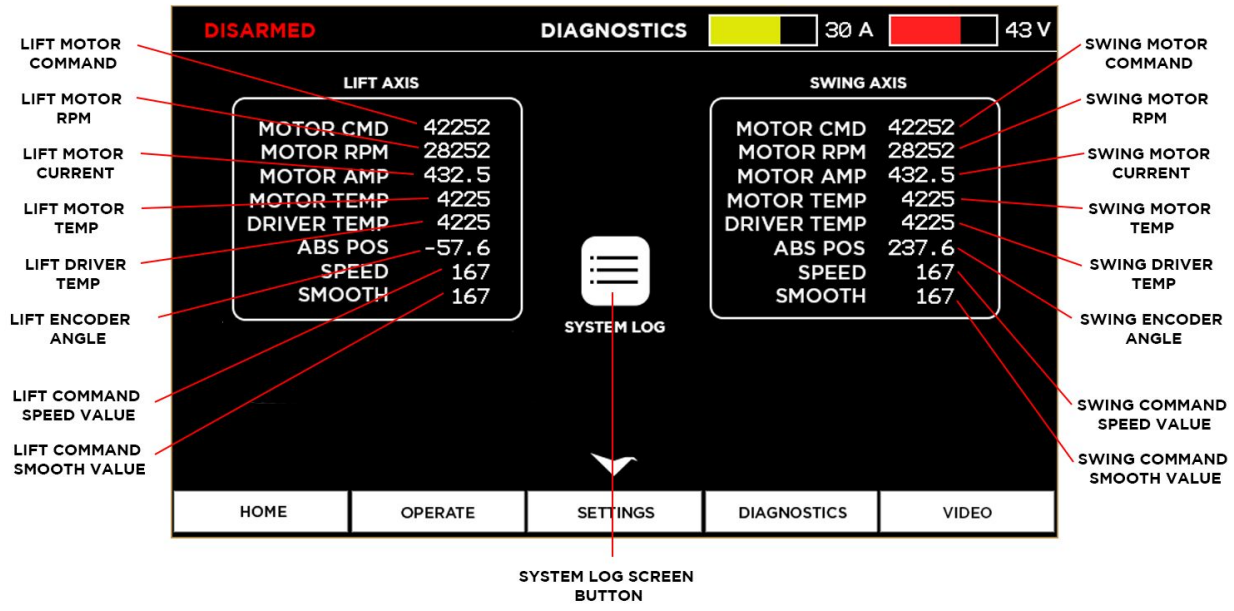
SETTINGS+ SCREEN



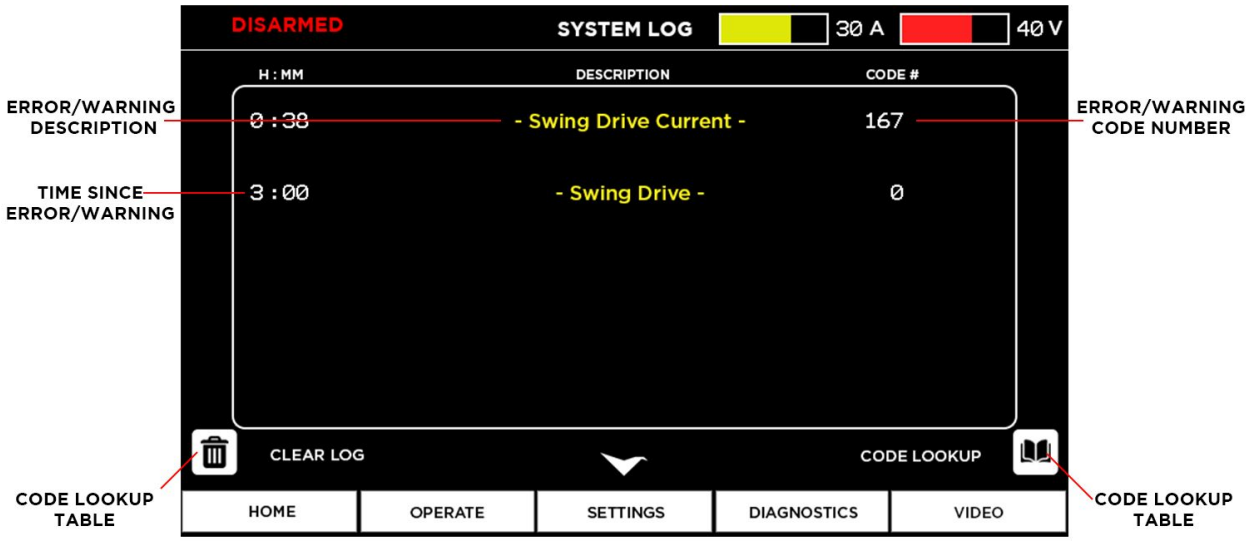
STATUS SCREEN



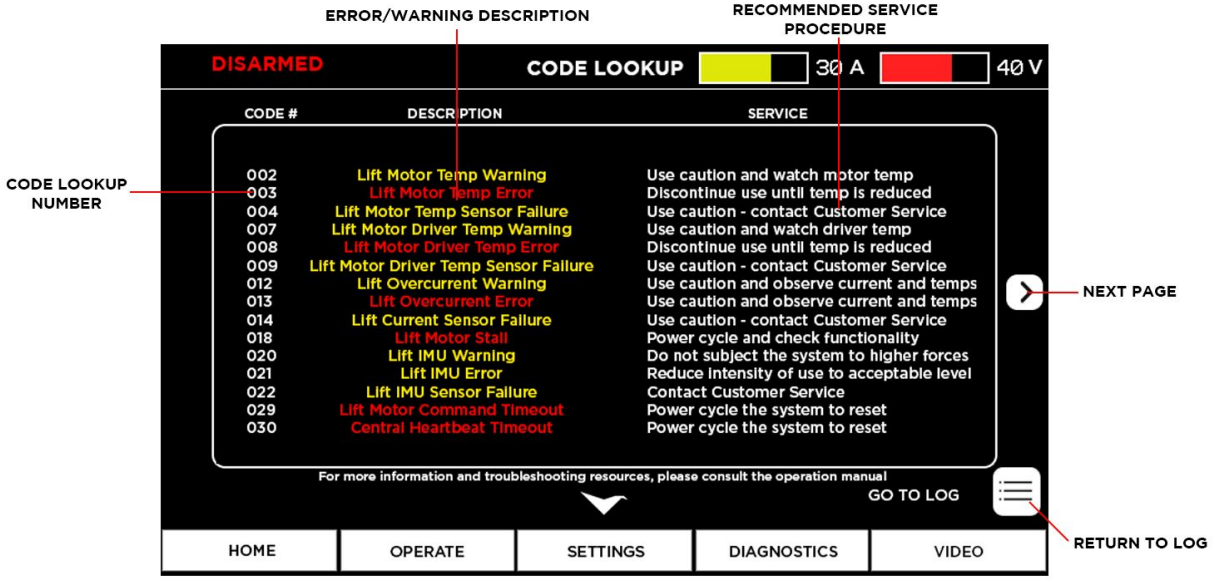
DIAGNOSTICS SCREEN



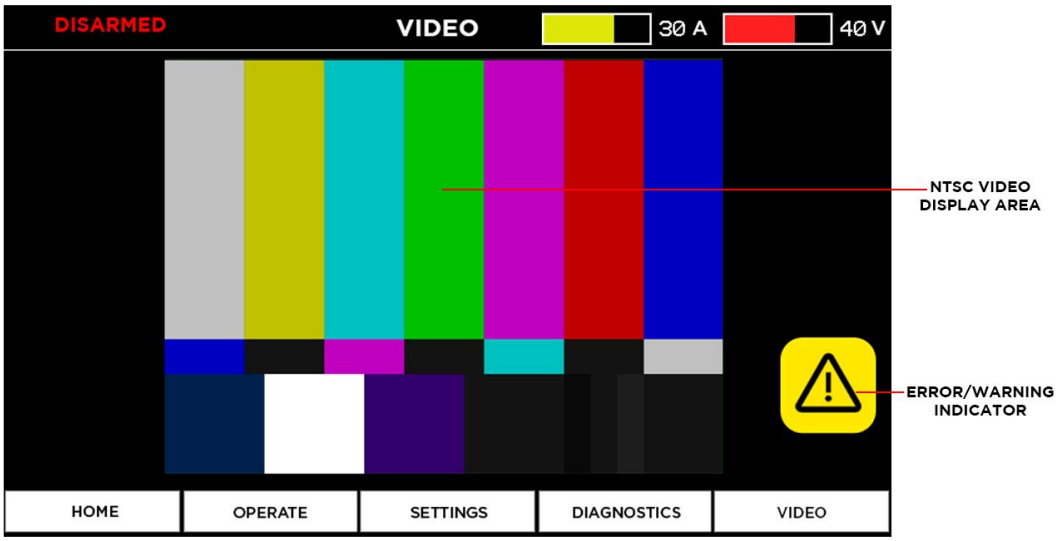
SYSTEM LOG SCREEN



CODE LOOKUP SCREEN



VIDEO SCREEN



Known Hazards

⚠WARNING The following list represents a list of known hazards that exist when operating ULTRA. This is not exhaustive, but represents some common hazards to watch out for.

- Your vehicle. Set limits and familiarize yourself with the acceleration and deceleration speeds to avoid driving the Booms or Fairing into your vehicle. Both sides (front and rear) can make contact and cause damage.

- Other vehicles. Make sure all vehicles on the filming location know where they should be driving to avoid collisions.

- Fixed objects. Always know your filming location and plan moves in advance to avoid collisions with things such as signs, bridges, and curbs.

