MāVI CARBON

USER MANUAL

To download the most current user manual for MōVI Carbon and all other Freefly Products, please visit http://freeflysystems.com/software-manuals.

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Revisions History

Revision	Date	Description
A	August 2018	Initial Release
B	June 2019	Battery Warning Updates

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MōVI Carbon Technicals

Disclaimer and Warning

IMPORTANT - Please read this disclaimer and warning carefully and review the MōVI Carbon Operation Manual prior to use. If you have any questions, please contact support@freeflysystems.com prior to using MōVI Carbon. You can review the most current version of this Operation Manual at www.freeflysystems.com/software-manuals/.
By using MōVI Carbon, you acknowledge that you have read, understand, and agree to this disclaimer. You agree that you are solely responsible for your conduct while using MōVI Carbon and for any direct or indirect consequences that may result from its use.
Freefly Systems reserves the right to revise this User Manual and make changes from time to time without obligation to notify any persons of such revisions or changes. In no event shall Freefly Systems, its employees or authorized agents be liable for any damages or losses, direct or indirect, arising from the use of any technical or operational information contained in this document.

- Always check MōVI Carbon and its components prior to operation.
- Always maintain awareness of your surroundings when operating MōVI Carbon.
- It is your responsibility to perform a full system check of MōVI Carbon prior to every use.
- It is your responsibility to learn how to safely operate MōVI Carbon.
- MōVI Carbon is a tuned system with custom integrated components. Modification to, removal, or substitution of MōVI Carbon components will void the warranty.
- It is your responsibility to create shots that amaze the world.

Batteries and Charging

MōVI Carbon uses MōVI Pro Battery Pack to supply power to the gimbal. You must read these safety instructions and warnings carefully before charging or using your MōVI Pro Battery Pack. Failure to exercise caution while using a MōVI Pro Battery Pack, a Lithium Polymer (LiPo) battery, and failure to comply with the following warnings can result in battery malfunction, electrical issues, excessive heat, fire, personal injury, and/or property damage.

Battery Safety and Warnings

You must read these safety instructions and warnings carefully before charging or using a MōVI Pro Battery Pack. Improper use may result in damage to the batteries, severe personal injury, and even fire.

- Do not leave the MōVI Pro Battery Packs and charger unattended during use.
- Always charge MōVI Pro Battery Packs in a vented, fire-proof container; away from any flammable/combustible materials. Never charge MōVI Pro Battery Packs inside an automobile.

- Stop using or charging MōVI Pro Battery Pack immediately if the battery pack becomes or appears damaged, starts to balloon or swell, leaks, becomes deformed or gives off an odor, exceeds a temperature of 140ºF (60ºC), or if anything else abnormal occurs. Disconnect the battery and observe in a safe area outside of any building or vehicle for at least 45 minutes, as a damaged battery can experience a delayed chemical reaction that could possibly result in fire.
- Never disassemble, modify, puncture, shock, crash, short circuit, and/or expose MōVI Pro Battery Packs to a flame. Leakage, smoke emission, ignition, explosion or fire can occur, which may result in personal injury or property damage.
- Never drop the charger or MōVI Pro Battery Packs.
- Never allow an electrical short between the battery's positive and negative terminals.
- Never allow minors to charge or use MōVI Pro Battery Packs without adult supervision.
- Never allow MōVI Pro Battery Packs to come in contact with moisture at any time.
- Never charge or store MōVI Pro Battery Packs in extreme heat (30ºC) or cold (0ºC), recommended temperatures for storage are between 10º-26ºC. High temperatures may cause a fire, even with undamaged MōVI Pro Battery Packs.
- Never leave MōVI Pro Battery Packs in an automobile or direct sunlight.
- Never place or carry MōVI Pro Battery Packs in your pockets or clothing.
- Always use MōVI Pro Battery Packs to power MōVI Pro.
- Do not store MōVI Pro Battery Packs that are fully charged for long periods of time.
- MōVI Pro Battery Packs should be stored in a vented, fire-proof container. No more than two MōVI Pro Battery Packs should be placed in a container to avoid chain reactions. Storage temperatures should not fall below 32ºF/0ºC or above 86ºF/30ºC.
- Damaged batteries are extremely sensitive to temperature fluctuation and care should be taken in their immediate disposal.
- Do not discharge MōVI Pro Battery Packs with current exceeding the 8-10A of continuous discharge current. It will cause the battery to overheat and may result in battery deterioration, swelling, bursting, or fire.
- Always discharge in a fireproof location.
- In purchasing a MōVI Pro Battery Pack as part of MōVI Carbon , the buyer agrees to bear all responsibilities of the risks and not hold Freefly Systems, its owners and employees, its distributors, and/or its retailers responsible for any accidents, injury to persons, and property damage. If you do not agree to these conditions, please return MōVI Carbon and MōVI Pro Battery Pack to the place of purchase in a new and unused condition.

All instructions and warnings must be followed exactly. Mishandling of MōVI Pro Battery Packs can result in fire. By handling, charging, or using the included MōVI Pro Battery Packs, you assume all risks associated with MōVI Pro Battery Packs. If you are not prepared to accept complete liability for the purchase and/or use of the batteries, you are advised to return them in new and unused condition to the place of purchase immediately.

Charging Procedure Safety and Warnings

You must read these safety instructions and warnings carefully before charging your MōVI Pro Battery Packs.

- Always charge MōVI Pro Battery Pack with MōVI Pro Battery Charger. An unqualified charger may cause damage to the batteries or a fire.
- Never charge or use a MōVI Pro Battery Pack that shows any damage or disfigurement of any kind, as this may be a sign of internal damage. Any damage to the protective cover or connector is also reason to discontinue use.
- Never charge a MōVI Pro Battery Pack unattended.
- Always inspect MōVI Pro Battery Packs before charging.
- Never charge near moisture, extreme temperatures, flammable or combustible materials.
- Never charge a MōVI Pro Battery Pack while inside a vehicle.
- Never attempt to charge a MōVI Pro Battery Pack that is damaged or is completely “dead.”
- Always monitor the temperature of MōVI Pro Battery Pack while charging. If a MōVI Pro Battery Pack becomes hot to the touch or begins to deform, discontinue charging immediately. Disconnect the battery from the charger and observe it in a safe place for at least 45 minutes.

Battery Disposal Procedure

LiPo batteries require special handling for safe disposal. The following steps must be taken to avoid damage or injury to yourself, your property or anyone who comes in contact with the battery.

1. Contact your state or local HAZMAT agency inquire about disposal procedures for LiPo batteries with battery management systems.
2. Follow any instructions provided by your state or local HAZMAT agency for the disposal of LiPo batteries.

Do not transport or ship batteries which have more than 1.0V per cell charged OR that show signs of damage without following the instructions given by the HAZMAT agency

Limitation of Liability

IN NO EVENT SHALL FREEFLY SYSTEMS BE LIABLE TO THE BUYER FOR ANY INDIRECT, CONSEQUENTIAL, PUNITIVE, INCIDENTAL, OR SPECIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM THE USE OF PRODUCT OR FROM LOSS OF USE, DATA OR PROFITS (HOWEVER CAUSED AND UNDER ANY THEORY OF LIABILITY), EVEN IF FREEFLY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL FREEFLY'S LIABILITY FOR A PRODUCT (WHETHER ASSERTED AS A TORT CLAIM, A CONTRACT CLAIM OR OTHERWISE) EXCEED THE AMOUNTS PAID TO FREEFLY FOR SUCH PRODUCT. NOTWITHSTANDING ANYTHING HEREIN, IN NO EVENT SHALL FREEFLY'S LIABILITY FOR ALL CLAIMS ARISING OUT OF OR RELATING TO THIS AGREEMENT EXCEED THE AMOUNTS PAID BY BUYER TO FREEFLY FOR PRODUCT IN THE LAST TWELVE (12) MONTHS. IN NO EVENT WILL FREEFLY OR ITS LICENSORS BE LIABLE FOR COSTS OF PROCUREMENT OF SUBSTITUTE GOODS BY BUYER. IN NO EVENT WILL FREEFLY OR ITS LICENSORS BE LIABLE FOR DAMAGES ARISING OUT OF ANY LATE DELIVERY. THE LIMITATIONS SET FORTH HEREIN SHALL APPLY TO ALL LIABILITIES THAT MAY ARISE OUT OF THIRD-PARTY CLAIMS AGAINST BUYER. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. THE LIMITATION SET FORTH IN THIS SECTION SHALL APPLY WHERE THE DAMAGES ARISE OUT OF OR RELATED TO THIS AGREEMENT.

Freefly shall not be liable for damages or injuries incurred directly or indirectly from the use of MōVI Carbon including, but not limited to, the following situations:

- Failure of operator to follow proper instructions and safety warnings found at www.freeflysystems.com.
- Failure of the operator to understand and operate the gimbal within the operating limitations described in this manual.
- Failure of the operator to follow onboard safety warnings while using MōVI Carbon .
- Failure of the operator to inspect MōVI Carbon and its components prior to operation.
- Failure of the operator to properly maintain and/or service MōVI Carbon through an authorized Freefly Service Center with genuine MōVI Carbon parts.
- Use of third-party products on MōVI Carbon .
- Use of MōVI Carbon in unsafe conditions, including but not limited to, bad or severe weather, such as rain, wind, snow, lightning, dust storms, etc.
- Improper operation, misjudgment or risky behavior while using MōVI Carbon .
- Infringement of third party data, audio or video rights recorded when using MōVI Carbon .

Warranty

Specifications

Freefly warrants all products will be of good quality and workmanship and free from material defects. Upon the expiration of the time periods below, all liabilities of Freefly will terminate. In no event shall Freefly be liable for consequential damages. Freefly may use refurbished parts for repairs or replacements. Certain products may be subject to a separate software license agreement.

Standard Warranty

A Standard Warranty is granted to the original purchaser by Freefly for a period of one (1) year, parts and labor. The Standard Warranty does not apply to MōVI Pro Battery Packs. The Standard Warranty covers parts and labor charges for Product that has been returned with pre-paid shipment to an Authorized Service Center by Buyer. Service or replacement decisions are at the sole discretion of Freefly. Proof of purchase is required for warranty claims. All warranty returns shall be done in accordance with Freefly's warranty Return Merchandise Authorization ("RMA") policy, which can be found on our website. Any repaired or replaced Product shall be warranted as set forth in this section for a period the greater of (a) the balance of the applicable warranty period relating to such Product or (b) ninety (90) days after it is received by Buyer. Only the components that were repaired or replaced will be eligible for the 90-day period as set forth above. The Standard Warranty effective date is the date of "ex works" from Woodinville, Washington.

Exclusive Battery Warranty

Freefly warrants that MōVI Pro Battery Packs purchased or included with the Product will be free from defects in materials and workmanship at the date of purchase by Buyer. Battery product warranty is limited to original defects in material and workmanship. Due to the nature and use of these batteries, there is no term warranty. Misuse, abuse, incorrect charging, failure to comply with applicable battery warnings and guidelines, and other inappropriate use of the batteries are not covered under this warranty.

Warranty Limitations

All Freefly warranties do not cover (a) maintenance, repair or replacement necessitated by loss or damage resulting from any cause other than normal use and operation of the Product in accordance with Freefly's specifications and owner's manual, including but not limited to: theft, exposure to weather conditions, operator negligence, misuse, abuse, improper electrical/power supply; (b) alterations, modifications or repairs by Buyer or unauthorized third parties; (c) accident, disaster, improper handling or storage, droppage, modification, opening sealed components, use of third party accessories or acts of nature or any other peril originating from outside the Product; (d) transportation damage, lack of or improper maintenance, defective batteries, battery leakage; and (e) cosmetic damage or other non-operating parts. Removal or modification of sealed components, including but not limited to, motors or electronics, voids any and all warranties. Breaking the seal on any sealed components, including but not limited to

motors or electronics, is prohibited and voids any and all warranties unless otherwise approved by Freefly. Any parts replaced by Freefly during warranty repair are the property of Freefly and will not be returned to Buyer. Freefly may use refurbished parts for repairs or replacements.

Freefly products are compatible with Freefly software, Freefly parts and Freefly products only. Use of any software, parts, or products, other than Freefly or Freefly approved software, parts, and products, which plug into or directly affect the function or performance of Freefly products voids any and all warranties.

Limitation of Liability

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Third Party Warranty

Freefly does not honor warranty agreements extended by third parties. Only warranty agreements granted by Freefly will be honored by Freefly.

Non-Warranty Repair

Product that no longer qualifies for Warranty Repair may be sent to an Authorized Freefly Service Center subject to an evaluation fee. Freefly will provide a quotation for the repair of the Product. The Customer is responsible for all costs associated with such refurbishment, such as troubleshooting, diagnosis, repair, test, calibration, storage, and shipping costs. The evaluation fee will be applied to the cost of the refurbishment if the cost of the refurbishment is greater than the evaluation fee. Any repaired or replaced product shall be warranted for ninety (90) days after it is received by Buyer. Only the components that were repaired or replaced will be eligible for the 90-day period. Any parts replaced by Freefly during non-warranty repair are the property

of Freefly and will not be returned to Buyer. Freefly may use refurbished parts for non-warranty repair.

Law Governing

These terms are governed by Washington State law (without regard to conflict of law principles or the United Nations Convention on Contracts for the International Sale of Goods.) Freefly reserves the right to change or modify this warranty at any time without notice. For up-to-date warranty information, visit www.freeflysystems.com.

Introduction to MōVI Carbon

MōVI Carbon represents the first generation of hand-held and drone mountable 5-axis stabilization systems. Designed and built with the goal of creating the world's most versatile camera movement system, MōVI Carbon will revolutionize and democratize the creation of professional motion picture content. Using two additional inner stabilization axes, MōVI Carbon gives filmmakers even more precise and creative control of the camera. Its integrated payload and plug-n-play design result in even more possibilities to create world-class content quickly and easily.

This manual will teach you how to set up, optimize, and use your MōVI Carbon. It also includes detailed descriptions of the system's features and capabilities to familiarize you with the possibilities of using it in conjunction with the Freefly ecosystem of products.

Throughout the manual, warnings, cautions and notes are used to highlight various important procedures. These are defined as follows:

Warning

Warnings are used to highlight procedures which, if not strictly observed, may result in personal injury.

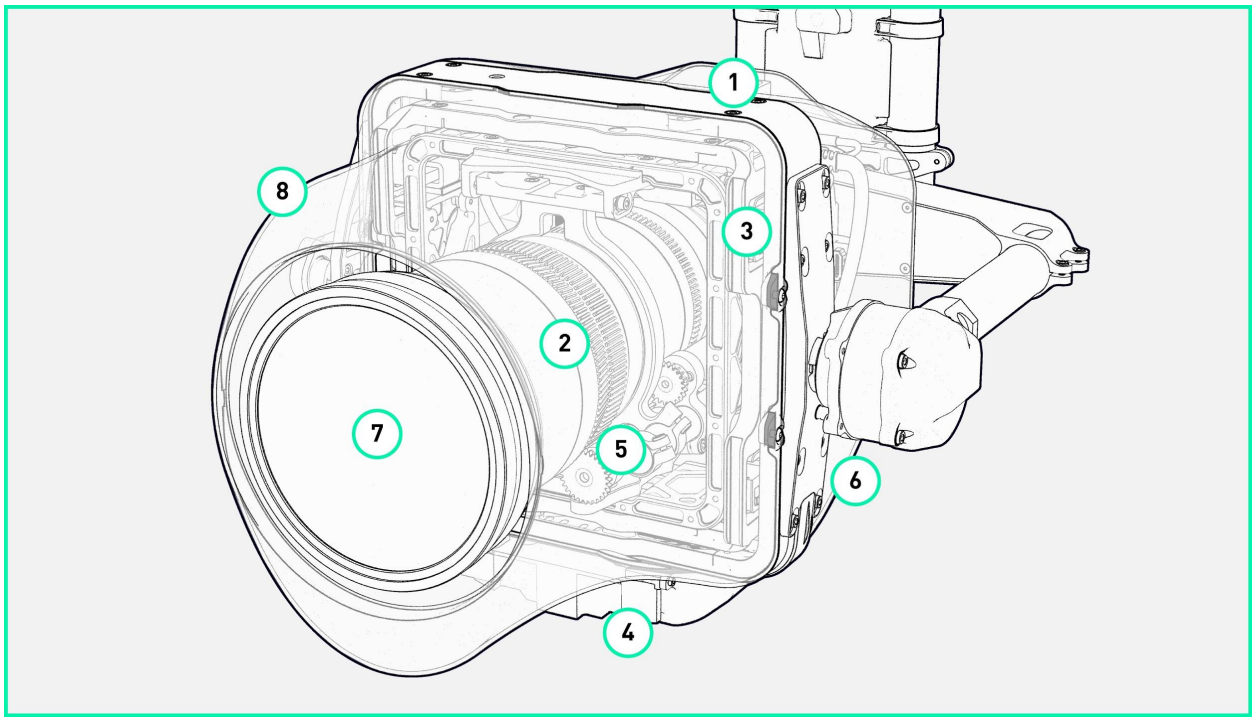
Caution

Cautions are used to highlight procedures which, if not strictly observed, may cause damage to equipment.

Note

Notes are used to highlight specific operating conditions,usability tips and tricks, or steps of a procedure.

Features



1. Panasonic GH5S
    a. Compact yet powerful, the Panasonic GH5S's ability to provide stunning video at 4K and absence of optical stabilization allow MōVI Carbon to record cinema-quality footage while zoomed in to 240mm.
2. Fujinon XK20-120mm T3.5 Cabrio
    a. The Fujinon XK Cabrio is sharp, parfocal, and has a great zoom range; all at a weight that still allows MōVI Carbon to fly!
3. MōVI Carbon Inner Stage
    a. The addition of ultra fast inner pan and tilt axes allow MōVI Carbon to reach unprecedented stabilization for a handheld gimbal.
4. Zoom Rate Scale
    a. Zoom rate scale allows for user adjustment of pan and tilt rate relative to focal length. This setting is accessible under the MōVI Expert menu in the MōVI Controller FW.
        i. Download the latest MoVI Controller FW
5. FIZ Autocal on Startup
    a. MōVI Carbon automatically calibrates focus, iris, and zoom.
6. High Performance Inertial Measurement Unit
    a. MōVI Carbon uses a state-of-the-art IMU to help it mitigate vibration, reject disturbance, and eliminate drift at up to 240mm focal lengths..

NOTE

Due to the IMU's warm up period, MōVI Carbon will reach optimal performance 400s (6.5minutes) after it is turned on.

7. Schneider Filter Kit
    a. Included in each Carbon is a Schneider Lens Filter adapter along with a set of three ND filters ranging from ND 0.6/0.9/1.2 and a UV filter for lens protection.
8. Shroud
    a. MōVI Carbon's shroud is designed to keep the lens and camera safe while reducing the drag of the gimbal when mounted to a moving vehicle, resulting is the smoothest shots possible.

