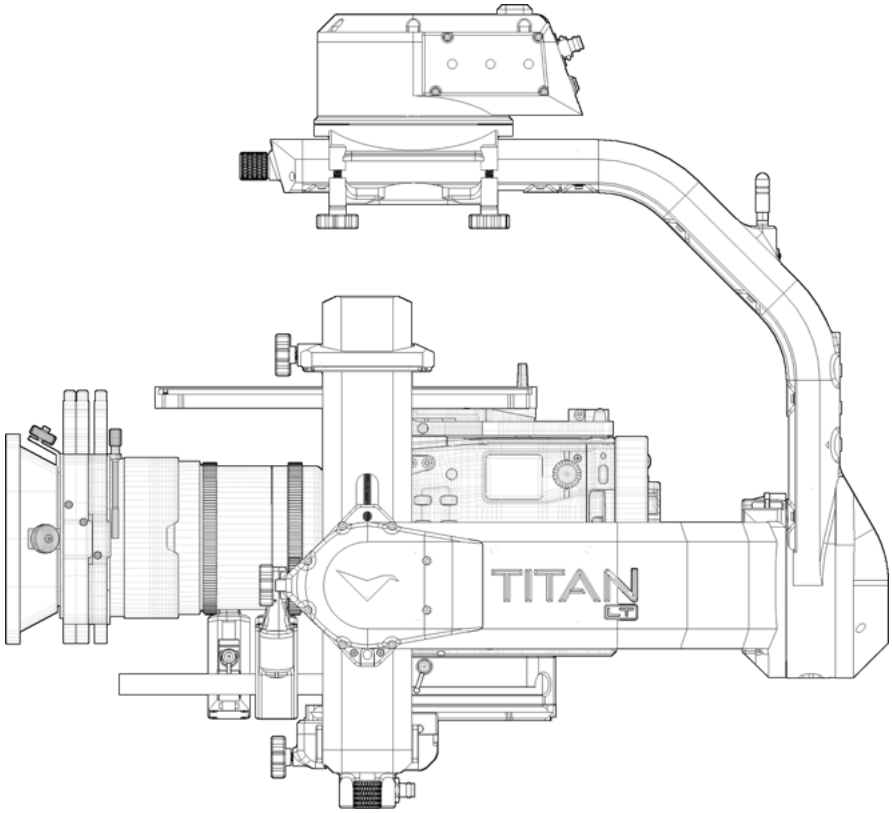
MOTOCRANE

TITAN LT



TITAN LT Operation Manual v1.2

AUG 2026

⚠WARNING

To minimize risk of serious injury, death or damage, before using MotoCrane MotoCrane TITAN LT, 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 MotoCrane TITAN LT.

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

Keep this Operation Manual near your MotoCrane TITAN LT 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 MotoCrane TITAN LT.

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Before the first usage:

Do the following before using MotoCrane TITAN LT 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/knowledge-base
4. **Recommended**: Attend MotoCrane Training for in-person demonstration

⚠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/knowledge-base. All terminology is referred to in the above diagrams.

IMPORTANT PRODUCT AND SAFETY INSTRUCTIONS

Safety

MotoCrane TITAN LT is not a toy and can cause serious injury, death or damage if not used properly. You must exercise caution during use of the MotoCrane TITAN LT 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

MotoCrane TITAN LT must only be used by trained operators 18 years of age or older when properly mounted on an appropriate support system, with adequate payload ratings for the application. This product is not designed for inexperienced users, and must not be used without proper training.

Do not modify or adjust MotoCrane TITAN LT. MotoCrane TITAN LT has been tested and calibrated before it is shipped to you. No modification or adjustment to MotoCrane TITAN LT 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 MotoCrane TITAN LT, 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 motocrane.com/legal 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 MotoCrane TITAN LT, 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 MotoCrane TITAN LT. By the act of use, setup or assembly, the user accepts all resulting liability.

Limited Warranty

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

Intellectual Property

Intended Use of MotoCrane TITAN LT

MotoCrane TITAN LT is intended to stabilize camera packages/payloads from angular movements that lie within the system's working frequency response range. TITAN LT does not stabilize against linear/parallel movements, which must be isolated from with a support apparatus such as a shock absorbing suspension arm.

Stabilization performance (frequency response) is limited by several factors, including motor power, the support structure for TITAN LT, payload stiffness, and user tuning. Any factor that has been compromised will result in reduced frequency response and therefore stabilization performance..

As focal length of a payload is increased (Degrees of field of view is decreased) these factors must be scrutinized with increased attention and care. Longer lenses with narrower Field of View will magnify stabilization errors compared to shorter lenses with wider FOV.

Most gimbals use a MEMS-based gyro for detecting angular movement. TITAN LT uses a state of the art system, which combines a MEMS-based gyro with 20-bit encoder feedback for precision, and also to eliminate the effects of drift. Drift is where the gimbal moves very slowly on its own, over the course of a long period of time. Even so, a poorly calibrated gyro may lead to drift, and so a gyro calibration must be performed from time to time.

Payloads must be assembled by the user with special attention paid to the stiffness (structural rigidity) of the payload from end to end. This is especially important on longer payloads, where lenses and camera bodies must be supported at their extents.
Without such adequate mechanical support, maximum tuning values will be compromised and stabilization performance will be compromised.

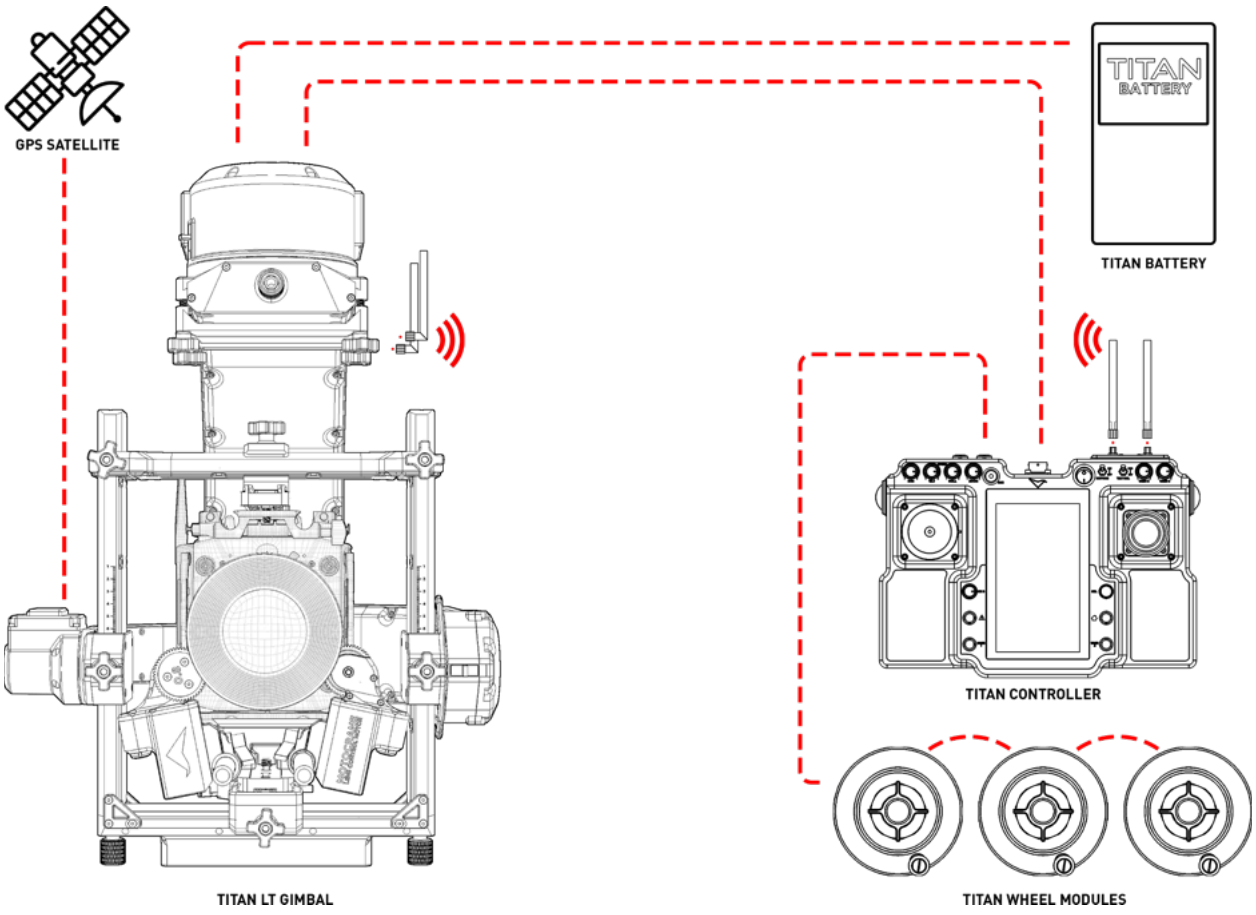
Payload balance also plays a critical role in maximum stabilization performance. As an application becomes more dynamic, any payload imbalance will work to shake TITAN LT away from its target stabilized angle. Ensure that perfect balance has been achieved on all 3 axes before use. Imperfect balance will also result in higher motor power being required, which can result in premature motor overheating and reduced battery life.

The user-selected support structure for TITAN LT (Telescoping crane, Tracking vehicle, etc.) should be analyzed for its structural rigidity and suitability for the application. Support structures with loose, or non-rigid, articulating components can result in flex/play where TITAN LT is mounted and faulted tuning.

Vibration Isolators are recommended for dynamic applications with incoming vibrations that may exceed the maximum frequency response of TITAN LT, and need to be reduced in order to be stabilized effectively.

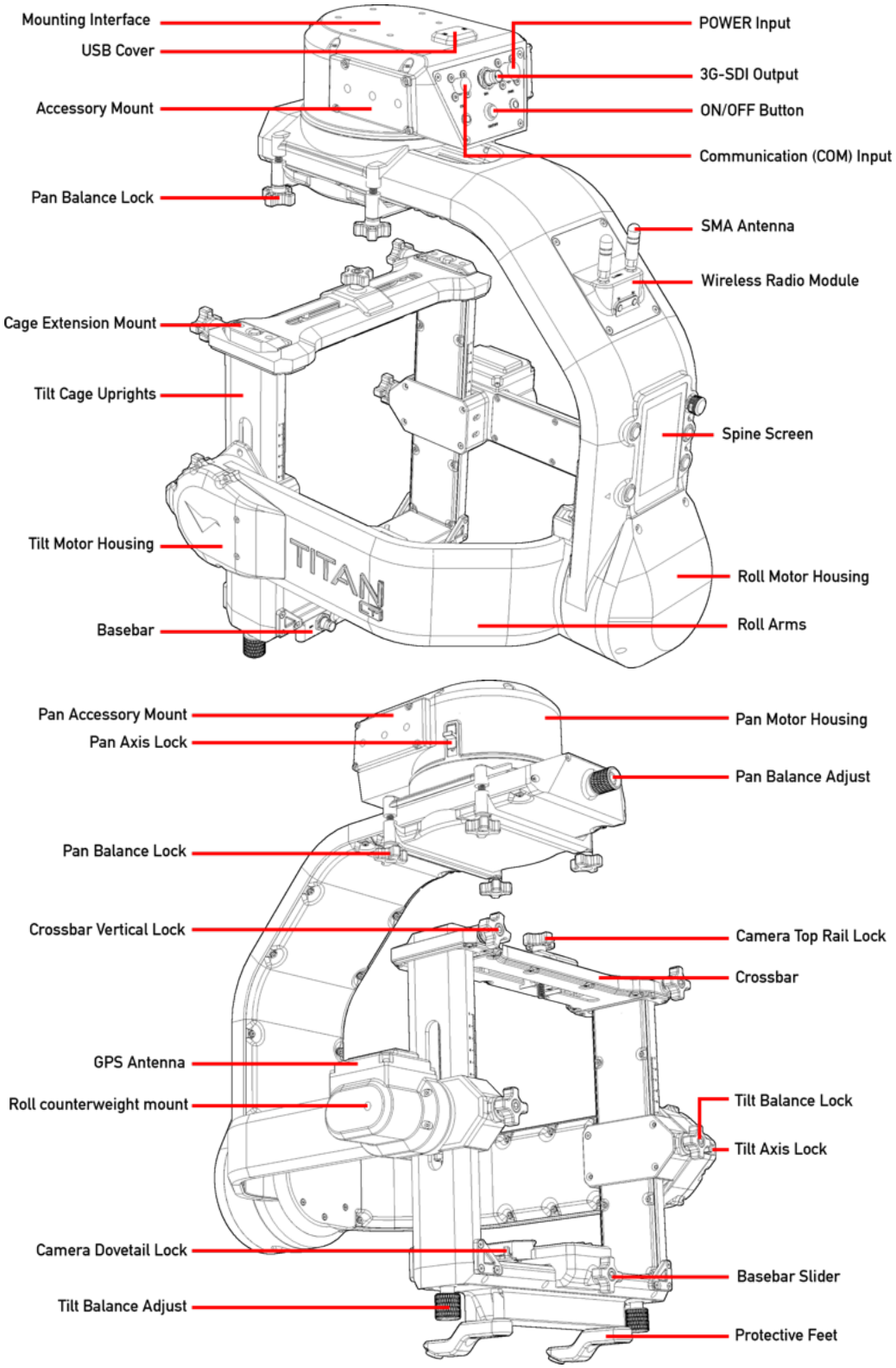
System Overview

Connection diagram



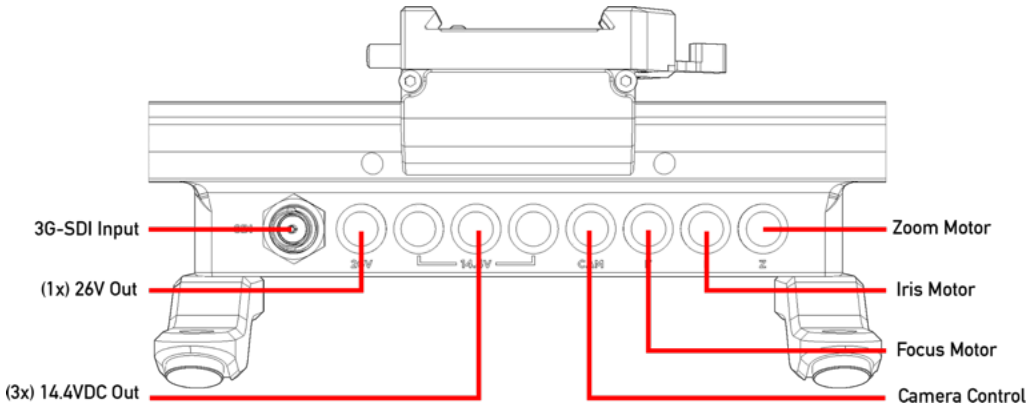
Components/Modules

TITAN LT Gimbal

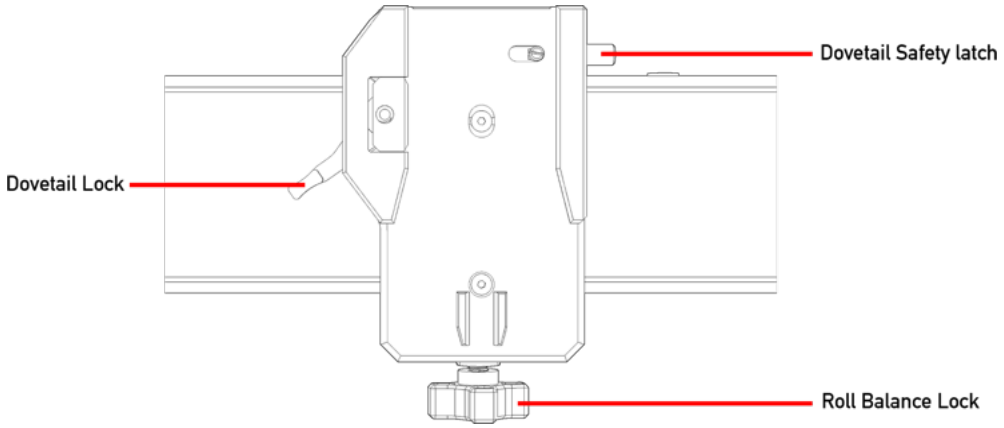


Basebar

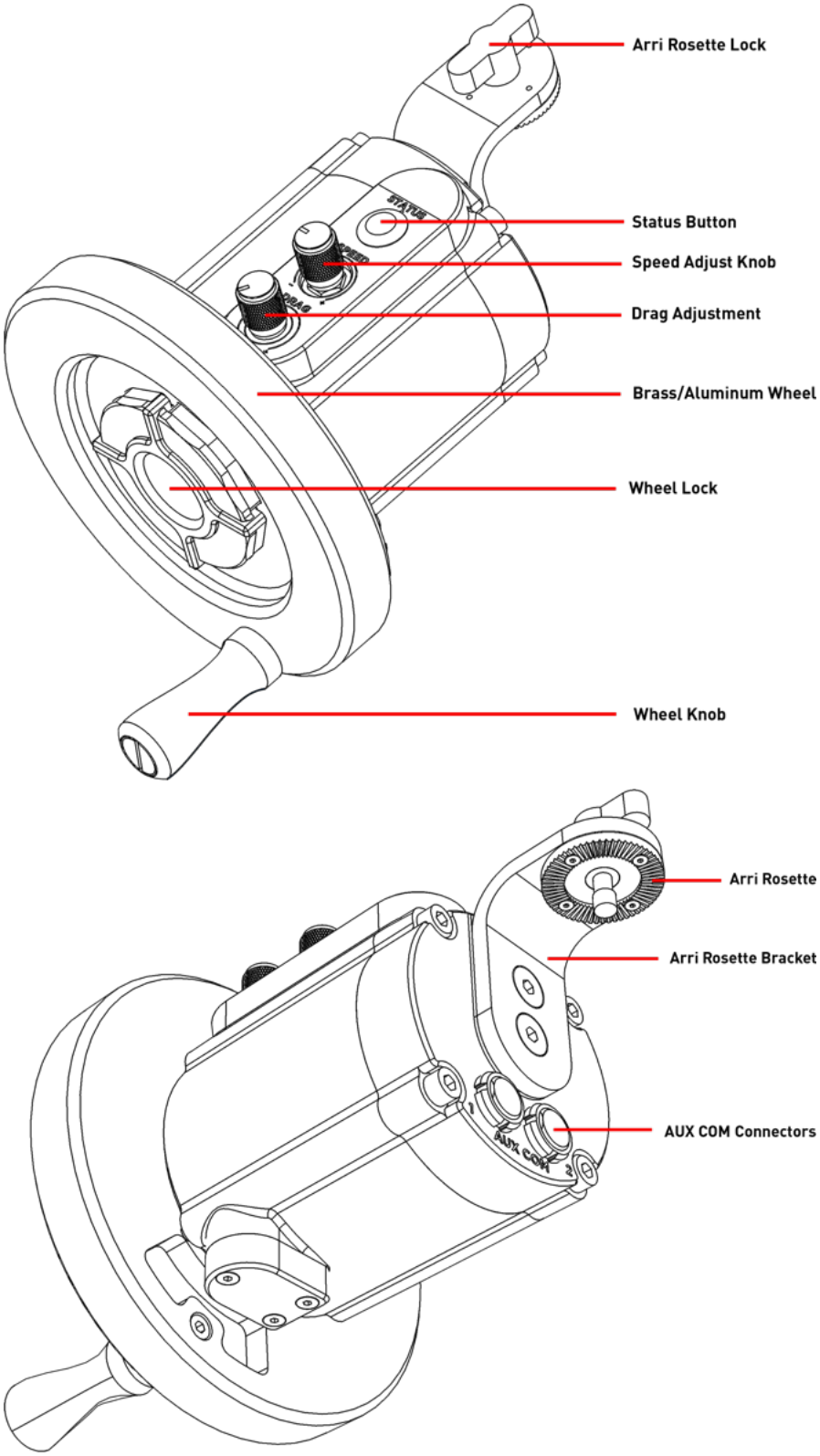
Electrical Connections



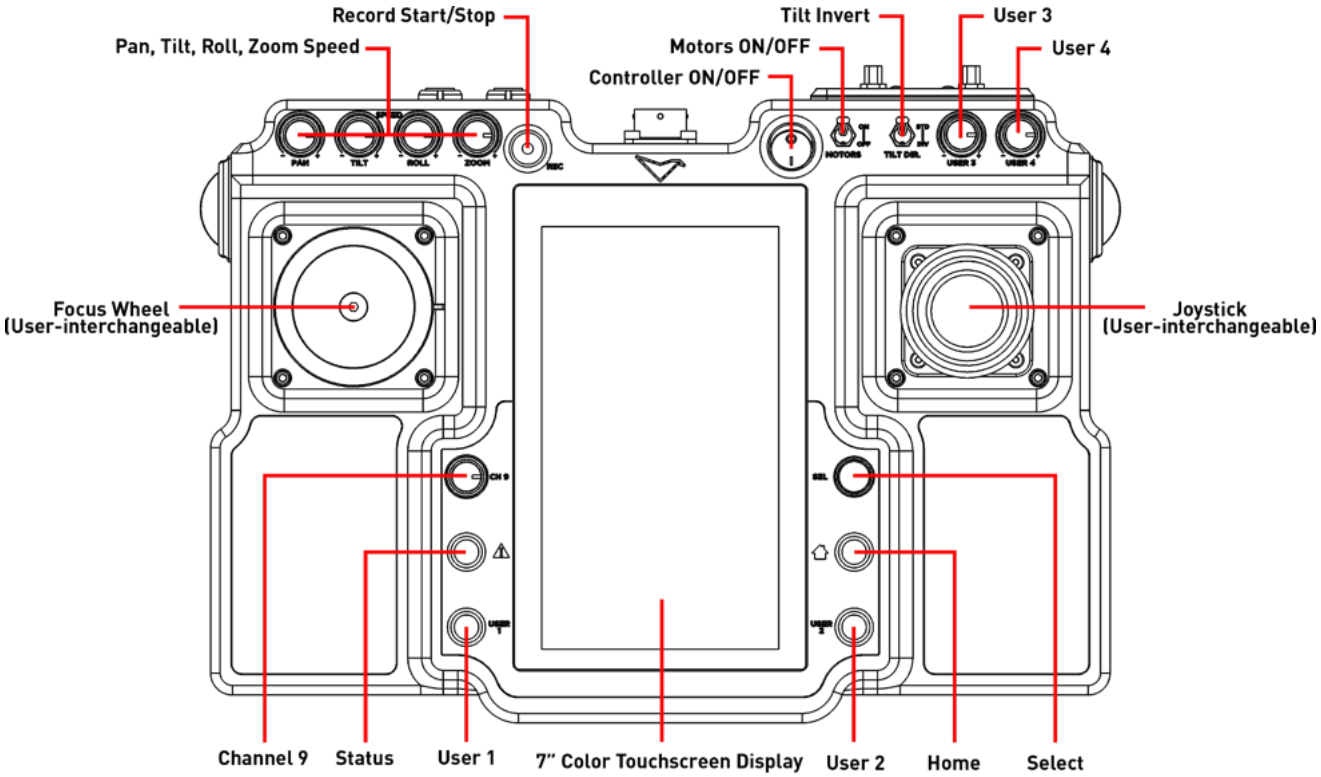
Basebar Slider

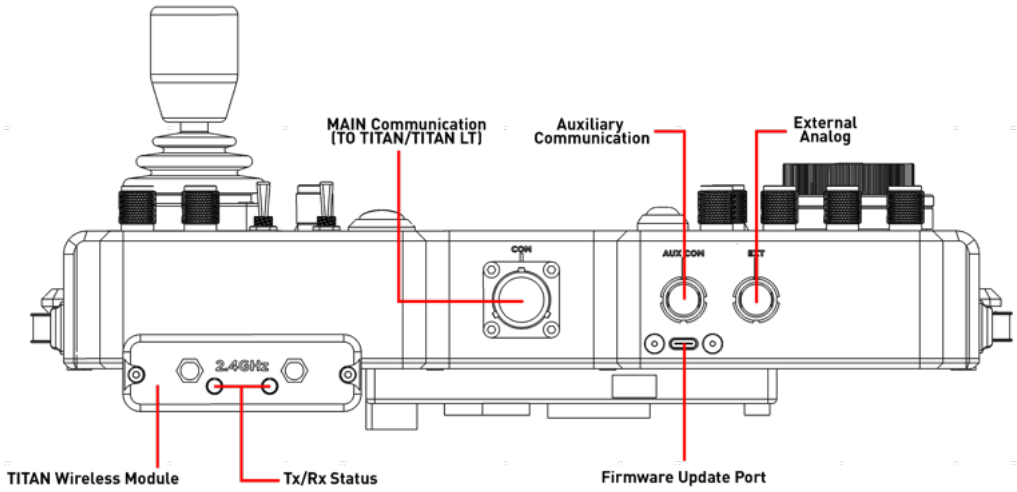


TITAN Wheel Module

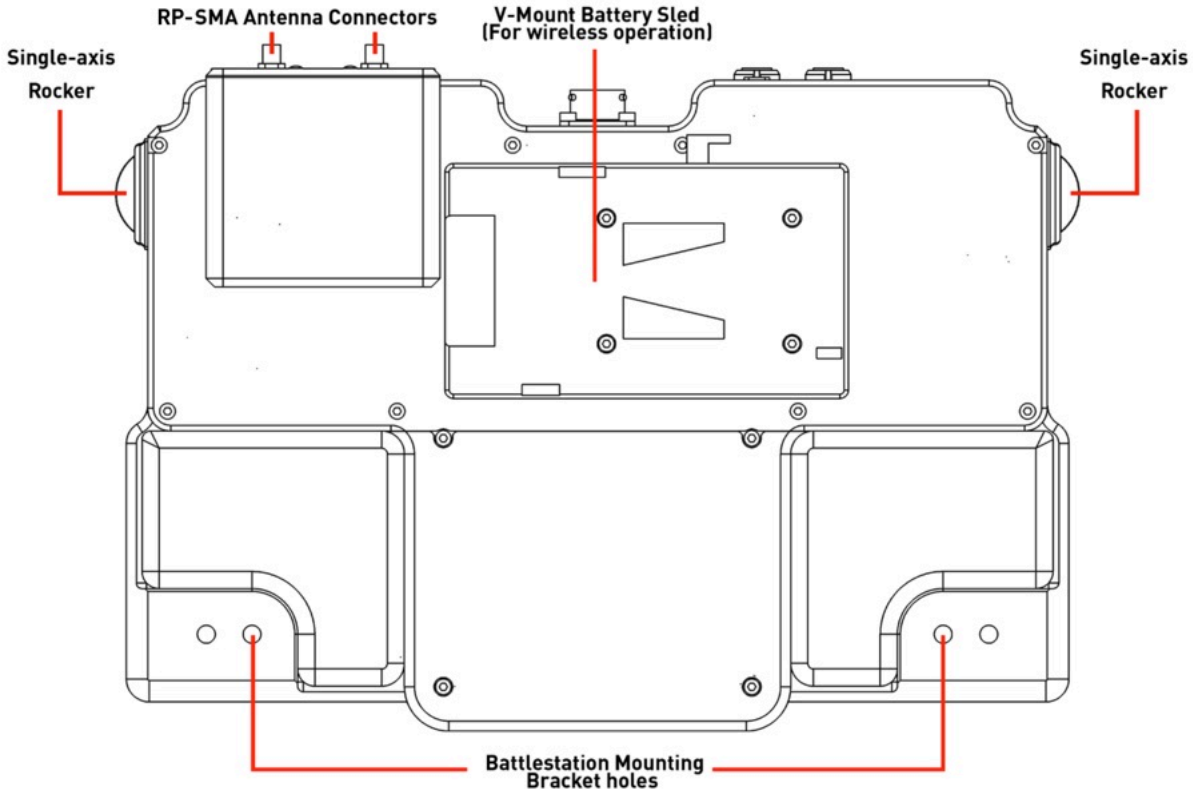


TITAN Controller

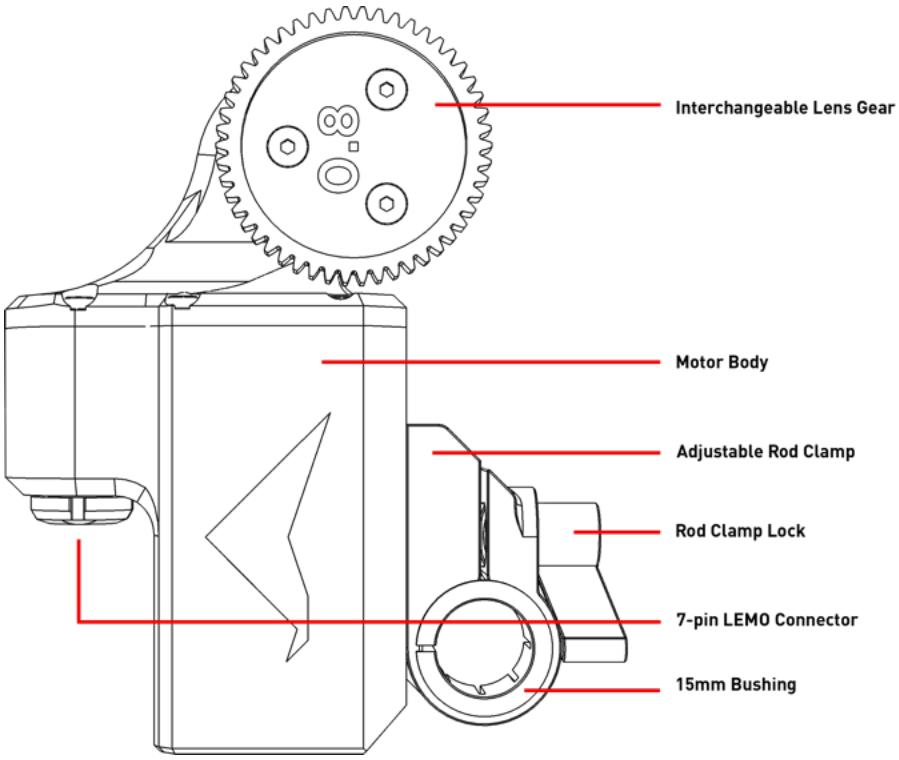


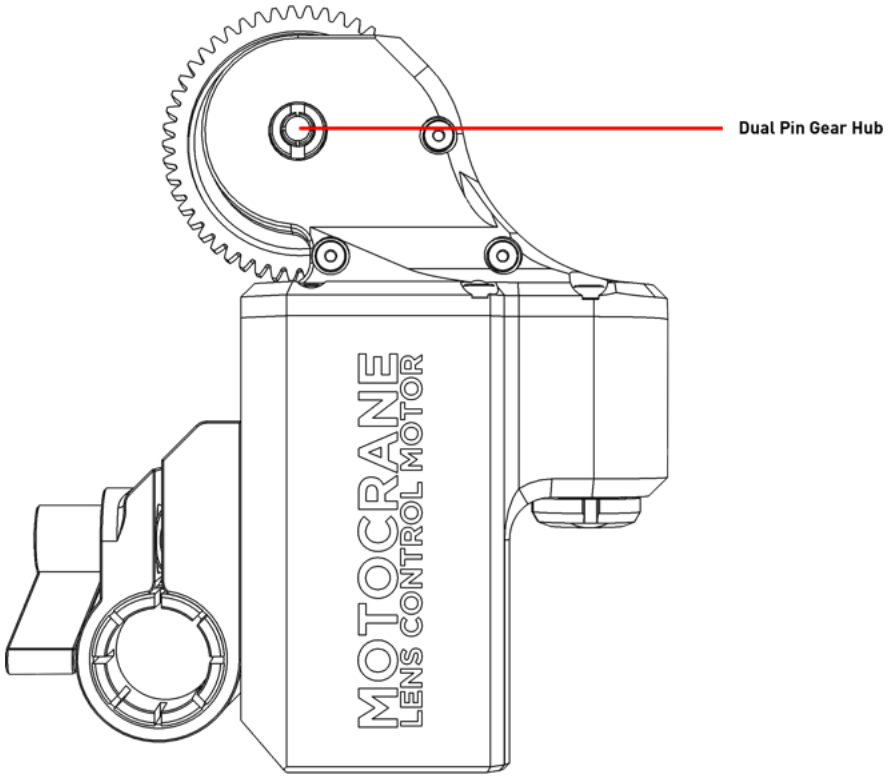


TITAN Controller (cont'd)



TITAN Lens Control Motor (LCM)

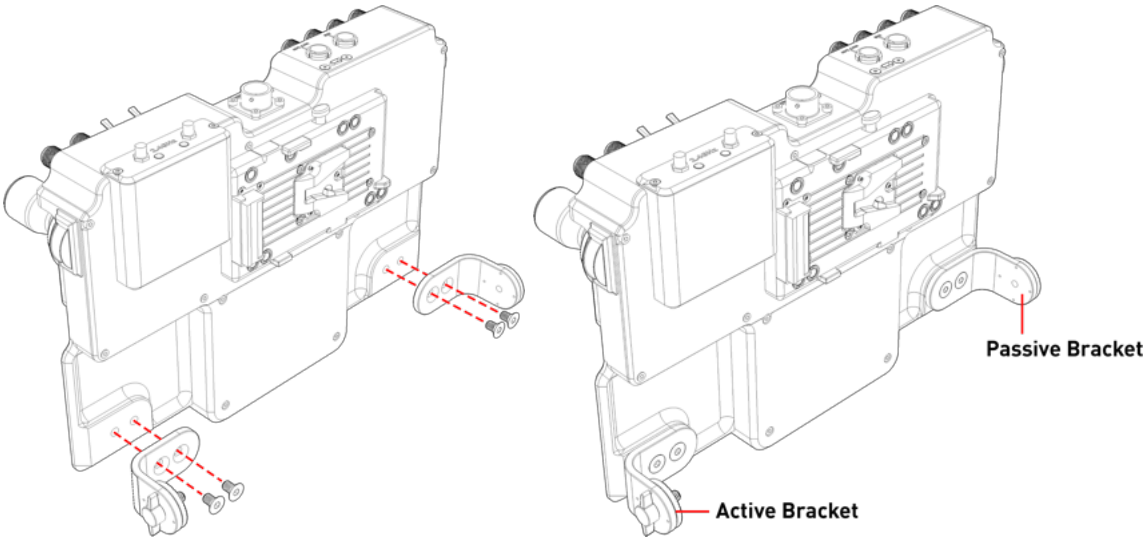




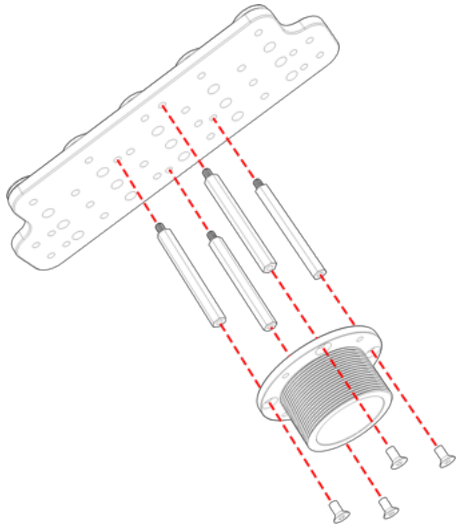
TITAN LT Setup

TITAN Controller & TITAN Wheels

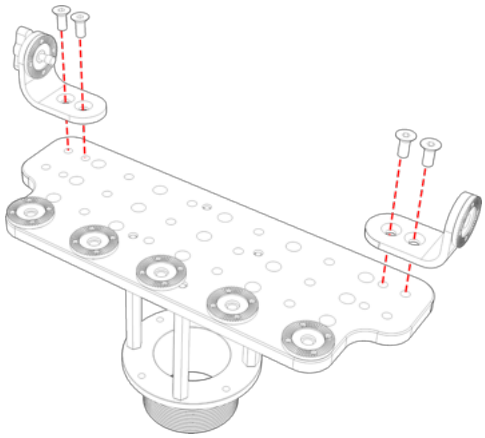
Depending on your application, you may choose to leave the TITAN Controller “floating” or mount it to a support structure such as a Mitchell Base or other rigging. This section explains how to mount the TITAN Controller and TITAN Wheel Modules to a support structure using the Battlestation accessory. Start by attaching the 2x Rosette Brackets to the TITAN Controller with the Active Bracket on the Right, and the Passive Bracket on the Left (when viewed from the front).