- Terrain. ULTRA is designed for moderate off-road use. It is not designed for extreme or airborne conditions. Jumps or shock load conditions produce excess force on the system and can damage the Boom, Isolator, or cause other damage.

- Speed. Do not use above rated speed. At the rated speed, wind can be too strong for stable swing movement. Even if traveling below the rated speeds, strong gusts of wind may push the total wind speed above the rated values, preventing the swing axis from moving. Make sure you know how the vehicle and wind speed affect the swing performance.

Terminology

Clear communication among drivers, operators, and other personnel is essential for safe and high quality production. Below is suggested terminology to allow for clear and efficient communication between operator(s) and driver.

Generally, one ULTRA operator should be in charge of the shoot, but it is up to the driver to receive the request, assess the situation, and only act if it is safe. All operation and movement should be coordinated in advance to prevent unsafe conditions.

⚠WARNING Drivers and operators must obey and observe all traffic rules and regulations and operate ULTRA in a safe manner and ensure that all personnel within the vicinity of ULTRA understand and abide by all safety precautions. It is the responsibility of the driver and operator to understand how ULTRA changes a motor vehicle's safety, performance and handling dynamics.

ULTRA Positioning

- Swing Axis Camera Position
  - "12 o'clock - forward
  - 3 o'clock - vehicle right
  - 6 o'clock - rear
  - 9 o'clock - vehicle left
  - All numbers in between for further specificity
- Lift Axis Camera Position
  - Low
  - Mid
  - High
  - Increments in between for further specificity
- Full position call examples = "Crane at 12, mid" or "Crane at 3, low"

Tracking Vehicle Position (relative to the subject)

- Position along road
  - Front
  - Along
  - Behind
- Position in lanes
  - Left - tracking car in the lane to the left of the subject
  - Center
  - Right
- Full position call example = "Car to front, left"

Tracking Vehicle Moves

- "Hold"
- "Drive by, slow" (..medium, fast, etc)
- "Let pass, slow" (..medium, fast, etc)