Getting to Know MōVI Carbon

Specifications

Dimensions and Payload	
MoVI Carbon	410 x 345 x 425mm (L*W*H)
Lens	Fujinon XK20-120mm T3.5 Cabrio
Camera	Panasonic GH5S

Performance	
Equivalent Focal Length	40-240mm
Rotational Disturbance Rejection	+/-1.5px @ 100mm Under +/- 5º, 1Hz
Acceleration Disturbance Rejection	+/-1.5px @ 100mm Under +/- 1g, 1Hz
IMU Biases	+/- 0.07deg/s

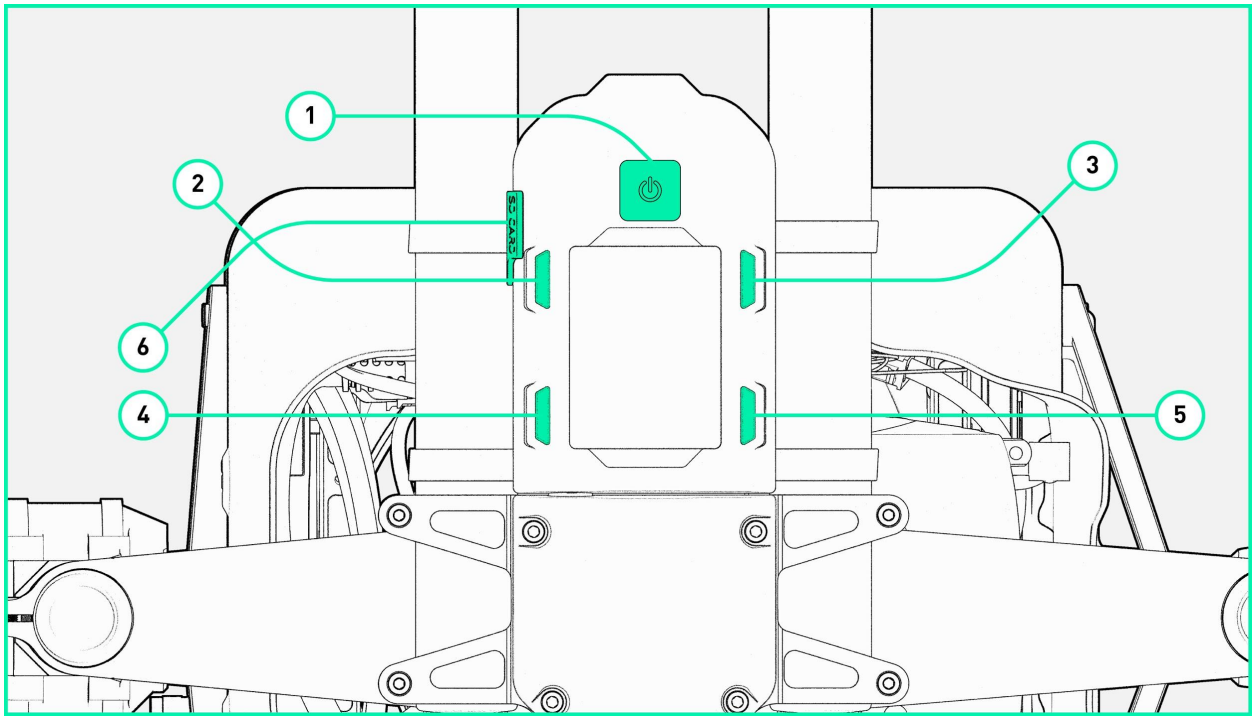
Mechanics	
Pan Range of Motion	±360º Continuous Rotation
Tilt Range of Motion	+165º to -90º
Roll Range of Motion	+/-60º
Max Tilt/Roll Rate	360º/s
Max Pan Rate	200º/s

Weight	8.70kg (19.2lbs)
Max Operating Speed* **	80kph (50mph) *Dependant on external conditions **The addition of the Velocity Kit can increase max speed
Operating Temperatures	-20° to 50°C (-4 to 122 °F)
Mounting System	Freefly Toad In The Hole (TITH) Quick Release

Electronics	
Data Logging Rate	5, 10, and 25 Hz
Connections	Bluetooth Low Energy v4.2 and 2.4GHz Custom FHSS Radio
Motor Type	3 phase Sinusoidal direct-drive Brushless Motors
Data Storage	microSD
Port Types	**GCU ports -** COM1, 12V, COM 2
Media	Dual Slot SD Cards (Class UHS-II or higher)

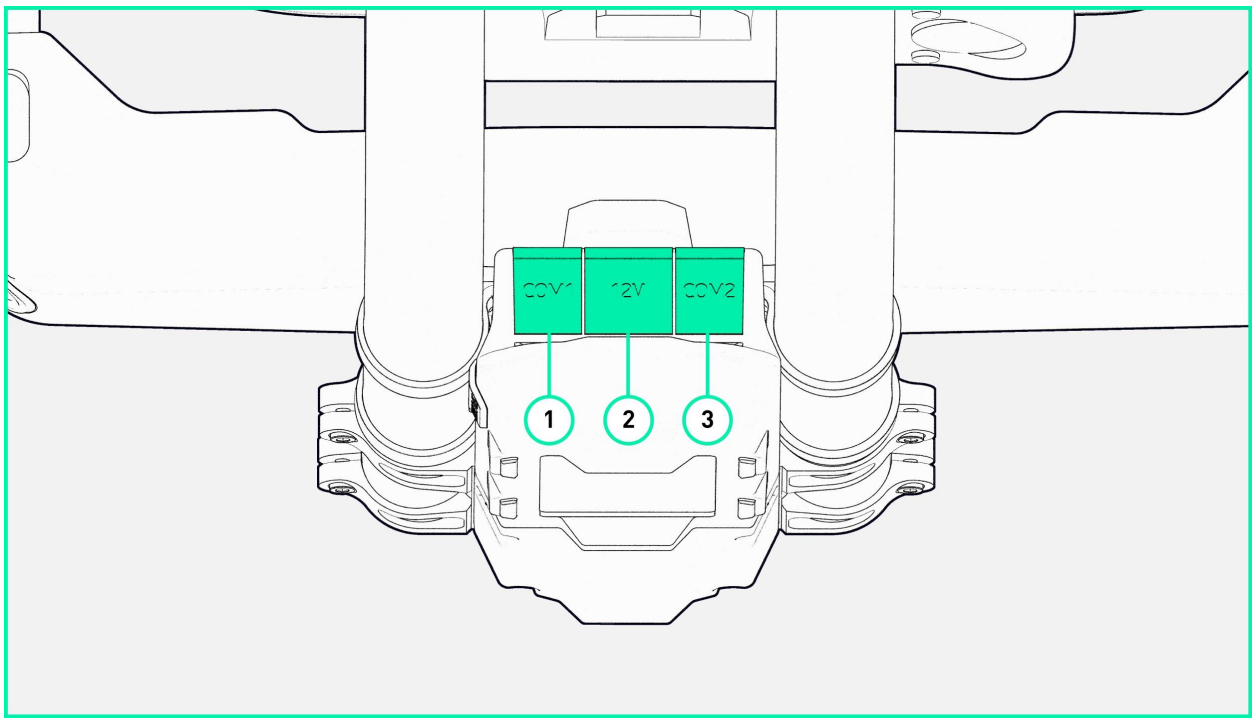
Battery	
Nominal Battery Voltage	22.2V
Max Battery Voltage	25.2V
Battery Size	1800 mAh
Cells	6 Cells
Max Battery Quantity	2 Battery
Run Time (w/Camera + Wireless TX)	185 Min

GCU Layout



1. Power Button
    a. Push (ON)
    b. Hold (OFF)
    c. Double Tap (Sleep/Wake)
2. Back Button
3. Forward Button
4. Select Option (-)
5. Select Option (+)
6. micro SD Card Slot

GCU Connector Layout

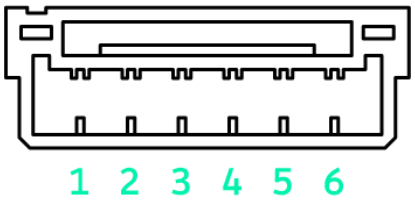
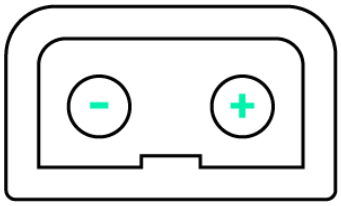
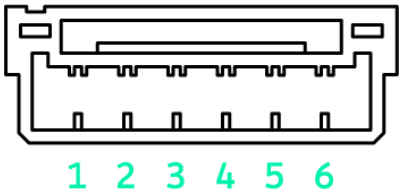


1. COM 1
2. 12V (1A)
3. COM 2

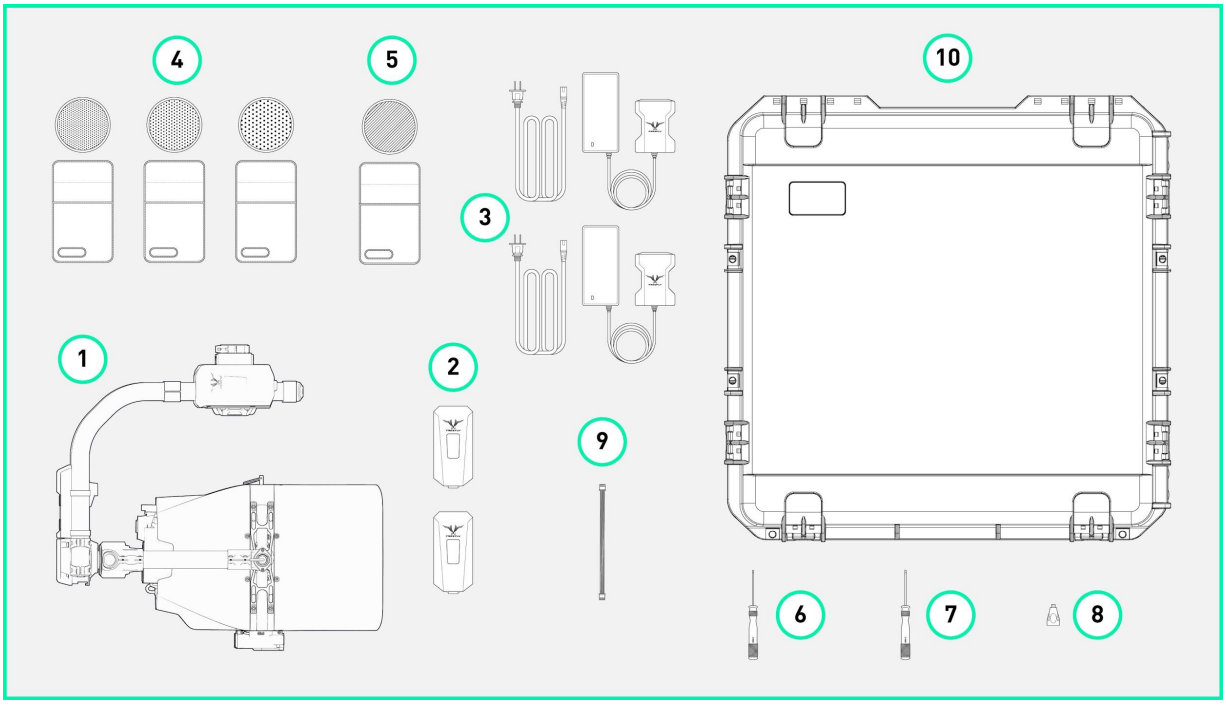
Connector and Pinouts

All connector pinouts are shown looking into the function side of the connectors on the GCU and TSU, unless stated otherwise.

Gimbal Control Unit

Connector	***Type***		***Pinout***
1. COM 1	JST GH 6-pin		1 - GND 2 - +5V 3 - UARTn_TX 4 - UARTn_RX 5 - UARTn_CTS 6 - UARTn_RTS
2. 12V	Female P-TAP		(+) 12V PTAP V+ (-) 12V PTAP GND
3. COM 2	JST GH 6-pin		1 - GND 2 - +5V 3 - UARTn_TX 4 - UARTn_RX 5 - UARTn_CTS 6 - UARTn_RTS

MōVI Carbon Package Contents



Included in MōVI Carbon

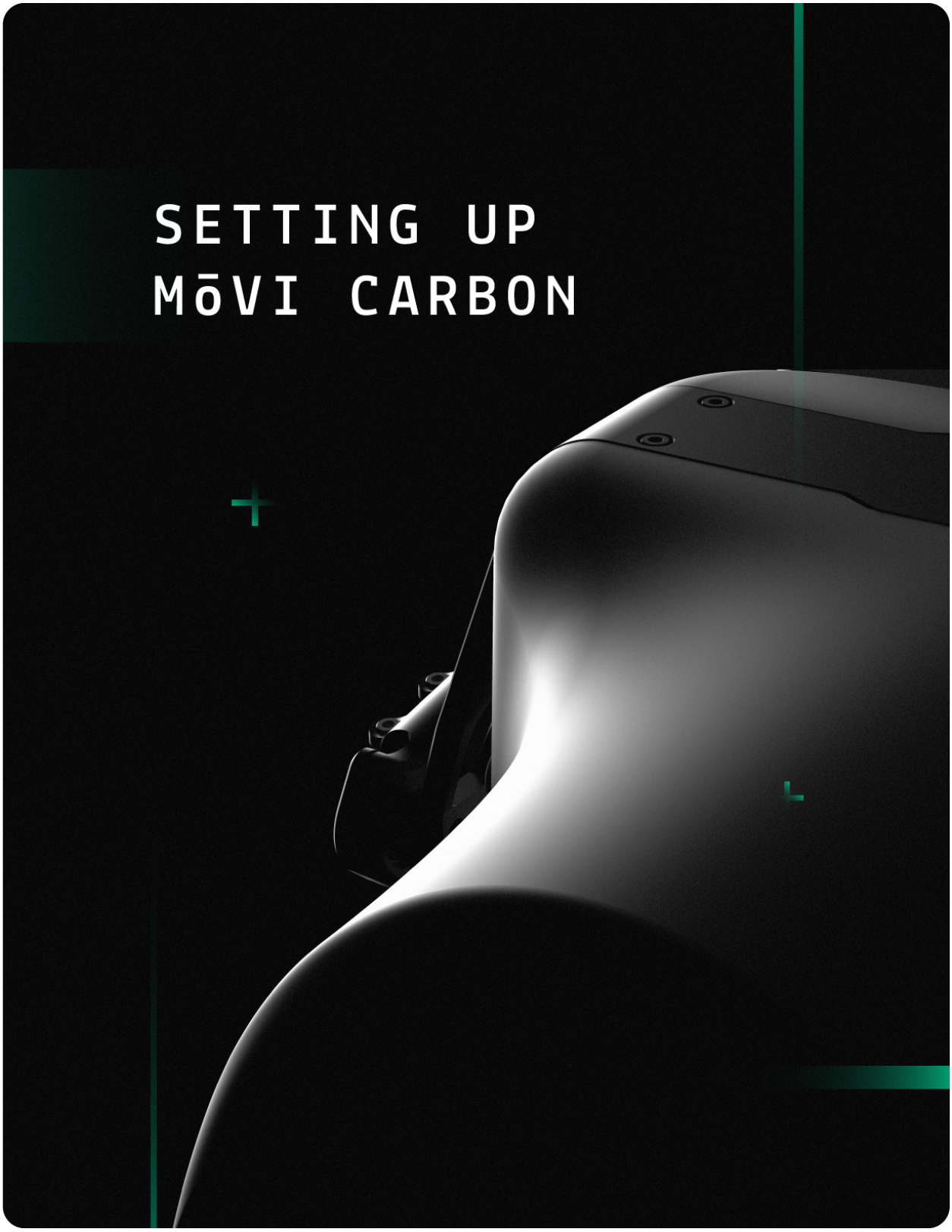
1. MōVI Carbon
2. (2) MōVI Pro Battery
3. (2) MōVI Pro Battery Charger
4. Schneider Compact ND Kit 114mm
   a. (ND 0.6/0.9/1.2)
5. Schneider 4.5" Round Clear Ultraviolet
6. 2.5mm Driver
7. 2.0mm Driver
8. HDMI to HDMI Mini Adapter
9. Aux UART to FRX Cable
10. MōVI Carbon Travel Case

- Freefly RX *(not shown)*
- Freefly Ring Pro *(not shown)*

Optional Accessories for MōVI Carbon

- MōVI Controller
- MōVI Pro Battery
- TITH (Male) Adapter
- MōVI Pro Battery Charger
- MōVI Ring Pro
- MIMIC Pro
- MōVI Pro Landing Gear
- MōVI Pro Pop-N-Lock Quick Releases
- Pilot F/I/Z Controller
- Classic Handles
- MōVI Pro Velocity Kit
  -

SETTING UP MōVI CARBON



MōVI Carbon Essential Setup

Right out of the box, MōVI Carbon is almost ready to shoot. Here are some features that give MōVI Carbon the shortest setup time out of the entire MōVI family!

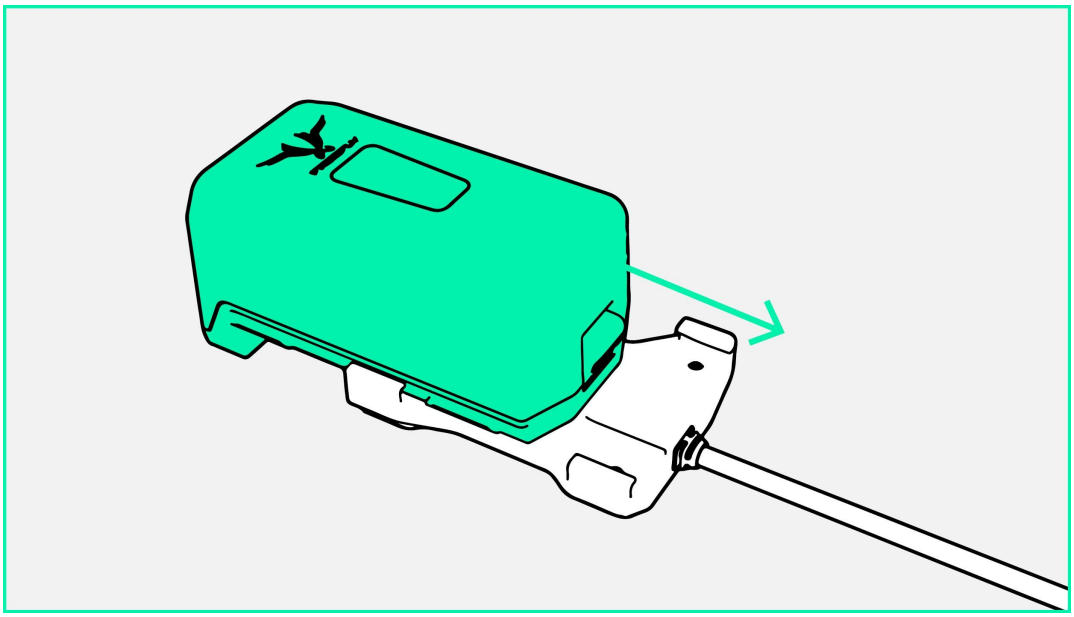
1. Preset Tuning Values
    a. Stiffnesses, filters, and hold strengths have all been preset on MōVI Carbon to get users up and shooting as soon as possible. Of course if your shot needs some slight adjustment, all of MōVI Carbon's setting can be changed in the app or through a MōVI Controller.
2. Integrated Panasonic GH5S with power and control
    a. Never worry about camera batteries again; MōVI Carbon powers and controls the integrated GH5S so users can focus on getting the shot.
3. Pre-balanced
    a. Each MōVI Carbon is carefully balanced at our headquarters in Woodinville,WA and never needs to be adjusted!
4. MōVI Carbon Case
    a. Included in MōVI Carbon, is its own case that fits everything you need to operate MōVI Carbon, while still being convenient enough to ship, fly, or roll to its destination.