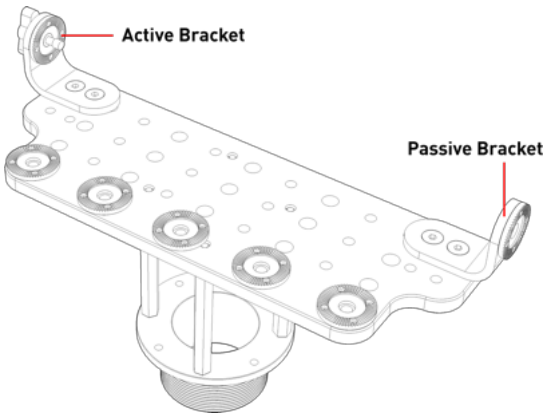


Next, mount the Battlestation to a support structure via either the included Male Mitchell mount (and M6 spacers, as necessary for TITAN Wheel Clearance) or by utilizing any of the ⅜-16 or ¼-20 threaded holes.

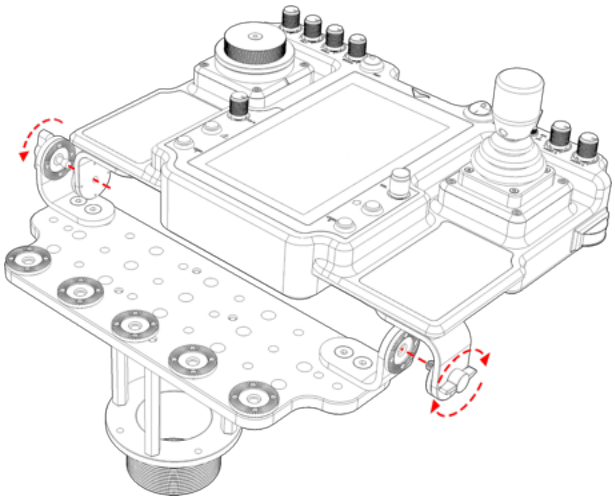


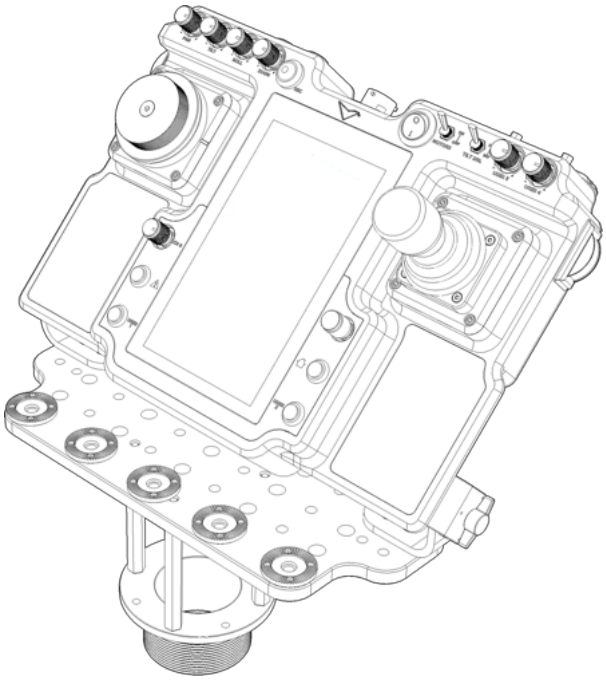
Attach the 2x Rosette Brackets to the Battlestation with the Passive Bracket on the Right, and the Active Bracket on the Left this time (opposite of the TITAN Controller).



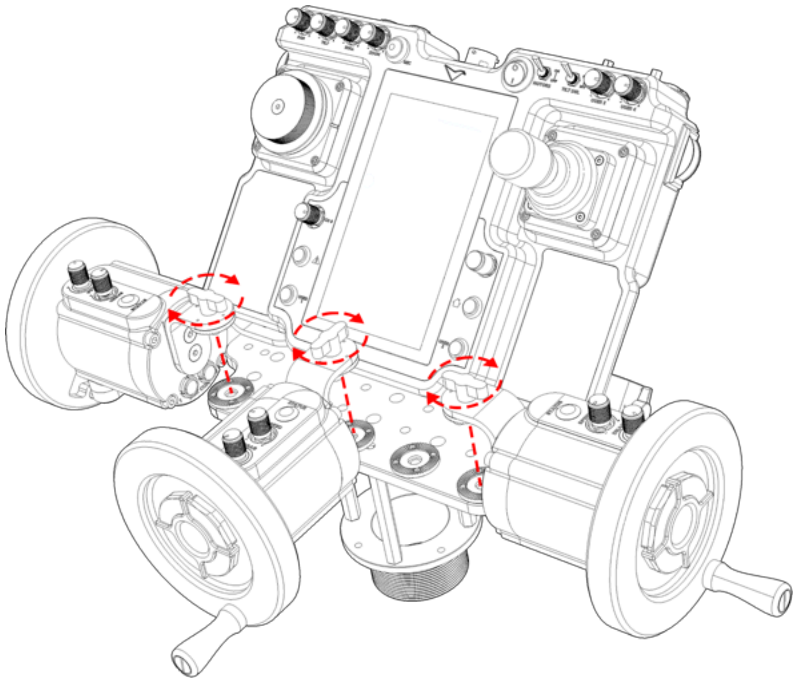


While holding the TITAN Controller at the bottom, and laying flat, position it near the Battlestation rosettes so that the M6 thumbscrews on the Active Brackets can be threaded to engage the Rosettes. Prior to locking, tilt the screen to your preferred position.

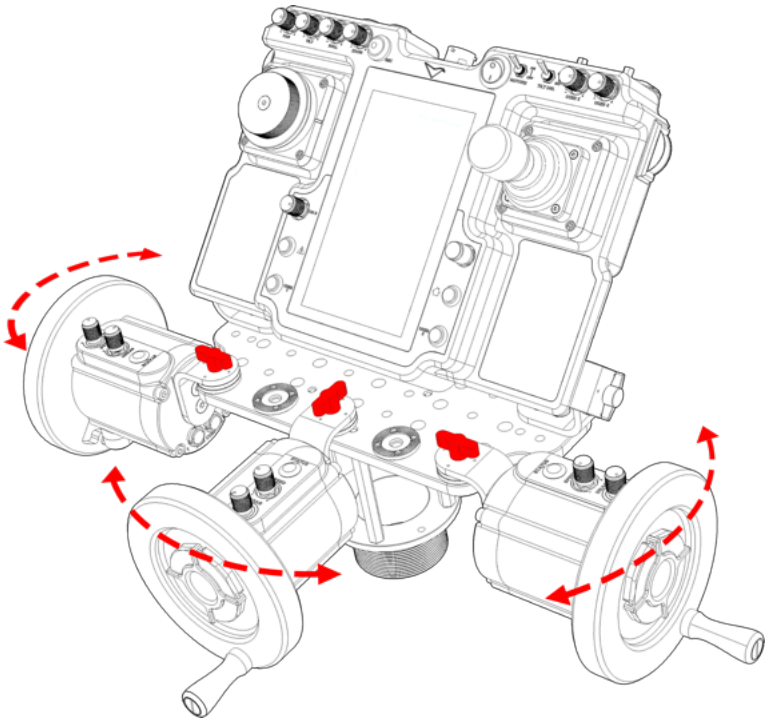




Next, mount the TITAN Wheel Modules on the Battlestation by positioning them on any of the 5x Rosettes, in whatever orientation or spacing you prefer, and thread the M6 thumbscrews so that the Rosettes can be engaged.

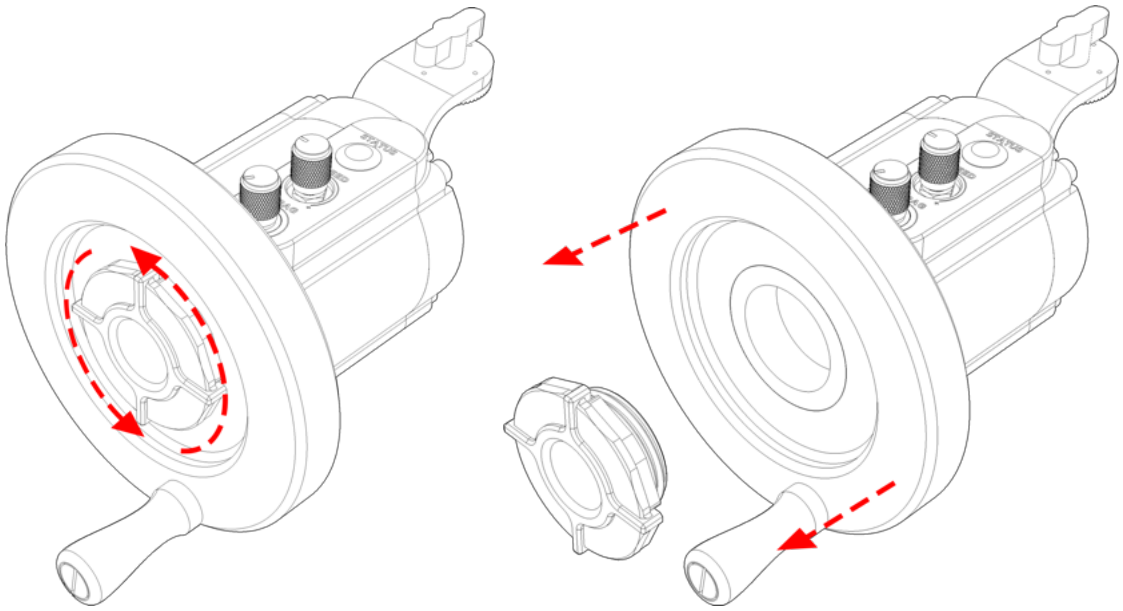


Adjust Wheel angles and/or spacing as necessary by loosening the Arri Rosette Lock, and then tightening the Lock once the desired mounting angle is achieved.

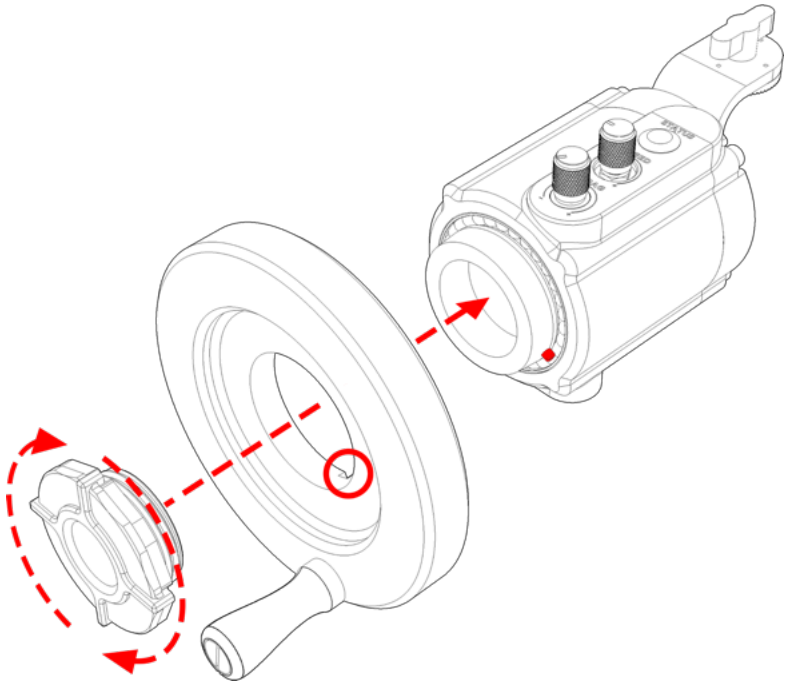


Changing TITAN Wheels

TITAN Wheel modules may be fitted with both Brass and Aluminum Wheels. To change or replace the Wheel, hold the Wheel firmly and loosen the large Wheel Lock screw until it's fully removed.

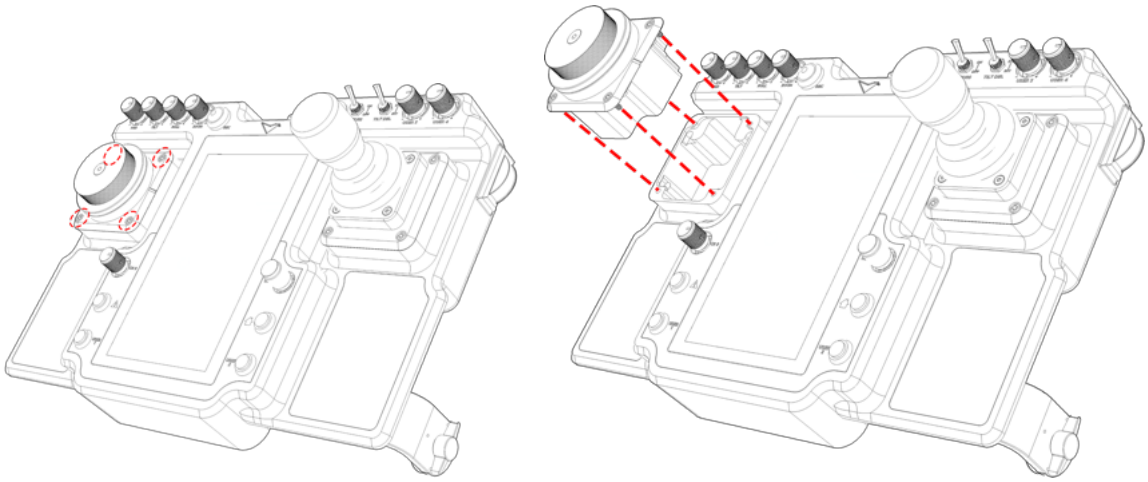


Then, pull the Wheel off the Axle and replace it, ensuring alignment of the key on the axle and Wheel. After the Wheel is on the axle, fasten the Wheel Lock screw back into the axle until it is hand tight.

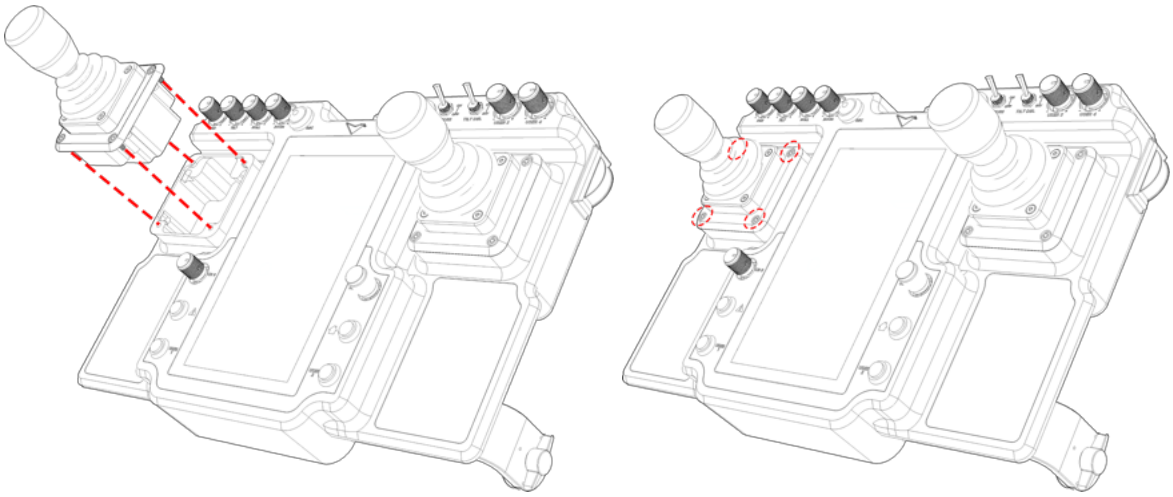


Changing TITAN LT Input modules on the Controller

To change or replace a TITAN Controller Input Module, **turn the Controller OFF** and unscrew the 4x M3 screws securing it to the controller and carefully pull it out from the Controller. The module should be easily removed without excess force.



Before installing the new Input Module, ensure the gold contacts on the module are aligned with those on the Controller. Position the replacement Input Module over the pocket in the Controller, and insert it fully. Fasten the 4x M3 fasteners to secure the Input Module into the Controller.



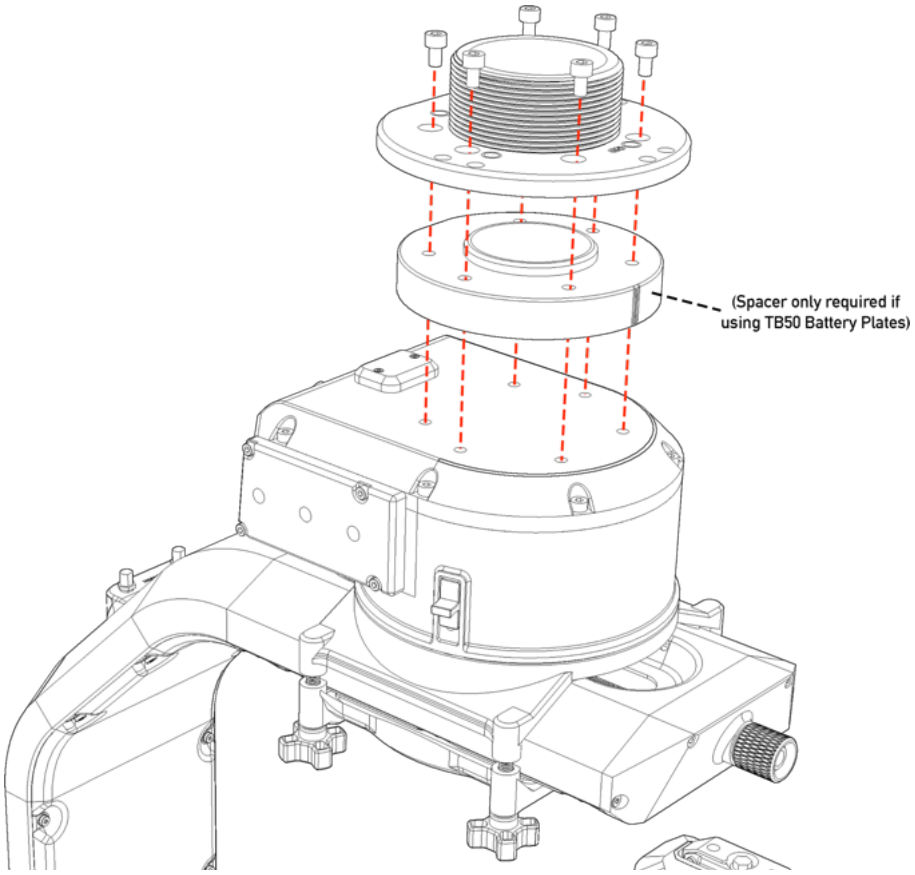
NOTICE Keep the gold contacts of Input Modules clean and protected from damage to ensure proper functionality. If contacts become dirty, wipe them gently with a clean and dry microfiber cloth.

Setting up MotoCrane TITAN LT

Mounting TITAN LT to Support

Male Mitchell Mount

Start by first preparing your support structure (telescoping crane, tracking vehicle, etc) with an industry standard Female Mitchell Mount. Attach the Male Mitchell adapter to TITAN LT via the 6x M5 SHCS fasteners. Insert the Male Mitchell into the Female Mitchell on your camera support, ensuring proper alignment of the key, and fasten the Mitchell nut with adequate torque.

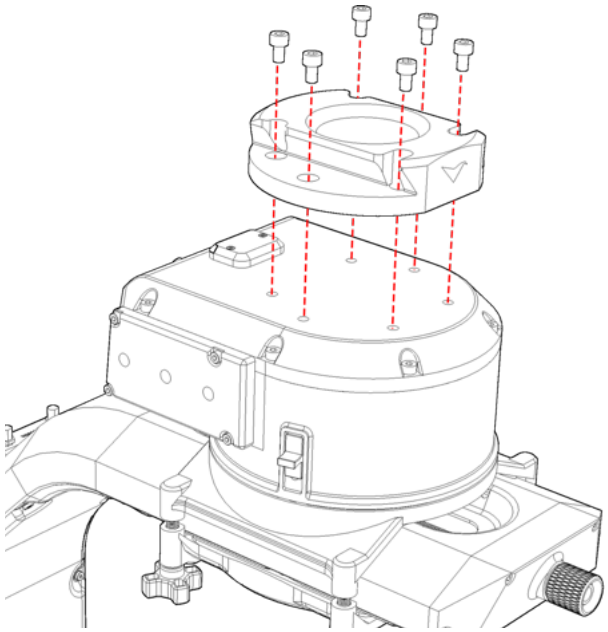


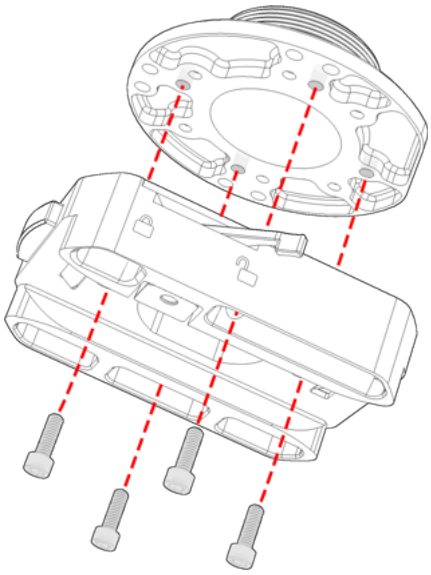
NOTICE Some Female Mitchell supports require the Mitchell nut to be captured within the support "posts" of the Female Mitchell plate. Check that your Mitchell Nut can be mounted within the Female Mitchell with adequate clearance for rotating and torquing the Mitchell Nut. ***The TITAN LT Male Mitchell adapter is compatible with common 2 ¾" - 12 UNC threaded Nuts.***

TITAN LT Quick Disconnect

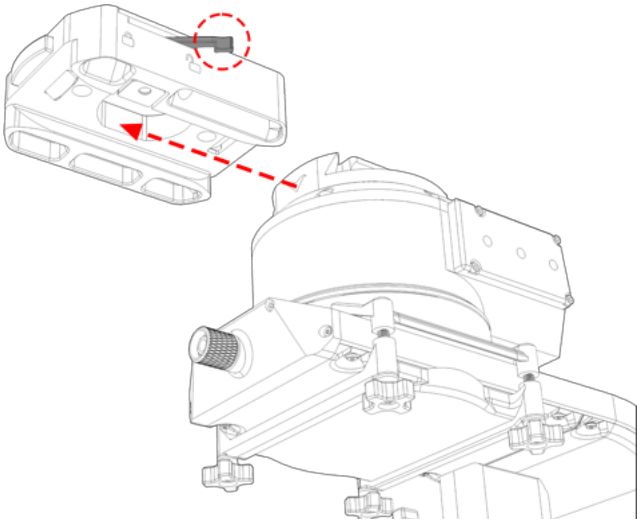
For faster installation and removal of TITAN LT from support, the Quick Disconnect (or QD) may be used. Start by installing the Male Dovetail to the TITAN LT Pan Housing using the supplied 6x M5 fasteners. Next, install the QD Receiver onto the support of your choice.

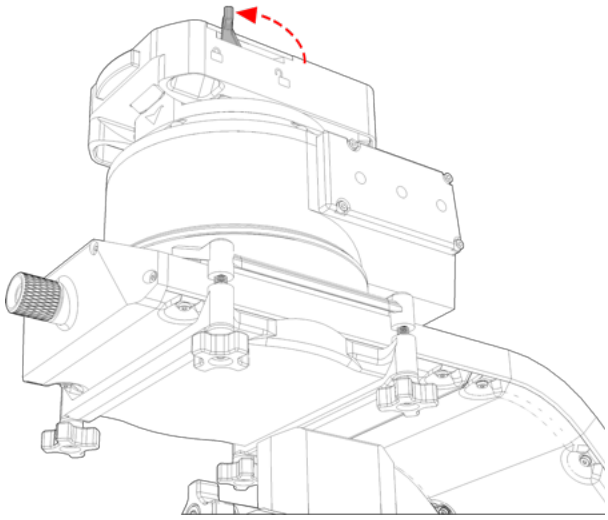
NOTE: The QD Receiver can be attached directly to the Male Mitchell for universal compatibility.





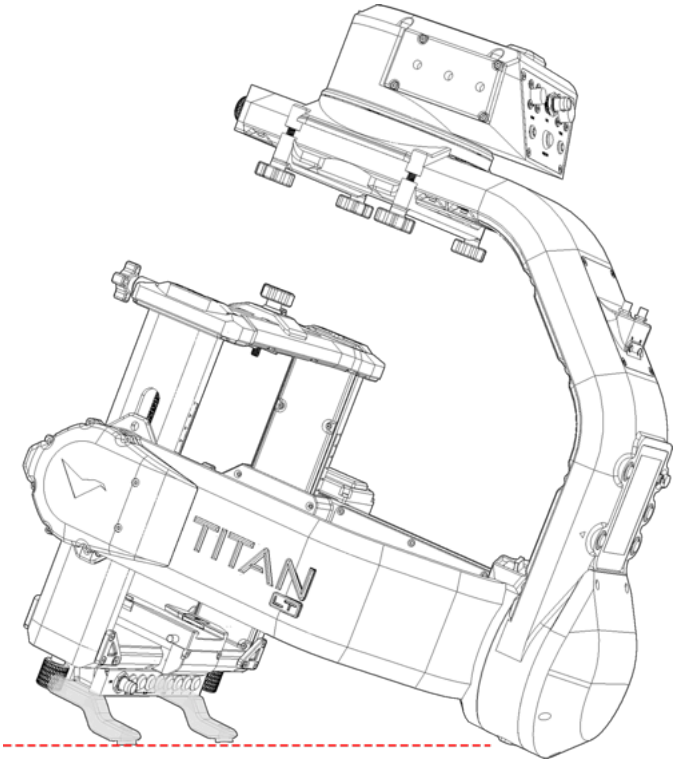
With the QD Receiver securely mounted to a compatible support, confirm the locking lever is in the "unlocked" position and slide TITAN LT into the receiver from either side (note the orientation of the Pan Housing. The safety latch will audibly "click" as it engages behind the receiver, preventing accidental disengagement.

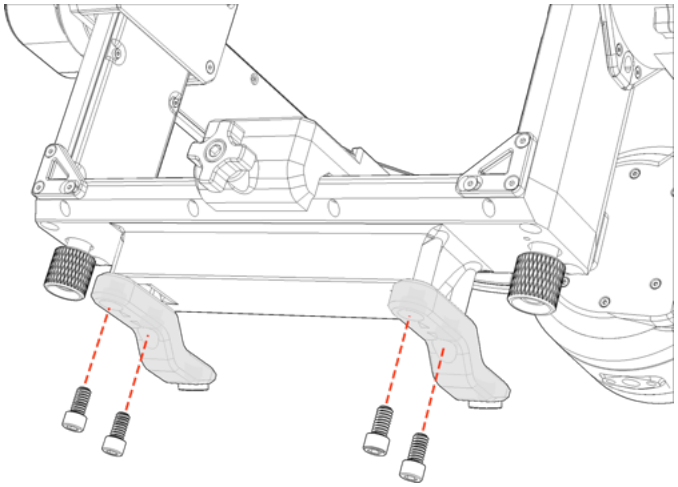




Protective Feet

Sometimes it is desired to work on the LT Gimbal while resting on a flat surface. To protect the LT Gimbal and any installed connectors/cables from accidental damage, Protective Feet may be installed to the bottom of the Basebar. For installation, attach the 2x Protective Feet to the ¼-20 threaded holes using the supplied hardware.



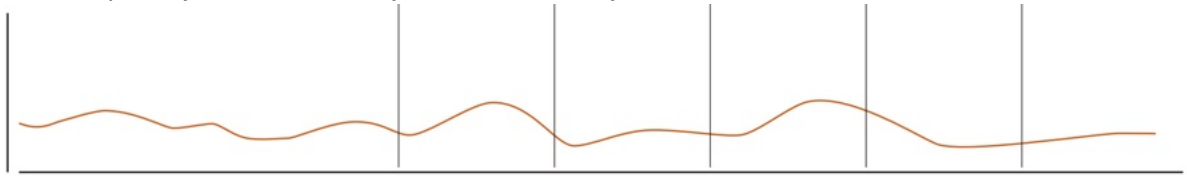


Using Anti-Vibration Mounts (AVM's or Vibration Isolators)

While studio applications are not likely to require the use of a Vibration Isolator, dynamic applications such as tracking vehicles will likely benefit from their use. Vibration Isolators help to reduce the frequency of an incoming vibration to within the working range of TITAN LT so that it can be stabilized effectively:

The below image shows an incoming vibration, which has high amplitude and fast frequencies that might not be stabilized effectively:

After a Vibration Isolator is added, the incoming vibration is softened so that its amplitude and frequency can effectively be stabilized by TITAN LT's bandwidth:



While many Vibration Isolators will likely work, we've found the **Flowcine Tranquilizer**, configured with **Pan 50 or 70 Barrels**, and Passive Plates to offer excellent results. Ensure your Vibration Isolator is rated/configured for your total payload with TITAN LT.