Pre-Flight Checklist

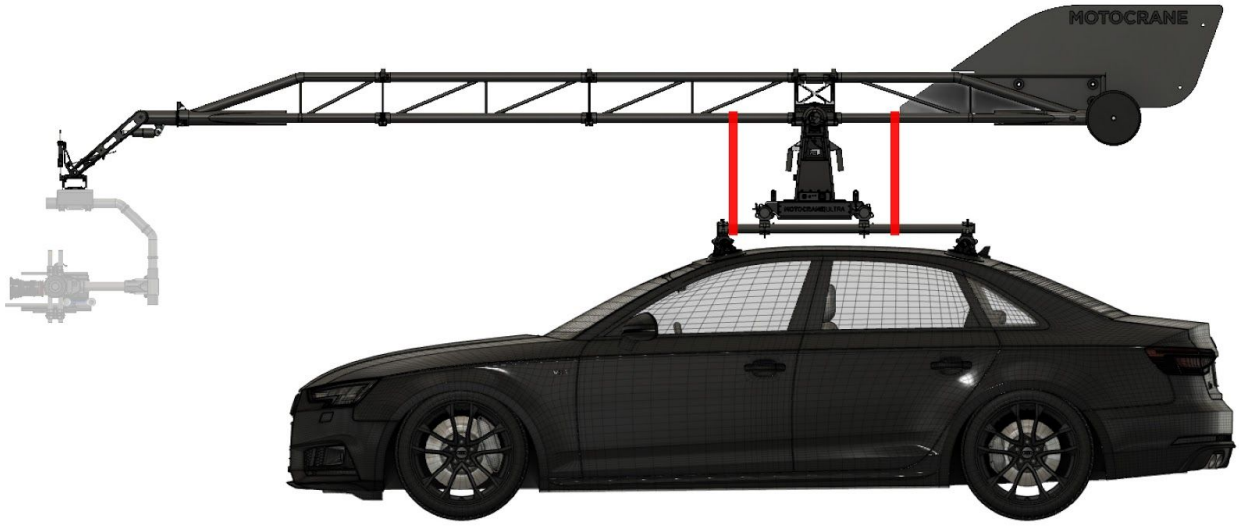
Before taking ULTRA on the road, go through this pre-flight checklist.

- Are all knobs, straps, safety latches, safety pins, and lanyards properly engaged?
- Are all persons at or near the filming location trained and aware of safety hazards?
- Have the driver and operator rehearsed the moves and made an effort to minimize safety hazards?
- Is ULTRA free of damage and performing as expected?

Transporting ULTRA

Transportation of ULTRA must always be executed in accordance with local laws, regulations or other legal requirements. We recommend the following steps be observed for safe transportation of ULTRA when the equipment is not being actively used/monitored.

1. Make sure the DISARM/E-Stop button is engaged (pressed down), then remove payload and counterweight, opposite of installation, leaving empty arm and 40lbs/18kg counterweight. *Optional: Payload and counterweight can be retained if they present no risk or danger.*
2. Release the DISARM/E- Stop button (twist clockwise), then move ULTRA to the Home position (level, and aligned longitudinally with the car.)
3. With the DISARM/E-stop button still released, adjust SPEED to "0" for both axes. This is so that any accidental joystick inputs will not cause ULTRA to move during rigging.
4. Secure the Middle and Rear Boom to rigging using two straps- 1 in front of, and 1 behind the fulcrum. The straps should be tight, but not overtightened.



5. Engage (pressed down) the DISARM/E-Stop button, which activates the Lift-Axis brake, and cuts power from the motor and motor drivers. You may also turn PSU Main Power switch "OFF" to conserve battery life.

The straps *(illustrated in red)* help to offload the bouncing movements of the arm from the Lift-Axis brake, and prevent any unwanted movement of the arm during transport.

⚠CAUTION Attaching straps or manually back-driving the arm while DISARM/E-stop button is engaged (pressed down) may cause damage to the Lift-axis brake.

Troubleshooting and Maintenance

Troubleshooting

Diagnosing with COM and Power LEDs

The Base Driver Unit, Base Pedestal, PSU, and Turret all contain LEDs to help quickly identify simple problems. The COM LED will turn on when the electronics at that location are successfully communicating on the CAN-bus with the other parts of the system. If this LED turns off, this indicates that either the electronics at that location have stopped functioning properly, or a wiring issue has developed that prevents normal communication to occur. The COM LEDs can help to diagnose cabling vs. electronics issues. If all COM LEDs are off, this could be an issue with the main cable from the PSU to the Base. If only the Base Driver Unit COM LED is on, this could indicate internal wiring problems in the Base. If both the Base Driver Unit and Base Pedestal COM LEDs are on, but the Turret COM LED is off, this could indicate a bad cable between the Base Pedestal and Turret. In a similar manner, 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.