Charging Batteries

Your MōVI Carbon comes with two MōVI Pro Battery Packs and two MōVI Pro Battery Pack Chargers. Follow the charging procedure below to maintain a safe charging environment.

MōVI Pro Battery Pack Charging Procedure

1. Insert the AC power cord into AC power adapter and plug the power cord into a 120 VAC wall socket (US)
2. The AC power adapter's LED will turn a solid GREEN. This means the MōVI Pro Battery Pack charger is ready to charge.
3. Slide the Charging Dock along the underside of the battery until the battery's connector is completely engaged with the Charging Dock.



4. The AC power adapter LED will turn RED to inform you that the battery is charging.

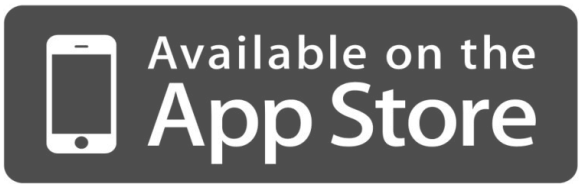
5. When the AC power adapter LED returns to GREEN, your battery is fully charged. Press the power button on the battery to check the power level, and disconnect the battery from the charger

For all warnings concerning the batteries and chargers please refer to the Warning section on page 5.

Only charge the MōVI Pro Battery Pack with a Freefly Systems MōVI Pro Battery Pack Charger. The use of 3rd party chargers is dangerous and may result in damage to the batteries, cause severe personal injury, or start a fire

Download the MōVI App

Download or update the MōVI App which is available through the App Store or Google play.

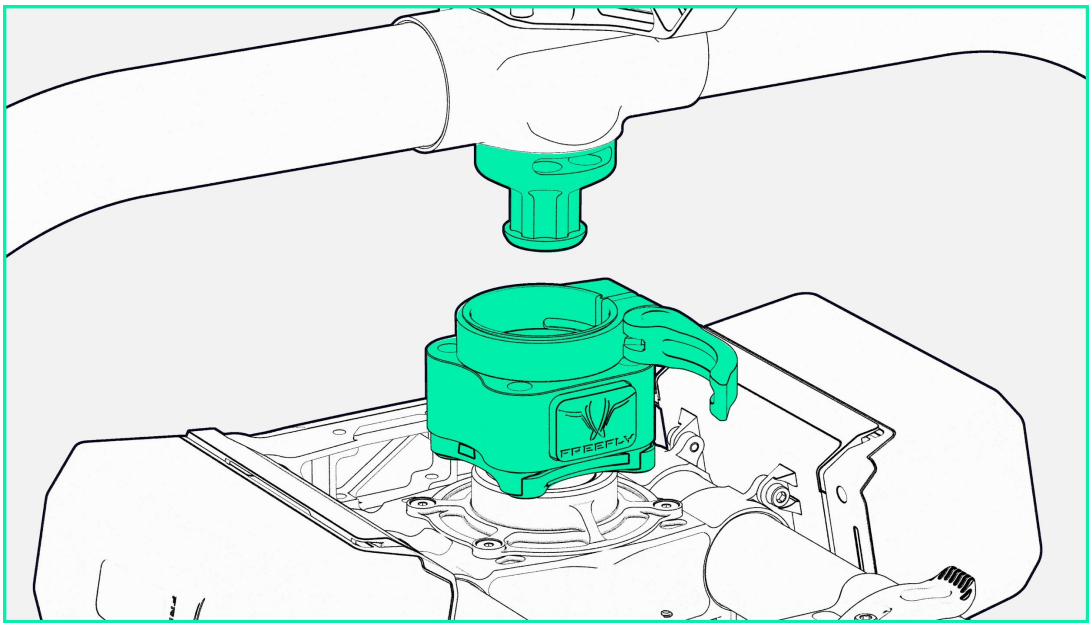


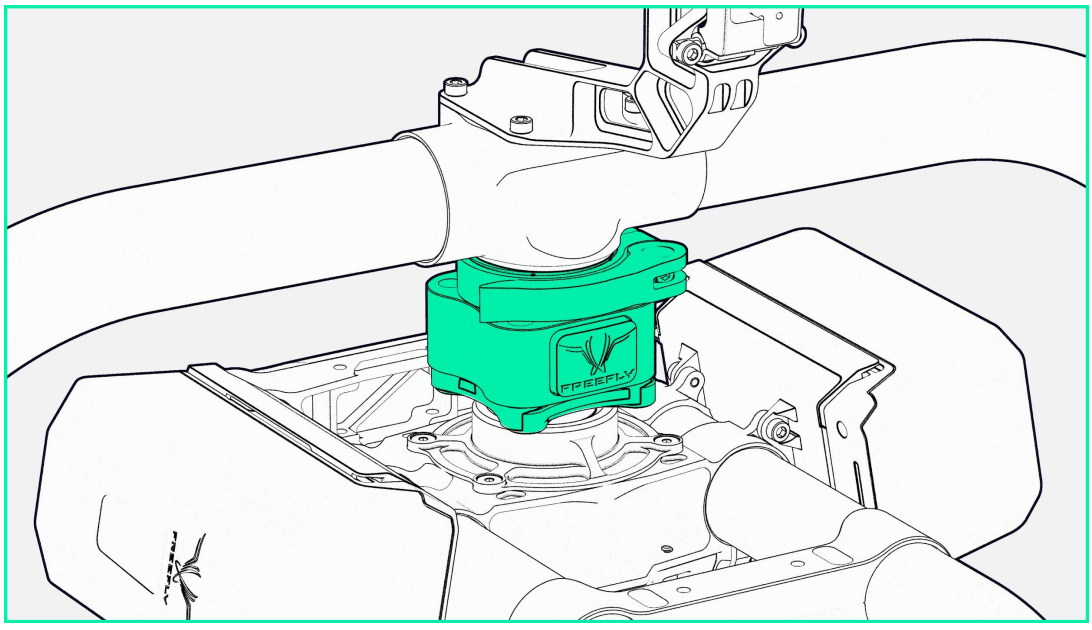
Mounting MōVI Carbon

MōVI Carbon uses Freefly's Toad in the Hole (TITH) Quick Release system. TITH Quick Releases aresleek, lightweight, low-profile quick release units, which provide an easy mount and release solution for all your Freefly products.

Mounting Procedure

1. Open the lever on the female part of the TITH (which is part of MōVI Carbon).
2. Align the male and female parts of the TITH and press them together until you feel the parts engage and hear a click.
3. Hold MōVI Carbon securely; check to see if the TITH engaged correctly and then rotate the TITH to your desired orientation.
4. Continue to hold MōVI Carbon securely and close the TITH's lever while making sure that none of the release buttons are pressed. This concludes the TITH mounting procedure.





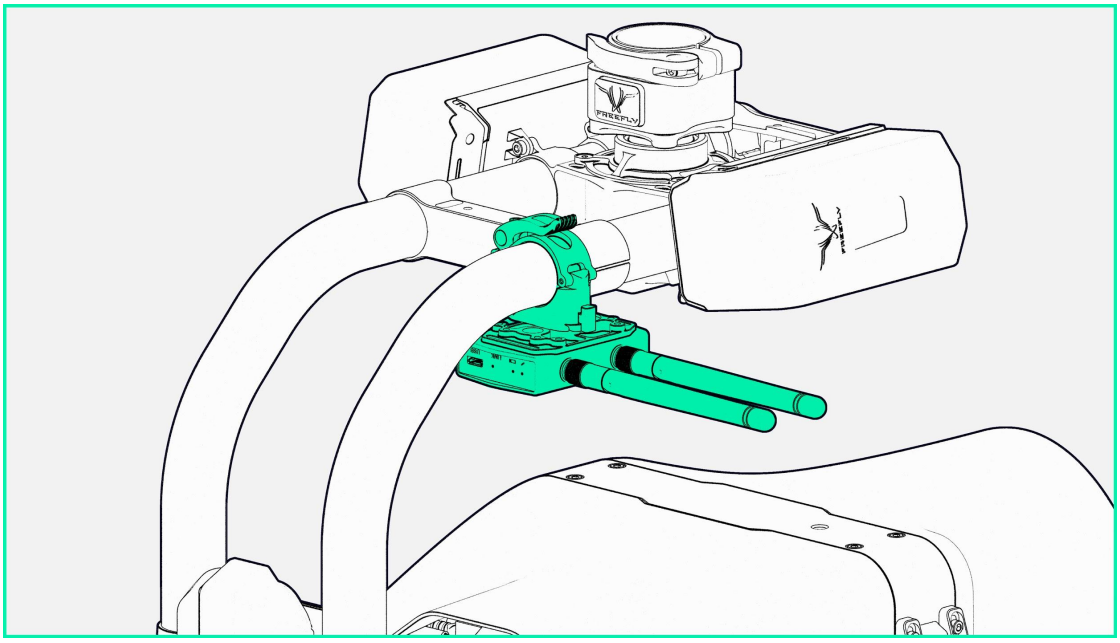
Release Procedure

1. Hold MōVI Carbon securely in one hand so the gimbal does not fall during the release process.
2. While supporting MōVI Carbon, open the lever and press the two release buttons on the TITH simultaneously
3. The male and female parts of the TITH have now released and can now be pulled apart.

CAUTION

Always check to see whether the TITH has engaged correctly and make sure that none of the release buttons are pushed while the TITH lever is being closed. Closing the lever on a TITH that has been incorrectly mounted can result in the sudden release of the gimbal which can cause damage to MōVI Carbon and any equipment mounted to it.

Mounting a Wireless System



Items Needed:

- 25mm Pop-N-Lock*
- Your preferred Wireless Video Transmitter*

*These items are not included with MōVI Carbon

1. Using the 25mm Pop-N-Lock, mount your prefered wireless video transmitter to the spine tubes as shown.
2. Power your wireless video transmitter using the 12V D-tap power output found on the GCU.Plug in the HDMI cable into your wireless transmitter. You can find the loose end of the HDMI cable secured just above the gimbal control screen.

NOTE

You may have to use the HDMI adapter provided with MōVI Carbon if your wireless transmitter uses an HDMI mini input.

Inserting the SD Card

Items Needed:

- SD Card UHS-II or higher*

*These items are not included with the MōVI Carbon

1. Open the GH5S's media door and insert your preferred SD card
    a. The dual media slots are located on the back right of the camera body.
    b. We recommend SD card types UHS-II and higher to benefit from the GH5S's video recording abilities.

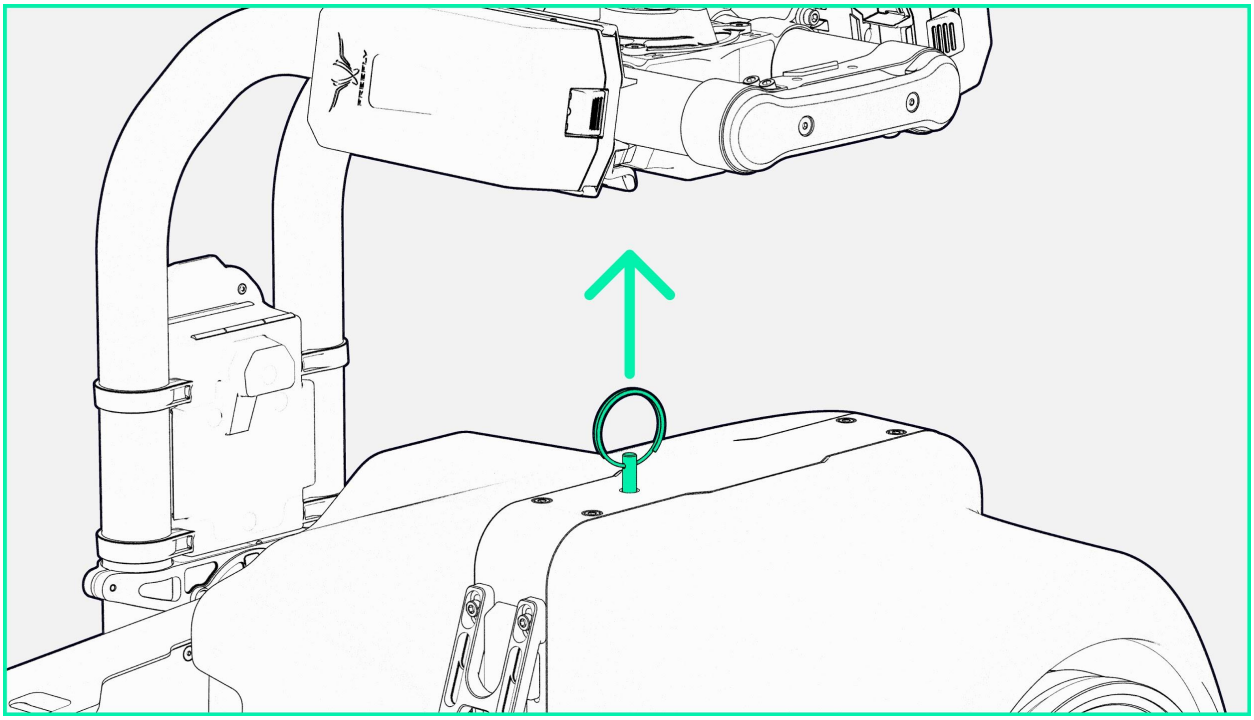
NOTE

The shroud does not need to be removed to insert and remove SD cards!

Unlocking the Inner Stages

In order to protect the inner stages during transportation, MoVI Carbon features a inner stage lock.

1. Remove the axis lock to unlock MōVI Carbon's inner stages.
    a. Locking the axes is as easy as reinserting the locking pin into MōVI Carbon.



NOTE

The best way to reinsert the pin is to gently move the inner stage as you insert the locking pin.

Always lock MoVI Carbon's inner stages before transportation or storage!

Powering Up MōVI Carbon

1. Power up MōVI Carbon by pushing the grey power button located near the gimbals control screen; MōVI Carbon will take a moment to initialize the inertial measurement unit and start an automatic calibration of the lens.
    a. There is no need to power the camera separately, everything powers up with MōVI Carbon!

Connecting to MōVI Carbon

There are many ways for user to take control of MōVI Carbon and all of its settings! The following section will walk you through each one.

Mobile Phone/Tablet + MōVI Carbon

Items Needed

- MōVI Carbon
- Mobile Device*

*These items are not included with MōVI Carbon

1. Ensure that MōVI Carbon is turned on and the gimbal has initialized.
2. Open the Freefly MōVI app on an iOS or Android mobile device and select the "Connect" icon.
    a. The connect icon is located at the top of the screen and flashes when it is not connected to a Freefly Product.
3. Use the Connect menu to select the desired Freefly product.
4. A successful connection will result in the name of the Freefly Product appearing on the top of the app's home screen.
    a. If the app did not connect, simply repeat steps 2 and 3.
    b. To disconnect from a device, open and close the connection menu without selecting a device.

Once you have connected the app to a Freefly device it will automatically reconnect any time the app is open and the device is turned on.

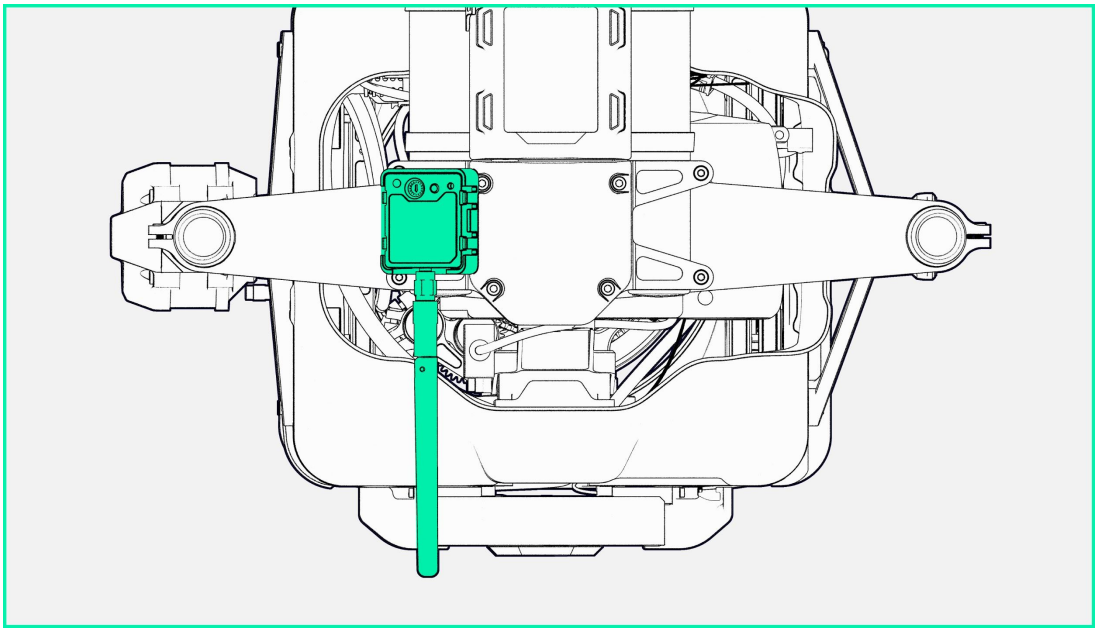
MōVI CONTROLLER + MōVI Carbon

Items Needed

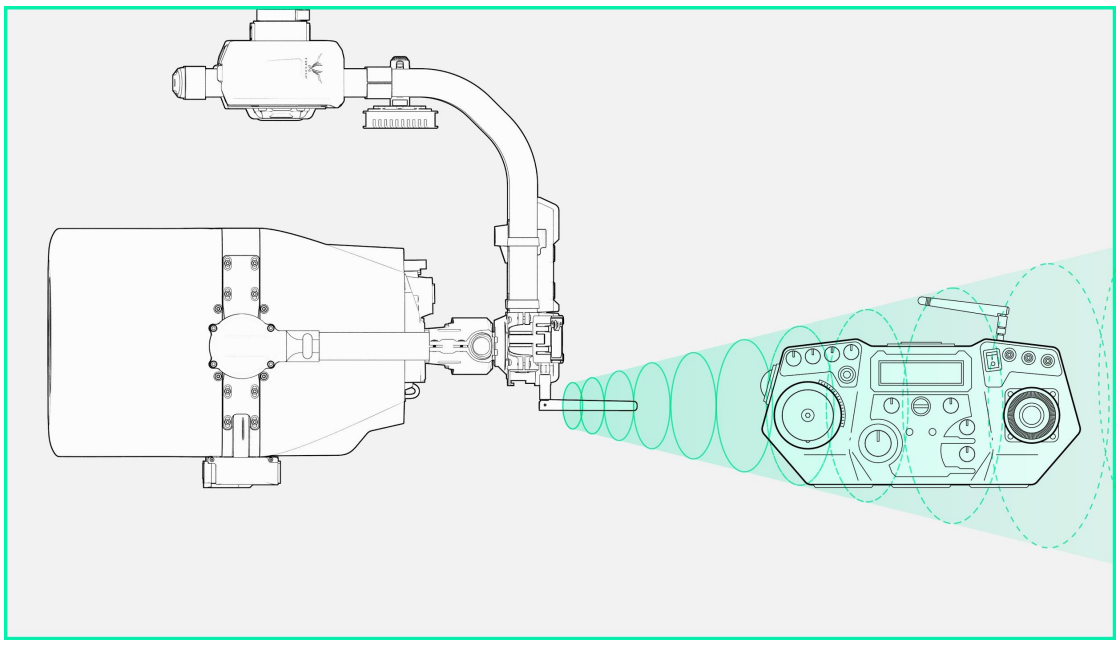
- MōVI Carbon
- MōVI Controller*
- Freefly Receiver (FRX)

*These items are not included with MōVI Carbon

1. Select the desired channel on Freefly Receiver (FRX) and ensure the FRX is connected to the COM1 port on MōVI Carbon's GCU.