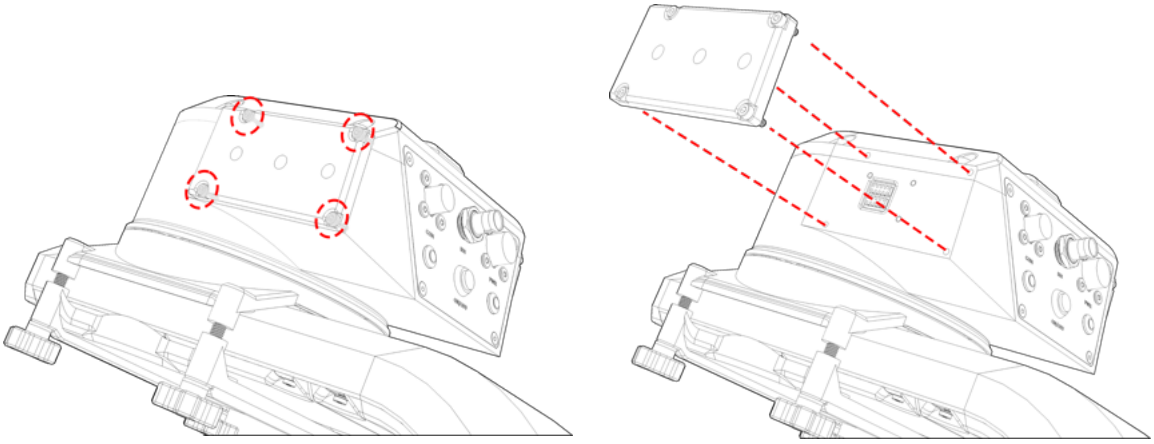
(Above) Flowcine Tranquilizer, image source © Flowcine AB

TB50 Battery Plates

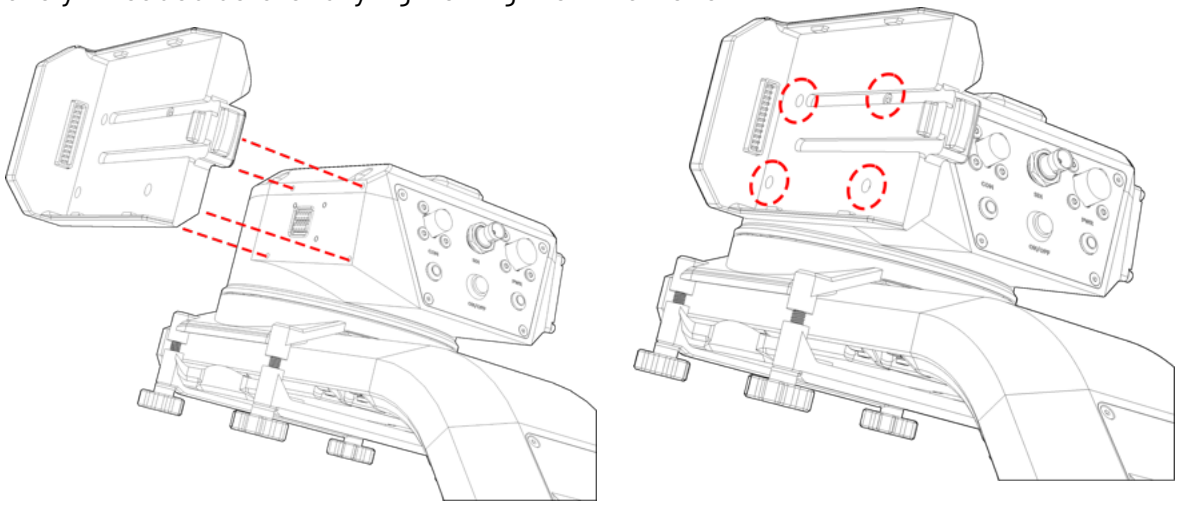
The TITAN LT Pan Housing features 2x Accessory Mounts which can be removed to install power accessories and other expansions such as the **TB50 Battery Plates**, which allow for use of the DJI TB50 batteries.

⚠CAUTION Before proceeding with TB50 Battery Plate installation, TITAN LT should be powered OFF and disconnected from any power source.

Start by removing the 2x Accessory Mounts from the LT Pan Housing – exposing the connectors underneath. Wipe the gold contacts on the Pan Housing and TB50 Battery Plates with a dry clean cloth to ensure there is no debris preventing successful connection.



Align the TB50 Battery Plate over the Accessory Mount threaded holes in the LT Pan Housing, and loosely install the 4x M3 fasteners. Make sure all 4x fasteners have been loosely threaded before fully tightening the 4x fasteners.



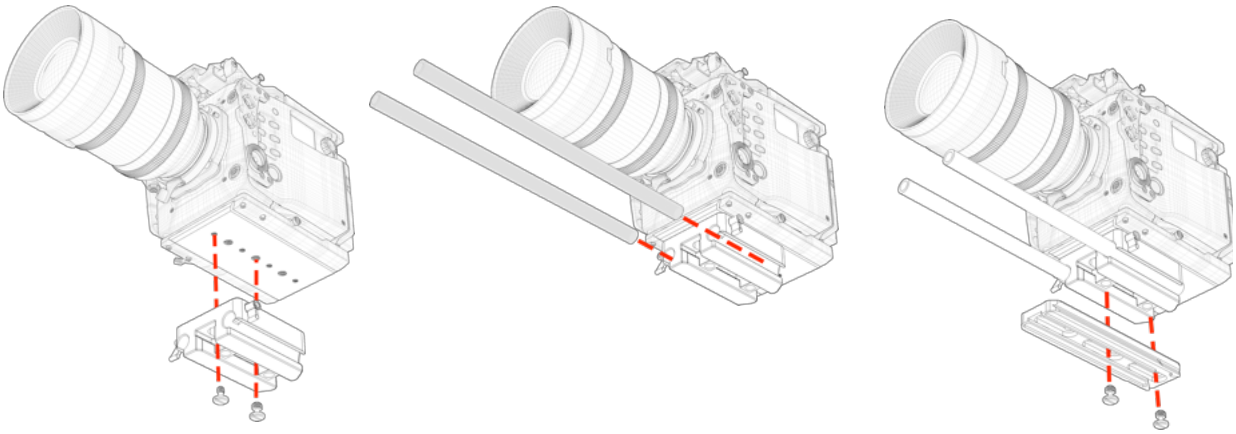
NOTICE Both TB50 Battery Plates must be used with 2x TB50 Batteries of equal charge. If "hotswapping" the TB50 Batteries is desired (or if simultaneous power from a larger source is desired) **a TITAN Battery must be connected simultaneously while using the TB50 Battery Sleds.**

Payload Setup

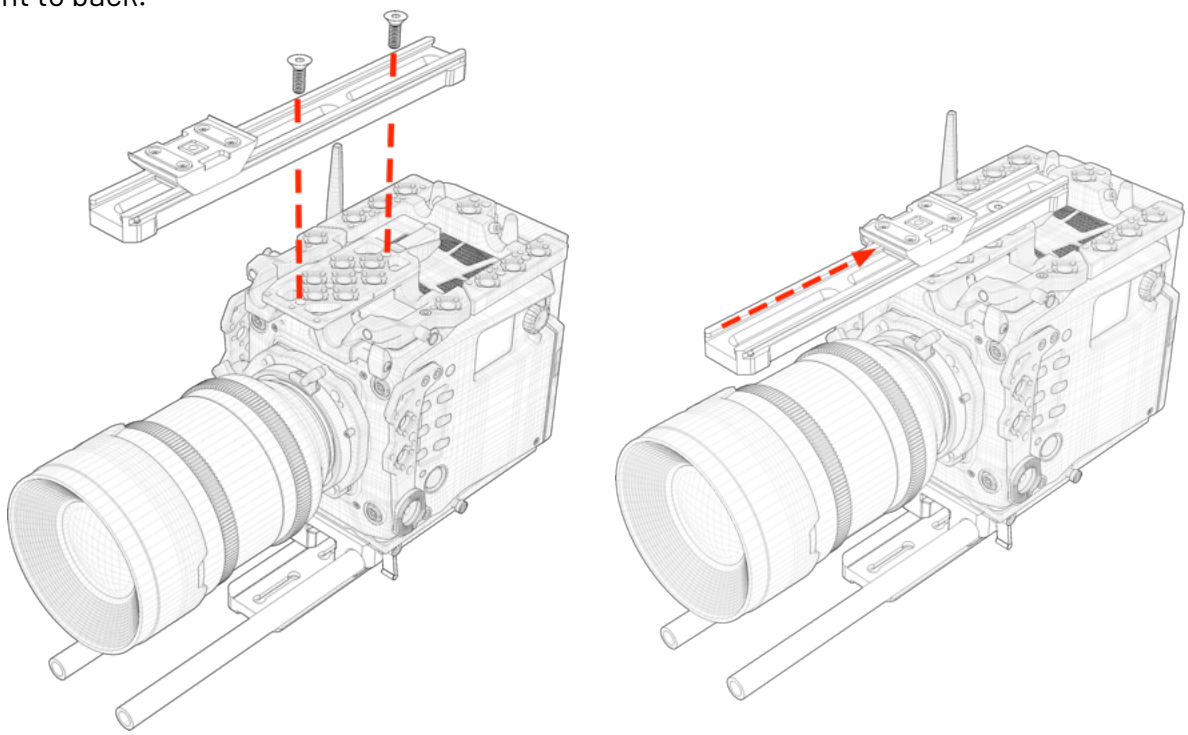
Building Camera/Payload

Attach the MotoCrane LT Bridgeplate to the bottom of your camera package with 2x fasteners (⅜-16 or ¼-20) for optimal rigidity. Add 15mm rods to the Bridgeplate, and lock them in place. Confirm they are long enough to reach the lens support point on your lens. Next, install the Dovetail to the bottom of the Bridgeplate.

NOTE: The Arrow on the Dovetail indicates the direction it is installed onto TITAN LT. The arrow should be pointed to the rear of your payload.

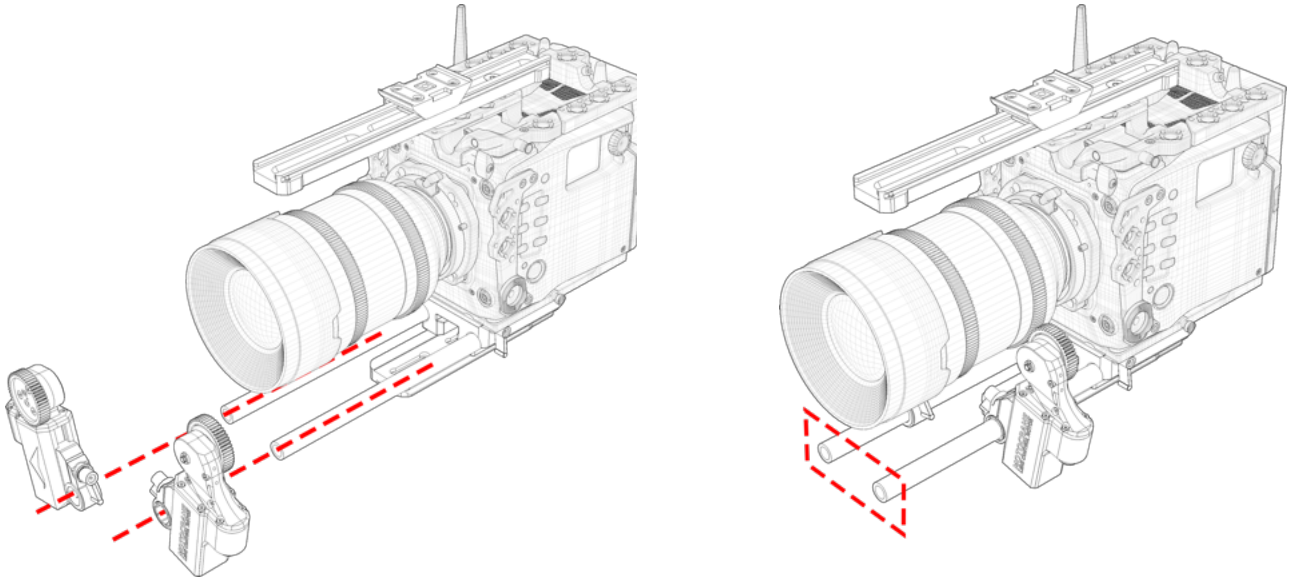


Attach the Camera Top Rail to the top of the payload with at least 2x Flat Head fasteners to prevent rotation. If necessary, attach a lens support between the top of the lens and the Camera Top Rail. Ensure the fasteners sit below the Slider so that it can still be positioned front to back.

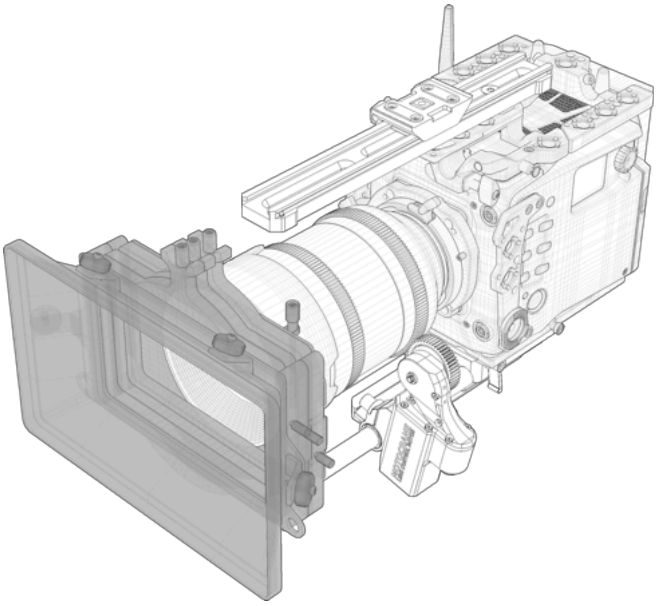


Attaching Lens Control Motors and Lens Supports

Before adding lens support, slide the lens control (FIZ) motors onto the 15mm rods and confirm their engagement with the lens. Usually, lens support must be added prior to a 3rd (Focus) motor.



Finally- add any mattebox or other accessories such as batteries, wireless transmitters, cables, FIZ motor drivers, Rangefinder focus accessories etc. which will contribute to the size/weight of the payload.

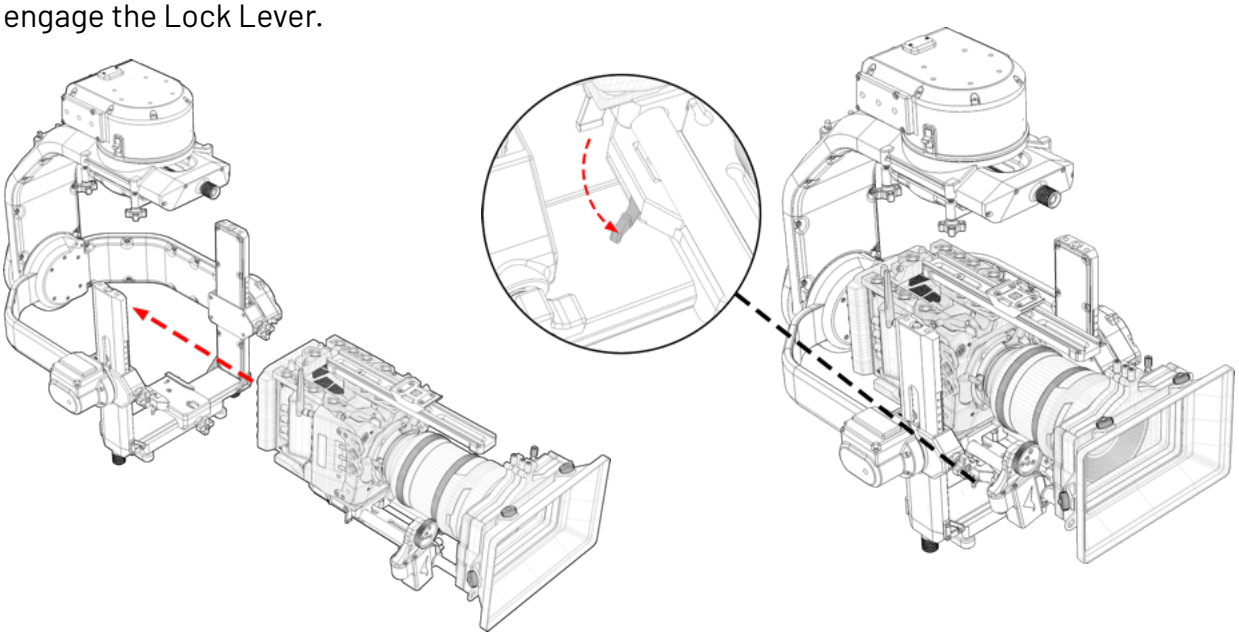


NOTICE Camera packages MUST be built with special attention paid to the end-to-end stiffness. This means the lens and matte box must be suitably supported so there is no flex that may be prone to vibrations. Camera packages without suitable lens support will be prone to poor tuning and stabilization results.

Mounting Payload to TITAN LT

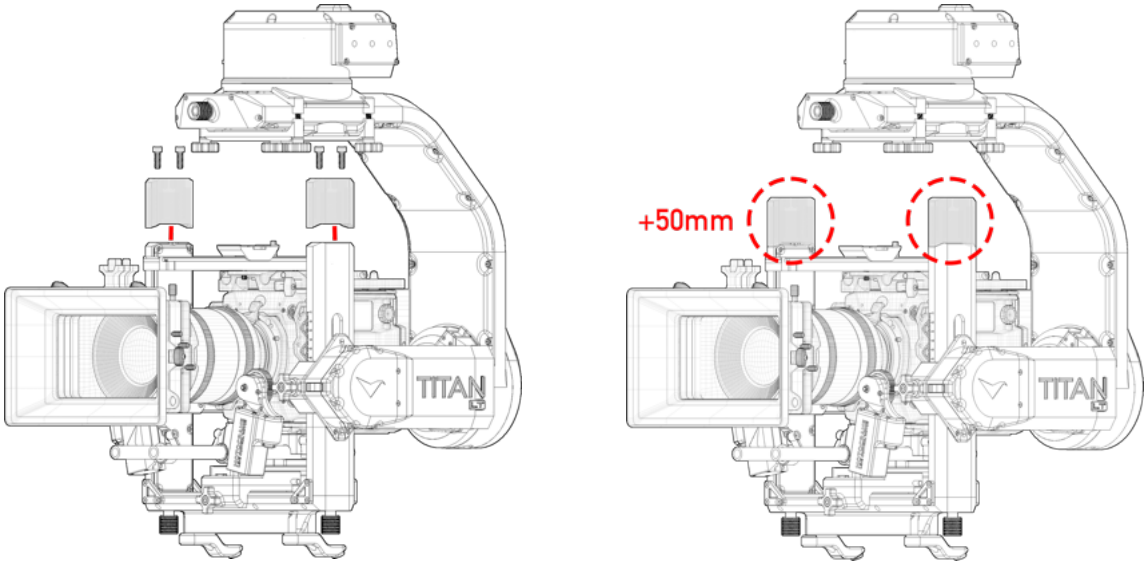
⚠CAUTION To avoid personal injury and damage to equipment, confirm that both the Tilt *and* Roll axis locks are engaged before installing the payload.

Slide the Payload into the Tilt Cage until the Dovetail engages with the Basebar slider. An audible "click" will be heard as the safety latch engages behind the Dovetail – preventing accidental sliding out of the payload. With the payload roughly centered front-to-back, engage the Lock Lever.

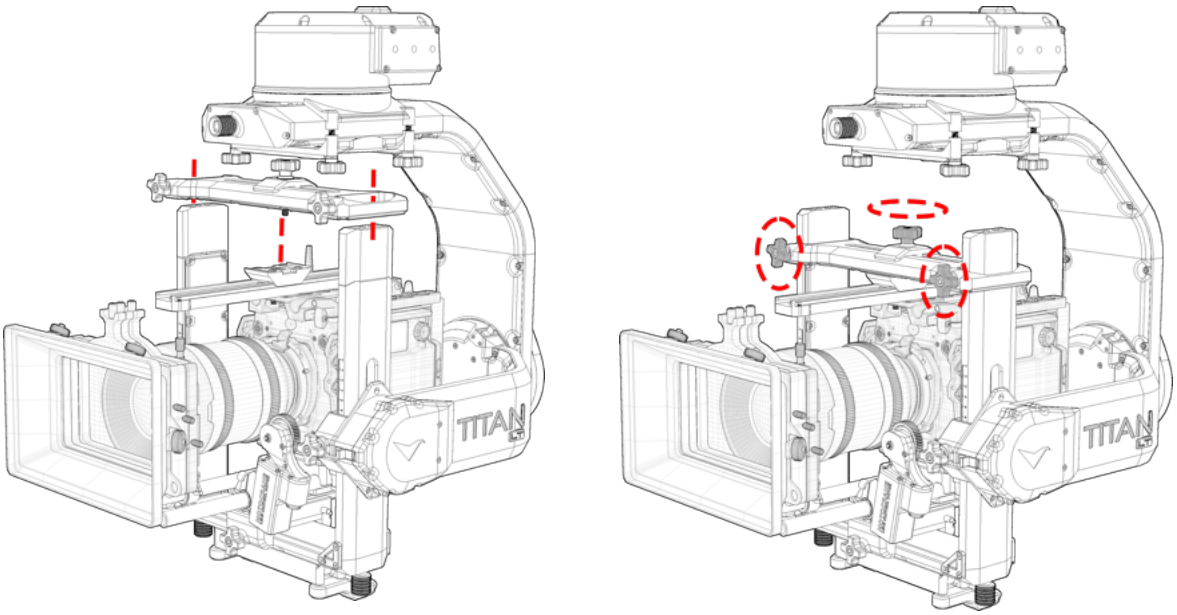


Installing Tilt Cage Extensions

Taller camera packages may require the use of the Optional **LT Tilt Cage Extensions**. They can be installed using the included M6 Fasteners to the top of the Tilt Cage uprights.

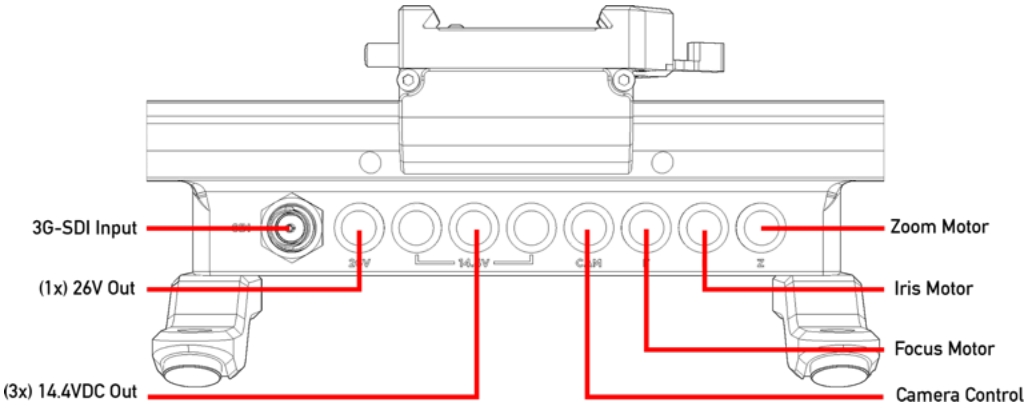


With the Crossbar loosened, slide it over the Tilt Cage uprights, sliding it down towards the camera package, and rotate the knob to attach it to the Camera Top Rail on the payload.



Camera Electrical Connections

TITAN LT is equipped with 1x 26VDC regulated power port for 24V cameras and accessories such as the Alexa35, and 3x 2-pin LEMO power outputs (14.4VDC regulated, 125W). Use the power connections for providing suitable power to your camera and accessories.



Connect your SDI video signal to the "SDI" port on the TITAN LT Base Bar for providing hardwired video signal out from TITAN LT (3G/1080p60 max) For supported Lens Control Motors, you may connect the motor to the built-in 3 channel Motor Driver via MotoCrane 7-pin LEMO LCM Drive Cable.

If you're using MotoCrane's Camera Control, connect your compatible camera to the CAM port on the LT Base Bar.

Balancing Payload on TITAN LT

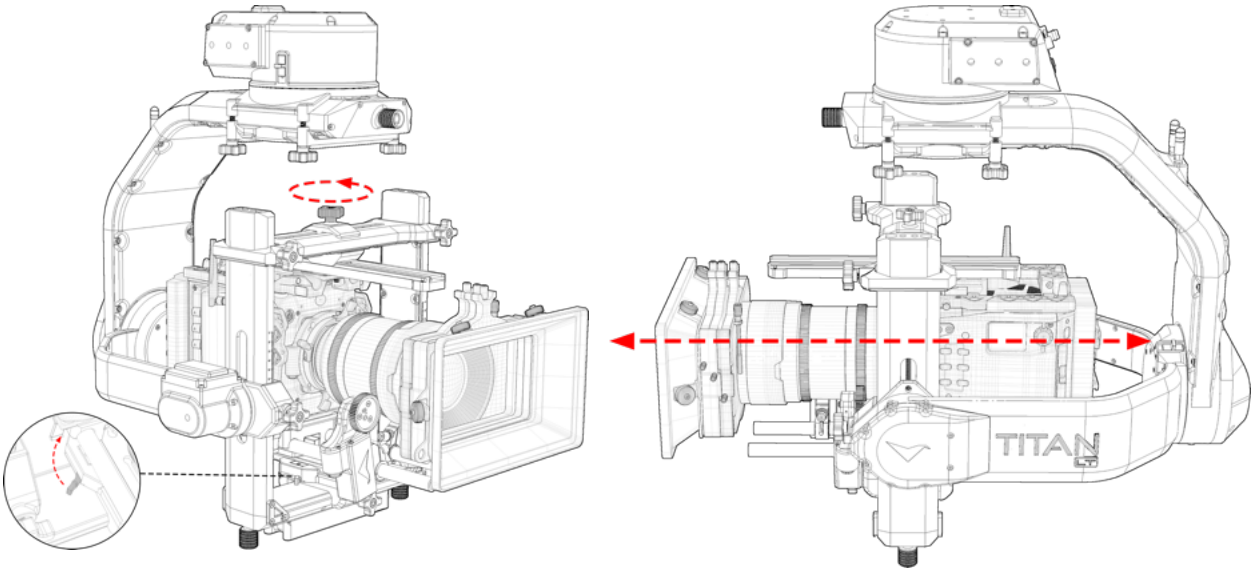
Balancing Overview

For all stabilized systems, optimal balance prevents inertia from adversely affecting stabilization. The better a camera package is balanced on all 3 axes, the better it will perform, especially in dynamic applications. Without proper balance, the TITAN LT motors must work harder to maintain the target angle, and can more easily be deflected away from the target angle. Imbalance may also lead to premature overheating and temperature related warnings. Taking the time to achieve perfect balance on all 3 axes (Pan, Tilt, and Roll) ensures peak performance of TITAN LT.

⚠CAUTION TITAN LT is equipped with axis locks on all 3 axes of rotation. Pay attention to when an axis is locked or unlocked to prevent accidental rotation of the payload, which may lead to personal injury or property damage.

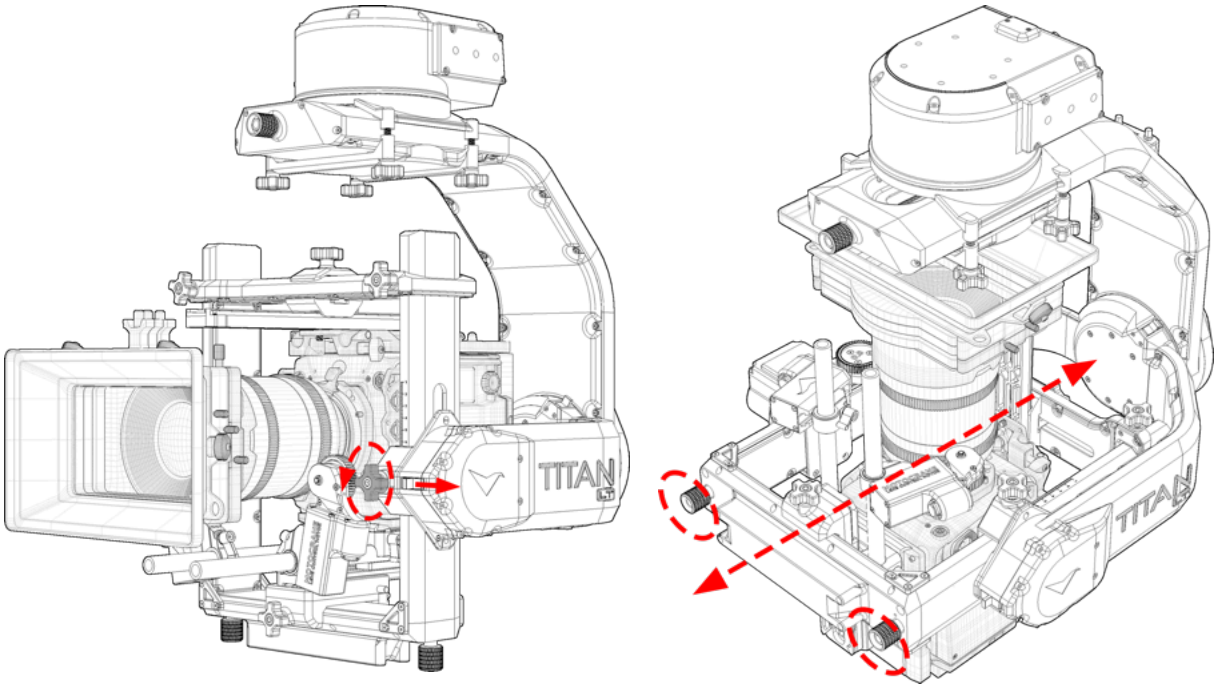
Tilt Depth Balance

With the payload roughly centered front to back, support the payload, and unlock the Tilt axis to assess the balance. To correct an imbalance, loosen the Basebar Lock Lever and Crossbar Knob to slide the payload front or back. If the payload is front heavy, slide it backwards. If the payload is back heavy, slide it forwards. After you've adjusted the payload, lock the Basebar and Crossbar and re-assess balance. Repeat until the payload does not tilt forward or backwards when level.