** 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.

Diagnosing with GUI Warning and Error Messages

ULTRA 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 page, 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, which is accessible through the Diagnostics page. The System Log will also provide a list of errors and warnings that have occurred, along with the time since the event occurred (in 2 minute increments). Note that the System Log will only hold the most recent 10 events, and is lost upon power cycling the system. From either the Status or System Log page, 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. For reference, the ‘Controller - GUI’ section of

the manual shows the location of the System Log and Code Lookup buttons within their respective pages. 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.

Code	Description	Service	Details
002	Lift Motor Temp Warning	• 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	The lift 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.
003	Lift Motor Temp Error	• 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	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.
004	Lift Motor Temp Sensor Failure	• Use caution and contact Customer Service • Avoid heavy use of lift moves in high ambient temperatures	The lift motor temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Turret internal wiring or electronics. Service on the Turret by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
007	Lift Motor Driver Temp Warning	• Use caution and watch driver temp • Make sure payload and counterweight are properly balanced • Make sure there are no	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 and higher than normal current being used by the motor.

		obstructions preventing the boom from raising or lowering	
008	Lift Motor Driver Temp Error	• 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	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.
009	Lift Motor Driver Temp Sensor Failure	• Use caution and contact Customer Service • Avoid heavy use of lift moves in high ambient temperatures	The lift motor driver temperature sensor reading has been lost by the system. The most likely cause of this failure is damage to the Turret electronics. Service on the Turret by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
012	Lift Over-Current Warning	• 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	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.
013	Lift Over-Current Error	• 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	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.
014	Lift Current Sensor Failure	• Use caution and contact Customer	The lift motor current sensor reading has been lost by the system. The most likely

		Service ● Avoid extreme movements of lift axis and make sure payload and counterweight are balanced	cause of this failure is damage to the Turret electronics. Service on the Turret by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
018	Lift Motor Stall	● 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 Turret needs to be serviced by MotoCrane.
020	Lift IMU Warning	● 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	● 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	● Use caution and contact Customer Service	The lift IMU reading has been lost by the system. The most likely cause of this failure is damage to the Turret electronics. Service on the Turret 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	● Power cycle system to	This error indicates that the lift driver

	Command Timeout	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	board 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.
031	Boom Imbalance - Front Heavy	● Ensure Payload and CW are properly balanced, in accordance with the guide in this manual	While lift limits are turned on, an option is available (within the Settings+ page of the GUI) to enable ULTRA to auto-detect Payload/CW imbalances. The system can generally detect situations where the Payload is more than +/- 5 lbs heavy/light.
032	Lift Limits Disabled From Error	● 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	● Ensure Payload and CW are properly balanced, in accordance with the guide in this manual	While lift limits are turned on, an option is available (within the Settings+ page of the GUI) to enable ULTRA to auto-detect Payload/CW imbalances. The system can generally detect situations where the Payload is more than +/- 5 lbs heavy/light.
035	Central Heartbeat Timeout	● 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. This error will be triggered if the Turret is not connected to the system, or if the cable between the Base Pedestal and the Turret has failed. COM LEDs on the Turret may also help to isolate the issue. If changing the cable does not solve the issue, the electronics may have

			been damaged and the Turret will need to be serviced. If the COM LED on the Turret is the only one that is not on, check the Diagnostics page in the GUI. If good values are present for the lift position, there is likely a problem with the Turret electronics, which will require service. If Code 109 is also seen, there is likely a cable problem, either between the Base Pedestal and the Turret, or internal to the turret.
042	Swing Motor Temp Warning	• 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.
043	Swing Motor Temp Error	• 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.
044	Swing Motor Temp Sensor Failure	• Use caution and contact Customer Service • 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	• 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	• Discontinue use until temp is reduced • Make sure there are no	The temperature of the swing motor driver electronics has risen to a level that is potentially dangerous to the system.