2. Power up MōVI Controller and set the channel on MōVI Controller to match the channel on the FRX.
    a. Home > Radio Config > Channel (cycle and select with Menu Set knob)
3. Set Radio Action to Write.
    a. Home > Radio Config > Radio Action (select Write with Menu Set knob)
4. Press Menu Set knob to enact the write command.
5. Power up MōVI Carbon and hold the Bind button on the FRX for 2-3 seconds.
6. Set Radio Action to Bind.
    a. Home > Radio Config > Radio Action (select Bind with Menu Set knob)
7. Press Menu Set knob to enact Bind command once the FRX is slowly flashing orange.
8. Wait 20 seconds until MōVI Controller and FRX are bound.

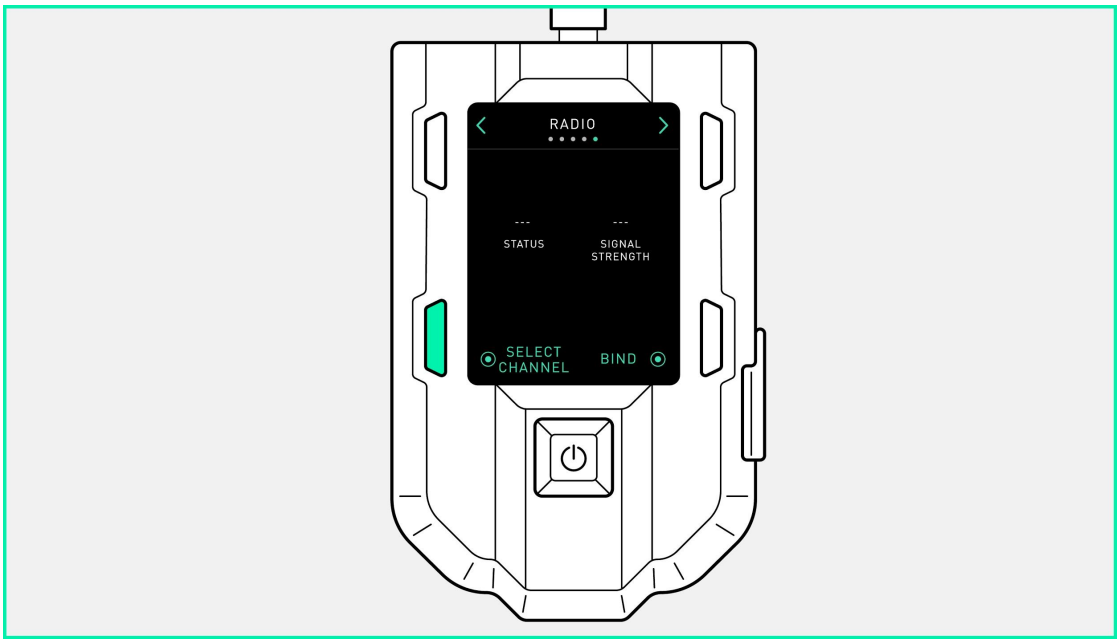


NOTE

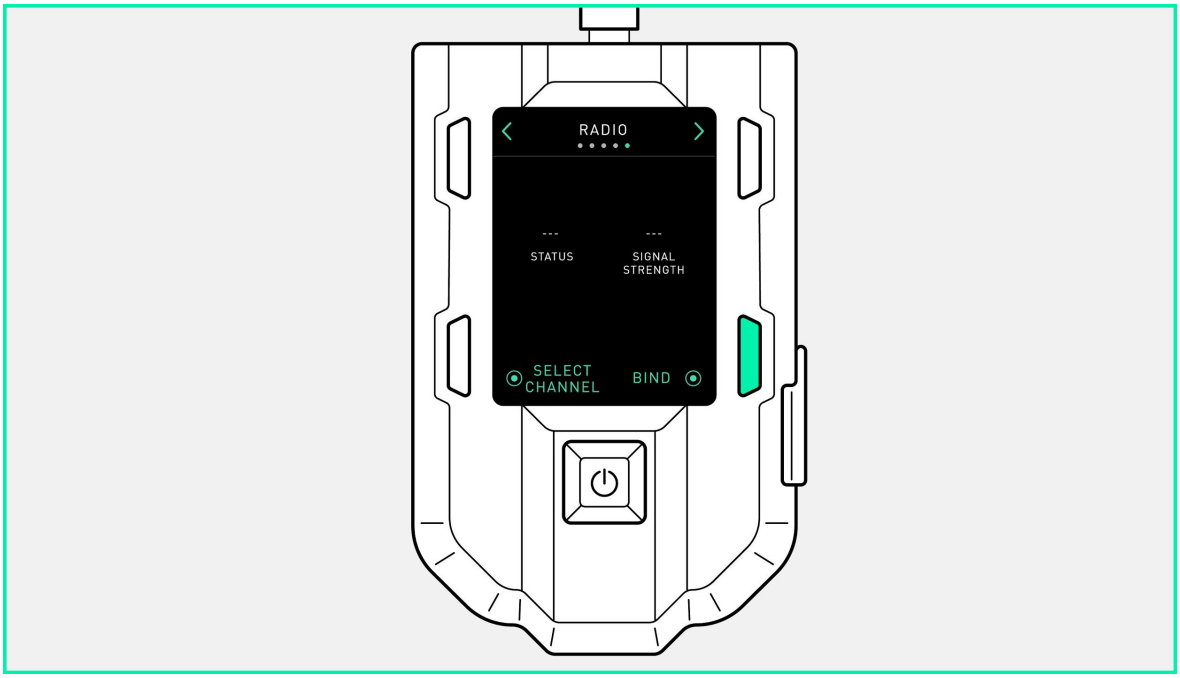
For instructions on the operating procedure and other information on MōVI Controller, please visit freeflysystems.com/software-manuals and download MōVI Controller User Manual.

PILOT + MōVI Carbon

1. Power up the PILOT by pushing the power button located below the display screen.
2. Use the display controls to move to the Radio Screen and use “Select Channel” to choose a channel, between (1-41)



3. Turn on MōVI Carbon and use the controls at the top of the control screen to move to the Radio Screen. Use “Select Channel” to set MōVI Carbon to the same channel as the PILOT.
4. Press the Bind button on the PILOT and MōVI Carbon within 5 seconds of each other and wait for the the devices to pair automatically.



NOTE

MIMIC uses a very powerful wireless transmitter to control the MōVI Carbon; when this transmitter is in close proximity to its receiver, the receiver can be oversaturated with input causing unwanted movements or binding issues. This is normal behavior for power wireless transmitters.

Multiple Controllers + MōVI Carbon

Freefly offers a wide variety of handheld controllers suited to professional cinematography. In order for these controllers to flawlessly interact with one another and MōVI Carbon there is a communication protocol that prioritizes and organizes all of the command inputs. Below is a quick guide which shows the order or priority that occurs when multiple control devices are bound to MōVI Carbon.

Priority	Controller
1	MIMIC/PILOT 1
2	MIMIC/PILOT 2
3	COM 1 (MōVI Controller or API)
4	COM 2 (MōVI Controller or API)
5	Mobile App

NOTE

Using Freefly System's communication protocol users can customize a set of input devices and break out orientation and FIZ control in any combination they need. For an in-depth review of the way multiple controllers interact with MōVI Carbon, please review the Freefly PILOT Operation Manual.

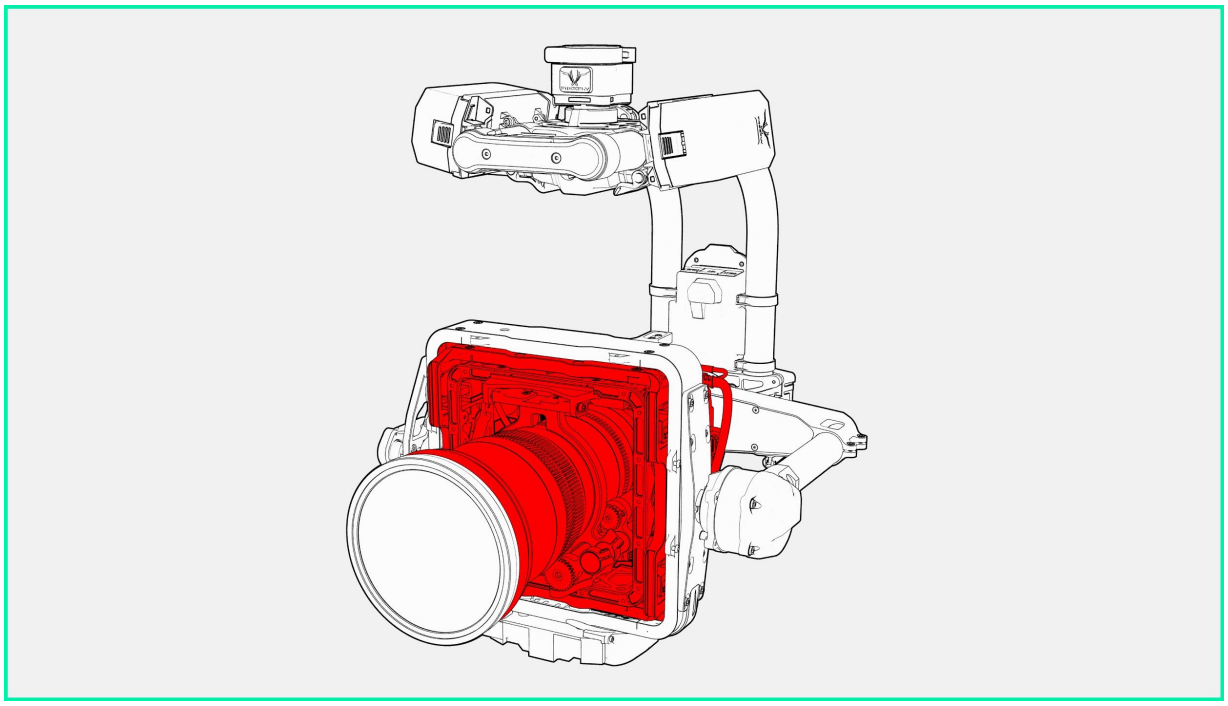
MōVI Carbon Advanced Setup

Camera and Lens

An integral part of MōVI Carbon is its camera and lens. Both the GH5S and the Fujinon XK Cabrio 20-120mm were chosen to provide outstanding cinema quality footage while keeping the entire gimbal light enough to hold by hand or fly with an ALTA.

As each MōVI Carbon is hand built, it goes through a complex balancing process which accounts for the extra axes and ensures that the Center of Gravity (CG) of the system is carefully dialed in. Once the CG is set, the design of MōVI Carbon ensures that it will not have to be balanced again. Due to this, we strongly advise users to refrain from attempting to adjust or remove parts of MōVI Carbon for use elsewhere.

DO NOT REMOVE CAMERA OR LENS



WARNING

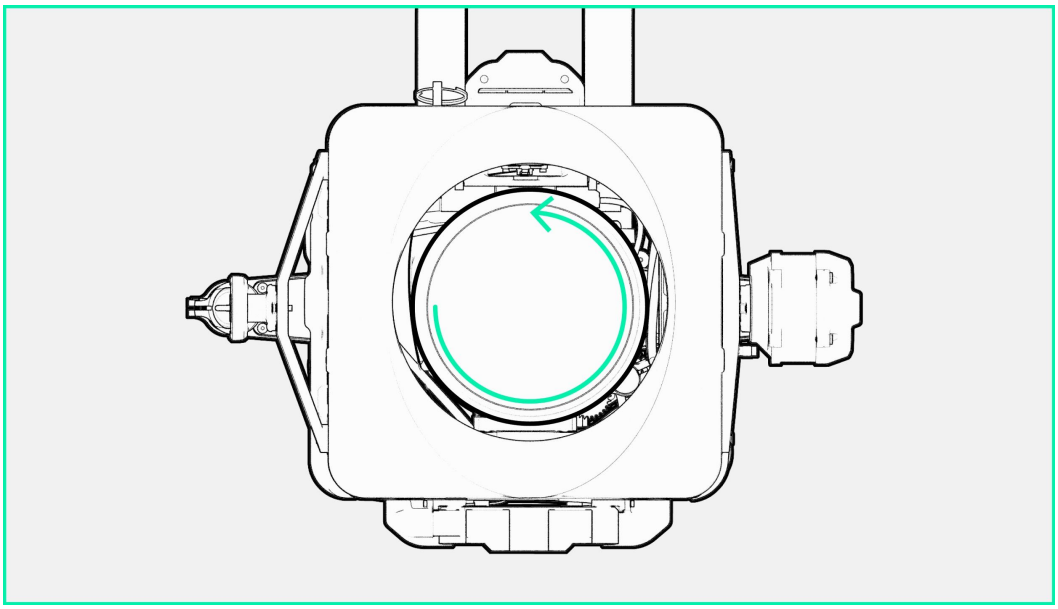
The camera and lens should **never** be removed from MōVI Carbon without explicit instruction from Freefly Systems. Units that have been disassembled will have to be sent back to Freefly for repair.

Changing ND/UV Filters

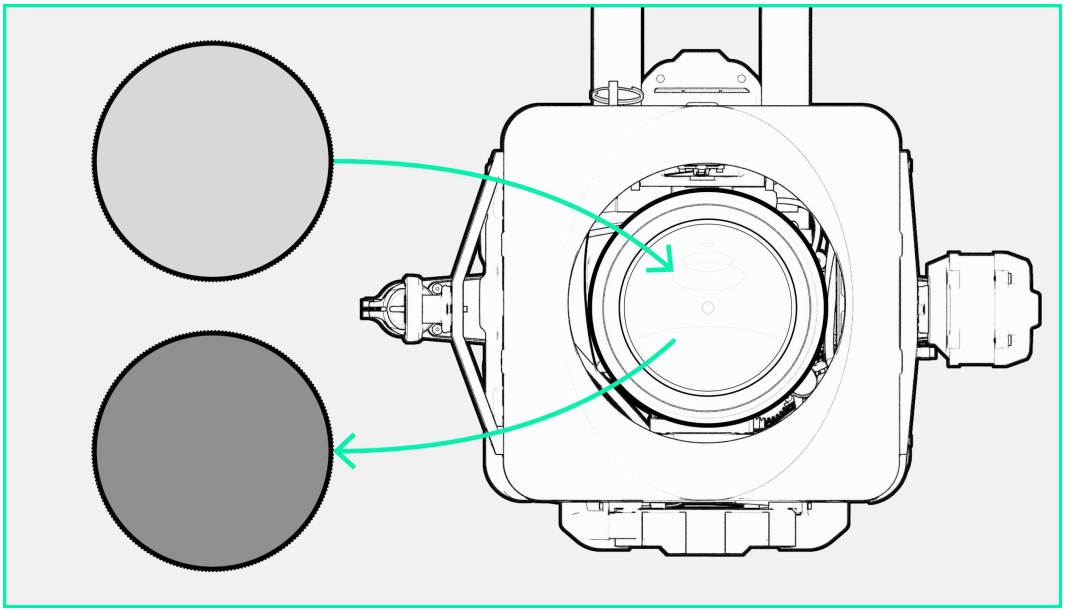
Items Needed

- MōVI Carbon
- Schneider Circular 114mm (4.5in) ND + UV Kit

1. Ensure MōVI Carbon's inner axes are locked, then unscrew the Schneider Filter Adapters retaining ring.
    a. Take care not to touch or scuff the filter while removing the retaining ring.



2. Once the retaining ring has been removed, carefully remove the filter that is underneath and store it in the Filter Kit's pouch.
3. Select the ND filter with the desired stop value and place it into the Schneider Filter Adapter.
    a. This kit will work with Schneider Circular filters that have a diameter of 114mm (4.5").
    b. Included with MōVI Carbon are the following filters; ND .6, ND .9, ND1.2, and UV.
4. Carefully thread the retaining ring onto the Schneider Filter Adapter to secure the ND or UV in place. Be careful not to over tighten the retaining ring.



ALTA + MōVI Carbon

Due to the unique design of the ALTA multirotor family, MōVI Carbon can be mounted on top of the ALTA in SkyView or underneath the ALTA in GroundView.