Tilt Height Balance

Unlock the Tilt axis, point the lens straight up, and assess any imbalance before re-locking the Tilt axis with the lens pointed straight up. Loosen the Tilt Cage Lock Knobs, and rotate the Tilt Balance Knobs to correct the imbalance. Tighten the Tilt Cage Lock Knobs, and then unlock the Tilt axis to reassess imbalance. ***ALL TITAN LT KNOBS SHOULD ONLY TIGHTENED BY HAND!***

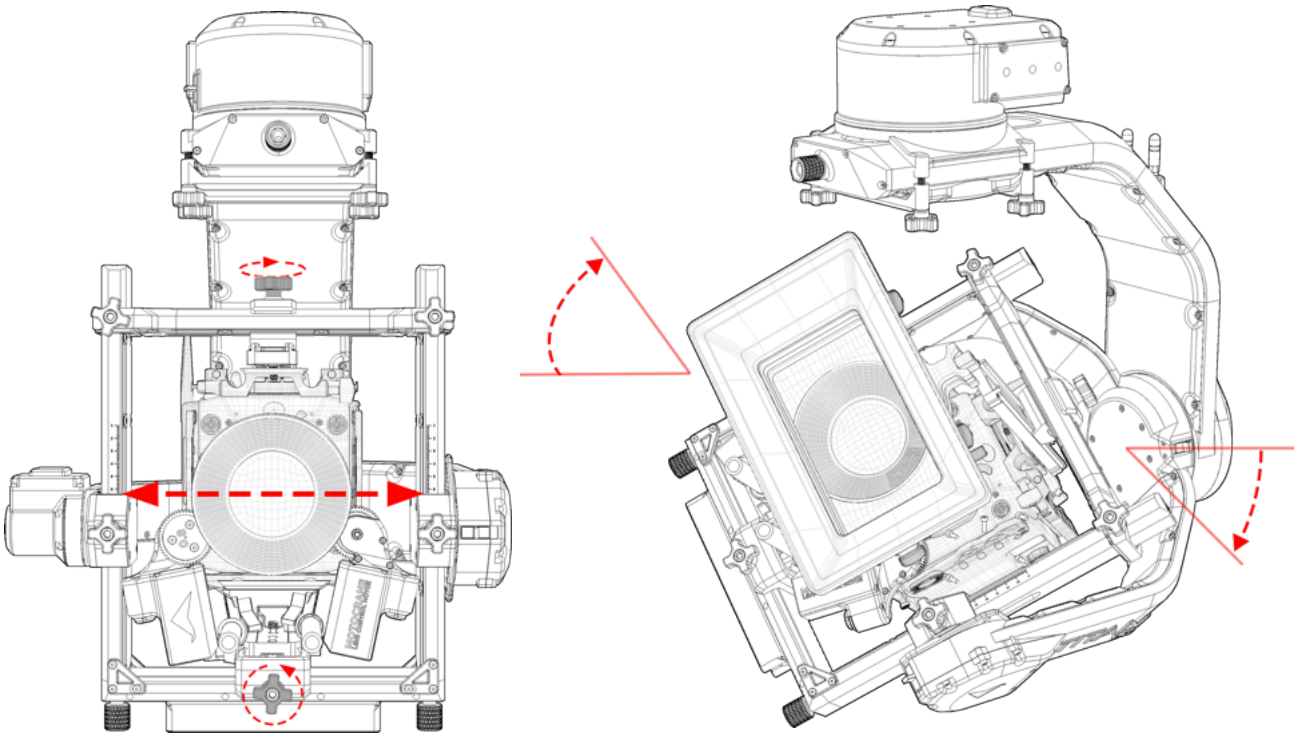


Repeat the process until the camera remains stationary (does not tilt backwards or forwards) when pointed up, down and level. Once complete, lock the Tilt axis in the level position.

NOTICE Ensure that the measurement marks on both sides of the Tilt Cage uprights are adjusted evenly. **If they do not align, the assembly could be skewed and cause the Tilt rotating assembly to bind, or even grind against close clearances.**

Roll (side-to-side) Balance

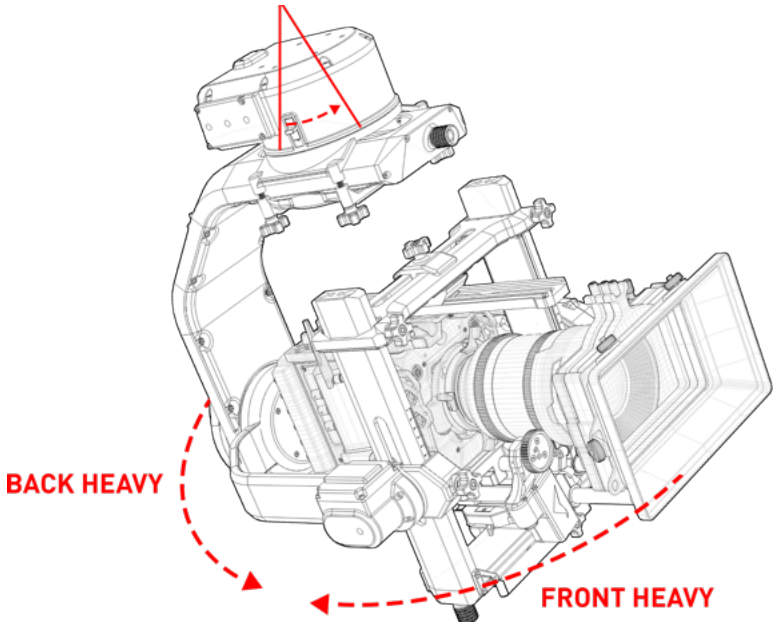
With the Tilt Axis level and locked, support the payload and unlock the Roll axis to assess any side-to-side (Roll) imbalance. With the Roll Axis locked, loosen the bottom 1x Basebar Lock knob and the 1x Camera Crossbar Lock knob. If the camera package rolls to the right, slide it to the left, and vice versa. Once balanced, lock the bottom 1x Base Bar Lock knobs and 1x Knob on the Camera Crossbar.



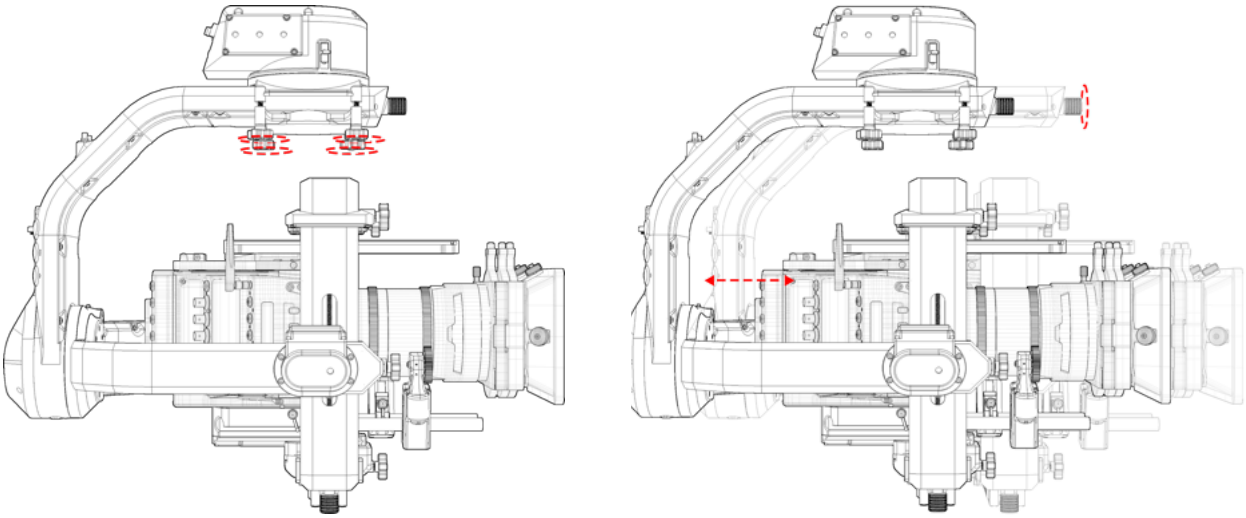
To confirm Tilt balance has been retained during Roll Axis adjustment, deflect both Tilt and Roll axis 45º and confirm position hold.

Pan Balance

In order to balance the Pan Axis, the gimbal support must be able to deflect (pendulum, or swing) the Pan axis away from vertical. On rigid underslung applications, a dampened U-joint should be used, or the gimbal must be balanced on a separate support structure.



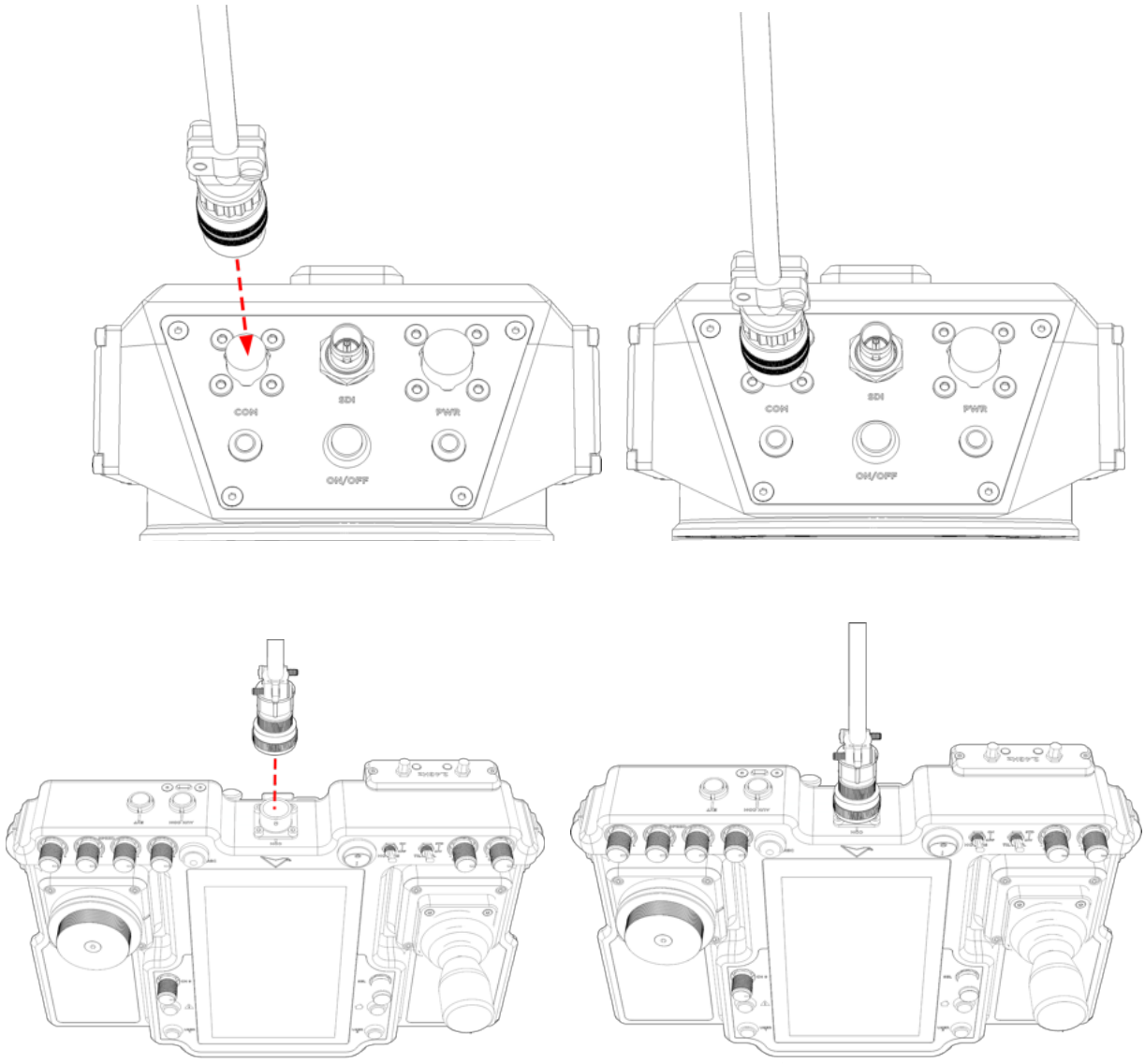
With the Pan axis unlocked, deflect the gimbal axis away from vertical and assess any imbalance. Loosen the 4x Pan Lock Knobs, and use the Pan Balance Knob to slide the gimbal forward or backwards to correct imbalance. You may need to rotate the Pan axis to several positions to ensure optimal balance.



Once balanced, tighten the 4x Pan Lock Knobs.

Powering ON TITAN LT

Now that TITAN LT is balanced, you're ready to proceed with powering ON. If you're using **Hardwired control**, connect a TITAN LT COM Cable to the COM port on the Pan Housing and the other side into the COM connector on the TITAN Controller:

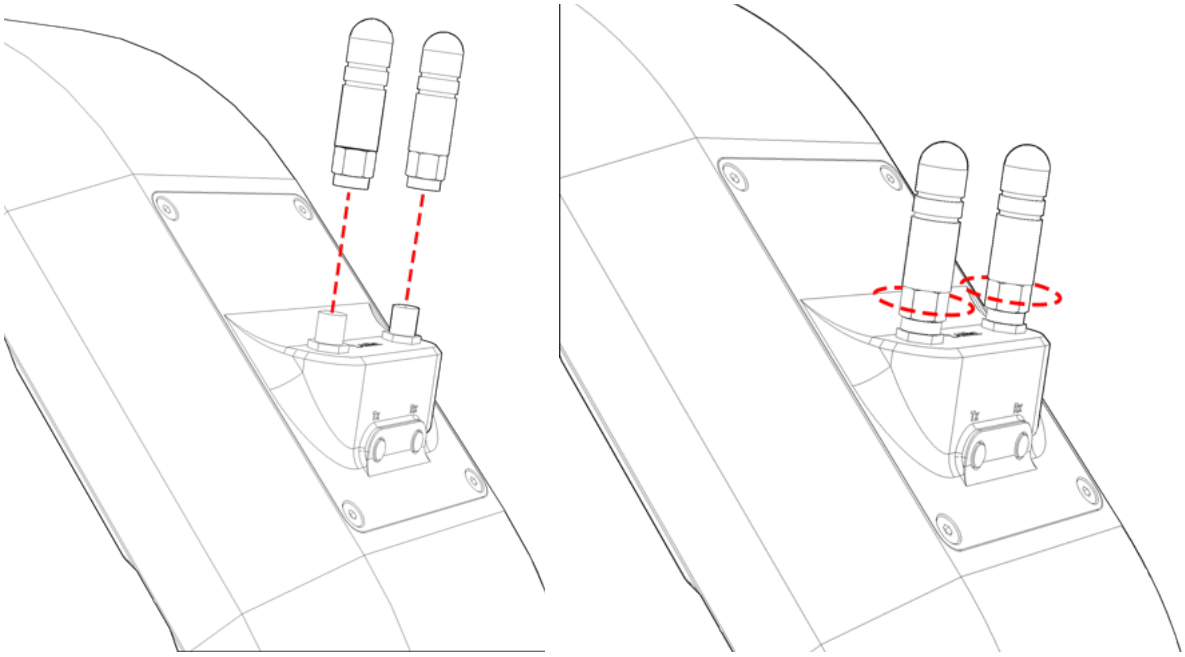


*If you're using **Wireless** control, do not install the COM cable. Instead continue to antenna installation on TITAN LT and the TITAN Controller.*

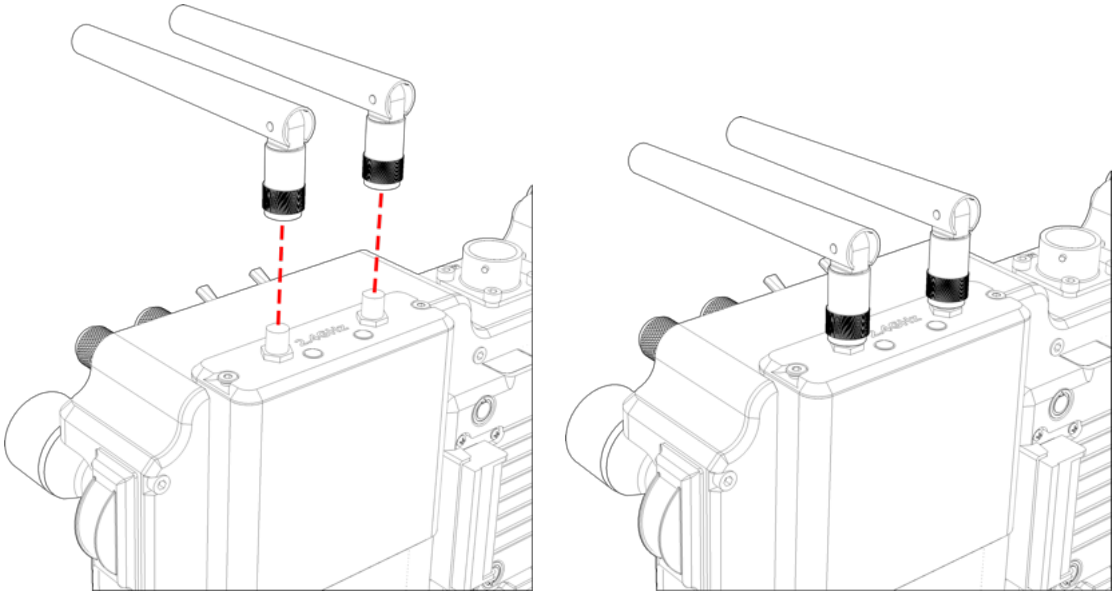
NOTICE With the COM Cable installed, any connected wireless radios are automatically set to a "Receive only" mode and will not transmit on their band.

If you're using **Wireless** control, ensure that 2x Antenna have been installed to the radio modules located on both TITAN LT and the TITAN Controller radio modules!

TITAN LT Wireless Module Antenna install

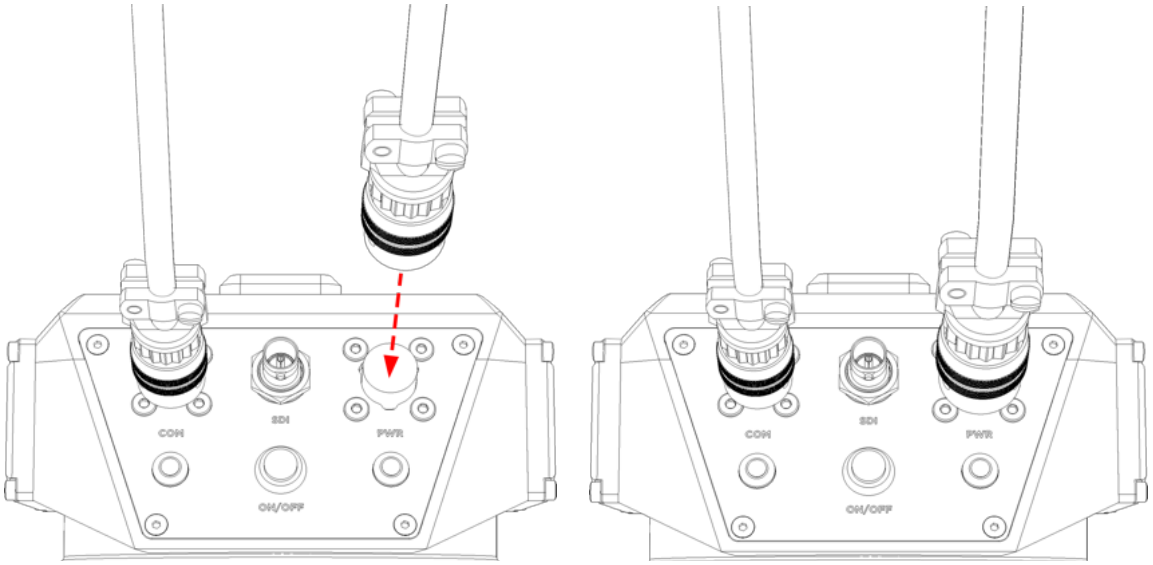


TITAN Controller Antenna install



NOTICE The standard 2.4Ghz TITAN Wireless Radio modules use discrete Transmitters and Receivers (Tx and Rx), which require BOTH antennas to be installed. Without BOTH antenna installed on Controller and Gimbal, wireless communication will not function properly. ***Upgraded LongWave Wireless modules each use a single radio transceiver with 1x antenna.***

Next, connect the TITAN LT Power Cable to the Power Input connector on the Pan Housing. If you're using the TB50 Battery Sleds, skip to the next page.



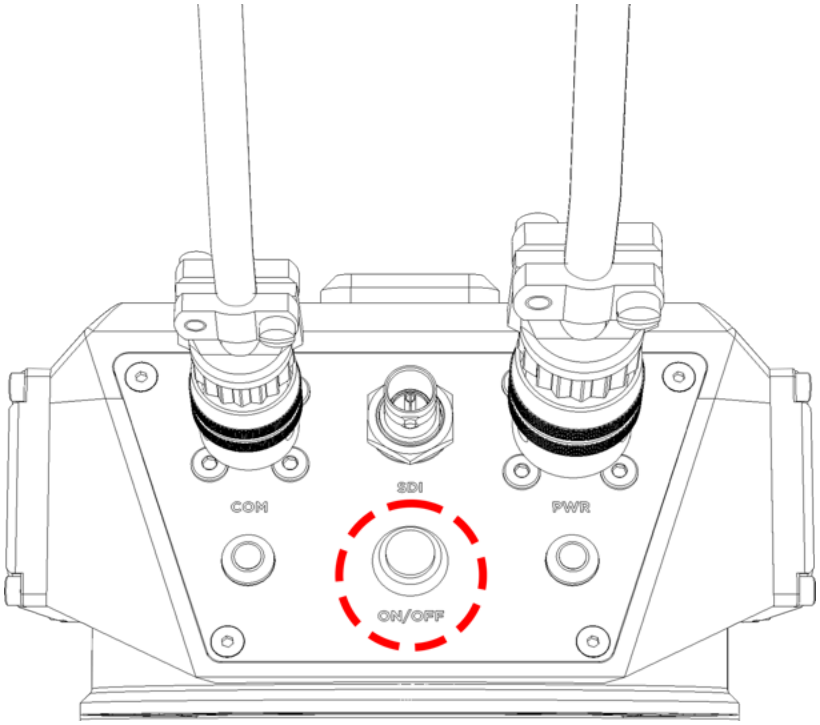
Next, connect the other end of the TITAN LT Power Cable to a fully charged TITAN Battery via the Anti-Spark QS8 Connector:

NOTICE Ensure the TITAN LT QS8 Power Connector is fully seated. Failure to fully seat the connector may result in unreliable power connection and or connector failure/damage.

Before powering TITAN LT ON, confirm that the following has been completed!

- Camera payload is securely mounted, optimally balanced, and in the correct orientation (Camera is leveled with the earth horizon).
- Camera electrical connections have all been secured and will not tangle/snag during operation.
- TITAN Battery is fully charged, or a suitable 48V power source is within voltage input ratings (42-53VDC MAX).

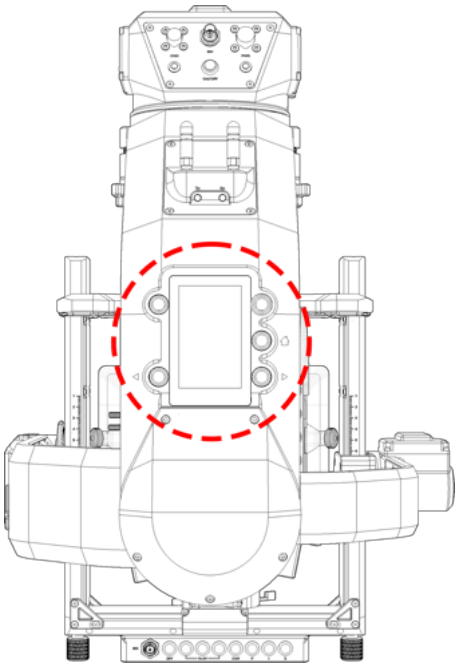
You're now ready to Power on TITAN LT by pressing and holding the ON/OFF Button:



⚠CAUTION Powering TITAN LT ON with the camera package upside down or in a sideways orientation may lead to erratic movement as the IMU sensor works to determine what is the normal working position. Ensure LT is in the normal (top side up) operating position during start up.

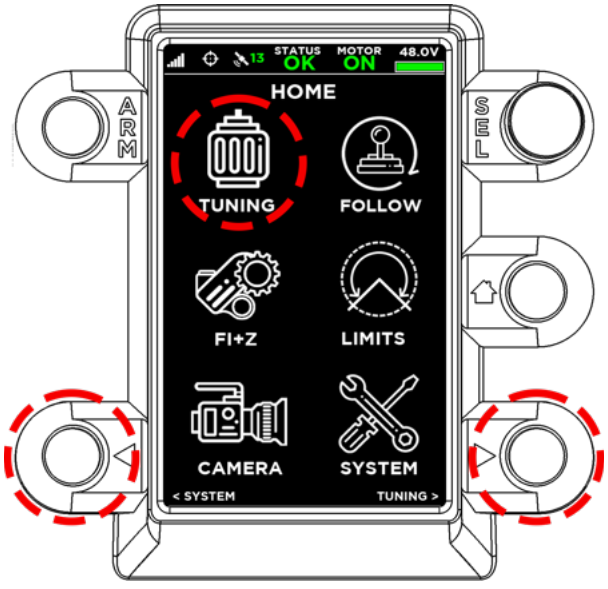
Basic tuning and configuration with TITAN LT Screen

TITAN LT is conveniently equipped with an onboard touchscreen that is used for basic configuration & diagnostics. **Because TITAN LT boots up in a safe (motors OFF) state, the screen is also used to ARM the motors so that they can be deliberately turned ON and OFF by the TITAN Controller! *See* *Quick Boot & Safe Arm (Firmware v1.1.5+)***



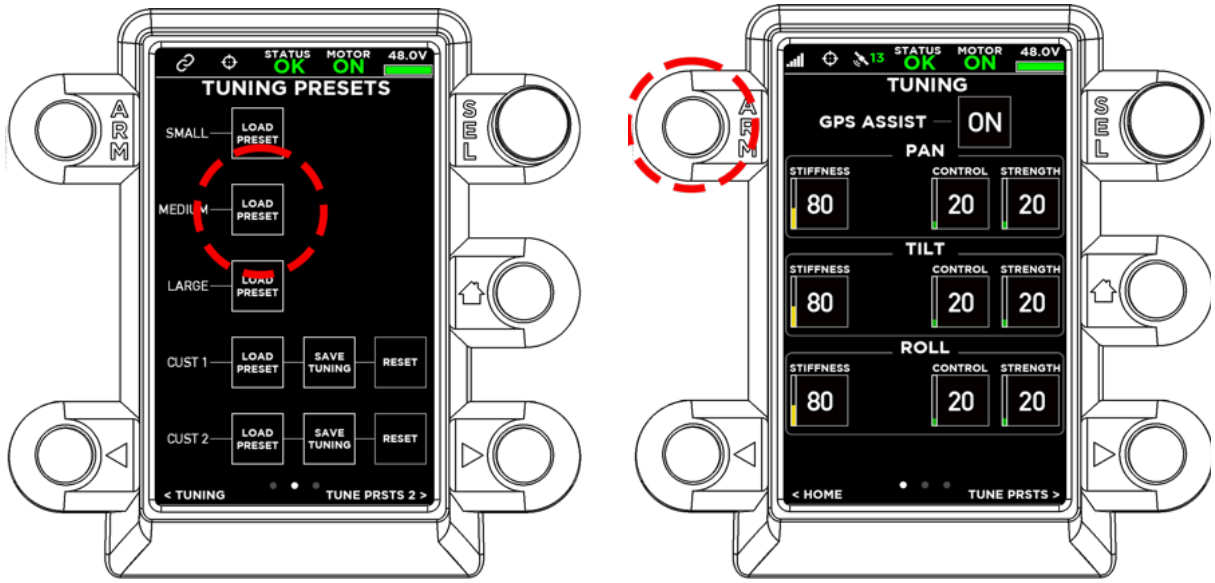
TITAN LT Spine Screen Navigation

While at the Home screen, you may touch an icon for quick navigation, or use the physical Left/Right for navigating between screens. Pushing left and right continuously will loop the navigation.



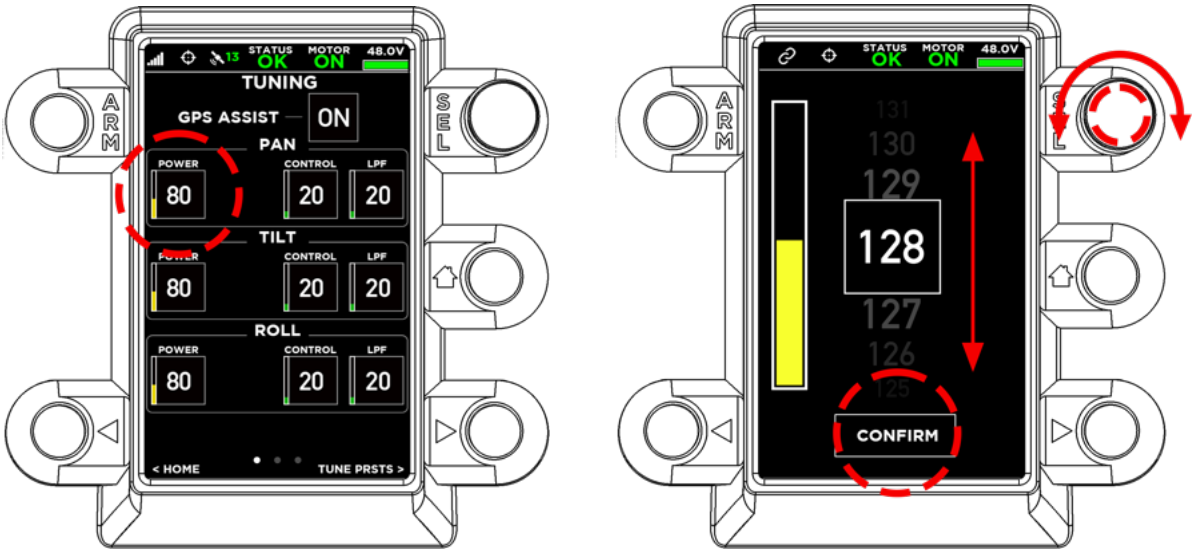
Tuning Presets and Motor Arming

The first step of basic tuning and configuration for TITAN LT, is to apply a Tuning preset which most closely matches your payload. Do this by navigating to the “Tuning Presets” page on the TITAN LT Spine Screen, and selecting the appropriate tuning preset:

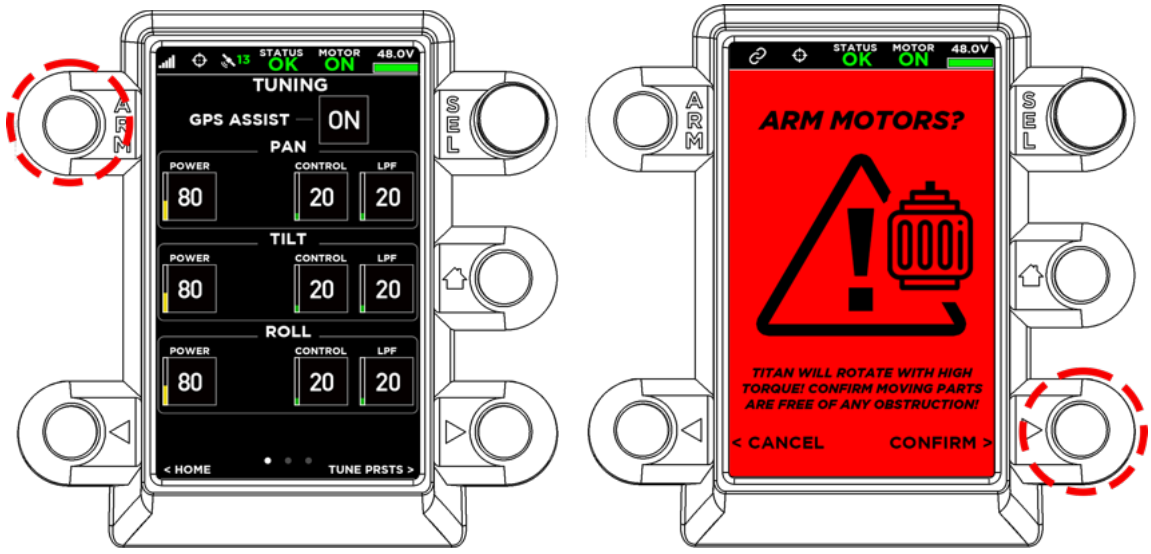


Return to the Tuning page, and make note of the Tuning values. For first time users, it will be difficult to determine if the Tuning values look correct, but with training and practice you’ll be able to determine if the values are roughly correct for the application.

Any adjustable value or parameter (such as Tuning values) can be adjusted from the Spine screen by touching the value and then scrolling the value up or down using the touchscreen or “Select” knob. After adjusting any value, press “CONFIRM” on the Screen, or push the “Select” knob in.