		obstructions preventing the boom from swinging	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	• Use caution and contact Customer Service • 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 Base 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.
052	Swing Over-Current Warning	• 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	• 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	• Use caution and contact Customer Service • 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 Base 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.
058	Swing Motor Stall	• 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	• 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	• 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	• Use caution and contact Customer Service	The swing IMU reading has been lost by the system. The most likely cause of this failure is damage to the Base 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.
069	Swing Motor Command Timeout	• Power cycle system to reset • Double check all cable connections • With system Disarmed, enter the Diagnostics page of the GUI and move the swing joystick to check for motor commands	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 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.
072	Swing Limits Disabled From Error	• Power cycle and calibrate swing orientation	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.
075	Swing Driver Heartbeat Timeout	• Power cycle system to reset • Double check all cable connections	This error occurs if the swing motor driver electronics are not detected in the system. This error will be triggered if the Base is not connected to the system, or if the cable between the PSU and the Base is disconnected or faulty. COM LEDs on the unit may also help to isolate the issue. If changing the cable does not solve the issue, the electronics may have been damaged and the Base will need to be serviced. Check the COM LED on the Base Driver Unit, as well as the COM LEDs on the Base Pedestal and the Turret. If the COM LED on the Base Driver Unit is the only one that is not on, there is likely a problem with the Base Driver Unit which requires service. If all COM LEDs are off, there is likely a problem with the cable from the PSU to the Base.
081	Swing Encoder Data Suspect	• Power cycle system to reset	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.
082	Swing Encoder Data Invalid	• Use caution and contact Customer Service • Try power cycling the system to reset the board	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.

089	Swing Encoder Heartbeat Timeout	• Power cycle system to reset • Double check all cable connections	This error occurs if the swing encoder electronics are not detected in the system. This error will be triggered if the Base is not connected to the system, or if the cable between the PSU and the Base is disconnected or faulty. COM LEDs on the unit may also help to isolate the issue. If changing the cable does not solve the issue, the electronics may have been damaged and the Base will need to be serviced. Check the COM LED on the Base Pedestal, as well as the COM LEDs on the Base Driver Unit and the Turret. If the COM LED on the Base Pedestal is the only one that is not on, there is likely a problem with the swing encoder electronics, which requires service. If all COM LEDs are off, there is likely a problem with the cable from the PSU to the Base.
101	Lift Encoder Data Suspect	• 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	• Use caution and contact Customer Service • Try power cycling the system to reset the board	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 at power cycling, the encoder electronics in the Turret need to be serviced.
109	Lift Encoder Heartbeat Timeout	• Power cycle system to reset • Double check all cable	This error occurs if the lift encoder electronics are not detected in the system. This error will be triggered if the

		connections	Turret is not connected to the system, or if the cable between the Base and the Turret is disconnected or faulty. COM LEDs on the unit may also help to isolate the issue. If changing the cable does not solve the issue, the electronics may have been damaged and the Turret will need to be serviced. Check the COM LED on the Turret, as well as the COM LEDs on the Base Driver Unit and the Base Pedestal. If the COM LED on the Turret is the only one that is not on, and error 035 is also seen, there is likely a cable problem between the Base Pedestal and the Turret. Otherwise, if all COM LEDs are on, and error 035 is not seen, there is likely a problem with the Turret encoder electronics which will require service.
121	System Over-Voltage Warning	• 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.
122	System Under-Voltage Warning	• 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.
123	System Over-Voltage Error	• 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.
124	System Under-Voltage Error	• 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.
125	Joystick Failure Error	• Disarm and power cycle • Ensure joysticks are not being touched during Controller power-up	This error detects joystick failure by checking for a normal operational voltage range. If the joystick outputs a higher or lower voltage than normal, for an

			extended period of time, it has likely failed. If power cycling does not resolve the issue, the Controller will require service to replace the faulty joystick.
126	System Over-Current Warning	• 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.
127	System Over-Current Error	• 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.
128	System Current Sensor Failure	• Use caution and contact Customer Service • Double check cable connections between PSU and Controller	The system current sensor reading has been lost. The most likely cause of this failure is damage to the PSU or Controller electronics. Service on both of these units by MotoCrane is required to resolve this issue. The unit can still be used with caution, but should be serviced at the earliest convenience.
129	Lift Joystick Initialization Failure	• 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.