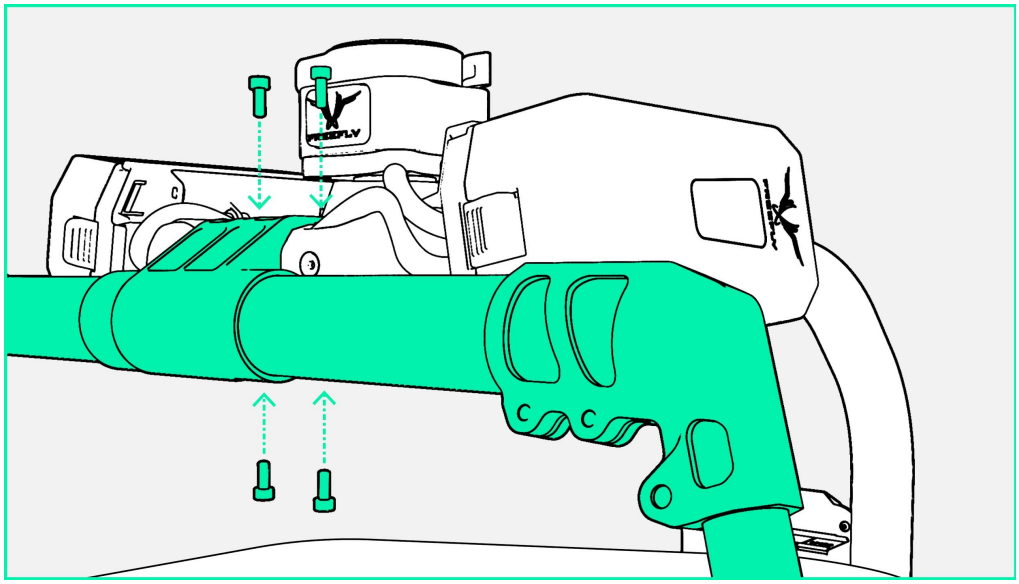
GroundView

Items Needed

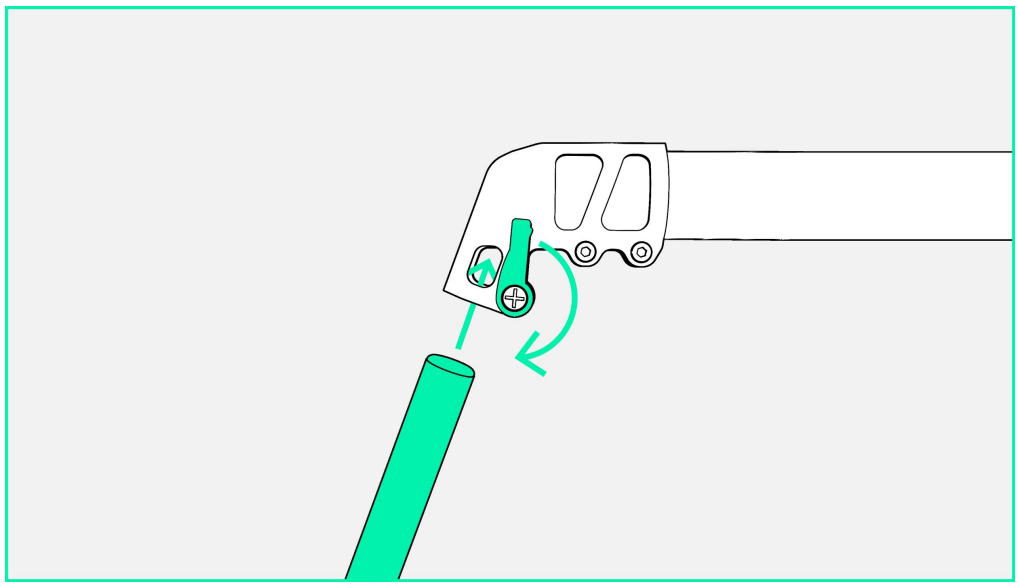
- MōVI Carbon
- MōVI Pro Landing Gear*
- 2.5mm Hex driver
- ALTA 8*

*These items are not included with MōVI Carbon

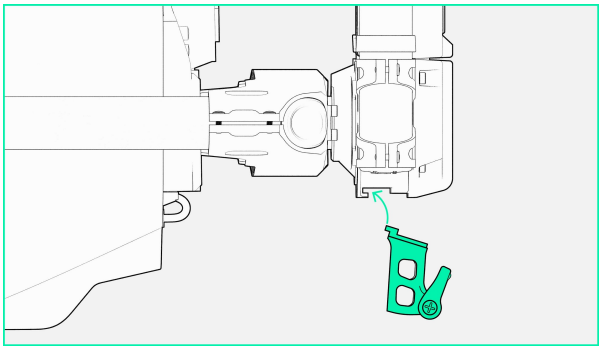
1. Use the four M3x8 screws included in MōVI Pro Landing Kit to attach the front landing gear to the front of MōVI Carbon's Pan arm.

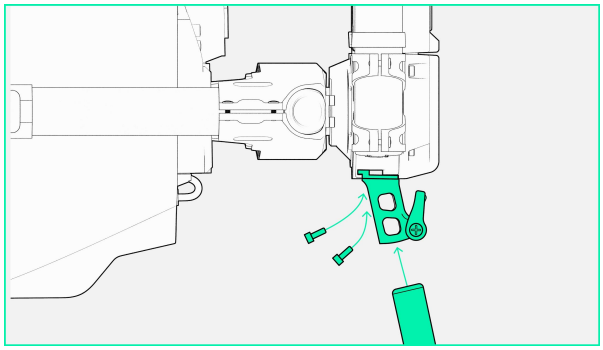


2. Attach the long carbon fiber tubes to the landing gear cross beam to assemble the front landing gear. Use the levers to hand tighten the rods into place.

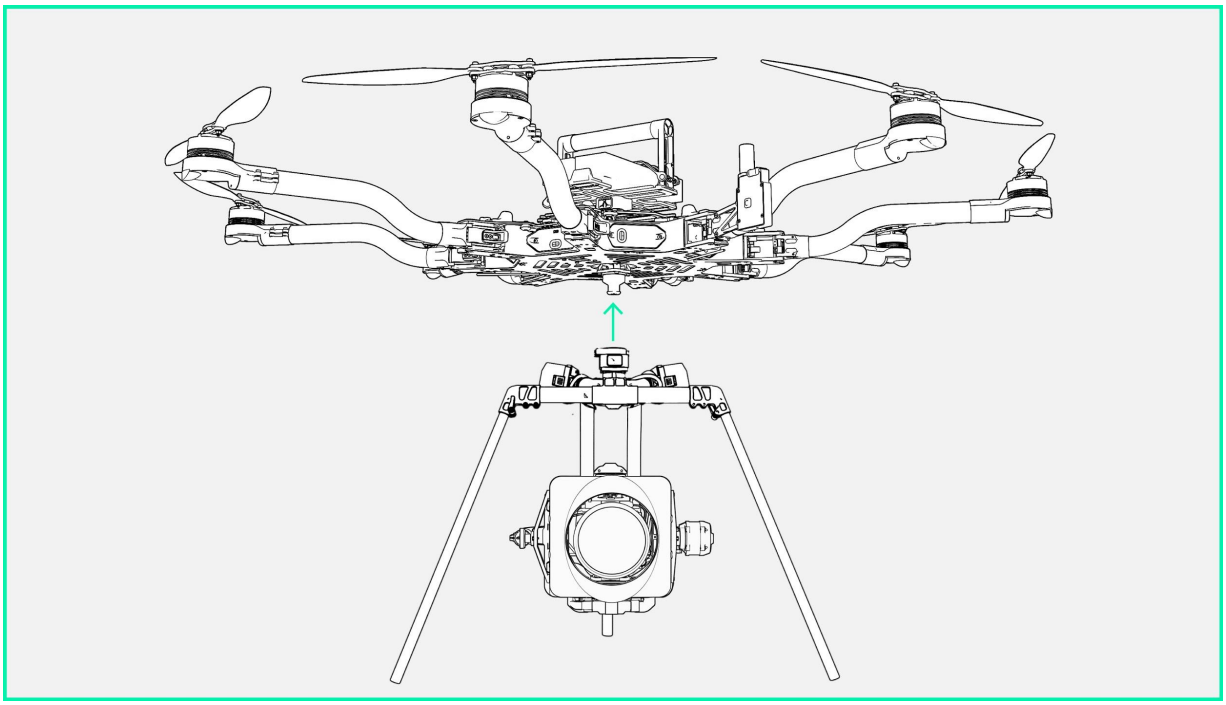


3. Slide the rear landing gear into the slot underneath the GCU from either side and secure it with two M3x8 screws.





4. Connect the ALTA with MōVI Carbon using the Male TITH connector found on the bottom of the ALTA 8.



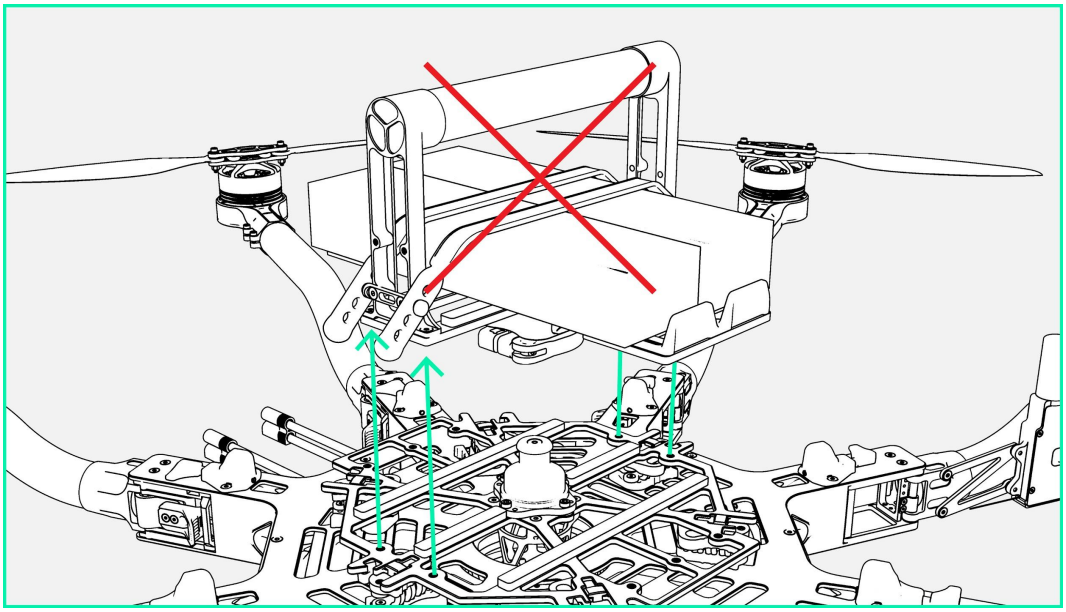
SkyView

Items Needed

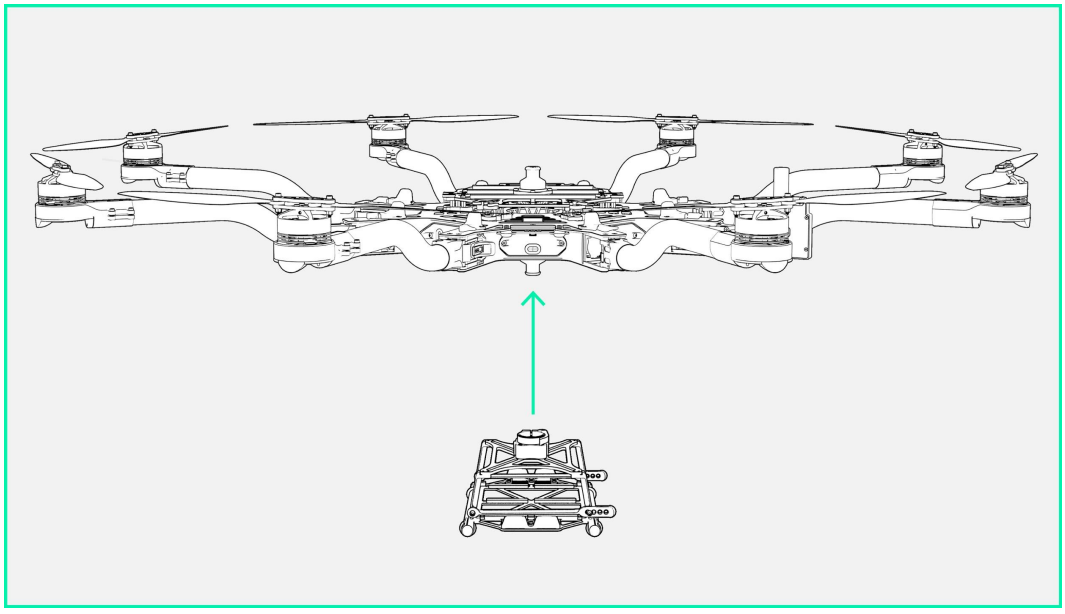
- MōVI Carbon
- ALTA SkyView Landing Gear*
- ALTA 8*

*These items are not included with MōVI Carbon

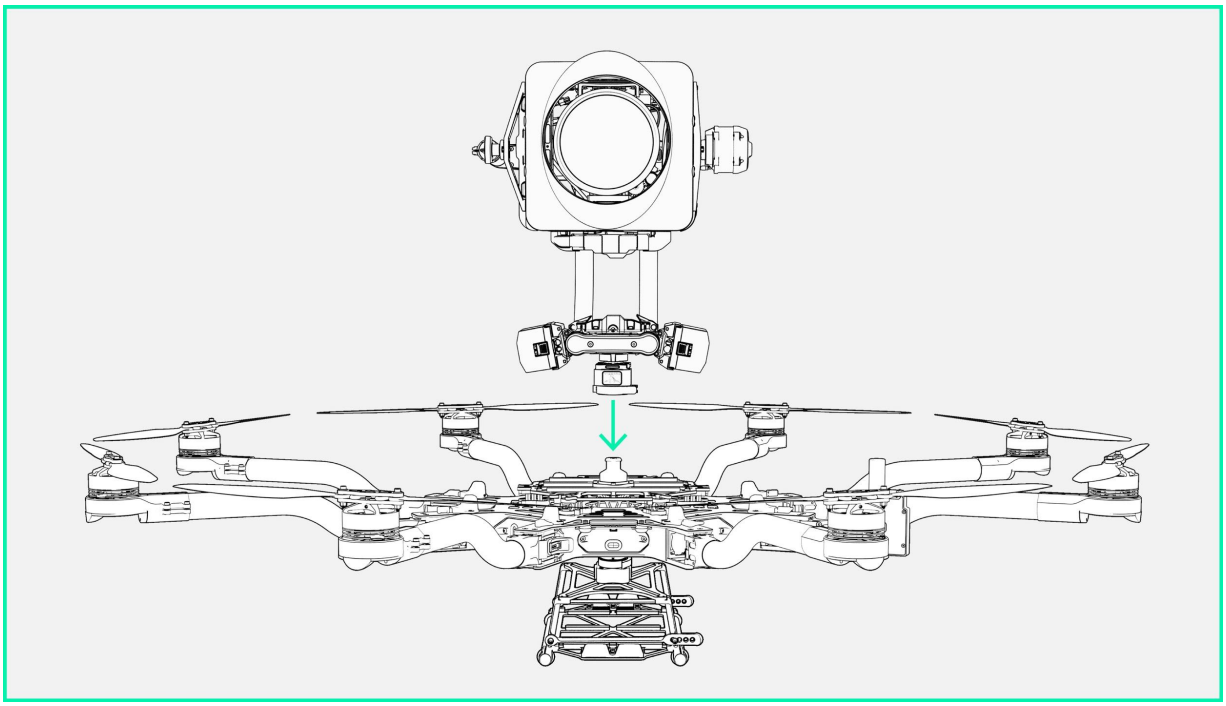
1. Remove the Quick Release Top Handle by disconnecting it from the TITH connector on top of the ALTA.



2. Attach SkyView Landing Gear to ALTA 8 using the TITH connector underneath the ALTA.



3. Attach MōVI Carbon to the top of the ALTA 8 and lock into place using the upper TITH connector.



NOTE

For instructions on the operating procedure and other information on the ALTA, please visit freeflysystems.com/software-manuals and download the ALTA Flight Manual.

Tune MōVI Carbon

MōVI Carbon comes pre-tuned, meaning it will provide great footage straight out of the box! However some situations may require slight adjustments to these settings; this section will walk through the available settings and how to get the most out of MōVI Carbon. If you are looking for the default tuning values; those can be found on pg#62.

Advanced Tuning

Sometimes configurations need to be adjusted in order to achieve a desired look, but can lead to a situation where users want to return to a known working state. If this happens a quick reset to MōVI Carbon's default configuration will solve most issues!

FILTERS

MōVI Carbon has a number of software filters that are applied to remove unwanted signals from the system. The Filter settings are the second most important setting for achieving maximum stabilization performance. The purpose of the filters is to eliminate noise and vibration due to structural resonances in the camera, lens, or gimbal. Setting the filters too high or too low can cause signal disturbances that can reduce the overall stabilization.

1. **Pan, Roll, and Tilt Filters**
   These control the strength of the filter that is applied to the motor controller signal. The filters apply to each respective axis individually and can be found under the Main page of the Tuning menu.
2. **Gyro Filter**
   This controls the strength of the filter applied to the Inertial Measurement Unit's (IMU) signal. Adjusting the Gyro filter can be done by going to the "Advanced" page under the tuning menu and selecting Gyro Filter. This filter applies to all three axes.

Tuning Filters

It will take experience to recognize the symptoms of too-high or too-low filters and some trial and error to find the optimum values for a particular setup.

1. If the gimbal is vibrating at a high frequency after tuning, increase the filter values.
2. If the gimbal is oscillating or rocking at a low frequency after tuning, decrease the filter values.

Hold Strengths

Stiffness values set how much the camera resists moving (with respect to the outside world) and Hold Strength sets how aggressively the gimbal tries to return to its target position if it displaced. Indirectly, this also sets how aggressively MōVI Carbon follows orientation commands from a second operator using a MōVI Controller or MIMIC. Increasing Hold Strength has pros and cons that should be considered depending on the shooting situation.

Tuning Hold Strengths

1. To tune hold strength, increase the hold strength of an axis and test its response to a disturbance.
2. If the axis returns to its original position too slowly, increase the hold strength.
3. If the axis overshoots its original position, decrease the hold strength.

4. The final value should be set by weighing the Pros and Cons and testing the setup to see if MōVI Carbon behaves as desired.

Jolt Rejection

To help enable higher Hold Strength settings while mitigating some of the cons listed above, Jolt Rejection can sense jolts and soften the gimbals recovery effort.

Tuning Jolt Recovery

Jolt Rejection helps prevent MōVI Carbon from overshooting its target orientation when responding to a sudden disturbance. A higher Jolt Rejection value increases the softening of the response; however, values that are too high can cause MōVI Carbon to react too slowly to disturbances.

Max Control Rate

The maximum rate of camera movement can be used to enable higher Hold Strengths while reducing the possibility of overshoot. This is especially helpful when shooting with longer focal lengths.