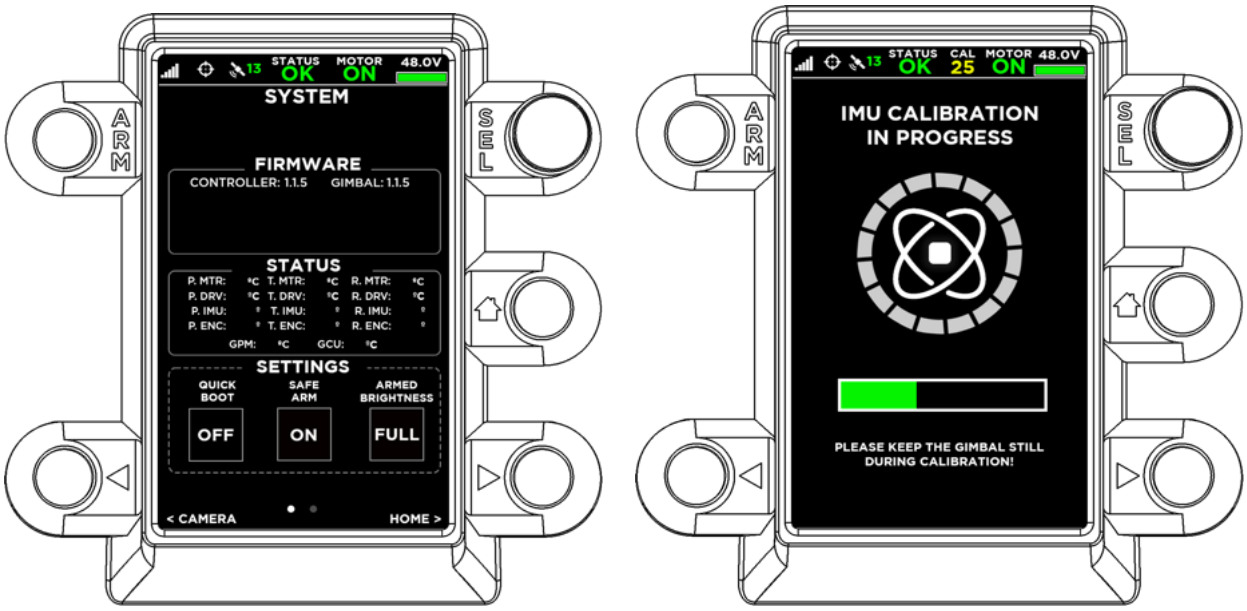
After confirming the Tuning preset has been applied, you're ready to ARM the motors. This can be done from any Spine screen page by pushing the physical "ARM" button, and then CONFIRM the command using the Right nav button.



⚠CAUTION By default, the "Safe Arm" feature is turned ON, which requires motors to be deliberately turned ON by the TITAN Controller after they have been ARMED. If the TITAN Controller is already in the ON position, it must still be toggled OFF and then ON again to energize the motors. See next section for Safe Arm ON/OFF configuration.

Quick Boot & Safe Arm *(Firmware v1.1.5+)*

You may choose the startup IMU calibration (*Quick Boot*) and Motor Arming (*Safe Arm*) behavior that best suits your workflow via the "SYSTEM" page on the Spine.



Safe Arm ON- (Default) Motors may be "ARMED" with the physical button on the gimbal, *but must still be toggled "ON" via the TITAN Controller to turn on/energize.* This is the safest option, but may be inconvenient for some users.

Safe Arm OFF- When Motors are "ARMED" from the gimbal they also turn "ON" and rotate with high torque. *This overrides the physical "MOTORS" switch on the TITAN Controller.* Recommended for experienced users only, who are comfortable with high-torque gimbals.

⚠CAUTION With Safe Arm turned OFF, the motors will energize and generate torque after ~3 seconds, so users have adequate time to move their hands away from the rotating parts of the gimbal.

Quick Boot ON- IMU calibration is skipped at startup and motors can be armed immediately. This may cause performance issues, as the operating conditions for the IMU may have changed since last calibration.

Quick Boot OFF- IMU Calibration occurs every startup for approx. 30 seconds, which provides the best system performance. Motors may not be Armed or Turned on during the start IMU calibration.

NOTICE With Quick Boot ON, the system is more prone to inaccurate initialization/calibration, and may result in IMU-related issues like drift, axis coupling, or irregular horizon alignment.

TITAN Controller

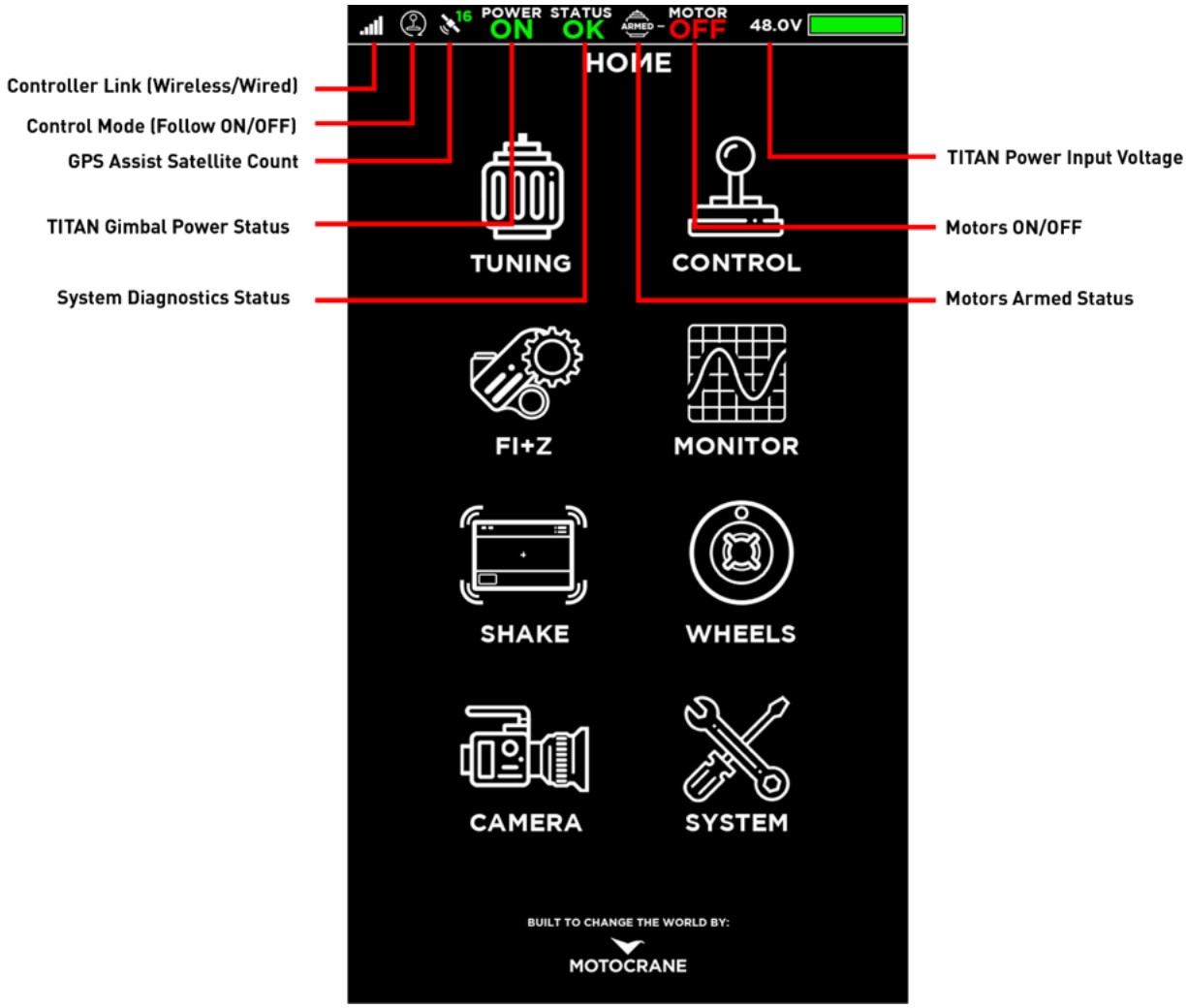
The TITAN Controller is an advanced control desk that gives users unparalleled ease of use and access to all aspects of head operation and configuration. The controller is constructed of 6061-T6 Aluminum, and features a 7" full color, high resolution, touchscreen display with simple user interface. There are two Input Modules, which the user may interchange for which hardware is preferred (dual axis joystick, single axis joystick, etc.). There are also several User-assignable buttons for quick access to shortcut features.

The TITAN Controller may be used hard-wired or wirelessly, and features a V-Mount battery sled on the back for providing power to the Controller during wireless use (***V-Mount Battery not needed during hard-wired use***). The TITAN Controller is also used as the connection and configuration device when using TITAN Wheel modules, which are connected via the Auxiliary Communication (AUX COM) port on the top of the Controller.

The TITAN Controller also has several monitoring and diagnostics functions for ensuring safe and sustainable operation of TITAN LT. The TITAN Controller is not IP-rated, so it should only be operated in a dry environment.

Home Screen and General Layout

At the top of the TITAN LT User Interface is the Header, which constantly displays real-time status information such as TITAN Controller connection status, TITAN LT Gimbal Status, Motor ON/OFF state, and Power Input voltage.

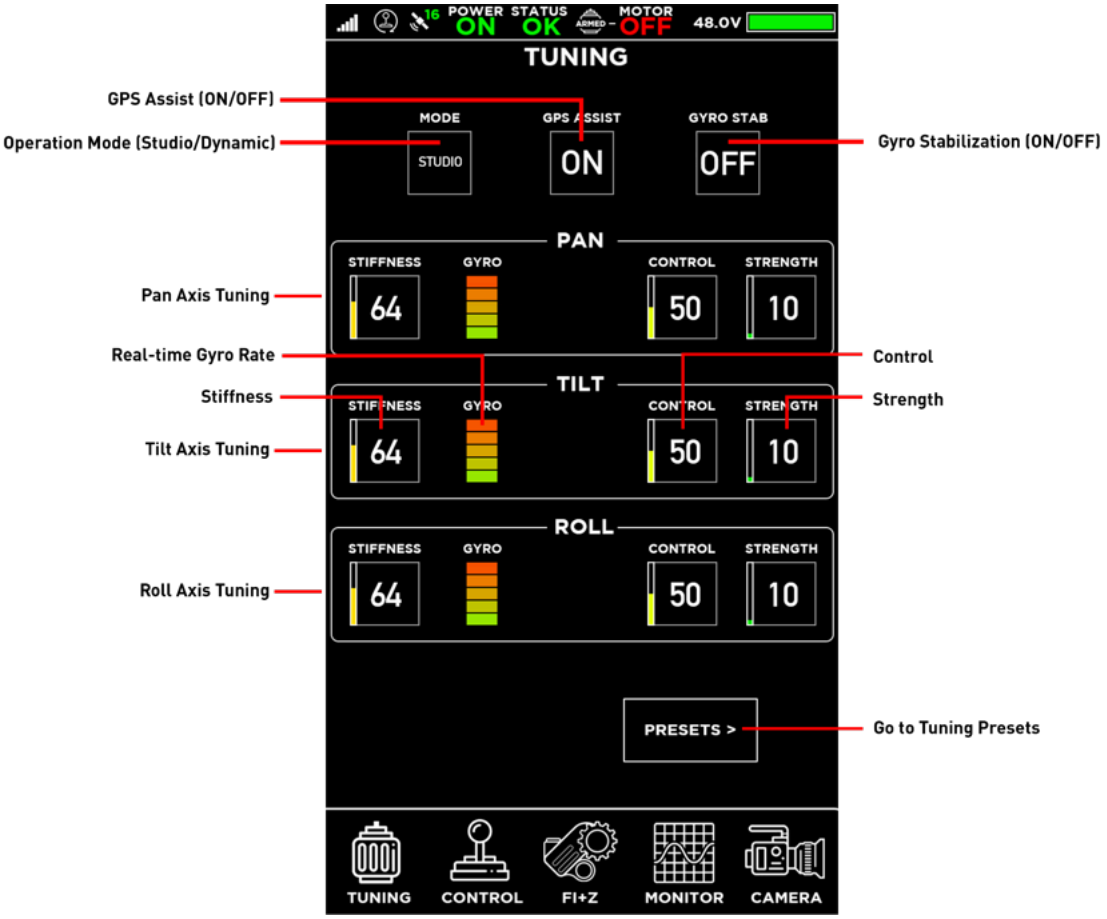


From the Home Screen, select any page icon for quick navigation to its parameters. The Home Screen can always be returned to by pushing the physical “HOME” button located on the TITAN Controller.

Tuning

What is Tuning?

Tuning values determine how TITAN LT uses gyro data to stabilize the payload. These values are the most important parameters for stabilization performance. As explained in the "Intended Use" section of this manual, many factors impact maximum tuning values such as Payload mass/inertia, Payload stiffness, Vibration Isolators, and support structure stiffness. It is **CRITICAL** to spend as much time as possible analyzing how these factors affect your application, and how to most efficiently maximize performance.



Parameters explained

Stiffness - The gain that is applied to the stabilization control loop. If the Stiffness is too low, the stabilization loop will not provide enough corrective stabilization force. If Stiffness is too high, the axis will oscillate and likely produce an audible buzzing sound.

Control - Helps to slow the axis down as it approaches the target angle, and prevents overshoot or "**low** frequency" oscillation. If Control is too low, the axis may overshoot the target easily or visibly shake. If Control is too high, the axis will buzz or oscillate with **high** frequency.

Strength- The motor strength applied to stabilization. Typically this value is set LOW for presets, as it largely depends on the rigidity of the support structure (using an AVM/iso-damp, hard-mount, etc.). When Strength is set too low, the axis may not stay firmly fixed on the target. If Strength is set too high, the axis may over-correct and induce shakiness.

GPS Assist - TITAN LT is equipped with the latest GNSS (Global Navigation Satellite System) sensors which measure lateral acceleration and speed in real time to help maintain Pitch and Roll angles. This mode is most useful for dynamic/exterior applications such as tracking vehicles. However, for studio/interior applications, GPS Assist may be turned OFF to eliminate artifacts associated with low satellite latching count (Pitch and Roll "nodding") You can observe the strength of your GPS connection in the header. 10+ Satellite connections is considered a good connection

If you are seeing fewer than 5 satellites, you may experience sub-optimal horizon holding in dynamic environments and drifting in studio environments. The color of the satellite count in the header refers to the quality of the GPS connection.

Green and >15: Excellent
Green and <15: Good
Yellow and <5: Not Good
Red: No connection.

If the satellite icon is faded, GPS assist is turned OFF.

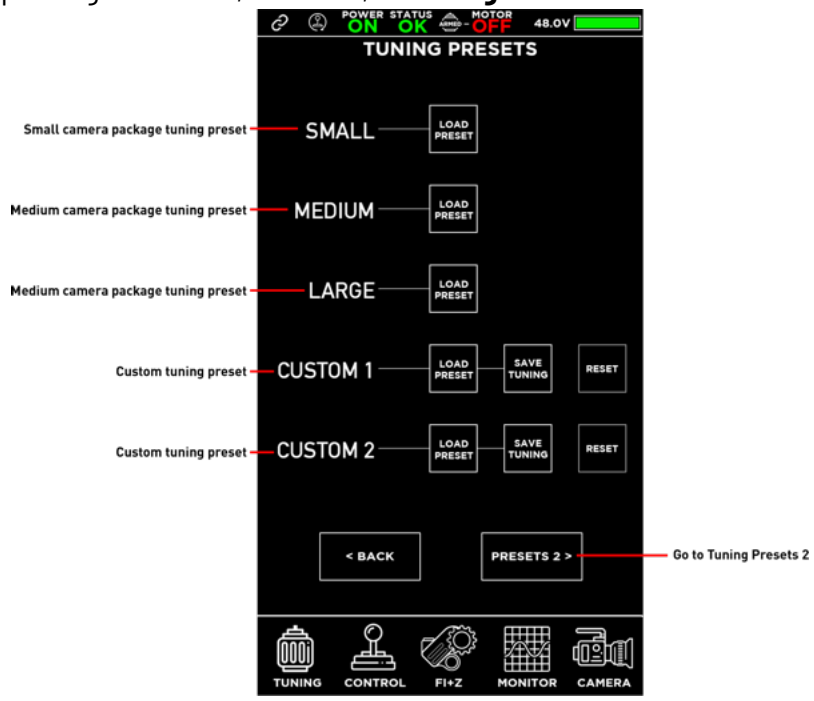
NOTICE SDI outputs set to 1080p/30fps creates a small field of wireless noise in the frequency band that all GNSS satellites communicate at. If your monitoring video feed is set to this data rate, let TITAN startup outdoors with the camera OFF, allowing satellites to connect before turning your camera ON.

Stabilization ON/OFF - While TITAN LT is a gyro-stabilized remote head, gyro stabilization may be turned OFF for all axes to help in with certain specialty cases where it may not be necessary. For example, you can turn stabilization OFF to achieve the smoothest 360º Roll without the artifacts of **Gimbal Lock.** Turning Stabilization OFF can also be helpful when TITAN LT is used on stationary platforms and it's desired to "lock off" the camera for extended periods of time.

Studio/Dynamic Mode - Optimizes the TITAN LT Motor Driver hardware for either STUDIO or DYNAMIC applications. Studio Mode is the default operation mode and provides quieter operation for acoustic-sensitive environments. Dynamic Mode increases Motor Driver control speed for more demanding stabilization environments like tracking vehicles.

Tuning Presets

To simplify the tuning process, three Tuning Presets are available as starting points for common camera packages - **Small**, **Medium**, and **Large**.



These presets are a summary of Camera/Lens size and weight, seen in the table below:

	Small Prime	Large Prime	Small Zoom	Medium Zoom
Red Komodo	SMALL			
BM PYXIS				
Red DSMC2				
Arri Alexa Mini				
Red V-Raptor		MEDIUM		
BM URSA Mini				
Arri Alexa 35				LARGE
Sony Venice 2				

NOTICE Additional accessories and "build out" of camera packages will lead to larger presets being more appropriate for a particular Camera + Lens combination.

After you've selected the appropriate Tuning Preset and completed the Tuning Procedure below, you may save the resulting configuration as a "Custom" preset for quick access later. Up to 7 Custom presets may be saved. This is especially useful when you frequently use a limited number of known camera packages.

Tuning Procedure (Basic)

1) LOAD the appropriate Tuning Preset for your camera package.
2) Test the stabilization performance in your working environment and observe what symptoms persist.
3) If an axis is not properly stabilizing, increase STIFFNESS on that axis by ~10.
4) Re-test the stabilization performance, and repeat step 3 as needed until buzzing/shaking occurs on the axis. Reduce by 5-10 for safety margin.
5) CONTROL, and STRENGTH may also be adjusted individually to remedy specific tuning issues such as low frequency shaking or high frequency buzzing.

IMPORTANT! Please note that certain aspects of gimbal performance, such how an axis responds to commanded input, can also be impacted by the CONTROL and WHEELS parameters depending on your configuration and desired performance.

Troubleshooting common tuning symptoms

"TITAN LT is not adequately stabilizing an external disturbance"
Root cause: Tuning settings are too low.
Solution(s): Ensure proper Tuning Preset (Small, Medium, or Large) has been selected. Increase Stiffness on problematic axis (Pan, Tilt or Roll) until buzzing or humming occurs, then reduce by 5-10. Depending on your application, a vibration isolator may be desired.

NOTICE TITAN LT is designed for stabilizing payloads with focal lengths up to 250mm on S35 formats (6º FOV) with perfect payload balance, proper tuning/configuration and adequate vibration isolation/support (suspension arm, etc.) for the terrain. If tuning, balance, or vibration isolation is compromised, the peak stabilization performance of TITAN LT will also be compromised.

"TITAN LT overshoots when stopping a controlled move"
Root cause: Strength too high, or payload inertia exceeds maximum motor torque.
Solution(s): Reduce Strength, or increase joystick/wheel "Smoothing" for softer end stop.

"TITAN LT is vibrating/buzzing when stationary"
Root cause: Stiffness or Control too high
Solution(s): Reduce Stiffness or Control tuning values. If reducing Stiffness eliminates the buzzing but poor stabilization is induced, attempt to increase Strength for adequate stabilization performance.

Tuning Procedure (Advanced)

The gimbal must be mounted in its final operating configuration for Advanced Tuning to yield optimal system performance, including any/all payload accessories, rigging, anti-vibration mount, etc.

1. LOAD the appropriate Tuning Preset for your camera package (Small, Medium, Large, or Custom)

> If deciding between 2 options (e.g. Small or Medium), choosing the smaller option will result in a more conservative tune, while choosing the larger option will yield a more aggressive tune.

Starting with the Pan axis, follow these steps.

2. Increase Stiffness until you observe a low frequency rumble.
3. Increase Control until the rumble stops.
4. As you increase Control, if the rumble turns into a high frequency buzzing, reduce Control and Stiffness a little bit as necessary to eliminate both.
5. Start with default Strength, but increase as necessary to increase your net stabilization effect.

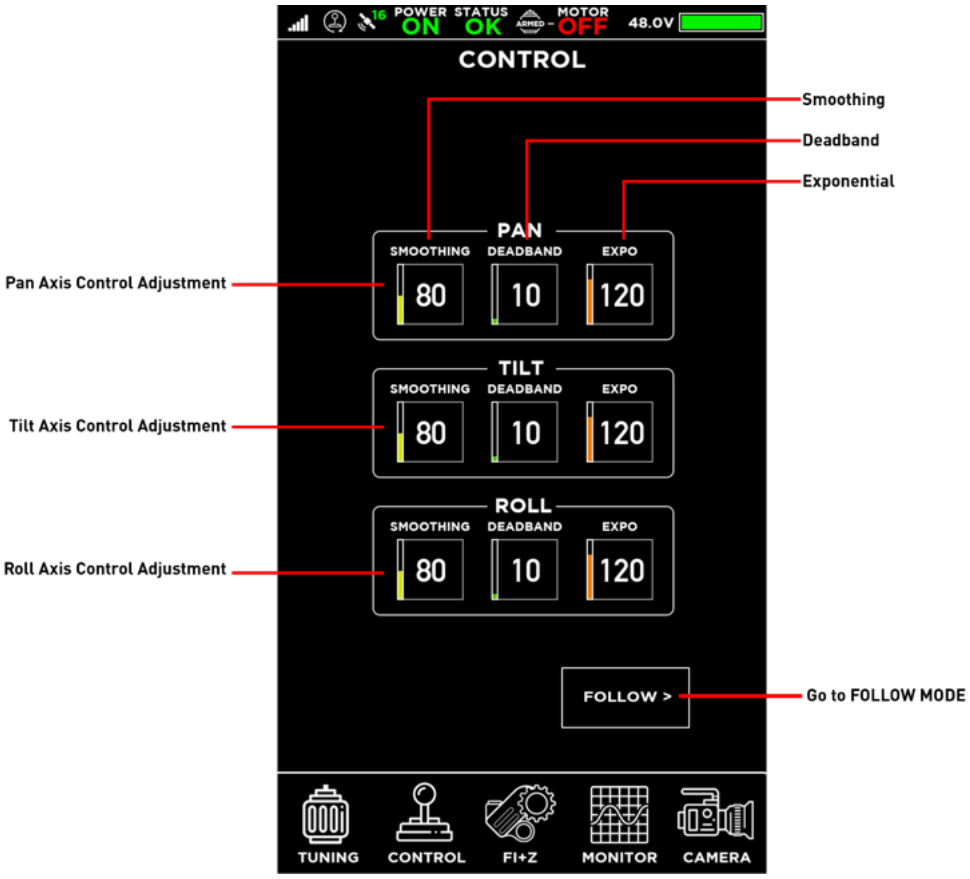
> Strength is generally set very low by Tuning Presets and can be increased significantly without issue. Increase Strength if stabilization looks *mostly* excellent, but large bumps or wobbles are seen only during large bumps or deflections. If you increase Strength too much, you may notice that the axis is now overcorrecting for *any* deflection.

Repeat 2-5 for Roll, then Tilt.

#protip- The need for an "aggressively" tuned Roll axis is generally low. Leave Roll tuning more conservative to allow for more aggressive tuning on Pan and Tilt axes.

Control

While controlling TITAN LT via the Joystick input modules, users may adjust how joystick movement and position corresponds to their desired commands. For example one user may desire a smoother start and stop to their commanded movement, while another user desires more snappy feedback from the joystick regardless of start/stop smoothness.



Parameters explained

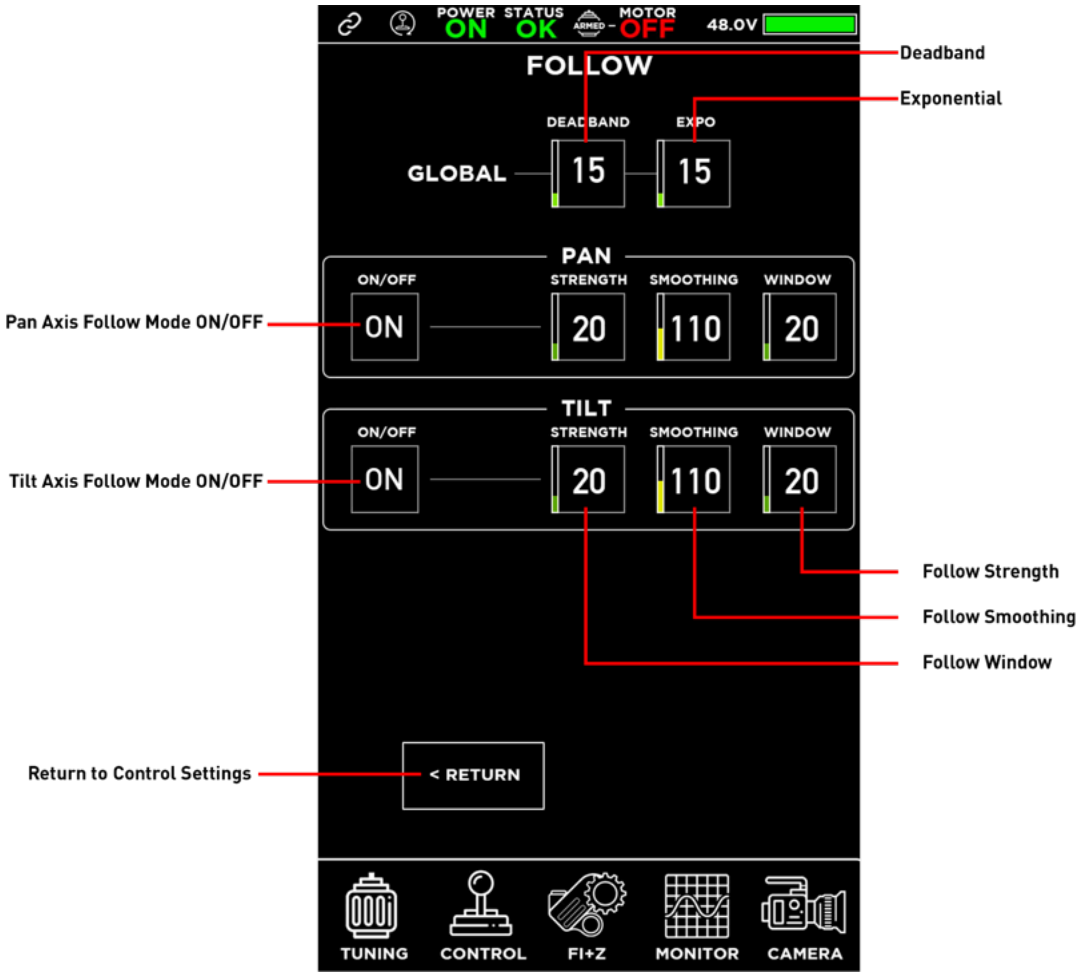
Smoothing - Averages current control input (ex. joystick position) with recent control inputs to create smooth motor commands. Low Smoothing values weight the current control input more heavily, whereas high Smoothing values weight recent control inputs more heavily. Low Smoothing values will feel more precise but "jerky" and may even overshoot the target; high Smoothing values will feel less responsive but smoother. **Medium values (60-100) are most common.**

Deadband - Creates a dead zone in the control input to prevent unintentional movement. High Deadband values require larger movements of the joystick before a motor command is generated. Some level of Deadband will usually be required in order to prevent unintentional movement or drift. Properly set Pan and Tilt Trim values will allow for the lowest possible Deadband. **Low values (5-10) are most common.**

Expo - Adjusts from a linear relationship (0) to an exponential relationship (255) between the control input and the motor command output. High Expo values retain the same maximum speed but allow for more precise low speed control through a wider range of joystick movement. High values allow for high maximum Speed values without losing low speed precision. **Medium values (50) are most common.**

Follow Mode

Follow Mode is used to assist the Pan and Tilt axes in tracking with the rotation of the support structure. Most commonly, Pan Follow is enabled so that the Pan axis follows the movement of a tracking vehicle. Follow Mode is fully configurable so that the movement produced meets the requirements of the application.



Parameters Explained

Deadband - Configures the range where support (e.g. Tracking Vehicle) rotation will ***not*** cause the gimbal to follow. Instead the gimbal will hold the current stabilized target until the support rotation exceeds the Deadband range. This parameter can be used to add delay, or smooth/ignore small jerks and movements in order to maintain a consistent frame despite small changes in support angles.
Low values (5-20) are common depending on the operation conditions.

Expo - Adjusts from a linear relationship (0) to an exponential relationship (99) between the angle exceeding the Deadband range proportional to each axis window range and the output motor commands. High Expo values will be configured with the same maximum speed at the Window edge as a low Expo value, but will allow for wider, more precise low speed range within the Window range. High Expo values allows for the gimbal to sufficiently follow at high angular rotation speeds with a high strength while retaining an adaptive low speed range for slower gimbal frame rotations. **Low values (10-20) are common.**

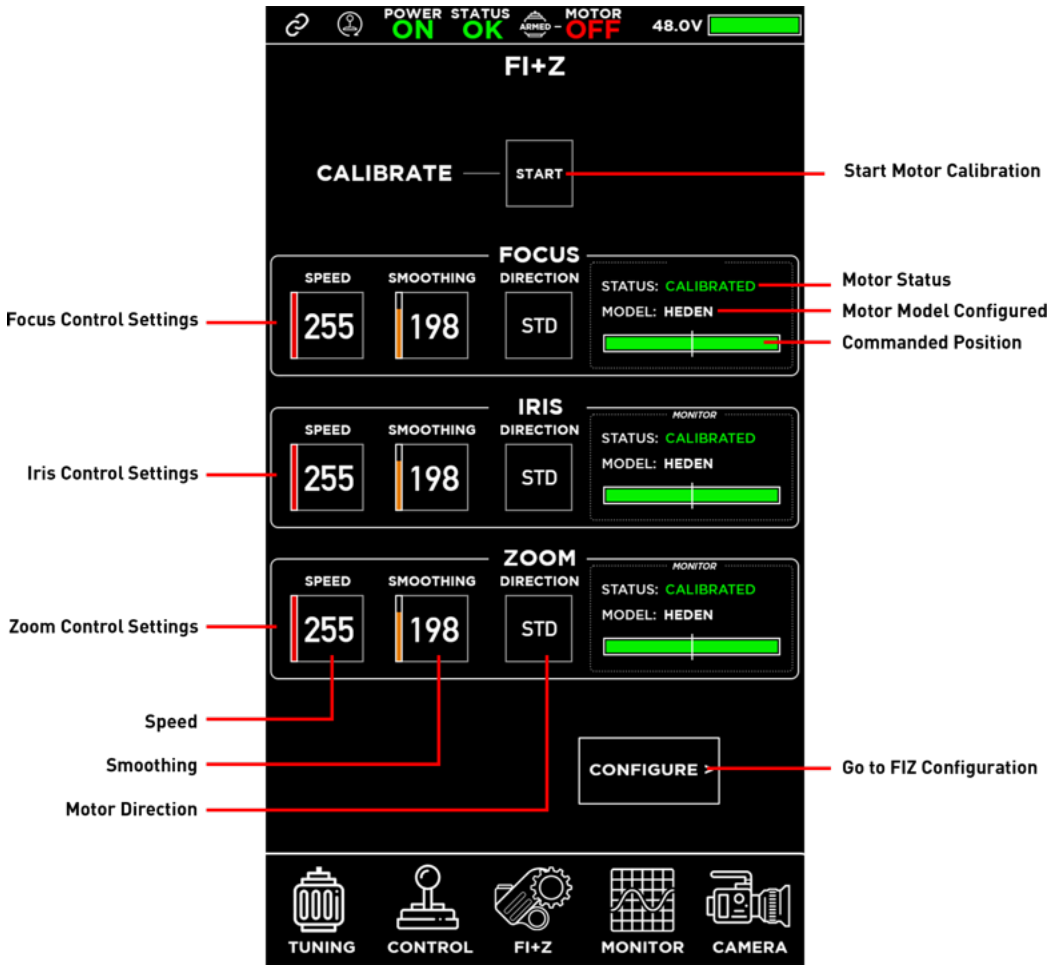
Strength - Sets the maximum motor speed that the gimbal will follow. This value is the set speed at the edge of the configured Follow Window. Any angular position of the gimbal frame exceeding the Follow Window will follow with this set speed. The optimal value for this parameter will vary depending on the application. **For high angular speed conditions, medium values (60-70) will ensure the gimbal can sufficiently follow while experiencing high speed rotations and turns.**

Smoothing - Averages the Follow movements to smooth the motor output commands. Low Smoothing values will cause the Follow to be more responsive, and potentially more "jerky". High Smoothing values will cause the follow control to be less responsive while being more smooth and resistant to "jerky" movements. **Medium values (50 - 120) are most common.**

Window - Adjusts the maximum amount, in degrees, that the axis will be allowed to deviate from the Follow target before maximum motor strength is applied. Low values will shrink the range at which the follow strength will ramp and will result with follow control being snappier; whereas high values will widen the follow strength range and allow for more variance and adaptability in follow strength at low speeds. **Low values (20-45) are most common with medium strength values.**

FI+Z (Focus, Iris + Zoom)

The FI+Z page contains Settings, Connection and Calibration status for each connected motor. When connecting FI+Z motors, you'll update each motor's Settings and Calibrate them from this page. The first time you connect a motor, it must be configured from the following FI+Z Configuration page before attempting calibration.