130	Swing Joystick Initialization Error	• 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.
131	Controller Heartbeat Timeout	• Power cycle system to reset • Double check all cable connections	This error occurs if the Controller is not detected in the system. This error will be triggered if the Controller is not connected to the system, or if the cable between the PSU and the Controller is disconnected or faulty. The GUI Diagnostics page may help in isolating the issue. If there are no values (zero) for speed, smooth, and motor commands, on both swing and lift, the Controller electronics are not working properly. If a power cycle does not solve the issue, the Controller is likely faulty and will require service.

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 on your options 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.

External Deactivation of Lift Drive Brake

In a rare situation, it is possible that the lift 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 lift drive brake is 'fail-safe', this means that when the system is unpowered (more specifically, the lift motor driver electronics are not receiving power), the brake is activated and the lift axis will not move, except in the case of extreme imbalance between payload and counterweight. In the event that

the lift motor driver electronics stop working, and the lift axis is stuck in an undesirable position, the following steps can be taken to manually unlock the lift axis:

1. Turn off power from the system and remove the short cable connecting the Base Pedestal to the Turret
2. Plug the main power input cable directly into the socket on the Turret (this cable normally connects directly to the Base Driver Unit)
3. Ensure the other side of the main power input cable is connected to the PSU
4. Remove the small rectangular cover on the Turret, immediately adjacent to the main power input socket (there are two small flat-head cap screws to remove)
5. Turn on the main power switch on the PSU
6. Depress and latch the button that was exposed by removing the rectangular cover on the Turret
7. An audible click should be heard when this button is pressed, and the brake should be deactivated
8. Manually position the boom to the desired location
9. Press the button again to un-latch it
10. Turn off the main power switch on the PSU
11. Replace the rectangular cover back on the Turret

Note that this feature is an immediate solution for re-positioning the fulcrum and boom, 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.

Maintenance

ULTRA needs maintenance to keep it running smoothly. This includes cleaning after use and lubricating or replacing moving elements. Please see the table below or contact support@motocrane.com to discuss appropriate maintenance for your use.

Exercise	Frequency	Indicators
Wipe down entire system with a dry cloth.	After every use.	Prevent surface rust on steel, keep system clean and functioning smoothly.
Lubricate OUTSIDE swing bearings.	As needed.	Unlubricated swing bearing will cause jerky movement. Required grease: Base Type: Lithium Complex NLGI No: Grade 2 Drop Point: 600 [deg F]

Weather & Water

Exterior ULTRA modules are weather resistant. The Controller and Power Supply Unit go inside the vehicle and are not weather resistant. After using ULTRA in wet or dusty conditions, wipe all components down with a soft dry cloth. Do not spray any cleaning liquids inside components of ULTRA that are not water resistant.

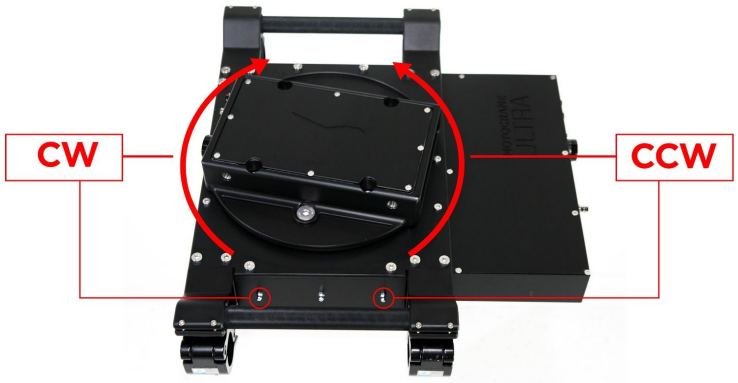
Module	Rating
Base	IP-65
Turret	IP-65
Booms, Isolator, Fairing	IP-65
Controller	NOT WATER RESISTANT
Power Supply Unit	NOT WATER RESISTANT

ULTRA Base (swing-axis) lubrication

The gear set housed within the ULTRA Base is lubricated and may require re-lubrication based on frequency and conditions of use. The primary symptom of a unit requiring re-lubrication is sticking during rapid deceleration/stopping of the Swing axis, even with high smoothing values of 95-99.