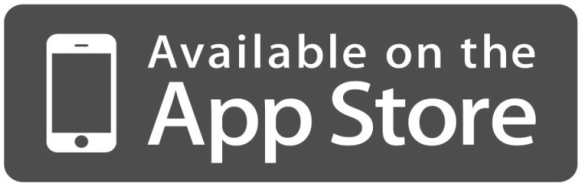
Tuning Max Control Rate

1. To increase the control over the camera's movements, increase the Max Control Rate.
2. To increase the smoothness of the camera's movements, decrease the Max Control Rate. This will reduce the operator's control over the camera's movements.

Updating MōVI Carbon

MōVI Carbon will arrive with the latest firmware already installed, so updating is not required before initial use. When future firmware versions are released, users can update MōVI Carbon using the following steps:

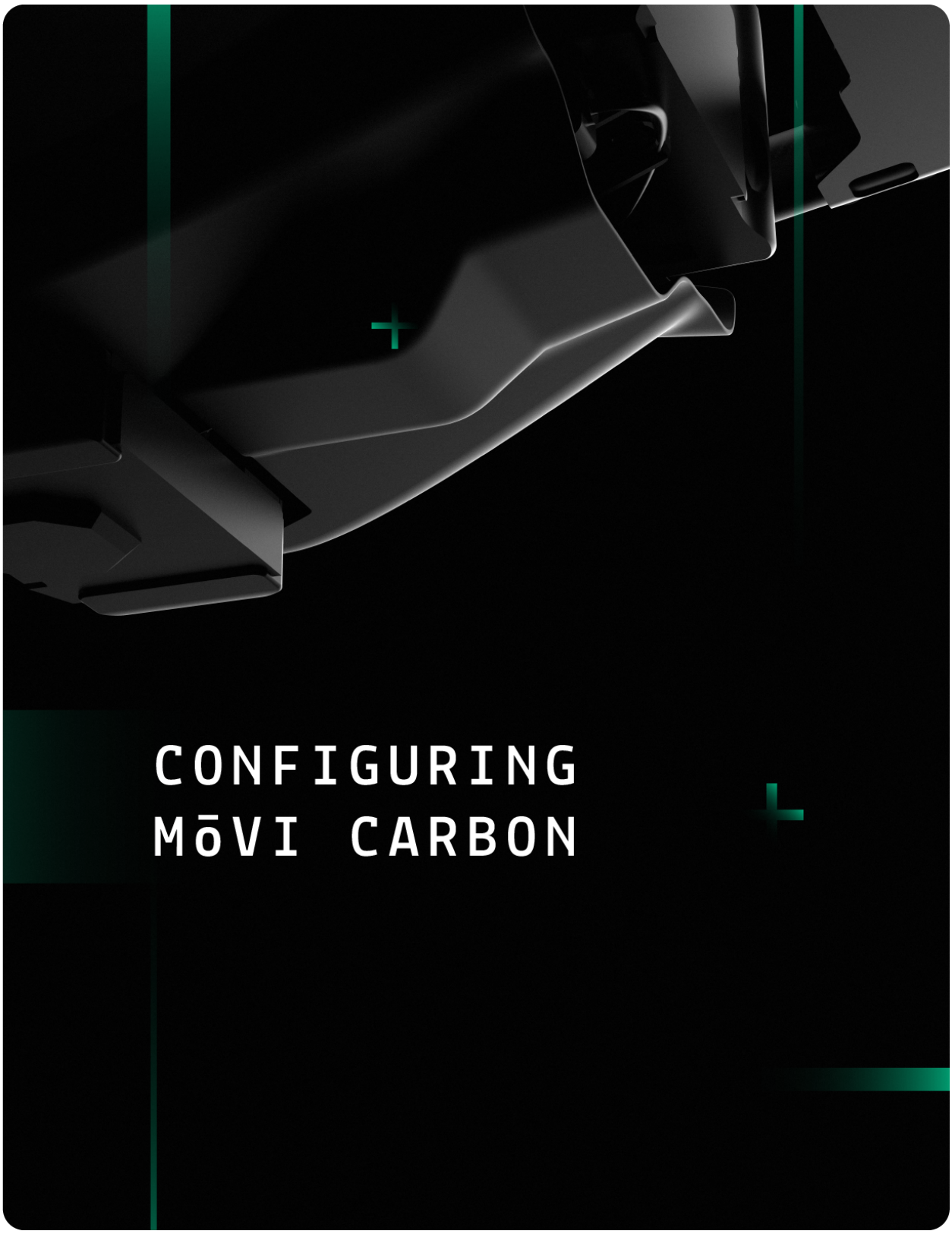
1. Download or update to the latest version of the MōVI app on your mobile device using the App Store or Google Play.



2. Turn on MōVI Carbon and allow the gimbal to boot normally.
3. Open MōVI Carbon app on your mobile device and it connect to MōVI Carbon.
4. If there is a new firmware update, your mobile device will prompt you to update MōVI Carbon.
    a. A red notification will appear under the 'Monitor' menu when an update is available.
5. If you wish to update MōVI Carbon select "update" to initiate the update process.
    a. Updates may take up to 20 minutes; please be patient while MōVI Carbon is performing the update.
6. Once the update has completed, MōVI Carbon will power cycle and turn off.

Please make sure the following criteria are met to ensure firmware updates are successful!

- MōVI Carbon has more than 30% of its battery life.
- The current configuration has been saved to the app; updates load default values to MōVI Carbon. For instructions on how to save configurations see pg#39.



CONFIGURING MōVI CARBON

Configuring MōVI Carbon is easy. With a built-in control screen and mobile app that can assume complete control over MōVI Carbon's settings, a user can adjust tuning values, remote controller setup, and switch modes on the fly. This grants the user complete freedom of customization and allows for endless creativity. The following section will guide you through the configuration options available to a MōVI Carbon user.

Setting Configurations

All configuration settings are saved on MōVI Carbon when it is shut down properly. You can also use the MōVI App to save configurations to your phone, these configurations can then be loaded back over to MōVI Carbon quickly and easily. This allows users to prep different configurations for different situations and switch between them without going through all of the setting one by one.

Saving Configurations to Presets

1. Open the MōVI App and ensure that MōVI Carbon is turned on and connected to the app.
2. Once MōVI Carbon has the desired settings go to the 'Configurations' menu in the MōVI app. Tap the word 'Configurations' at the top of the screen to enter the 'Presets' menu.
3. Tap 'New' and enter a descriptive title so this specific configuration can be quickly found again.
4. To load or delete a previously saved configuration, simply find it in the list of configurations stored on the phone and tap the name.
    a. Select 'Apply' to load the configuration onto MōVI Carbon.
    b. Select 'Delete' to delete the configuration from the phone. This cannot be undone!

Default Configuration

MōVI Carbon comes with default configuration values that ensure performance to our standard. Sometime this configuration needs to be adjusted in order to achieve a desired look, but can lead to a situation where users want to return to a known working state. If this happens, a quick reset to MōVI Carbon's default configuration will solve most issues!

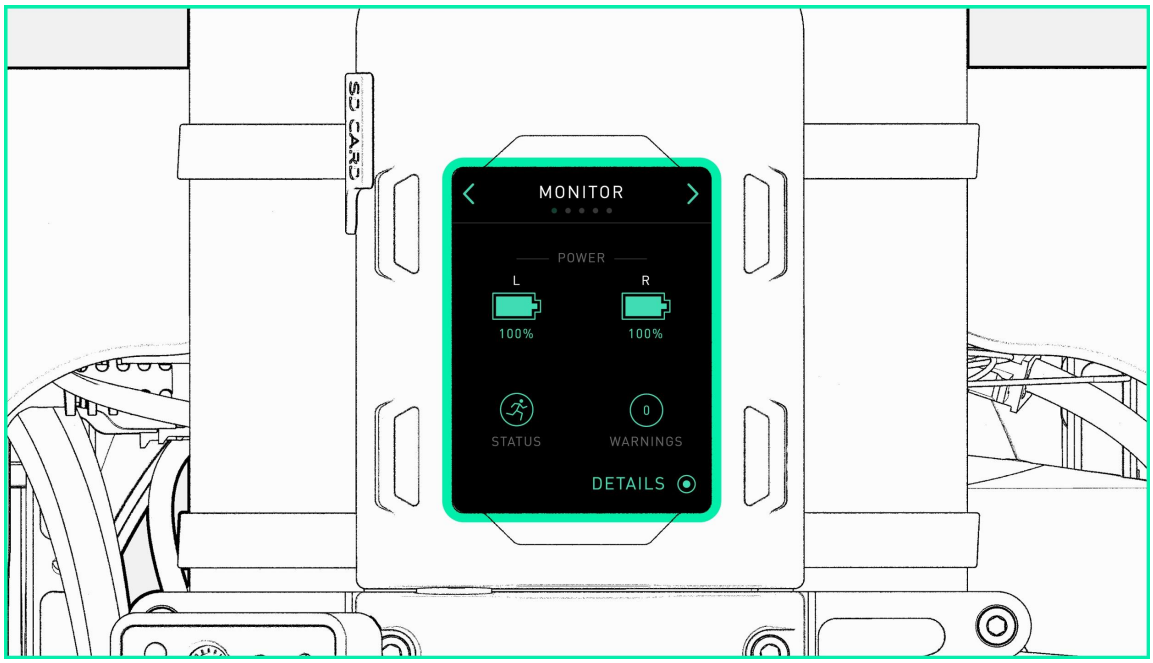
1. Repeat Steps 1-2 from the 'Saving Configurations to Presets' section.
2. Select 'Freefly Default Config' and then apply!
3. MōVI Carbon will revert to its default settings; to ensure these values get saved turn MōVI Carbon off by holding the Power Button.

MōVI Carbon Embedded Display Configurations

MōVI Carbon is equipped with a built-in display and display navigation system. This allows a user to check MōVI Carbon's system status and make quick adjustments to tuning, tilt mode, radio options, and more

Monitor Screen

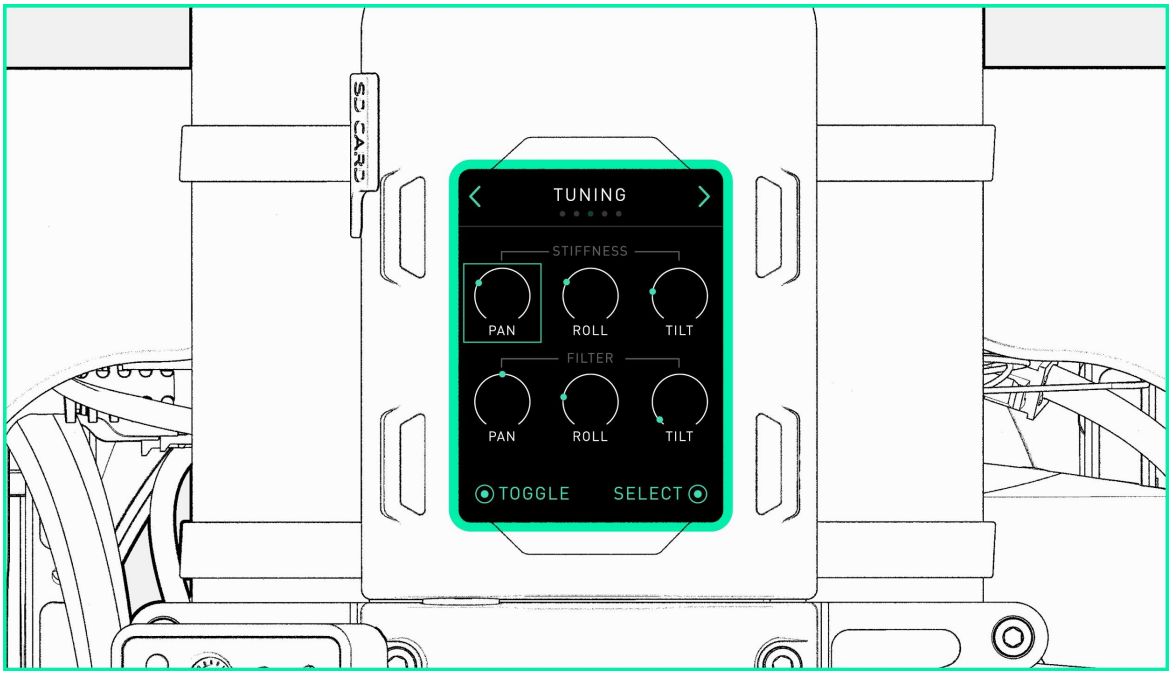
This screen monitors MōVI Carbon's battery levels and system details including warnings and device status.



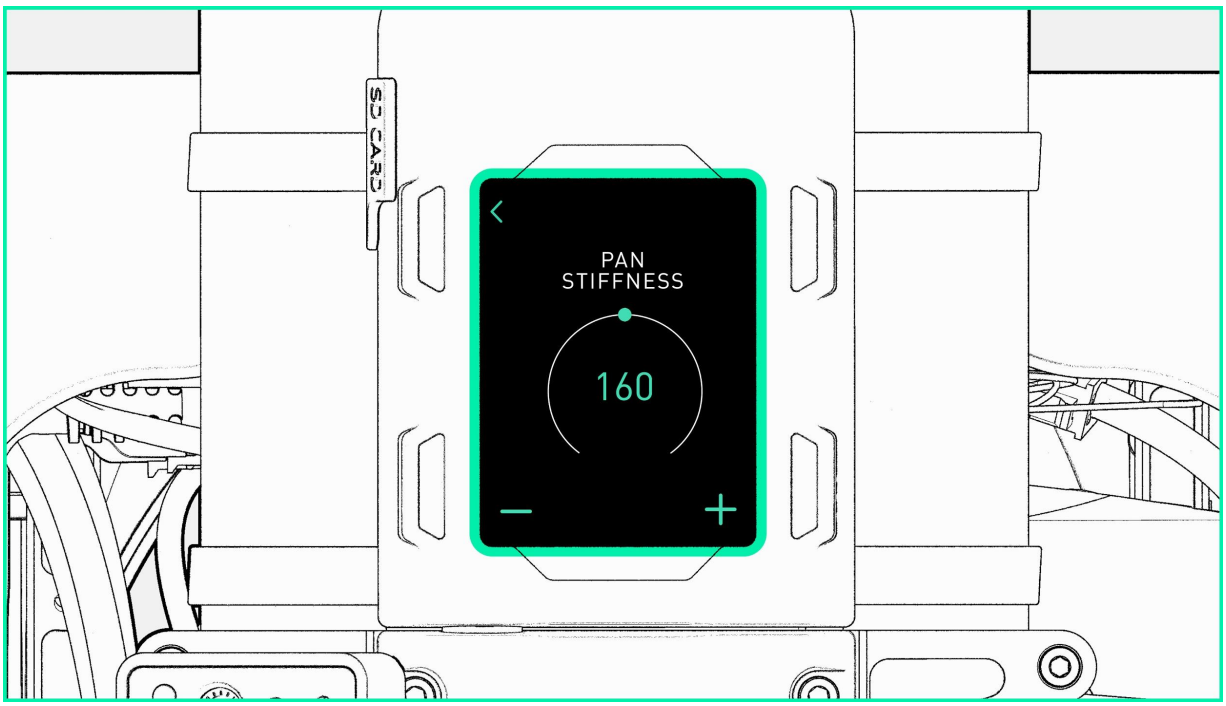
Option	Description
1. Left Battery Power (%)	Displays the power remaining in the left battery as a percentage.
2. Right Battery Power (%)	Displays the power remaining in the right battery as a percentage.
3. Next Screen Button	Takes users to the next GCU screen.
4. Details Button	Takes user to MōVI Carbon's component status.
5. Status Icon	Displays the current status of MōVI Carbon, for example whether booting or stabilization has initialized.
6. Warning Icon	Displays warnings about MōVI Carbon. To view these warnings select the Details button.
7. External IMU Icon	Displays the current status of external IMU's state. A yellow symbol denotes an external IMU that is connected and is warming up; once the external IMU has reached optimal performance the symbol turns grey. This symbol is found in the bottom left of the screen.

Tuning Screens

These screens allow users perform manual tuning adjustments to MōVI Carbon without needing to connect to another device.



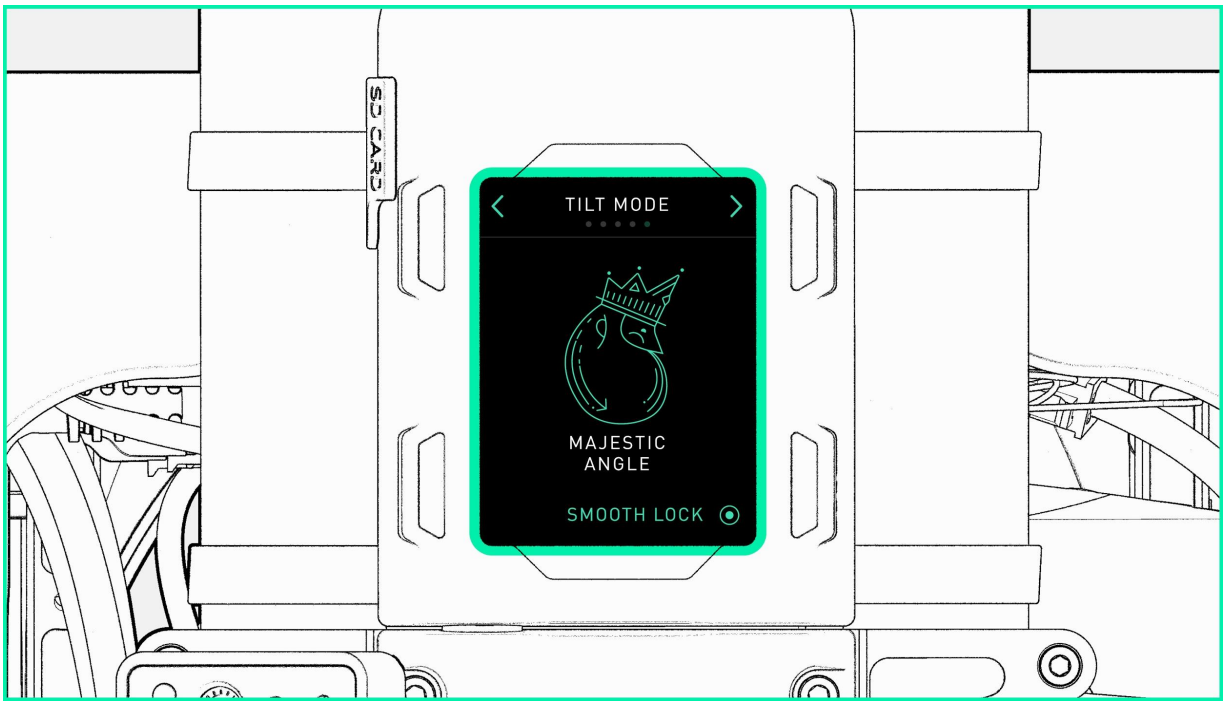
Option	Description
1. Toggle	Toggles through the stiffness and filter parameters for each axis.
2. Select	Selects the highlighted parameter and moves to the respective parameter adjustment screen.
3. Stiffness Values	Displays a visual of the Pan, Roll, or Tilt stiffness values.
4. Filter Values	Displays a visual of the Pan, Roll, or Tilt filter values.
5. Next Screen Button	Takes users to the next GCU menu screen.
6. Previous Screen Button	Takes users to the previous GCU menu screen.