Parameters explained

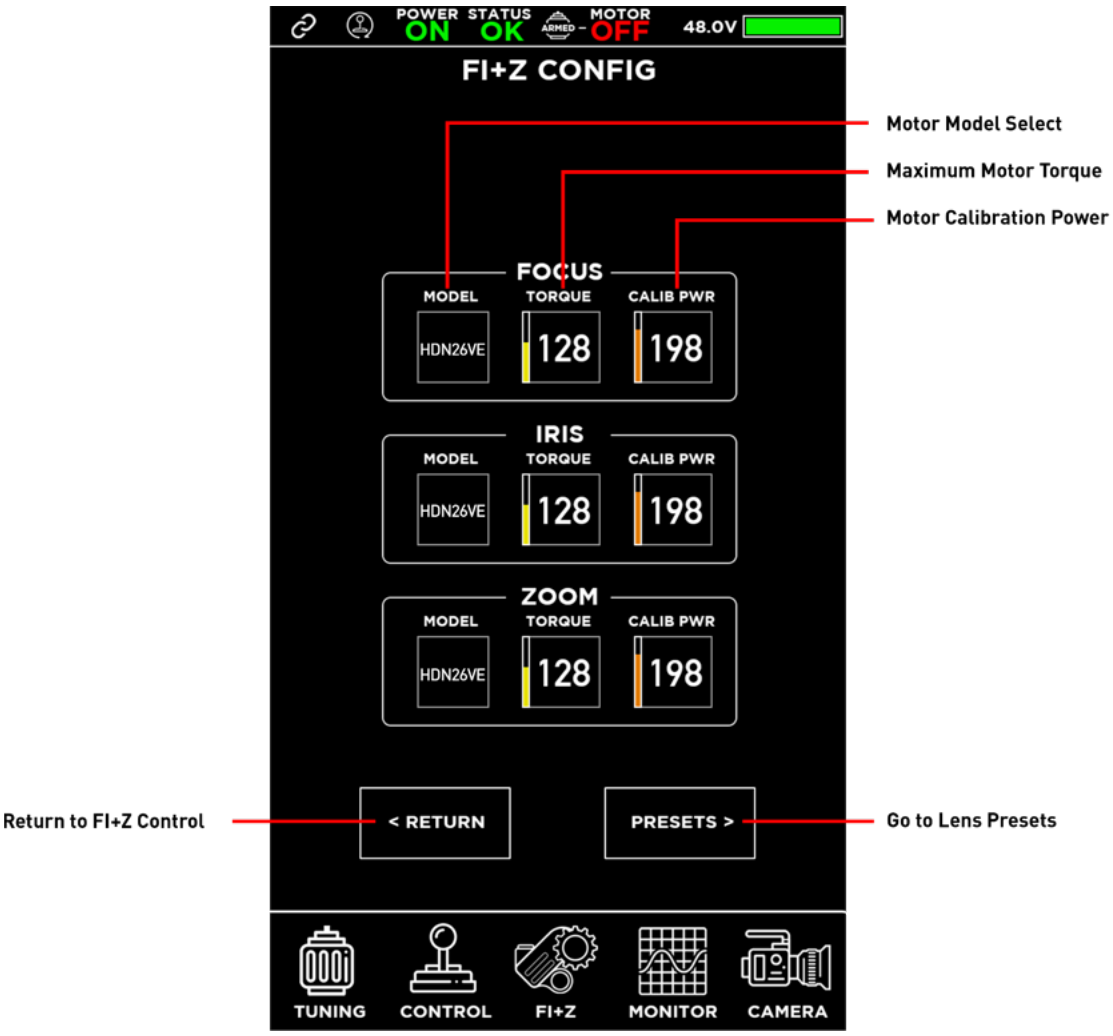
Speed - Controls the maximum allowable motor speed. Only available within the interface for Focus and Iris since there is a physical potentiometer for the Zoom Speed. High values (220-255) are most common for quick, responsive tracking of an input knob. When using a joystick, lower values may be preferred for more precise control.

Smoothing - Averages current control input (e.g. joystick position) with recent control inputs to create smooth motor commands. Low Smoothing values will feel more precise but "jerky"; high Smoothing values will feel less responsive but smoother. For precise tracking of an input knob, use low values (0-50).

Direction - Allows for inverting the direction of the control input. Toggles between Standard (STD) and Inverted (INV). This is often changed when a motor is mounted upside down, or when swapping between camera packages with motors mounted on either side of the lens.

FI+Z Configuration

The FI+Z Configuration page is used to configure which Motors are connected to TITAN LT, and the necessary Torque and Calibration Power for their operation. Appropriate “Torque” and “Calibration Power” values are determined based on how ***Loose*** or ***Stiff*** the rotating elements of the Lens being used are.



Parameters Explained

Model - Allows selection of which compatible Lens Control Motor is connected to TITAN LT. It is important that the correct Model is selected to avoid damage to motors or lenses. Supported Motors (v1.1 Firmware):

- MotoCrane LCM (Lens Control Motor)
- Hedén M26VE (both 256 and 512 encoder variants)
- Hedén M21VE (both 256 and 512 encoder variants)
- Preston DM2
- Redrock Torque Micro

Torque - Controls how much force the motor is allowed to apply. Lenses with stiffer rotating elements will require higher Torque values. Start with low/medium values, and increase only if required for the last stage of calibration to finish. Torque can be thought of as inversely proportional to speed, that torque should be raised to make extremely slow movements look smoother, and lowered when doing fast movements to reduce noise and potential overshoot of the target lens position.

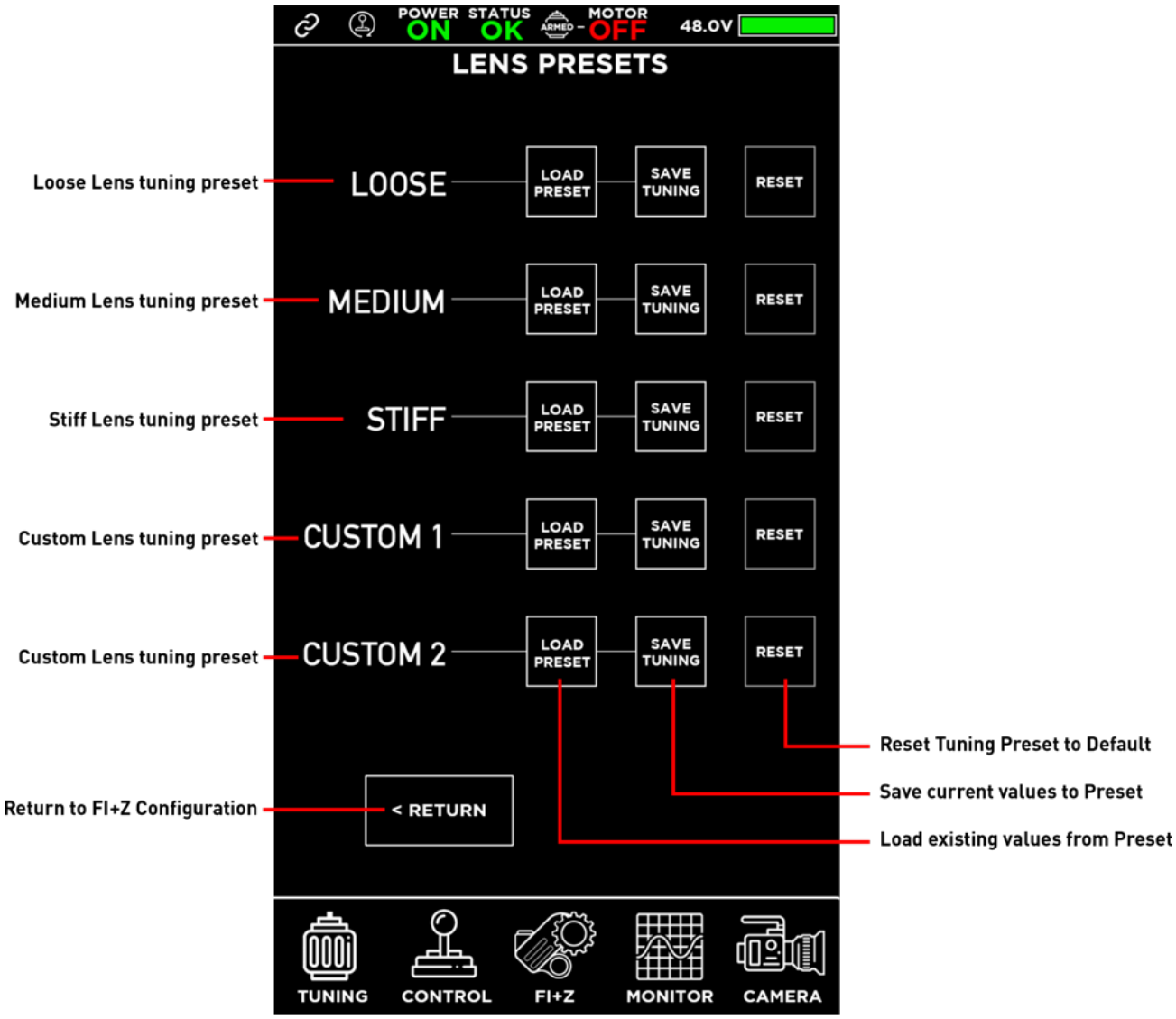
⚠CAUTION Higher torque values than necessary will produce more noise when operated at high speed.

Calib PWR - (Calibration Power) Controls how much motor power is applied during calibration. Stiffer lens rings will require higher values. If the calibration isn't turning the lens rings to their limit, or is getting caught on stiff points on the lens during calibration. increase Calib PWR incrementally until full range of motion is achieved.

⚠CAUTION If Calib PWR is set too high, motors can deflect slightly upon hitting endstops, causing the calibrated range to be larger than necessary, which makes the motor more likely to hit end stops with greater force during operation. For this reason Calib PWR should be set to the lowest setting capable of calibrating your lens.

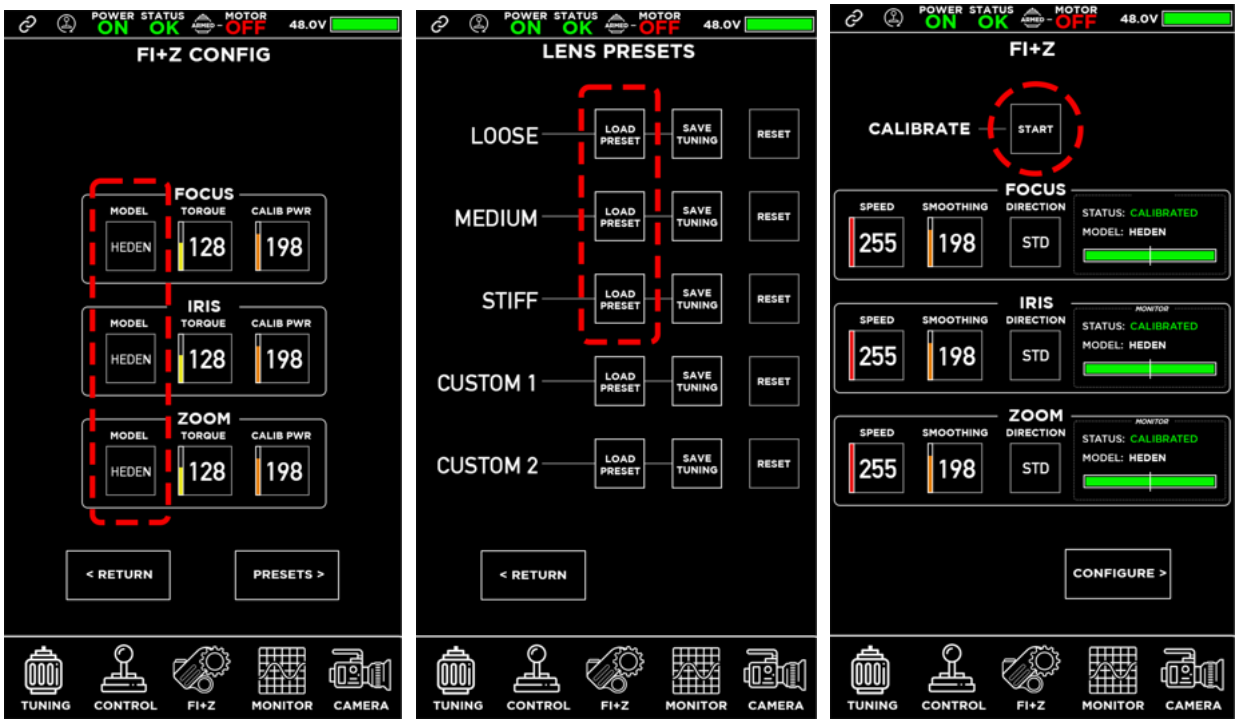
Lens Presets

For convenience, Lens Presets can be Loaded, which will set approximate values for "**Torque**" and "**Calibration Power**" on the previous FI+Z Configuration page. After a preset has been Loaded, and then adjusted following the Calibration procedure below, it may also be Saved as a Custom Preset for quick access later.



FI+Z Calibration Procedure

1) With compatible motors connected and **firmly engaged with the lens**, ensure the correct Model is properly configured in FI+Z CONFIG.
2) Go to LENS PRESETS and select the appropriate preset for your lens being used. For example, older Zoom lenses may have very freely rotating elements (Loose), while new Prime lenses with shorter throw may require more force to rotate (Stiff). NOTE: Extreme temperatures changes will affect the mechanics of a lens (such as extreme cold making the lens much more stiff to rotate). If you are unsure, select Medium.
3) With Model and Lens Preset selected, return to FI+Z and press CALIBRATE.

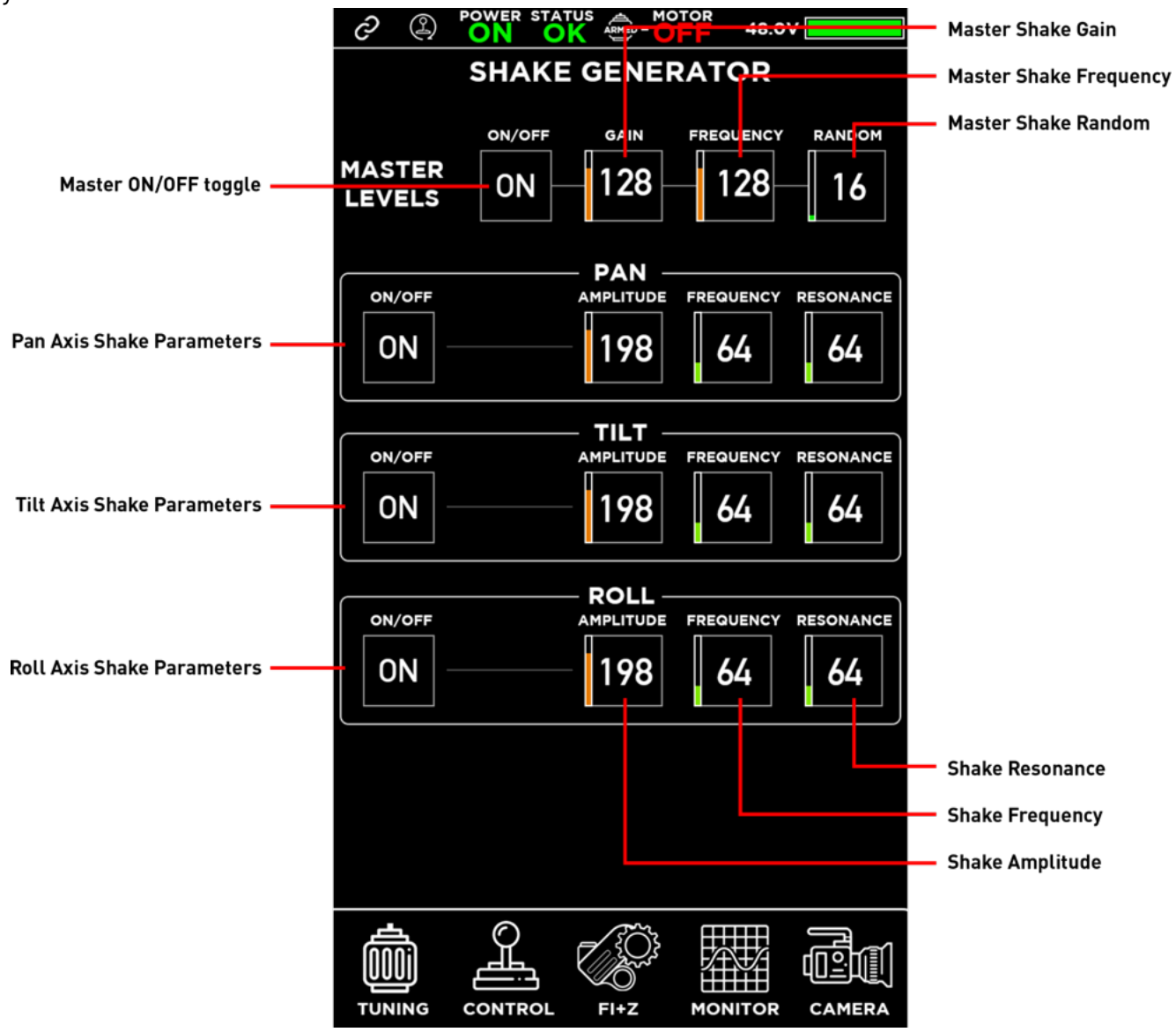


4) If a motor fails to reach both endstops in calibration, go to FI+Z Config and ensure there is sufficient CALIB PWR, then return to FI+Z and press CALIBRATE again. If a motor successfully reaches both endstops of the lens, but there is a CALIBRATION FAULT, increase the TORQUE value and CALIBRATE again.

⚠CAUTION For best results use the minimum CALIB PWR necessary to calibrate your lens.

Shake Generator

Shake Generator is a feature that intentionally de-stabilizes the image, in a controlled manner, to create a certain dramatic/creative effect. Shake Generator is fully-customizable so that the Shake matches the desired characteristics and is present only on the desired axes.



Parameters explained

Master Levels - These are the settings applied to the complete Shake Generator effect.

On/Off - Toggles complete Shake Generator effect ON/OFF.

Gain - The Master Gain, which amplifies or minimizes the complete Shake Generator effect.

Frequency - The Master Frequency at which the complete Shake Generator effect is applied. Lower values will slow down the occurrence (deflections per second) of the Shake, while Higher Values will increase the occurrence.

Random - Adds random mix into the deflections, which helps the Shake appear more organic

Pan/Tilt/Roll Axis Levels - These are the Shake settings applied to an individual axis.

On/Off - Toggles Shake Generator effect ON/OFF for that axis only.

Amplitude - How far the deflection (Shake) moves away from the neutral Target.

Frequency - How often the deflection (Shake) occurs.

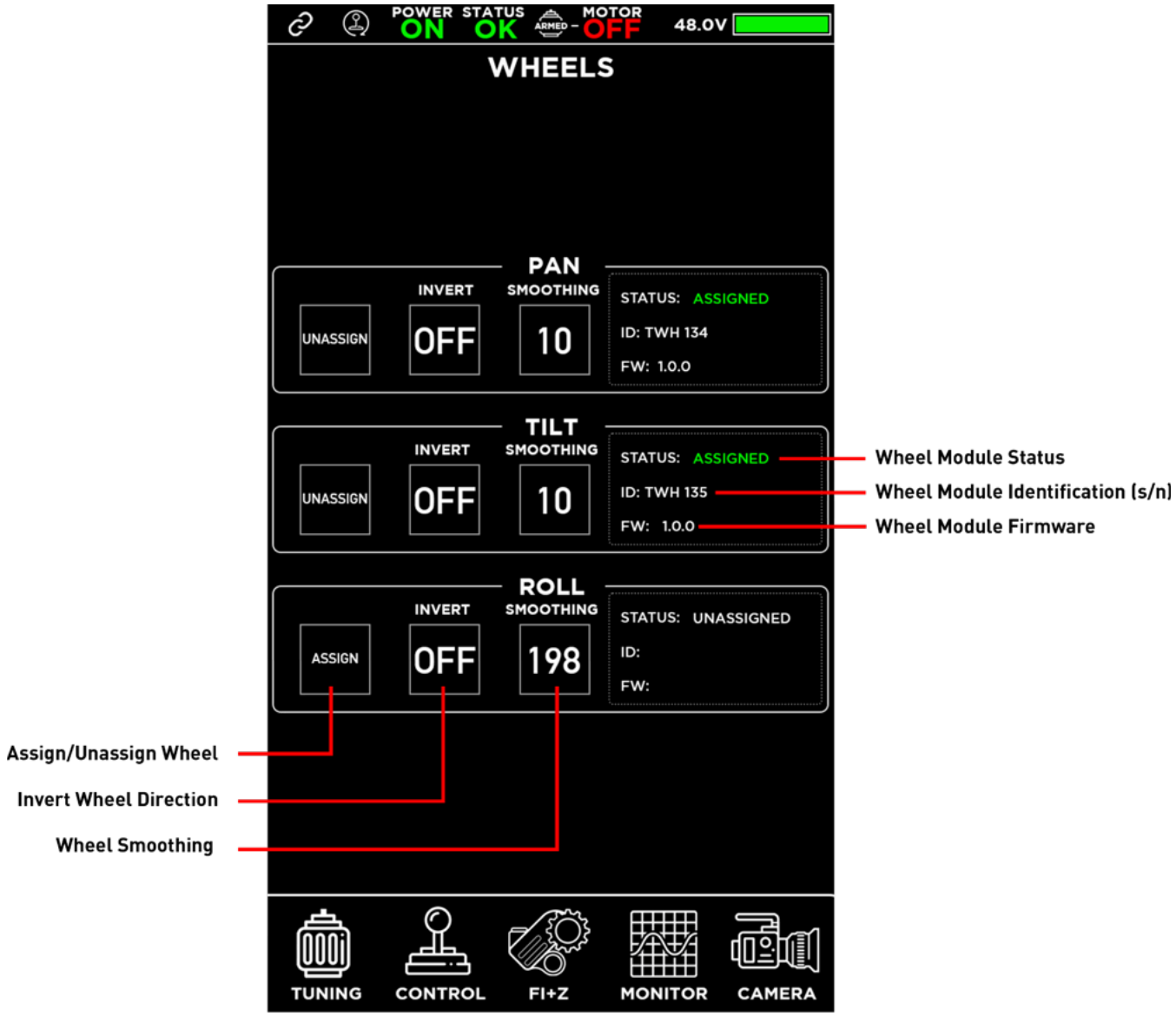
Resonance - Adds "reverb" at the end stop of each movement which looks more organic.

NOTICE **Shake Generator utilizes motor power, which consumes energy and generates heat, to create the Shake effect**. Depending on payload mass/inertia and Shake Generator configuration, motors may prematurely overheat and require periodic cooling before re-use. Excessive use may also lead to decreased battery life.

⚠CAUTION Shake Generator physically shakes the payload/camera package. Ensure that all aspects of the payload are securely fastened and that the shaking effect will not cause any aspect of the payload to become loose or detached!

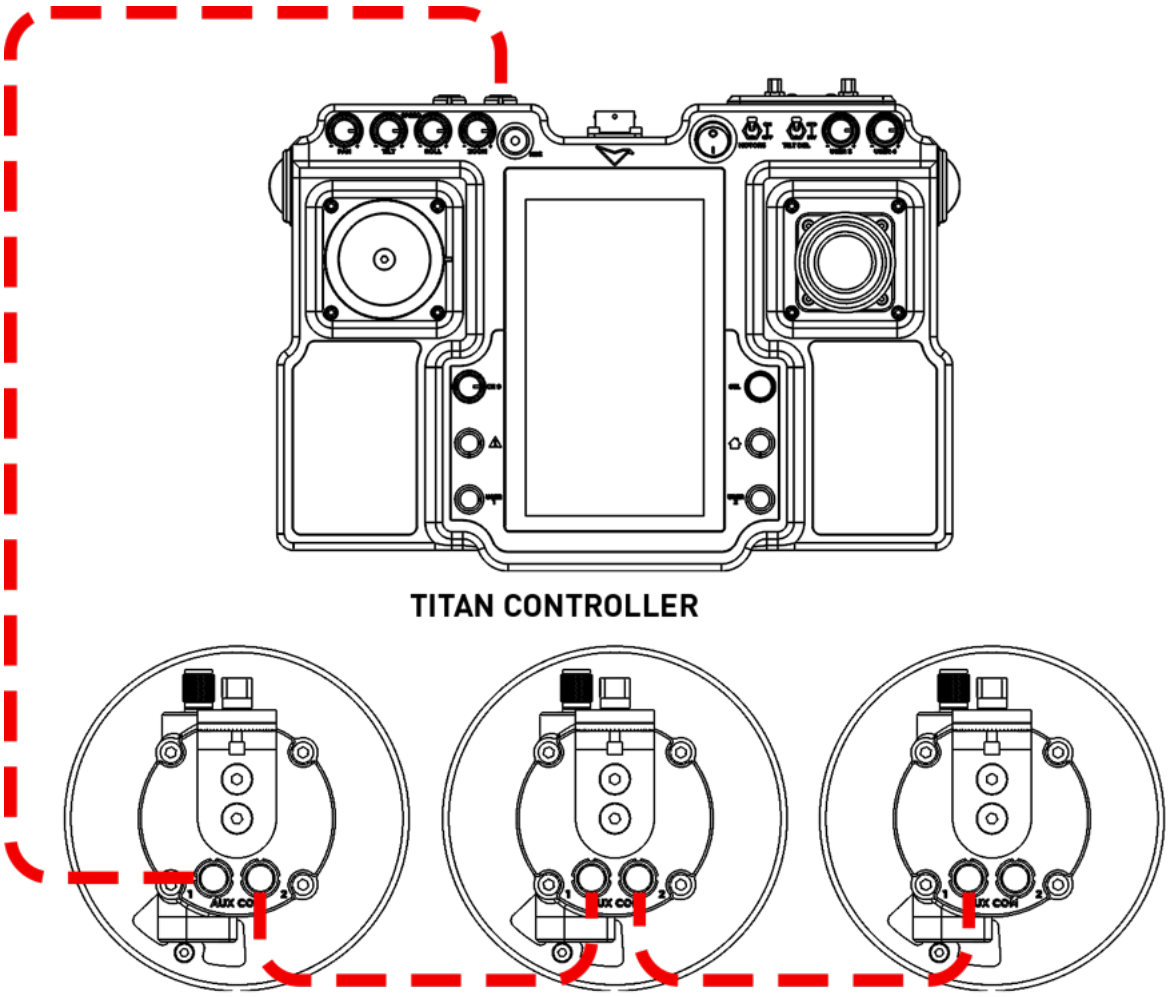
TITAN Wheels

TITAN Wheel modules allow users to control TITAN LT like a classic geared head, offering more precision and separated axis control when compared to a dual-axis joystick. The wheels page is used for setting up and configuring your TITAN Wheels.



Wheels Setup

With the TITAN Controller ***OFF***, connect a **TITAN Wheels Cable** from the AUX COM Port on the Controller to an AUX COM port on the 1st TITAN Wheel (it does not matter which Wheel, or if you use AUX COM "1" or "2"). Using the remaining AUX COM port on the 1st TITAN Wheel, plug another TITAN Wheels Cable in and connect its loose end to the 2nd Wheel in your daisy-chain. Continue this if you're using a 3rd wheel. Turn the TITAN Controller ***ON*** and navigate to the Wheels page.

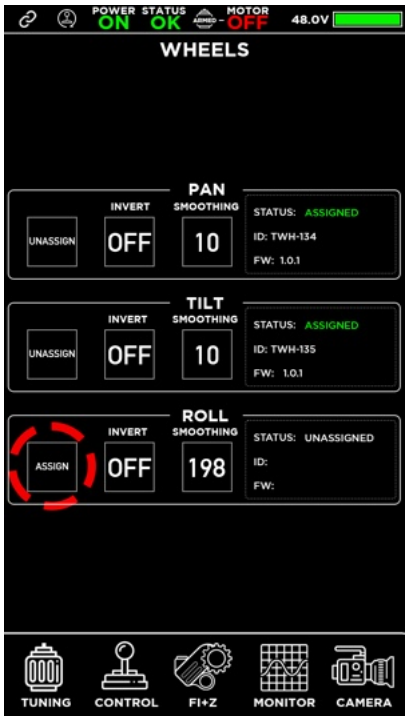


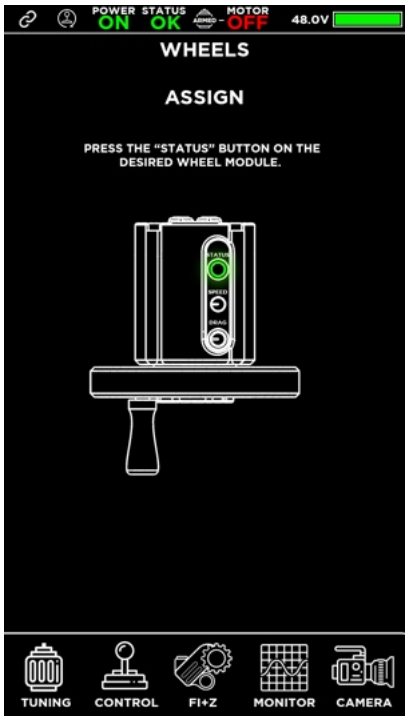
TITAN CONTROLLER

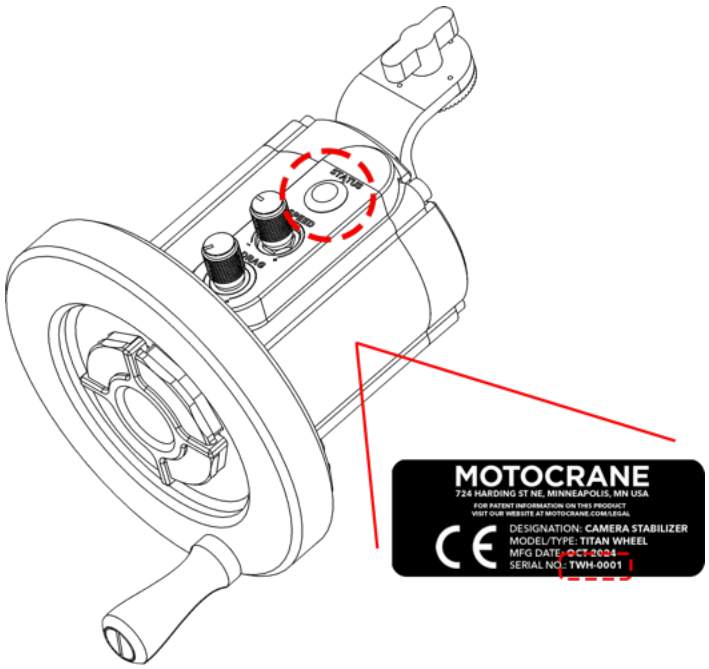
TITAN WHEEL MODULES

On the first connection, all wheels "Status" should display "UNASSIGNED"- meaning they have not been assigned to control any axis.

Press “ASSIGN” for an axis which you would like to assign a wheel to, and the Status LEDs on each connected Wheel Module will begin flashing. Press the Status button of the Wheel that you would like to assign to that axis, and it will stop flashing once assigned.