⚠CAUTION Over-lubrication can result in internal seal failure and may cause permanent equipment damage. We recommend contacting support@motocrane.com to confirm that your unit needs re-lubrication before proceeding.

1. Determine which direction your unit is sticking in **when stopping** (CW or CCW). Units needing lubrication will likely only exhibit symptoms in one direction. If unit is sticking when stopping in both directions, proceed with both procedures.



2. Use either Swing Jog button to slowly turn the Swing Axis and add **1 pump** (.5 oz MAX) of compatible grease (listed in the Maintenance section of this manual) to the corresponding grease nipple. This ensures uniform distribution of the grease.

3. If the unit still shows signs of sticking, the main chamber also needs lubrication. Using either Swing Jog button, slowly turn the Swing Axis and add **2 pumps** (1 oz MAX) to the center grease nipple.

Specifications

ULTRA Modules

- Base
- Turret
- Booms
    - Front Boom
    - (2) Middle Booms
    - Rear Boom
- Isolator
- Fairing + Fairing Extension
- Counterweight
- Controller
- Power Supply Unit (PSU)
- Cables:
    - (1) 10’ Main Power Input Cable
    - (1) 10’ Controller COM Cable
    - (1) 12’ PSU to Base Main Power Cable
    - (1) 1.5’ Base to Turret Main Power Cable
    - (1) 2’ Power Input Flying Leads
- Miscellaneous: Fasteners, safety pins, hex wrench

*SWING NOTE – There is a finite amount of torque to Swing ULTRA around the car. Wind speed, vehicle speed, payload size and desired swing speed are all factors which contribute to what is achievable. The Controller’s Touchscreen User Interface is an essential feedback tool for understanding how much power the swing motor can handle. Greater vehicle speeds are achievable, but the swing motor may not achieve a complete rotation at these speeds. Positioning movements, and half-revolution swings are acceptable. Always follow notifications on the Touchscreen User Interface, which include notifications for motor temperature and current.

You must test the system to its ratings and determine what is achievable for your application. If your application demands additional performance, please contact us.

Mechanical

Module Weight
Controller: 4lbs
Power Supply Unit: 2lbs
ULTRA Base: 67lbs
ULTRA Turret: 62 lbs
All Booms: 45lbs
Fairing: 7lbs
Max Payload: 55 lbs

Certifications: CE, RoHS

Working Performance

Max Acceleration: 1g lateral, longitudinal
Operating Temp: MIN: -30°F, MAX: 120°F

Suitable applications (SSG ONLY)
Roof: Flat, glossy mounting points (non-fabric, non-glass)

Range of Motion: Unlimited Swing Rotation, 35 deg up, 35 deg down
Top Speed: 360° Swing rotation limited to 70mph wind speed SEE *SWING NOTE
Boom Length: 12' reach from center, 16.5' end to end
Max Controlled Speeds: 7.5 sec 360° Swing, <2sec -35 to +35° Lift
Weather: IP65 (Can be sprayed with low pressure water from all directions)

Electrical

Control: Wired CAN-BUS control via MotoCrane Controller
PSU Main Power Input: 48VDC (45V-60VDC MAX), 50A Peak (3kW PEAK)
PSU Accessory Power Input: 5V-60VDC, 20A MAX
PSU Output: 48V Power, CAN-BUS Signal
Internal System Voltage: 48V

Revision History

Revision	Date	Description
1.0	01NOV18	Initial Release
1.1	22JAN19	Added details about limits protection and controller LED, updated GUI views and error codes since V1.0
1.2	17APR19	Added details about proper Z-Axis tuning, temperature acclimation of hydraulic dampers Updated illustration of Turret (remove turret lock)
1.3	20JUL19	Illustration and description for use of M12 washers Notes about Payload, AUW Weight in kilograms added to AUW vs CW Chart AAG for MoVI XL payload building Notice added for CW fine tune balancing required Transporting ULTRA added ULTRA Base re-lubrication added Peak power consumption added to Electrical specs

MotoCrane Support
support@motocrane.com

This content is subject to change.

Download the latest version from
www.motocrane.com/support

If you have any questions about this document, please contact MotoCrane, LLC by sending a message to contact@motocrane.com.