Option	Description
1. Previous Screen Button	Takes users to the previous GCU menu screen.
2. “+” Button	Increases the selected stiffness or filter value by (1) if pressed and (5) if held.
3. “-” Button	Decreases the selected stiffness or filter value by (1) if pressed and (5) if held.

Tilt Mode Screen

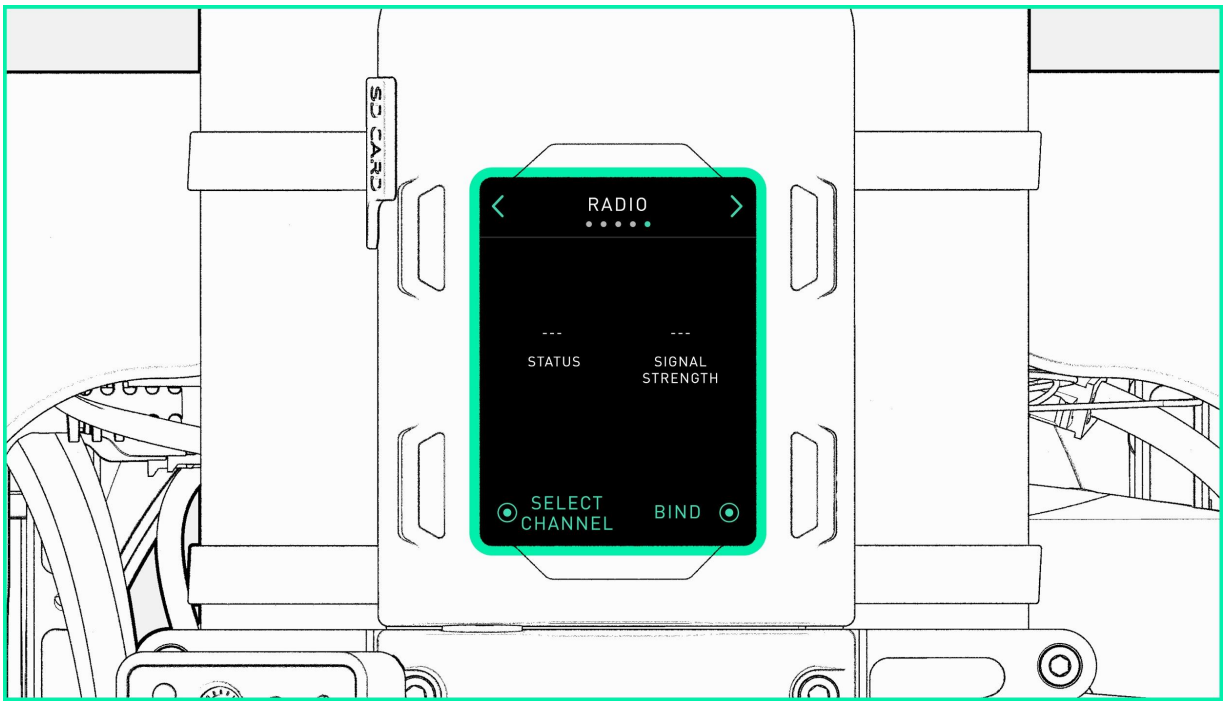
This screen allows users to control MōVI Carbon's tilt mode without the need of a second device.



Option	Description
1. Tilt Mode Status	Displays the current Tilt Mode status.
2. Majestic Angle/Smooth Lock	Switches the Tilt Mode from Smooth Lock to Majestic Angle. Pressing the same button will return the Tilt Mode to Smooth Lock.
3. Next Screen Button	Takes users to the next GCU menu screen.
4. Previous Screen Button	Takes users to the previous GCU menu screen.

Radio Screen

This screen allows users to select MōVI Carbon's receiver channel and bind MōVI Carbon to a MIMIC or Pilot FIZ controller .



Option	Description
1. Radio Status	Displays the signal status and strength.
2. Select Channel	Allows the user to select MōVI Carbon's receiver channel.
3. Bind	Allows the user to bind MōVI Carbon to a Dual-Op device.
4. Previous Screen Button	Takes users to the previous GCU menu screen.

MōVI Carbon Modes Configuration

The Freefly MōVI App grants users complete control over MōVI Carbon, its configuration and all of its modes. The app is designed to be intuitive and easy to use, so nothing slows you down on set!

NOTE

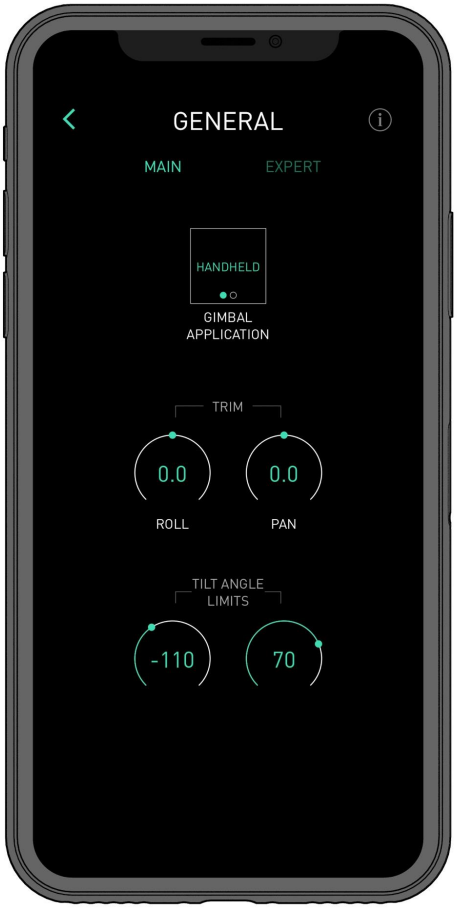
When the MōVI App is disconnected from a Freefly device all settings will be greyed out and uneditable, however, the device will keep any settings that were changed.

General Configuration

General Menu

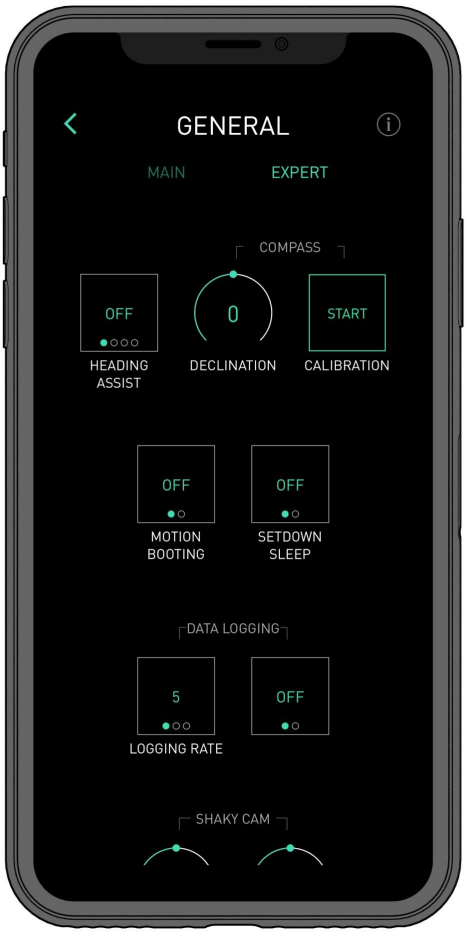
MōVI Carbon's settings are accessible through the General icon under the Configurations menu

Main Panel



Option	Description
1. Gimbal Application	Select whether MōVI Carbon will be used in "Handheld" or "Airborne" mode. This selection will affect the center position of the Mode switch in while in Dual-Op by enabling Majestic Pan in "Handheld" mode or locking each axis for take-off and landing in "Airborne" mode.
2. Trim (Pan, Roll)	Increase or decrease the trim angle of the pan and tilt axis so users can perform fine adjustments on gimbal orientation or create a certain look for a shot.
3. Tilt Angle Limits	Set the minimum and maximum angle of the tilt axis. This can be used to place a soft stop and prevent a camera, lens, or wiring from becoming a mechanical stop.

Expert Panel



Option	Description
1. Heading Assist	Use to orient MōVI Carbon under different circumstances. “Fixed Mount” should be used when MōVI Carbon is stationary to avoid any pan drift; “GPS” should be used in high acceleration situations commonly observed when using MōVI Carbon with an aerial platform, and “Compass” can be used when MōVI Carbon is handheld or aerial.
2. Declination	Set the declination angle when using the “Compass” Heading Assist mode. A declination angle is used to adjust for the Earth’s magnetic variance due to global position.
3. Compass Calibration	Calibrate the compass on MōVI Carbon to increase the performance of the Compass Heading Assist mode. Follow the instructions provided by the app when initializing a compass calibration.
4. Motion Booting	Enable “Motion Booting” to allow MōVI Carbon to boot in situations where there is significant movement during the initialization process of the gimbal such as on a boat. For optimum performance in normal use, motion booting should be turned off.

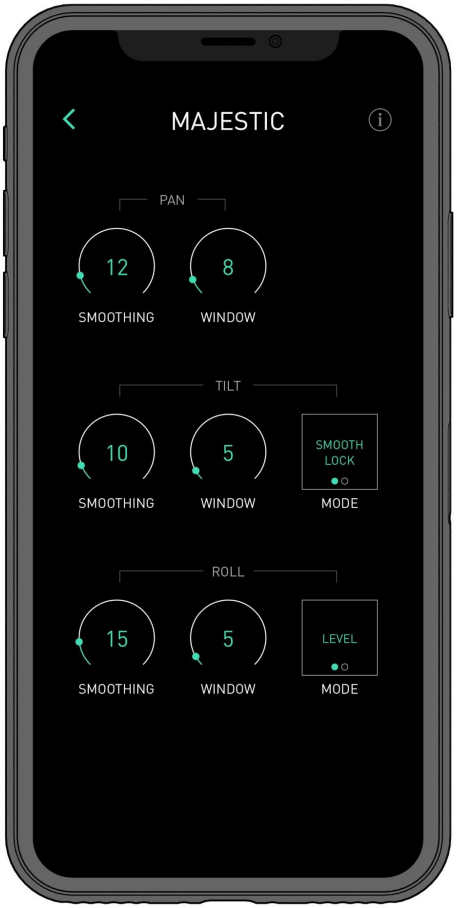
5. Setdown Sleep	Enable “Setdown Sleep” to allow MōVI Carbon to enter sleep mode when motors are stalled for more than 4 seconds. MōVI Carbon will exit sleep mode when joint motion is detected.
6. Logging Rate	Select MōVI Carbon’s data logging rate.
7. Data Logging	Enable MōVI Carbon’s data logging function via a MicroSD card in the GCU.
8. Shaky Cam (Pan, Tilt)	Enable Shaky Cam for the pan and tilt axis. Shaky Cam deliberately disturbs the orientation of the gimbal to create a lead or lag effect.

Mode Configuration

The creation of professional cinematographic content is made simple through the use of MōVI Carbon’s modes from intuitive orientation control, to custom dynamic time lapses, and more. All of MōVI Carbon’s modes are accessible through the MōVI app and MōVI Controller.

Majestic Mode

Majestic Mode allows a single user to have complete control over MōVI Carbon by stabilizing the camera and following movement inputs from the user. The Majestic Mode GUI allows a user to configure the Majestic Mode to suit a particular shot.



Option	Description
1. Smoothing (Pan, Tilt, Roll)	Adjust the smoothing value to dial in the camera movement's flow from one point to another. Smaller values will result in gimbal movements that are responsive and agile .
2. Window (Pan, Tilt, Roll)	Define the range of handle movement that will be ignored by MōVI Carbon in Majestic Mode. Higher values will ignore more unintentional movements.
3. Tilt Mode	Select "Smooth Lock" or "Majestic Angle" as the tilt mode. Smooth Lock will maintain a set tilt angle regardless of handle position. Majestic Angle links the tilt axis to the handle movement, allowing a single user to control the tilt angle.
4. Roll Mode	Select "Level" or "Majestic Angle" as the roll mode. Level mode will maintain the horizon line regardless of handle position. Majestic Angle links the roll axis to the handle movement, allowing a single user to control the roll angle.
5. Span (Pan, Tilt, Roll)	Increase or decrease the span value to influence how quickly the gimbal reacts to a majestic control inputs. Lower span values will allow the gimbal to perform whip pans while high span values give even smoother movement.

Timelapse Mode

Timelapse mode lets users create stunning camera movements for timelapses in seconds. Users can create and edit keyframes of the desired motion and quickly adjust variables such as Timelapse Interval and Timelapse Duration.

Timelapse Path Panel

Option	Description
1. Preview	Initiates a condensed preview of the timelapse path.
2. Start	Initiate the timelapse progression through all keyframes taking the total duration calculated on the Setup panel.
3. Clear	Delete all keyframes.
4. Keyframe Display	Display each of the keyframes being used and the pan and tilt path used to travel from one keyframe to the next.
5. Virtual Joystick	Use to set or edit keyframe positions.
6. Add/Set/Done	Use to add and edit the timelapse keyframes. Select “Add” to place a keyframe in the current pan and tilt orientation of MōVI Carbon. To

reposition a keyframe tap the desired keyframe on the keyframe display and reposition it using the virtual joystick, the MōVI Controller, or an authorized 3rd party radio controller. Once desired keyframes are repositioned, select “Set” and then “Done” to exit the keyframe editing mode.

NOTE

Timelapse works best when Heading assist is set to “Fixed Mount.” This can be set on the Expert panel in the General Menu.

NOTE

MōVI Carbon Keyframe positions may be set by hand or remotely via the MōVI Controller or an authorized 3rd party radio controller.

Timelapse Setup Panel

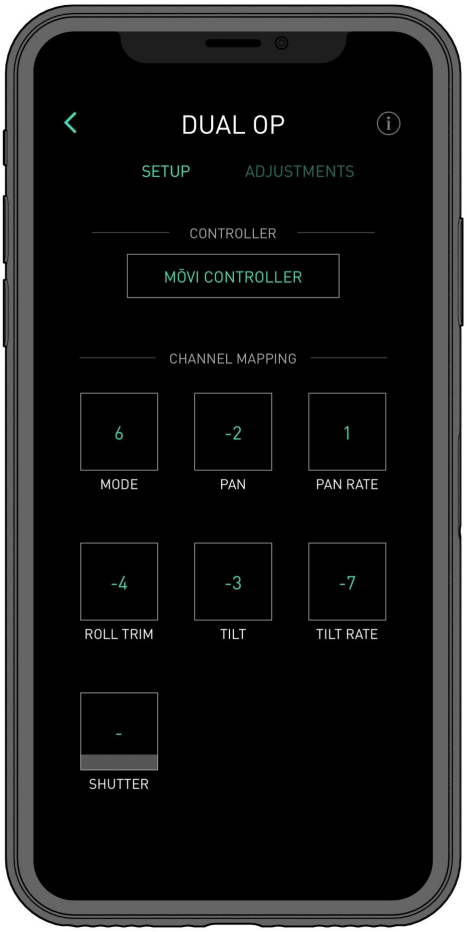
Option	Description
1. Timelapse Interval	Select the time interval between shots. An intervalometer (not included) must be used to operate the camera’s shutter and set to the same time interval used in the app.

2. Target Clip Length	Select the desired length of the video resulting from the timelapse images.
3. Target Clip FPS	Select the desired frames per second (FPS) in the video resulting from the timelapse images.
4. Total Photos	Displays the total number of photos that will be taken during the timelapse. Total Photos = Target Clip Length * Target Clip FPS
5. Timelapse Duration	Displays the time duration of the timelapse. Timelapse Duration = Timelapse Interval * Target Clip FPS * Target Clip Length
6. Curve Fit (Pan, Tilt)	Toggle between linear and cubic paths between keyframes

Dual Op Mode

Dual Op mode allows one operator to concentrate on framing and lens control while another operator has control of movement. Dual Op is possible using the MIMIC, MōVI Controller, or certain 3rd party RC controllers

Setup Panel



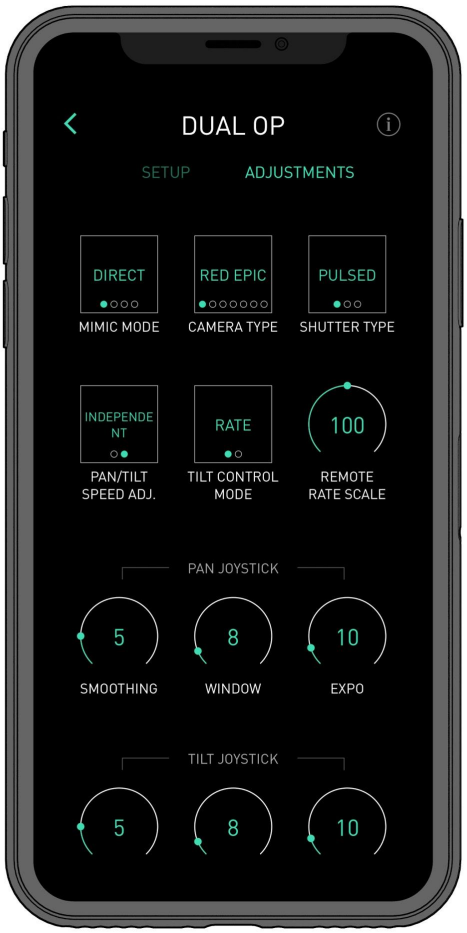
Option	Description

1. Controller	Use this to select the type of radio control you will be using to input control commands. There is no need to change this when using the MōVI Controller and MIMIC.
2. Channel Mapping	Use the Channel mapping to configure inputs being sent from 3rd party RC Controllers. There is no need to change the channel mapping when using a MoVI Controller.

NOTE

Refer to the MoVI Controller User Guide (pg#25) for information on channel mapping with 3rd party RC controllers.