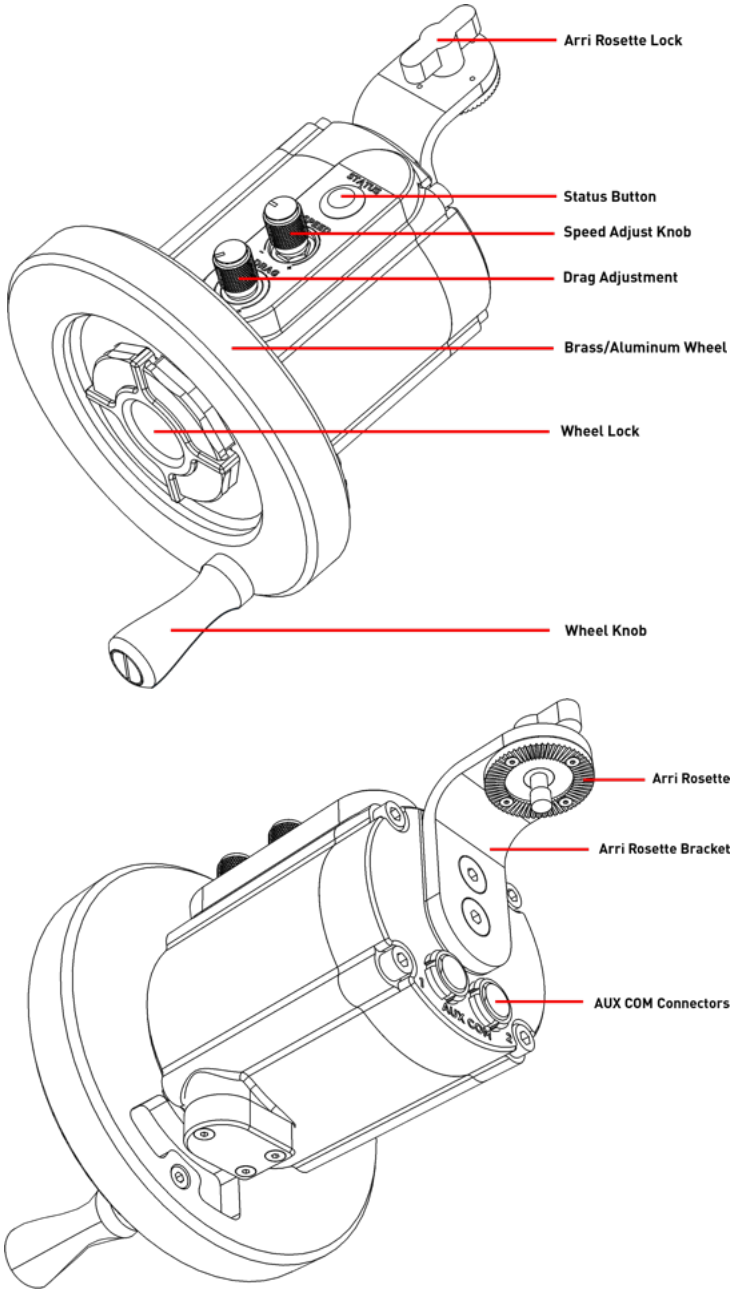
Repeat this process for each connected Wheel. Each TITAN Wheel Module has a designated ID/Serial number programmed into it and **labeled on the side of the module**.

Configuring TITAN Wheels

Speed (Gear Ratio) - When an axis has a TITAN Wheel assigned, the speed of its movement is adjusted on the Wheel Module itself. The maximum speed (or gear ratio) for a TITAN Wheel is 10:1, and the minimum speed is 2000:1. *(Wheel Rotations:Axis Rotation)*

Drag - Each TITAN Wheel has a mechanical drag mechanism, which adds fluid resistance to the rotation of the wheel for assisting with more precise movements.

Status (Pause) - During regular operation, the Status button can be pressed to pause its commanded output, and pressed again to resume output. This feature is most commonly used to move Wheels to a desired position without moving TITAN LT.



Using NODO Inertia Wheels

Using the **MotoCrane Serial Adapter**, connect the NODO Inertia Wheels in the desired configuration. The MotoCrane Serial Adaptor has 2 different mounting options for attachment to the TITAN LT Pan Housing, Basebar, Inertia Wheels, or floating/hanging in-line.

SETUP: On the Inertia Wheels, Navigate to Menu>Output>Signal Path. If connected directly from the Inertia Wheels to the TITAN Controller, Select "**AUX UART**". If you are using the NODO Wireless Receiver (connected to either the TITAN Controller, or directly to TITAN LT), select "**Wireless**". If you are connected from the Inertia Wheels to the NODO Wireless Receiver via the cable included with your Inertia Wheels, and then Connected from the Wireless Receiver to the TITAN system, Select Wired.

Upon successful connection of the MotoCrane Serial Adapter to the NODO Inertia Wheels, Both PWR and COM lights on the MotoCrane Serial Adapter will be illuminated (solid)

USING MOTOCRANE SERIAL ADAPTER STATUS LIGHTS

- If Green is Solid but Blue is not lit at all - the Inertia Wheels are not sending data to the Serial Adapter properly. Check your settings on the Inertia Wheels, and confirm that your cabling is properly connected.
- If Green is Solid but Blue is blinking - the Inertia Wheels are sending data to the Serial Adapter but the Serial adapter is not connected to a TITAN. Make sure that your TITAN is powered on and check your AUX COM cable connection.
- If neither Green nor Blue lights are on, your Serial Adapter is not getting proper power. This is almost certainly a cabling issue between your TITAN system (Controller AUX COM port, TITAN CAM port, or TITAN COM port) and the Serial Adapter. Try different cables or a different configuration (If connected to a Controller, try connecting to the CAM or COM ports on TITAN, for example).

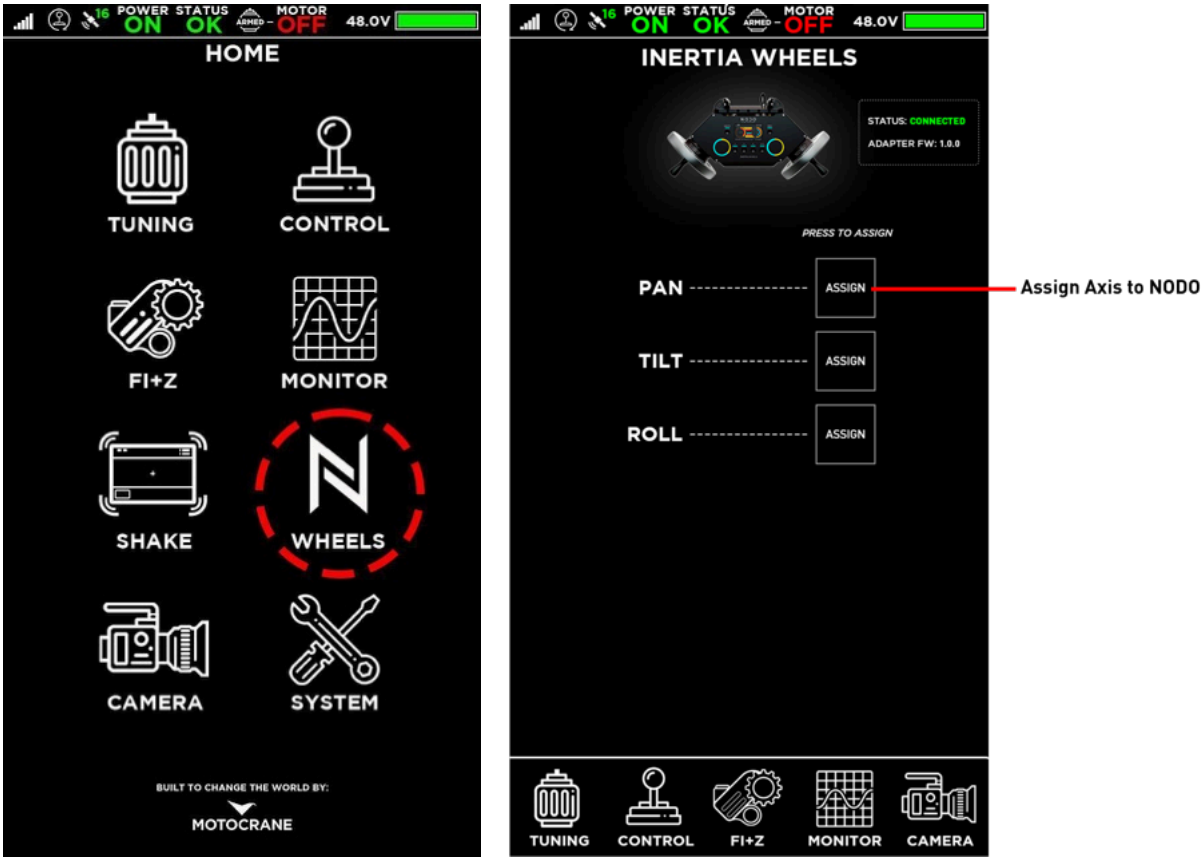
Once the Inertia Wheels are successfully connected to TITAN LT, the screen of your Inertia Wheels will look roughly like this:

In the top center, connection status is displayed. If your TITAN LT is currently in an OKAY, ERROR or WARNING state, the subtext will read OK, ERR or WRN, respectively.

SHORTCUTS: Via Menu>Dashboard, you can select up to 4 of the following LT User Assignable shortcuts to be displayed on your home page:

- MOTOR ON/OFF - Toggle LT motors on/off state from your Inertia Wheels
- HORIZON LEVEL - Level TILT and ROLL axes to the Horizon.
- ROLL LEVEL - Level ROLL axis to the Horizon. You should use *this* ROLL Level shortcut instead of the ROLL level command built into the Inertia Wheels.
- STAB ON/OFF - Toggle Gyro Stabilization On and Off. This is the same setting that is available in the "TUNING" Page of the TITAN Controller.

Once the NODO Inertia Wheels are connected (both lights on the Serial Adapter are solid) the WHEELS icon on the TITAN Controller Home Screen will be replaced with the NODO icon. Navigate to this screen and tap Assign on each axis that you want to assign.



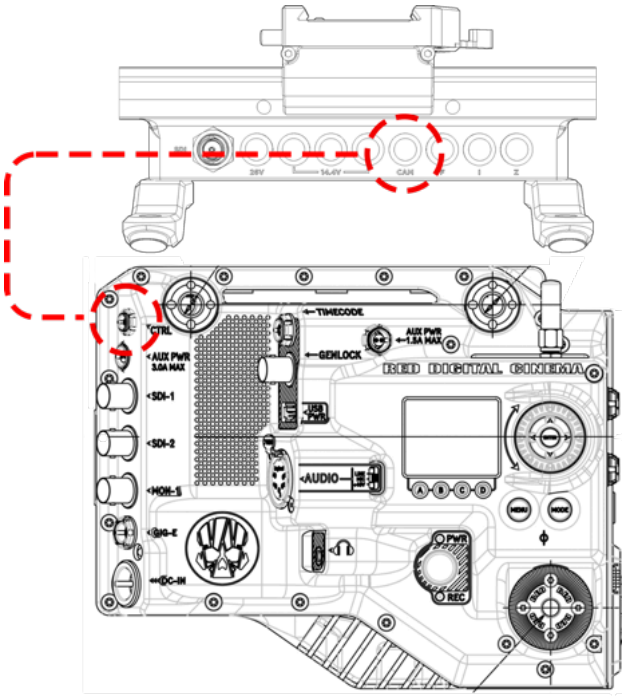
After axes are assigned to the NODO Inertia Wheels, you can configure their settings via the NODO Inertia Wheels directly.

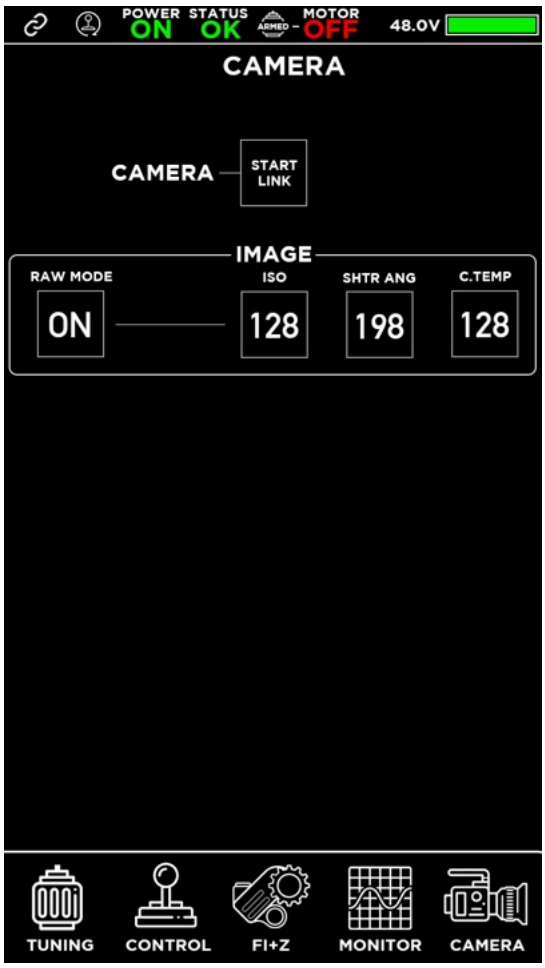
To UNASSIGN from the Inertia Wheels, simply re-map the corresponding control using **CHANNEL MAPPING** or **WHEELS**. Assigning a new control to an axis assigned to the Inertia Wheels will automatically unassign the Inertia wheel from that axis, without needing to manually un-assign. Your Inertia Wheels assignments are persistent across power cycles, and stored on the Controller, so they can be saved and restored using Controller Profiles.

Camera

The Camera page is used for controlling compatible cameras and their accessories while they're connected to the "CAM" port on the IMU Housing. To setup, plug the required cable for your camera in the "CAM" port on the bottom of the IMU Housing, and click "Start Link"

You can find available Camera Control cables **HERE**





Camera Control Compatibility

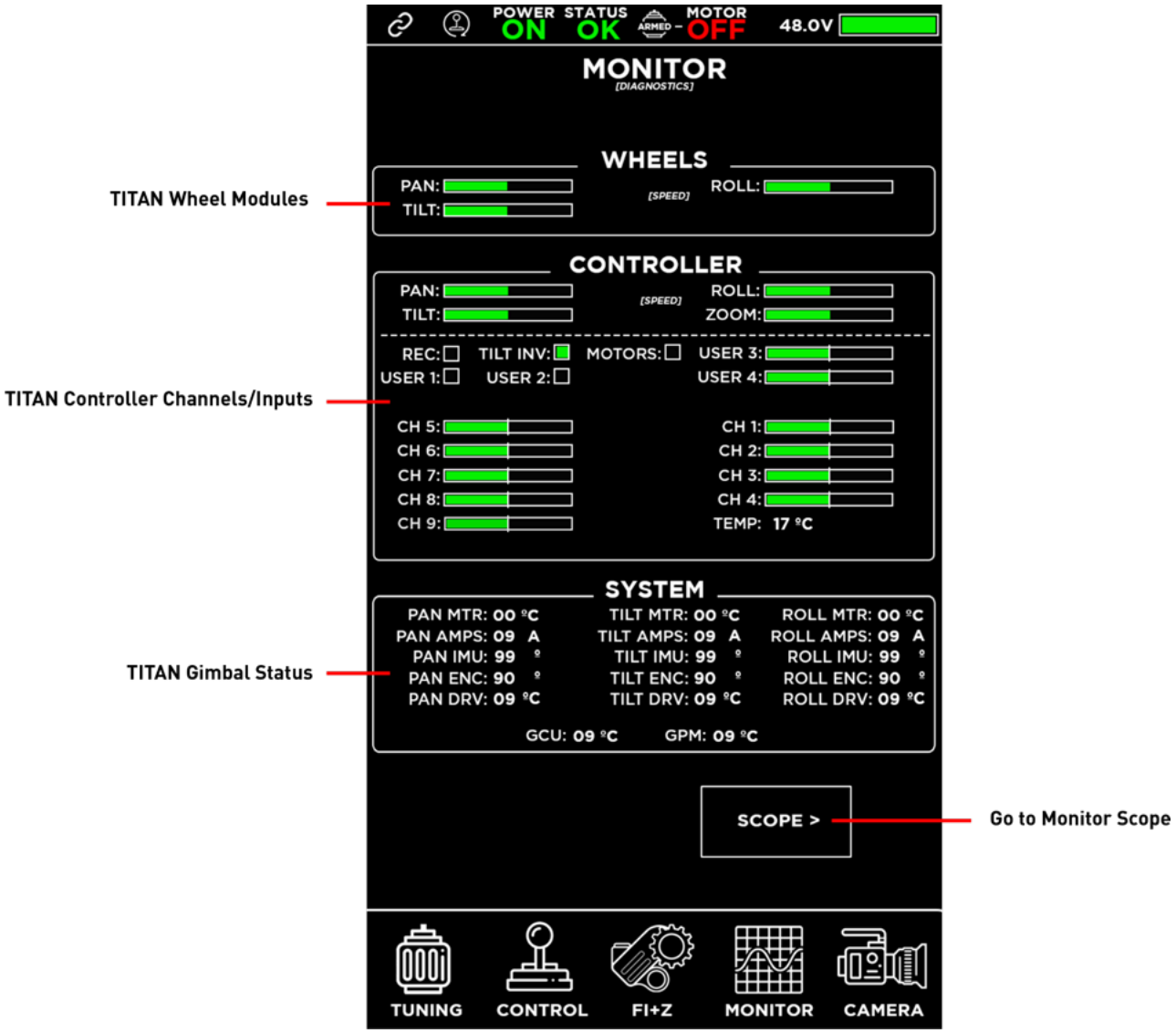
The following ©RED DSMC2 cameras are currently supported *(TITAN Firmware v1.1+):*

- RED Epic, Weapon, Ranger

Monitor

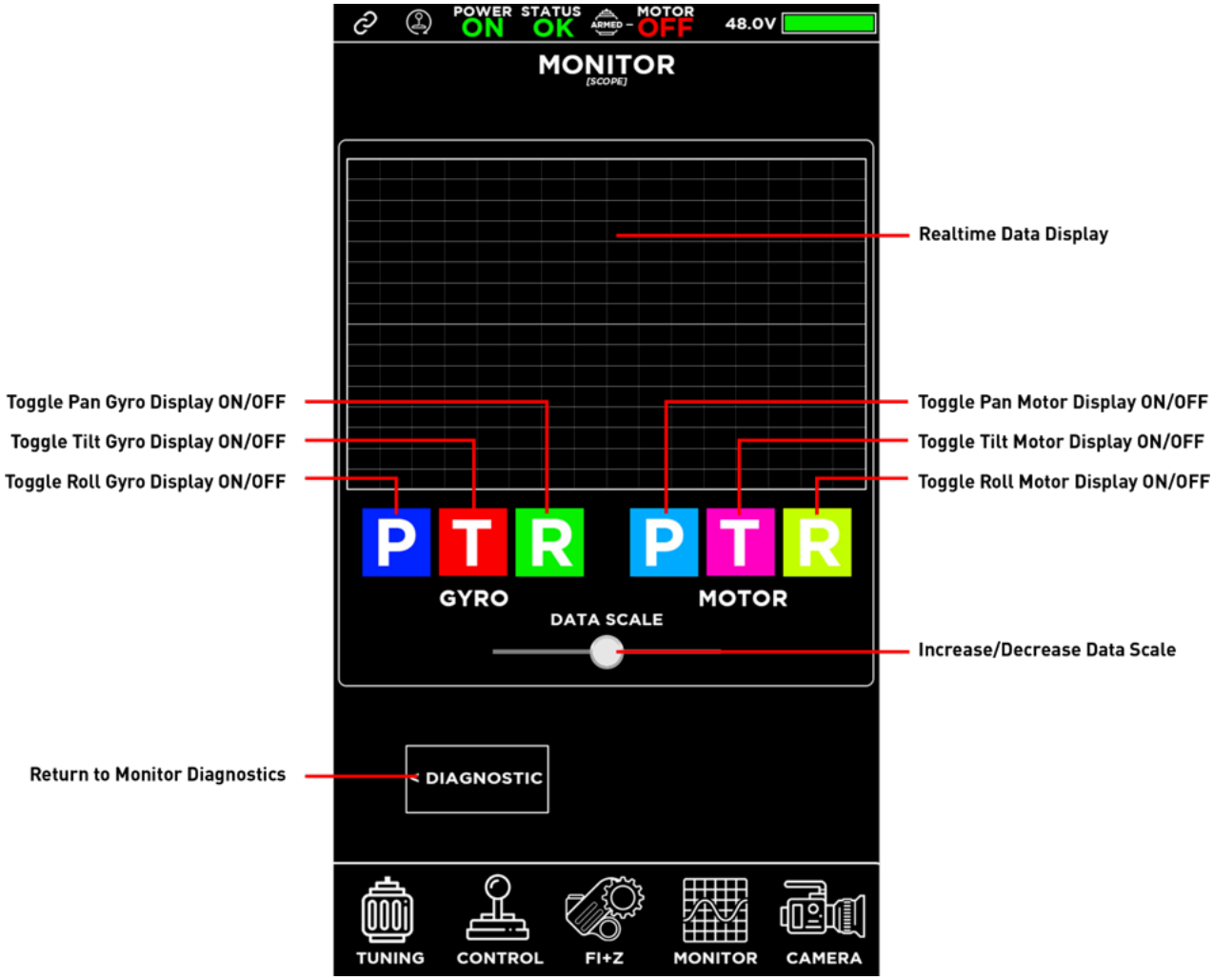
Diagnostics

Monitor contains real-time status information about TITAN LT, the TITAN Controller and connected modules like TITAN Wheels. You can use this page for diagnosing, troubleshooting, and also monitoring critical system performance.



Scope

Scope is used for monitoring the stabilization performance of TITAN LT in real-time. Users can select specific axes and toggle between displaying gyro rate and motor power for each axis. This is particularly useful when determining which axis is causing a noted symptom during operation.



How to use Scope

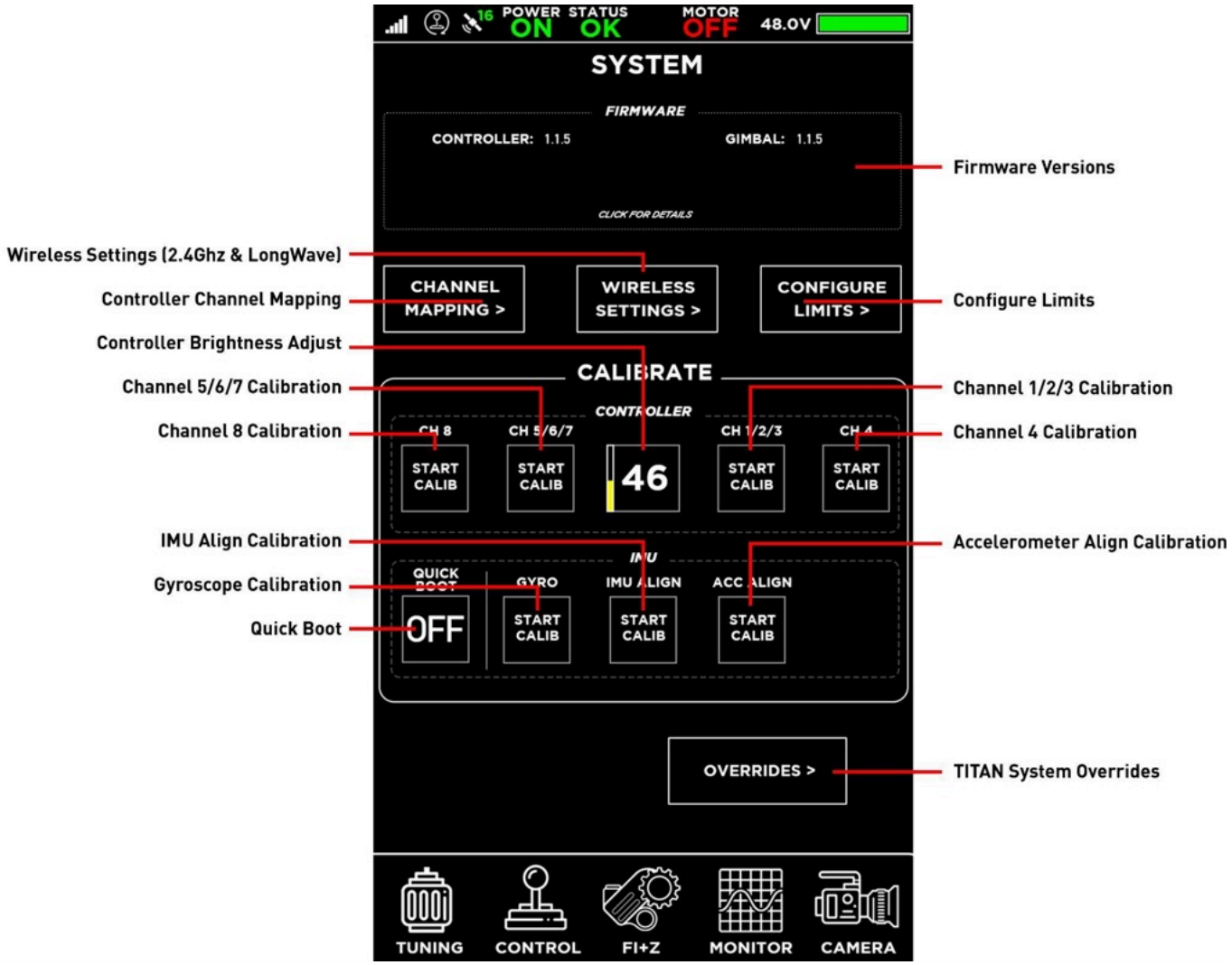
Gyro – The rotation rate of an axis. A smooth line indicates no rotation (or shake). A bumpy line indicates that the axis is shaking.

Motor - The power generated by the motor on each axis. A smooth line indicates that no/low power is being used A bumpy or elevated line indicates power consumption.

Data Scale - Used to increase/decrease the size of Realtime Data displayed in the scope.

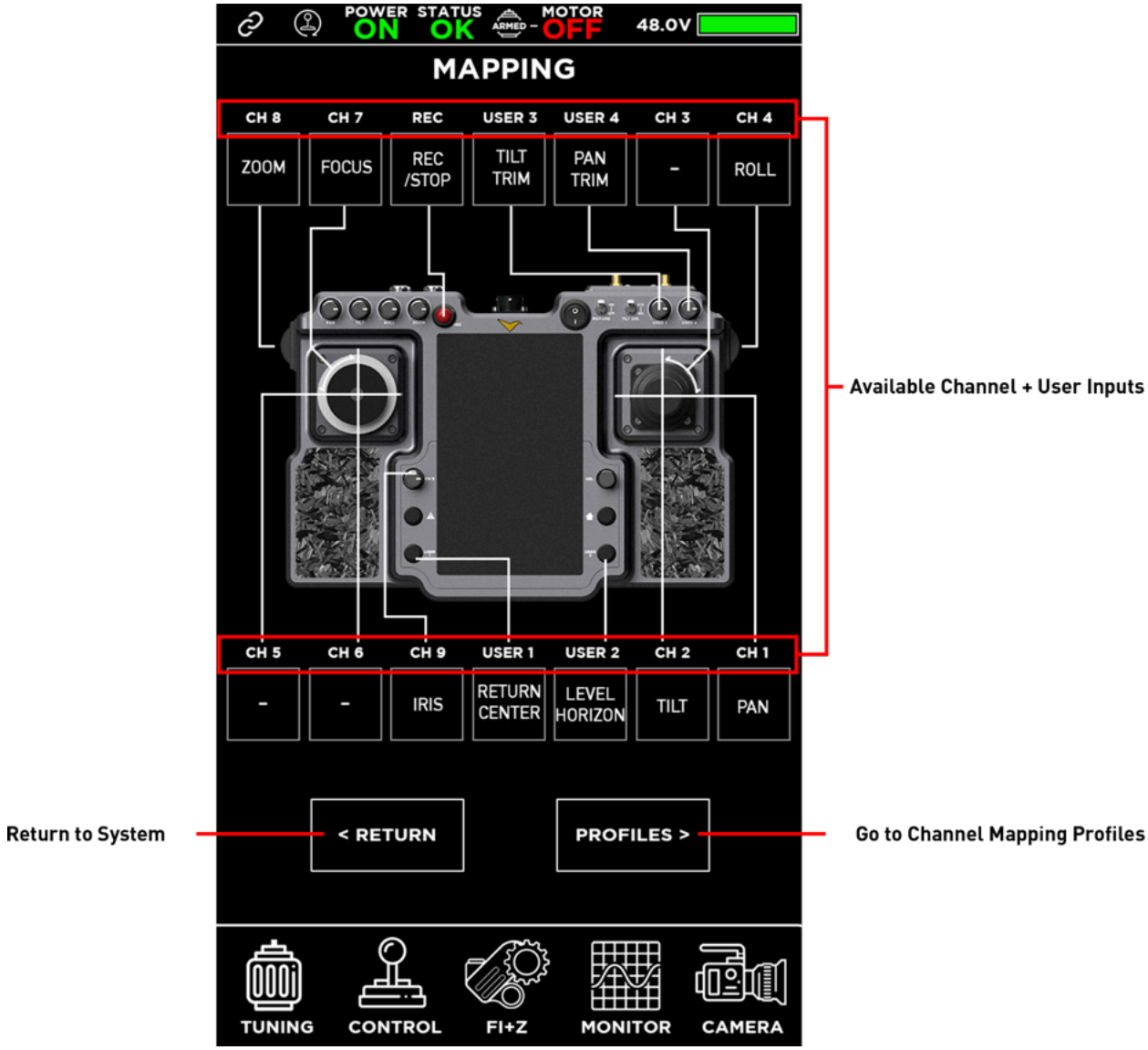
System

System is used for general system information, configurations of Channel Mapping, Wireless Settings, Limits, Calibrations, and also access to physical system Overrides that are helpful when TITAN LT is inaccessible to a user.



Channel Mapping

Channel Mapping allows the user to map (assign) TITAN LT controls/commands to the desired channels of their choice. The Channels available on this page will update in real-time to represent the installed Input Modules (Single axis joystick, Dual axis joystick, or Focus Wheel).

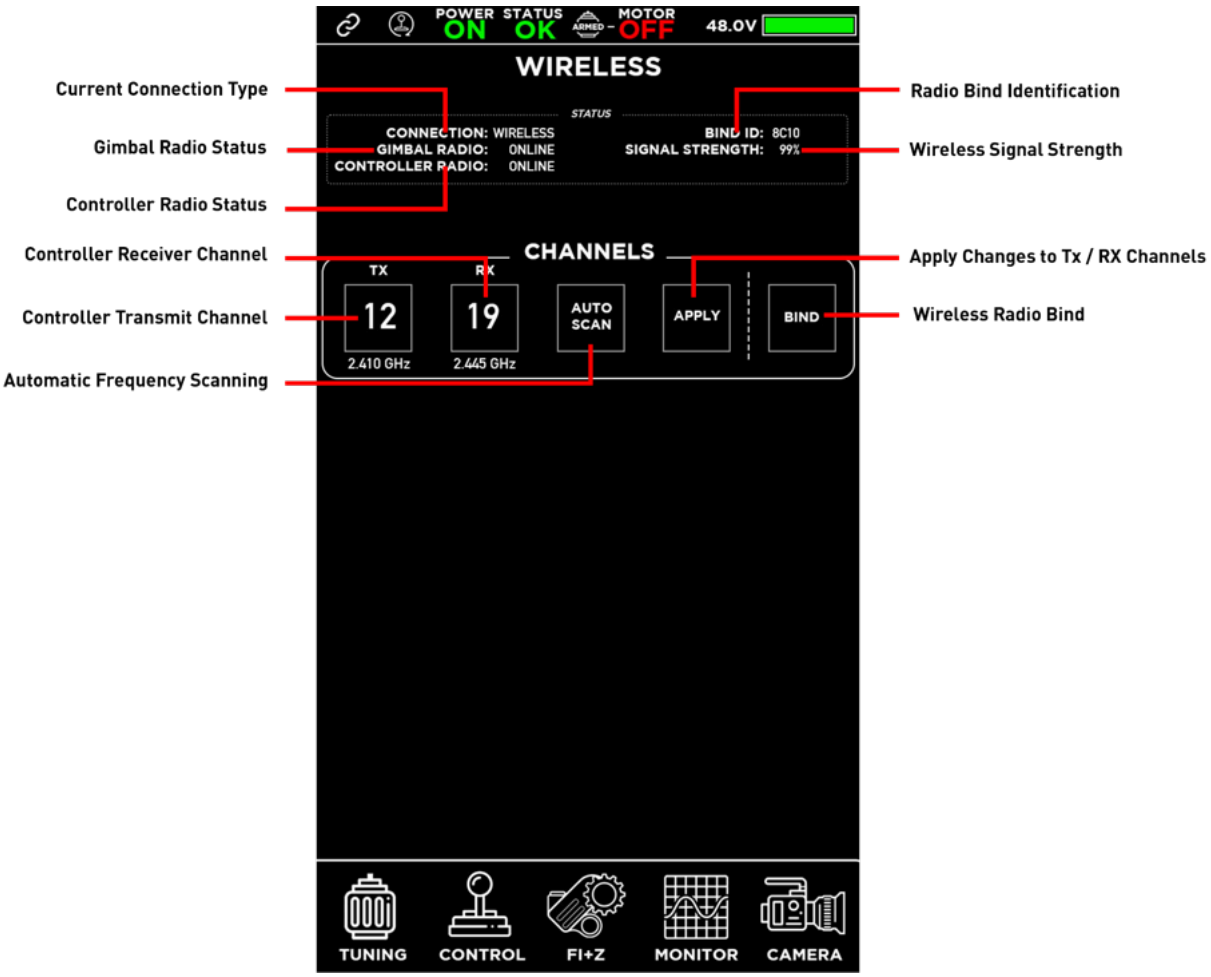


With the desired Input Modules installed, simply press a Channel or User button, then scroll through the list of available controls/commands and press “Select” on the desired option.

NOTICE Channel Mapping User Profile must match the installed Input Modules in order to function.

Wireless Settings *(standard 2.4Ghz)*

Depending on any RF (Radio Frequency) congestion/traffic present between TITAN LT and the TITAN Controller, users can manually set the Tx and Rx channels. Additionally "AUTOSCAN" can be used to determine optimum (uncongested) channels for wireless operation.



Parameters Explained

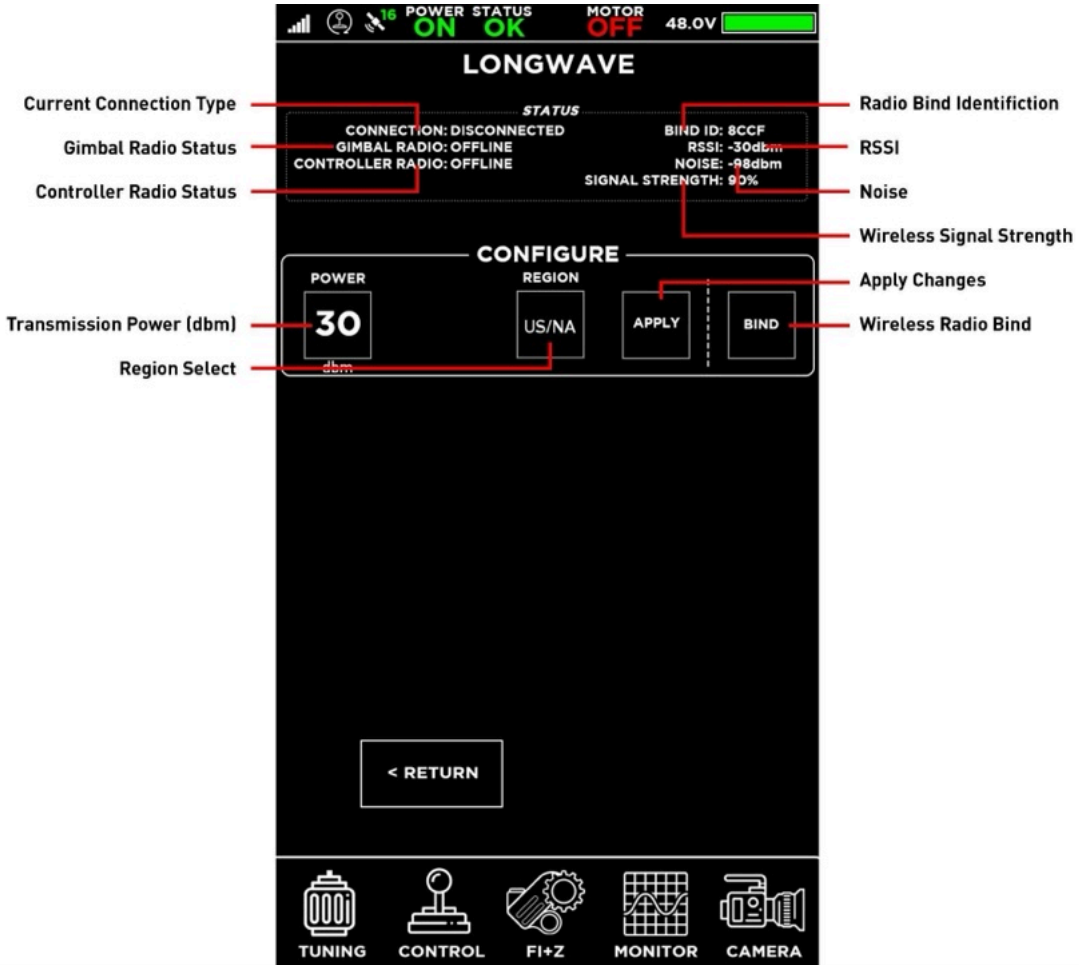
Tx/Rx - Channels can be selected from 1 - 19 (2.401 - 2.495Ghz) After adjusting, the new UNSAVED values will be displayed in **YELLOW** until you press **APPLY.**

Auto Scan - The Controller Rx is used to analyze Radio Frequency congestion and determine channels with the least congestion/traffic. After Auto Scan is complete, the new UNSAVED values will be displayed in **YELLOW** until you press **APPLY.** Auto Scan is recommended if you're experiencing poor signal strength within close operating distances

BIND - Only used when a Wireless Module is replaced from the factory pairing. To bind, ensure both Wireless Modules are installed in both the TITAN Controller and LT. Then, connect the TITAN Controller to LT using a COM Cable, and power ON the TITAN Controller and LT. Finally, navigate to SYSTEM > WIRELESS SETTINGS and press "BIND". The Bind will generate a unique RADIO BIND ID displayed in the upper right corner.

Wireless Settings *(LongWave)*

The TITAN Controller will auto-detect the LongWave radios once installed *(fw 1.1.5+)* and display the appropriate configurations/settings.



Parameters Explained

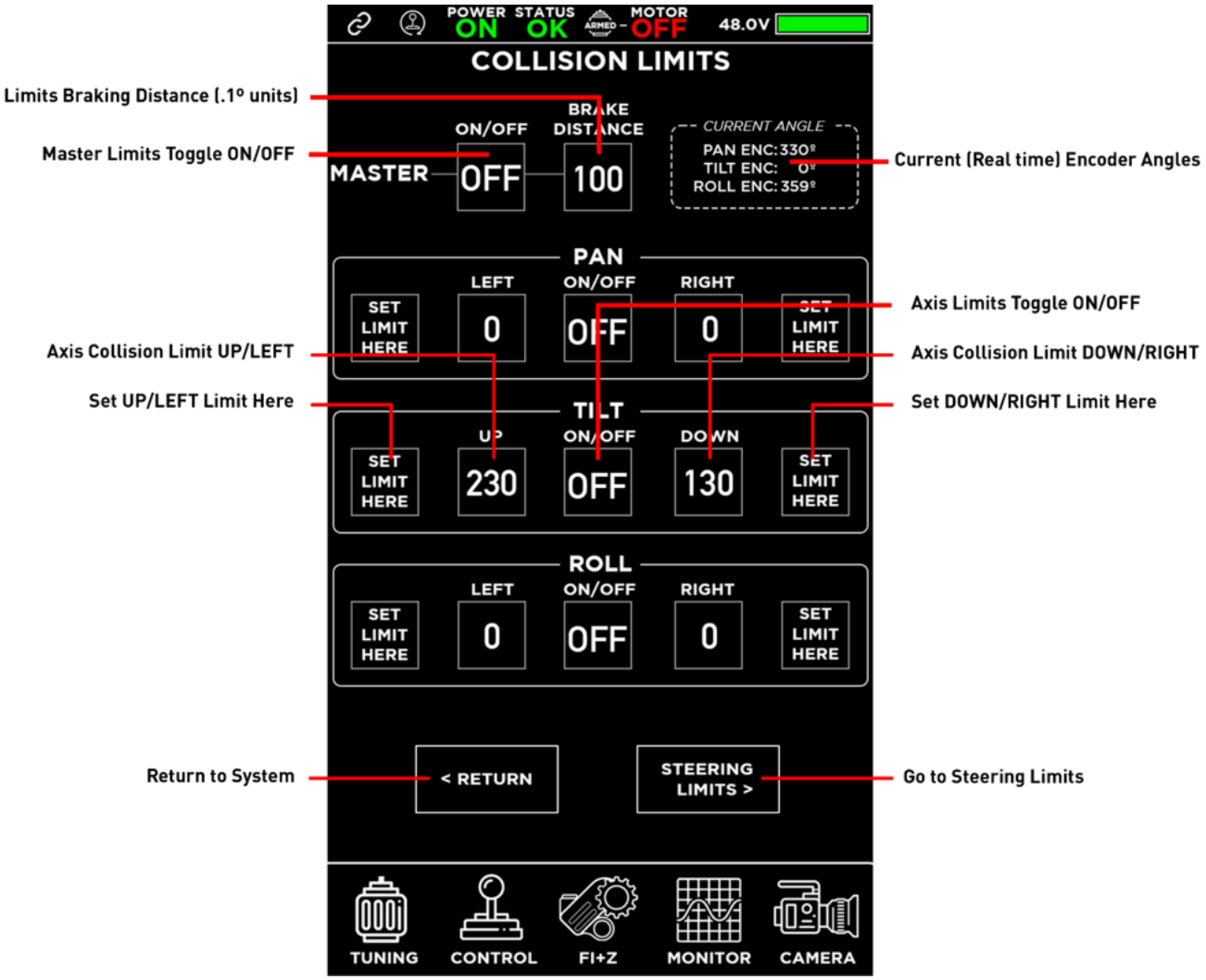
Transmission Power- Adjusts the Transmission power (in dBm) of both radios. Outdoor applications will likely benefit from higher/highest Gain ("30"), while indoor applications may perform better with lower power levels of "20-25". If you're experiencing worse wireless performance at a closer range, reduce Transmission Power.

Region - *MUST BE PROPERLY CONFIGURED FOR YOUR REGION to comply with local law and regulations!* Adjusts the total bandwidth available to LongWave during frequency hopping.

Bind - Used when a Wireless Module is replaced or binding is lost from the factory pairing. To bind, ensure both Wireless Modules are installed in both the TITAN Controller and GImbal. Then, connect the TITAN Controller to the Gimbal using a COM Cable, and power ON the TITAN Controller and Gimbal. Finally, navigate here (SYSTEM > WIRELESS SETTINGS) and press "BIND". The Bind will generate a unique RADIO BIND ID displayed in the upper right corner.

Limits

Limits (or "End Stops") are used to help an Operator not exceed a certain range of motion during operation. Limits may be configured and turned ON/OFF for each axis.



Due to the nature of stabilized systems, there are two types of Limits available:

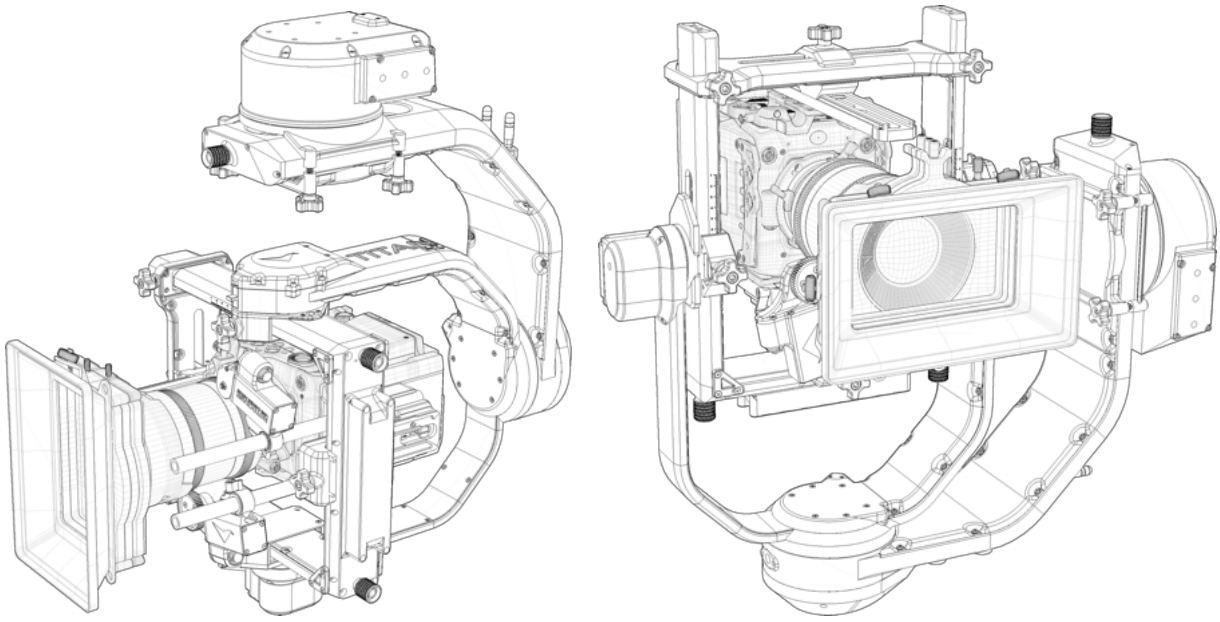
Collision Limit – This is applied to the rotating joint of an axis, using ***ENCODER*** data, usually configured to help prevent Collision of the Payload with LT or the LT with the support structure.

Steering Limit – This is applied to the stabilized angle of the axis using ***IMU*** data. This is commonly desired since it is what's viewed through the camera. Because these limits are IMU/Gyro-based, they may not be used when GYRO STAB is turned OFF.

Example: A long payload, with a large matte box, is installed.When Tilting UP the large matte box makes contact with the TITAN LT Spine at extreme angles (60º). ***Collision Limits*** *should be configured on Tilt to prevent the contact during operation (Up: ~50º, Down: ~50º)*

Understanding Gimbal Lock

"Gimbal Lock" is a condition that occurs with any 3-axis stabilized system, where two axes become parallel/aligned.



TITAN LT in Gimbal Lock while underslung (LEFT) and in Matrix Mode/Nose Mount (RIGHT). In this state the Pan and Tilt Motors are parallel to each other.

Sophisticated math is used to help handle the payload transition through Gimbal Lock, but there are physical/mechanical limitations to what can be achieved in this condition, where:

1) Only 2 axes are effectively stabilizing.
2) TITAN LT must prioritize moving one axis over another to ensure a smooth transition through gimbal lock. This is sometimes called "wrist flip".

NOTICE If the smoothest operation through gimbal lock is the ultimate priority, you can turn Gyro Stabilization "OFF" in the Tuning page.

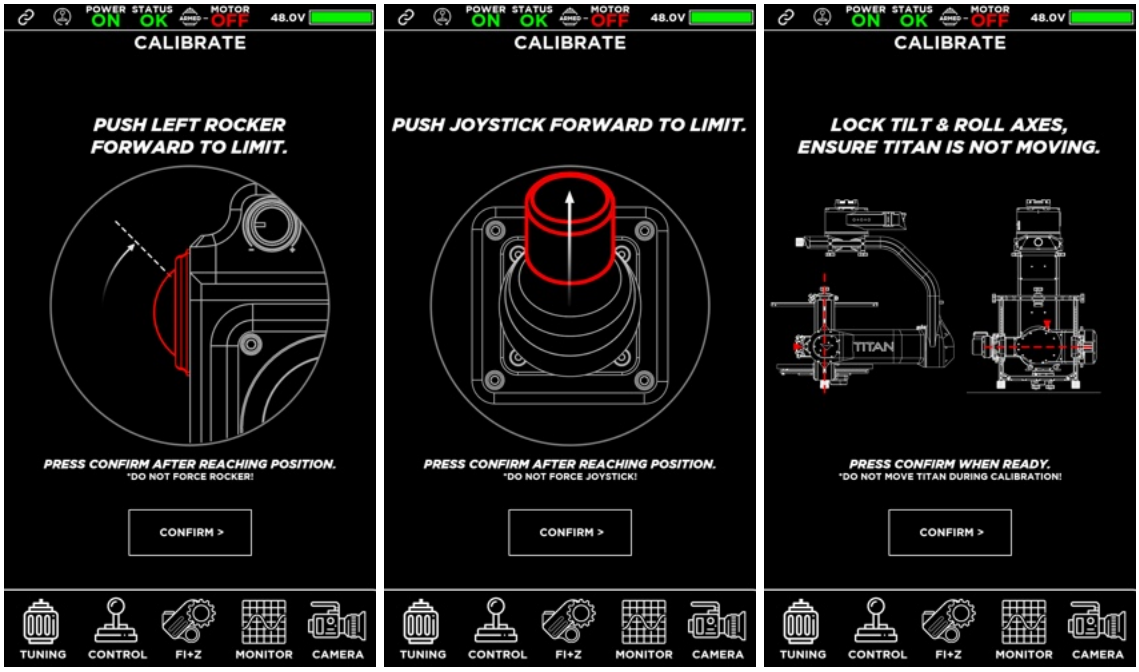
⚠CAUTION While TITAN LT allows for unlimited 360º control of Pan and Roll, rotating the Roll axis 90º creates the "Gimbal Lock" condition, and must be executed with attention and care to limitations.

Underslung to Overslung auto-transition

During operation, LT is able to transition its mounted orientation from underslung to Matrix Mode/Nose Mount, and through to overslung. LT will detect the change in orientation and remap controls accordingly for seamless, intuitive operation.

Calibrations

Calibrations are used to ensure modules have been adjusted to the current operating conditions. Input Modules, as well as the IMU, may be calibrated to eliminate unwanted commands and/or drift. To perform a calibration, select the desired Calibration from the System page, and follow the on-screen instructions.



When should I calibrate?

The two most common scenarios where calibration is required are:

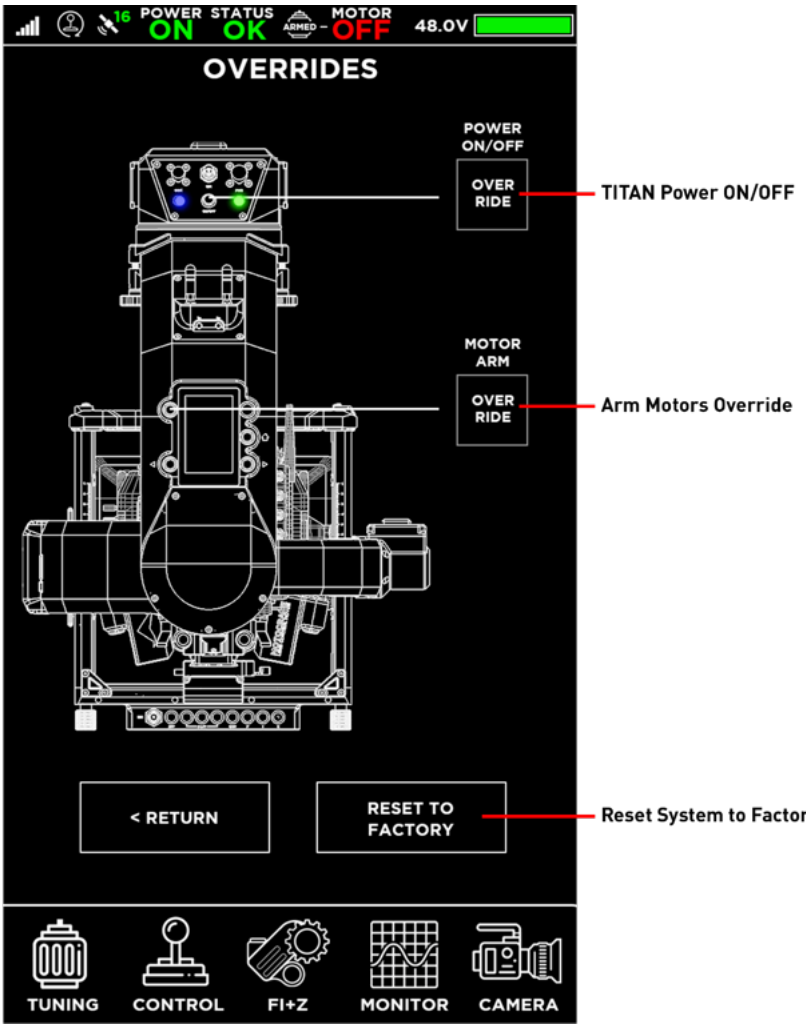
1) **Control drift**- When the joystick is commanding movement despite being in a neutral position. Increasing Control Deadband, or adjusting Pan/Tilt Trim can also remedy this issue, but may not be desired depending on Operator preference.

2) **IMU Drift** - When the IMU's gyroscope is causing movement despite no Control input (*Joystick and or Wheels speed are turned to "0" … use the "**GYRO Calibration**")*

If you're experiencing other performance symptoms, please contact MotoCrane Technical Support before performing any advanced calibrations (ACC ALIGN, IMU ALIGN.)

Overrides

Overrides are used when you need to physically access a function on TITAN LT (Turning Power ON or OFF) but the gimbal is not physically accessible or is inconvenient to access.



Power On/Off - Turns all Gimbal Power ON/OFF

Motor Arm - Arms/disarms motors so that they can be switched ON or OFF by the Controller.

Reset to Factory - Resets all settings to their factory configurations.

Known Hazards

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

- Lifting. When TITAN LT is fully loaded with a payload it can weigh in excess of 50lbs. Operators should exercise caution when lifting and use proper technique to reduce physical strain

- Pinch Points. TITAN LT is built to support large payloads which develop high inertia around pinch points. These pinch points are labeled on each TITAN LT, but operators must exercise caution during use and while setting up MotoCrane TITAN LT.

- Dropping. When operated above people, TITAN LT should always be equipped with a safety line and tethered to its support structure with suitably rated steel wire rope and carabiner or quick link.

- Moisture Ingress. While TITAN LT is IP65 rated for operation in wet environments, IP65 does not protect against complete submersion or highly pressurized jets of water.

⚠WARNING Operators must obey and observe all applicable law and regulations and operate MotoCrane TITAN LT in a safe manner and ensure that all personnel within the vicinity of MotoCrane TITAN LT understand and abide by all safety precautions. It is the responsibility of the driver and operator to understand how MotoCrane TITAN LT changes a motor vehicle's safety, performance and handling dynamics.

Transporting MotoCrane TITAN LT

MotoCrane offers the TITAN LT Flight Case Set, which is a customized transport solution for keeping TITAN LT and its components safe during storage and transportation.

The same storage and transportation solution is available for the TITAN Wheels modules. TITAN LT Batteries do not include a case, but they should be stored and transported in a dry environment, ensuring that the QS8 and Charging Ports are protected from collision and/or breakage.

⚠CAUTION Failure to transport TITAN LT, TITAN Wheels, the TITAN Controller and TITAN LT Batteries safely may result in equipment damage that leads to serious injury. Follow these instructions to ensure safe and reliable equipment.

Maintenance

MotoCrane TITAN LT does not require regular maintenance, but based on its application, may require service from time to time. To extend time between service, make sure TITAN LT is cleaned and dried after each use, and that any solid debris, like dust or dirt is cleared from rotating parts using a cloth or compressed air as necessary.

From time to time, it may be convenient to add lubrication to rotating parts, such as balance adjusters or any accessible bearings. This will keep them operating smoothly and quietly.

NOTE: If you feel your TITAN LT needs maintenance, please contact MotoCrane Technical Support by visiting motocrane.com/technical-support or sending an email to support@motocrane.com

Specifications

MECHANICAL

TITAN LT Gimbal Dimensions	446(L) x 415 (W) x ~550mm (H) *depends on config*
Camera build volume Dimensions	225mm (W) x 236mm (H) x 270mm (D)
TITAN Controller Dimensions	340mm (W) x 225mm (H) x 70mm (D) *depends on config*
TITAN Battery Dimensions, Weight	280mm x 150mm x 120mm, 18lbs/8.2kg
Construction	6061-T6 Aluminum
Max Operational Speed	100+ MPH
Max Motor Torque	11Nm
Max Payload Capacity	40lbs/18.2kg STATIC, 30lbs/13.6kg DYNAMIC
Dry Weight	19/8.6kg
Mounting System	Mitchell Mount + Adapters
Payload Mounting	DJI Ronin 2 Style Dovetail
Max Pan Speed	360º/sec
Max Tilt Speed	270º/sec
Max Roll Speed	90º/sec
Pan Range of Motion	∞ 360º
Tilt Range of Motion	+/- 135º
Roll Range of Motion	∞ 360º
Video Connectivity	3G-SDI
Ingress Protection	IP65

ELECTRICAL

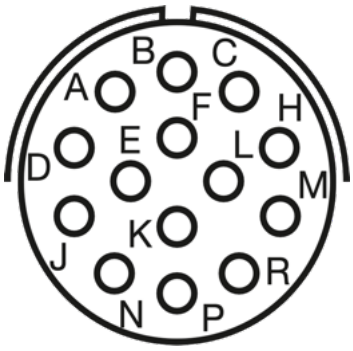
Input Voltage	48V (42-53VDC MAX)
Communication	CAN-BUS Hard-wired, 2.4Ghz Wireless, *(900Mhz LongWave only)*
Max System Power *(Watts, Amps)*	960W, 20A @ 48VDC
Motor Type	3-Phase Brushless
GPS Assist	GPS/Galileo/GLONASS/BeiDou
Antenna Connector Type	RP-SMA on 2.4Ghz (*SMA on LongWave)*
Accessory Power Outputs	3x 14.4V Lemo 2-pin (125W) + 1x 26V (125W) *250W Combined*
Wireless Range	200m/.125mi, *2km/1.2mi
Working Temperature	-30ºF - 120ºF

requires **LongWave*

Connector Pinouts

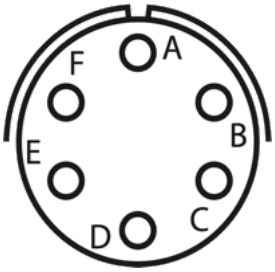
Controller Communications (COM)

Part #	PT02A-12-14S
Pin A	-
Pin B	-
Pin C	CAN 26V
Pin D	-
Pin E	-
Pin F	-
Pin H	CAN GND
Pin J	-
Pin K	-
Pin L	-
Pin M	CAN H
Pin N	-
Pin P	-
Pin R	CAN L



LT Gimbal Power

Part #	PT02E-10-6S-X
Pin A	CAN H
Pin B	48V
Pin C	48V
Pin D	CAN L
Pin E	GND
Pin F	GND



Gimbal Communications (COM)

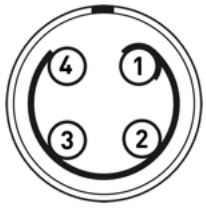
Part #	PT02E-8-4S-X
Pin A	GND
Pin B	CAN PWR
Pin C	CAN H
Pin D	CAN L

Focus, Iris, Zoom Motor Connections

Part #	HGG.0B.307.CLLP
Pin 1	Motor +
Pin 2	Motor -
Pin 3	Encoder A
Pin 4	Encoder 5V
Pin 5	Encoder GND
Pin 6	Encoder B
Pin 7	FIZ Identification

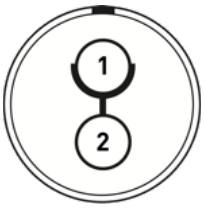
26VDC Accessory Power

Part #	HGG.0B.304.CLLP
Pin 1	26V
Pin 2	GND
Pin 3	GND
Pin 4	26V



14.4VDC Accessory Power

Part #	HGG.0B.302.CLLP
Pin 1	GND
Pin 2	14.4V

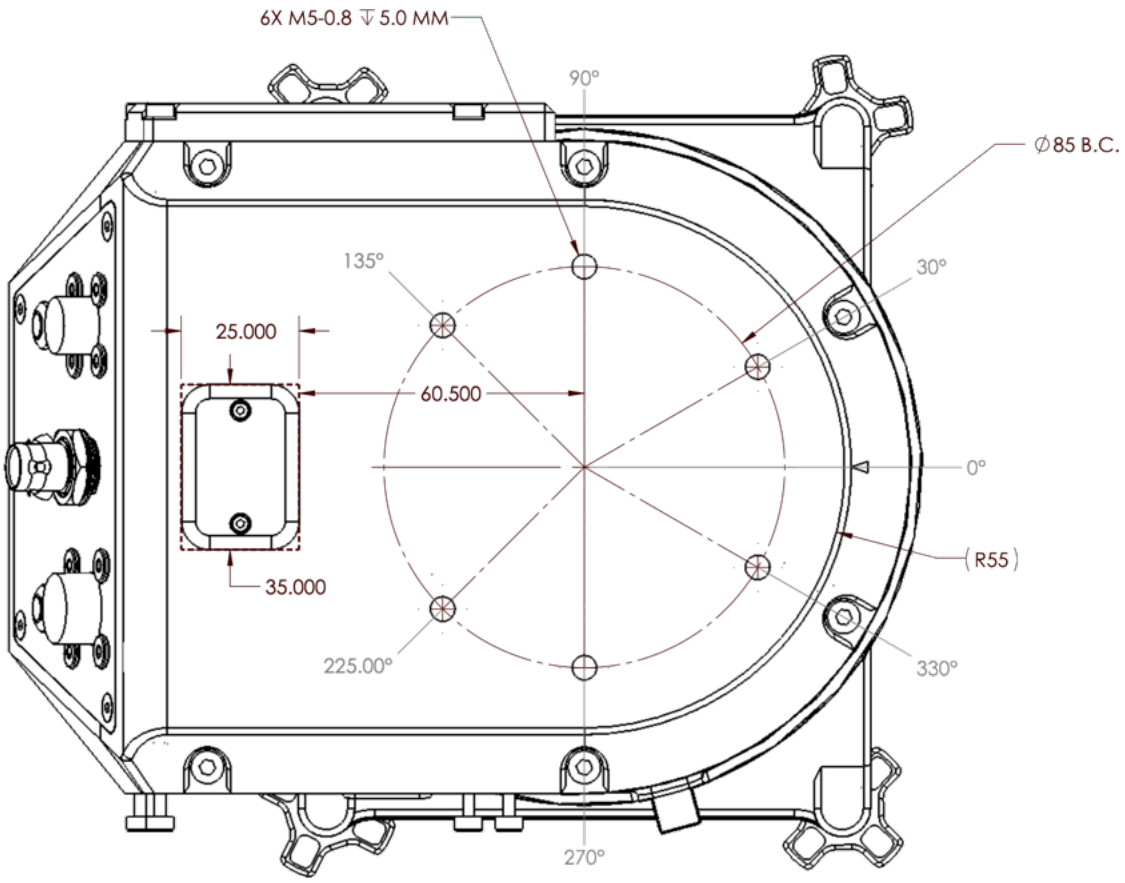


CAM (Camera) Control

Part #	HGG.0B.309.CLLP
Pin 1	GND
Pin 2	5V
Pin 3	RCP_RX (CAM_TX)
Pin 4	RCP TX (CAM_RX)
Pin 5	LANC/GPIO
Pin 6	24V
Pin 7	CAN H
Pin 8	CAN L
Pin 9	-

Mounting Patterns

Pan Housing Mounting Pattern



Revision History

Revision	Date	Description
1.0	NOV 2025	Initial Release
1.1	APR 2026	Notes about orientation auto-transition, corrected SMA to RP-SMA antenna type, IMU boot-up time, TB50 battery operation, wireless range added for 2.4Ghz + LongWave
1.2	AUG 2026	Added v1.1.5 features, LongWave compatibility & specs, *Tuning Procedure (Advanced), corrected*

MotoCrane Technical Support
support@motocrane.com

This content is subject to change without notice.

Download the latest version from
www.motocrane.com/knowledge-base

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