Adjustments Panel

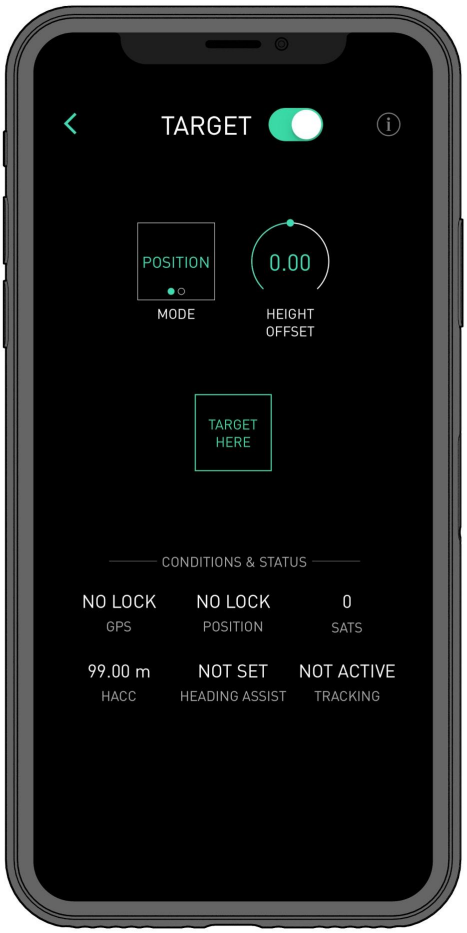


Option	Description
1. MIMIC Mode	Select the mode (Direct, Level Roll, Majestic Pan, Majestic Pan/Tilt) in which the MIMIC controls MōVI Carbon. • Direct mode allows the MIMIC to control MōVI Carbon's pan, tilt, and roll movement. • Level Roll mode allows the MIMIC to controlMōVI Carbon's

	pan and tilt movement. ● Majestic Pan mode allows the MIMIC to control MōVI Carbon's pan movement in Majestic mode. ● Majestic Pan/Tilt mode allows the MIMIC to controlMōVI Carbon's pan and tilt movement in Majestic mode.
2. Camera Type	Select the type of camera being used in order to ensure the correct camera control protocol is enacted.
3. Shutter Type	Select the shutter type (Pulsed, Latched, Camera I/F).
4. Speed Adjustment (Pan, Tilt)	Select whether the pan and tilt rates are controlled together (Combined) or separately (Independent).
5. Tilt Mode Control	Select tilt control mode (Rate, Angle). Angle mode is recommended for single operator multirotor use while Rate mode is recommended for all other situations.
6. Remote Rate Scale	Select the Remote Rate Scale value. A higher value will increase the maximum pan and tilt rates when in Dual Op mode.
7. Smoothing (Pan, Tilt)	Sets how much smoothing is applied to the pan and tilt joystick inputs while in Dual Operator mode. A higher number will apply more smoothing.
8. Window (Pan, Tilt)	Defines a range of pan and tilt joystick movement from center that will be ignored.
9. Expo (Pan, Tilt)	Set the exponential curve value that controls the pan and tilt movement. A higher value will make the reduce the sensitivity in the center of the joystick's range and increase the sensitivity toward the edges.

Target Mode

Target Mode allows MōVI Carbon to track a GPS coordinate or the Freefly MIMIC automatically. In Target Mode, MōVI Carbon autonomously frames the subject using the positional data from MōVI Carbon and/or MIMIC sensor.



Option	Description
1. Toggle	Turn Target mode on and off by selecting the virtual toggle.
2. Mode	Select MōVI Carbon's target. • Position mode will target a specific location. • Position/Alt mode will target a specific location and altitude.
3. Height Offset	Select a height offset for Pos/Alt mode.
4. Target Here	Mark a the GPS location that MōVI Carbon targets while in Pos and Pos/Alt mode.
5. Conditions and Status	Displays critical information about Target mode. Target mode will not be active until MōVI Carbon has achieved position lock

Target Mode performance relies significantly on the quality of the GPS signal and a good compass calibration. Experimentation with target mode in different situations and environments is recommended before use in productions.

Always put MōVI Carbon into “Compass Heading” assist mode and perform a compass calibration before using Target mode in a production environment.


APPENDIX

Troubleshooting Guide

Gimbal Won't Turn On

Possible Cause	Possible Solution
Batteries are discharged	Replace discharged batteries with fully charged batteries
Batteries are damaged	Replace all damaged batteries Dispose of damaged batteries properly
Batteries unplugged or connections not seated properly	Check that the battery connections are properly seated

Gimbal 'On' But Not Stabilizing One or More Axes

Possible Cause	Possible Solution
Axis Stiffness is set to 0	Use GCU Display or Mobile App to raise the stiffness values on axes with (0) stiffness
Dual Operator Radio Controller is in Kill Mode	Use the Mode Switch on the Radio Controller to activate Dual Operator Mode
Gimbal is still initializing	Make sure the gimbal is steady for 5 seconds
Gimbal is in sleep mode	Tap the 'Power' button on MōVI Carbon twice to take MōVI Carbon out of sleep mode.

Horizon (Roll Axis) Is Not Level

Possible Cause	Possible Solution
Roll Trim set to	Adjust the Roll Trim setting to achieve a level horizon

Horizon (Roll Axis) Is Not Level Under Accelerations

Possible Cause	Possible Solution
IMU not fully warmed up	Wait 400s (6min) for the IMU to fully warm up before subjecting MōVI Carbon to high accelerations.

No Control in Dual Operator Mode

Possible Cause	Possible Solution
Dual Operator Radio Controller is off, or set to Kill or Majestic Mode	Turn on Radio Controller and set Mode Switch to Dual Operator (DUAL) Mode
Radio Controller Mapping is misconfigured	If you are using a Spektrum DX7, ensure that the Radio Mapping settings in the GUI are correctly mapped. (Refer to the Dual Op Mode Configuration section)

Pan/Tilt Speeds are set to ‘0’	Increase the Pan/Tilt speeds to the desired levels by turning the speed knobs on the MōVI Controller.

No Control Over FIZ

Possible Cause	Possible Solution
F/I/Z axes have been ‘Locked’ by the MōVI Controller	Go to the FIZ Main screen on MōVI Controller and unlock the axes that are locked.
Zoom speed is turned to ‘0’	Increase the Zoom speeds to the desired levels by turning the speed knobs on MōVI Controller.

Vibrations On One Or More Gimbal Axes

Possible Cause	Possible Solution
Stiffness setting is too high	Reduce the Stiffness setting of the axis that is oscillating using the Tuning menu on the GCU or MōVI app
Locking Pin is still engaged	Remove the Locking Pin

Frequently Asked Questions

Hardware

What ships with MōVI Carbon?

● MōVI Carbon ● 2x MōVI Pro Battery ● 2x MōVI Pro Battery Charger ● Schneider Compact ND Kit 114mm (ND 0.6/0.9/1.2) ● Schneider 4.5" Round Clear Ultraviolet	● 2.0mm Driver ● 2.5mm Driver ● HDMI to HDMI Mini Adapter ● Aux UART to FRX Cable ● Custom Carbon Transportation Case

What is the total weight of MōVI Carbon? With batteries? Without batteries?
Total weight: 19.2lbs
Total weight (w/o batteries): 17.8lbs

Can I remove the inner axis of MōVI Carbon, and use it as a standard MōVI Pro?
No, MōVI Carbon cannot be taken apart and used as a standard MōVI Pro.

Can I use the MōVI Pro Landing gear, or do I need special landing gear?
Yes, MōVI Carbon is compatible with the MōVI Pro Landing gear as well as some other MōVI Pro accessories such as; Velocity Kit, Mimic Pro, Pilot, and MōVI Pro batteries.

What kind of lens motors does MōVI Carbon use?
Carbon uses high performance coreless motors to provide precise lens control.

Can I use my own FIZ system or FIZ controller with Carbon?
No, MōVI Carbon's FIZ system is integrated into its design and cannot be swapped for an off the shelf FIZ system.

Can I use wheels with MōVI Carbon?
Yes, MōVI Carbon is compatible with most industry wheels that are able to connect to the MōVI Controller; such as the A1 Alpha Wheels and Klassen Wheels.

Can I upgrade my existing MōVI Pro to a MōVI Carbon?
No, unfortunately we are not able to upgrade a MōVI Pro to a MōVI Carbon.

Can I mount MōVI Carbon on an ALTA? Inverted?
Yes, Carbon has been designed so it can be flown on the ALTA 8 in the traditional and inverted orientations. MōVI Carbon cannot be flown on an ALTA 6 due to payload restrictions.

Can I mount additional devices and accessories to MōVI Carbon, or is there a weight limit?
Can I use an external recorder in tandem with MōVI Carbon?

A wireless video transmitter may be mounted to MōVI Carbon's pan tubes as shown in the quick start guide; however we do not advise attaching additional accessories due to a reduction in gimbal performance due to aerodynamic issues.

How long will a set of batteries last?
A single set of batteries will power Carbon for over 3 hours. This includes powering the FIZ, Camera, and wireless video transmitter.

Can I use an external power source to power MōVI Carbon?
External power should not be used with MōVI Carbon; use of any non-Freefly power sources will result in voiding of the warranty.

Can I turn off the extra 2-axes, and use it just as a standard 3-axis gimbal?
No, MōVI Carbon's inner stages are crucial to its stabilization and the gimbal cannot function as a standard 3-axis gimbal when the inner stages are turned off.

Can I use the same third party controllers (Futaba, Spektrum, etc), to control MōVI Carbon?
Yes, to ensure customers can use their prefered method of control MōVI Carbon has been designed to accept all control methods that work with MōVI Pro.

Does Carbon work with MōVI Controller?
Yes, to ensure customers can use their prefered method of control MōVI Carbon has been designed to accept all control methods that work with MōVI Pro.

Does Carbon work with Pilot/MIMIC?
Yes, to ensure customers can use their prefered method of control MōVI Carbon has been designed to accept all control methods that work with MōVI Pro.

Do I need the shroud, or can I operate without it?
To ensure optimum performance and protection from the elements we recommend using MōVI Carbon with the shroud mounted. Users can remove the shroud if desired but this is not recommended.

Camera/Lens Hardware

What make/model lens does it have?
A Fujinon XK20-120mm T3.5 Cabrio Premier Lens is integrated into MōVI Carbon.

What make/model camera does it have?
MōVI Carbon uses an integrated Panasonic Lumix DC-GH5S Mirrorless M4/3 Digital Camera .

If the camera or lens needs service, does the Carbon need to be shipped back to Freefly?
MōVI Carbon can be shipped back to Freefly for maintenance; however some simple service procedures can be done by the user.

Does it have built in ND filters?
MōVI Carbon comes with a Schneider 114(4.5”)mm circular filter adapter as well as a set of ND and UV filters

- ND0.6
- ND0.9
- ND1.2
- UV

Is the camera body powered by MōVI Carbon?
Yes, the Panasonic GH5S is powered by MōVI Carbon and does not need its own battery!

Can I use a different camera body?
No, the Panasonic GH5S has carefully been selected as the camera of choice for this gimbal due to its outstanding video performance and ability to meet the rigorous standards needed to allow MōVI Carbon to optimum stabilization performance.

Can I use a different camera lens?
No, the Fujinon XK20-120mm has carefully been selected as the lens of choice for this MōVI Carbon because of its cinema picture quality and zoom capability while still being lightweight enough to fly.

What video transmitter works with Carbon?
Any wireless video transmitter that allow HDMI input will work with Carbon; some of the ones we’ve tested are; Amimon Connex/Connex Mini, Paralinx Tomahawk, Vaxis 1000F.

How often do I need to change the camera battery?
Never! The Panasonic GH5S integrated into MōVI Carbon is being powered by MōVI Carbon itself so the camera battery never has to be changed.

Why did Freefly choose the GH5S?
The Panasonic GH5S had the best size-to-performance-to price balance of cameras we looked into. Also, the image sensor does not have Optical Image Stabilization (OIS). Current OIS systems are not capable of dealing with high accelerations and thus have unsatisfactory performance in the conditions we expect Carbon users to shoot in—think sensor jello and abrupt translations.

Why did Freefly choose the Fujinon XK20-120mm?
Initially we intended to included a telephoto-type zoom lens, however, this presented multiple challenges. One, the center of gravity of the lens changed drastically over its range. Second, given that these types of lenses collapsed upon themselves, they were not mechanically rigid and thus prone to flexing, causing optical oddities. None of those types of lens are parfocal, which makes shooting video a huge challenge. The Fujinon XK6 Cabrio is sharp, parfocal, great zoom range, all at a weight that allows us to hit our under 20lb system target.

MISC

Can I rent MōVI Carbon?
Yes! Customers may rent MōVI Carbon through the Freefly Systems Webstore!

Does MōVI Carbon fit in my existing MōVI Pro travel case?
MōVI Carbon comes with its own case! This case has been specifically designed to carry everything you need to use MōVI Carbon and protect all your gear during transportation. The best part is that the case is no bigger than the recently redesigned MōVI Pro Travel Case.

Can I buy the case insert for my existing Pelican case?
No, we don't sell the insert separately—MōVI Carbon comes with it's own case! This case has been specifically designed to carry everything you need to use MōVI Carbon and protect all your gear during transportation. The best part is that the case is no bigger than the recently redesigned MōVI Pro Travel Case.

Do you sell a travel case specifically for MōVI Carbon or does it come with one?
MōVI Carbon comes with it's own case! This case has been specifically designed to carry everything you need to use MōVI Carbon and protect all your gear during transportation. The best part is that the case is no bigger than the recently redesigned MōVI Pro Travel Case.

Software

Does MōVI Carbon use the same app as MōVI Pro?
Yes, similar to MōVI XL and MōVI Pro, MōVI Carbon uses the MōVI app. Once you've connected to your MōVI Carbon, the app will detect the Carbon and show all applicable menus.

How do I update the firmware on MōVI Carbon?
Firmware updates on MōVI Carbon are done through the mobile app. The process is identical to the update procedure for MōVI Pro/XL.

Does the MōVI Controller need different firmware to control MōVI Carbon?
Yes, we've made some Carbon-specific updates to the MōVI Controller that will require a MōVI Controller update.

How do I tune MōVI Carbon?
MōVI Carbon comes with tuning values specifically chosen to provide great video out of the box. Users can adjust these values via the MōVI App or MōVI Carbon's built in controls; both options allow users to adjust the stiffnesses and filters to fine tune MōVI Carbon as needed. We do not recommend the use of Autotune with Carbon!

Default Tuning Values

Tuning Setting	Value	Tuning Setting	Value
Autotune Percentage	70	Target Height Offset	0
Data Logging	1	Target Here	0
Declination	0	Target Mode	0
Gimbal Application	0	Tilt Control Mode	0
Gyro Filter	1	Tilt Hold Strength	30
Heading Assist	0	Tilt Joystick Expo	10
Jolt Rejection	0	Tilt Joystick Smoothing	5
Logging Rate	0	Tilt Joystick Window	5
Map Remote Mode	6	Tilt Majestic Span	90
Map Remote Pan	-2	Tilt Mode	0
Map Remote Pan Rate	1	Tilt Smoothing	10
Map Remote Roll Trim	-4	Tilt Stiffness	30
Map Remote Shutter	0	Tilt Window	5
Map Remote Tilt	-3		
Map Remote Tilt Rate	-7		
Max Control Rate	200		
Max Roll Angle	45		
Max Tilt Angle	70		
Mimic Mode	0		
Min Tilt Angle	-110		
Motion Booting	0		
Output Filter	1		
Output Pan Filter	10		
Output Roll Filter	5		
Output Tilt Filter	1		
Pan Hold Strength	30		
Pan Joystick Expo	10		
Pan Joystick Smoothing	5		
Pan Joystick Window	5		
Pan Majestic Span	135		
Pan Smoothing	10		
Pan Stiffness	90		
Pan Trim	0		
Pan Window	10		
Pan/Tilt Remote Speed Adjustment	1		
Power Supply	0		
Radio Type	5		
Remote Rate Scale	100		
Roll Hold Strength	90		
Roll Stiffness	60		
Roll Trim	0		
Setdown Sleep	0		
Shaky-cam Pan	0		
Shaky-cam Tilt	0		
Target Enable	0		

Data Logging Fields

Field	Field Units	Description
Accel X	g	The IMU derived acceleration along the X axis
Accel Y	g	The IMU derived acceleration along the Y axis
Accel Z	g	The IMU derived acceleration along the Z axis
Baro Height	m	Height derived by barometric pressure measurement
Charge	mAh	Total charge remaining in the battery packs
Current	A	Total current draw seen on battery packs at a specific moment in time
Ext IMU Type		Shows presence of external IMU
GPS Accel East	m/s	The GPS derived eastward acceleration
GPS Accel North	m/s	The GPS derived northward acceleration
GPS Accel Up	m/s	The GPS derived upward acceleration
GPS Altitude	m	The altitude determined by received GPS signals
GPS East	m	GPS measured positional change in the lateral axis; where positive values indicate movement to the East
GPS Latitude	deg*1e7	GPS determined latitude multiplied by 10^7
GPS Longitude	deg*1e7	GPS determined longitude multiplied by 10^7
GPS North	m	GPS measured positional change in the longitudinal axis where positive values indicate movement to the North
GPS Hr: Min: Sec	HH:MM:SS	The Universal Coordinated Time determined by received GPS signals
GPS Up	m	
GPS Vel East	m/s	The GPS derived eastward velocity component
GPS Vel North	m/s	The GPS derived northward velocity component
GPS Vel Up	m/s	The GPS derived upward velocity component
Hacc	m	The horizontal accuracy of specific GPS coordinates
IMU Time	s	Time measured by the IMU; with ‘0’ being when the IMU initializes after the gimbal is turned on
Pan ESC Temp	degC	Pan Motor speed controller temperature
Pan Joint	Deg	Pan Motor position derived from the Pan encoder position
Pan Motor Current	A	The amount of Pan current being drawn by the Pan motor
Pan Motor Temp	degC	The temperature of the Pan motor
Pitch	Deg	The IMU derived pitch angle where positive values indicate pitch up
Pitch Rate	Deg/s	The IMU derived pitch rate where positive values indicate an upward pitch
Radio Pitch	us	RC pulse width (1000-2000µs) where increasing values are for pitch up
Radio Roll	us	RC pulse width (1000-2000µs) where increasing values are for roll right
Radio Yaw	us	RC pulse width (1000-2000µs) where increasing values are for yaw to the right
Roll	Deg	The IMU derived roll angle where positive values indicate a roll to the right
Roll ESC Temp	degC	Roll Motor speed controller temperature
Roll Joint	Deg	Roll Motor position derived from the Pan encoder position
Roll Motor Current	A	The amount of Roll current being drawn by the Pan motor
Roll Motor Temp	degC	The temperature of the Roll motor

Roll Rate	Deg/s	The IMU derived roll rate where positive values indicate a rightward roll
Sacc	m/s	Horizontal speed accuracy reported by GPS
Sats	#	Number of satellites used for position calculation by GPS
Temperature	degC	The IMU derived temperature inside the GCU
Tilt ESC Temp	degC	Tilt Motor speed controller temperature
Tilt Joint	Deg	Tilt Motor position derived from the Pan encoder position
Tilt Motor Current	A	The amount of Tilt current being drawn by the Pan motor
Tilt Motor Temp	degC	The temperature of the Tilt motor
Voltage	V	Main battery voltage measured by the GCU
Yaw	deg	The IMU derived yaw angle where positive values indicate yaw in the clockwise direction
Yaw Rate	deg/s	The IMU derived yaw rate where positive values indicate a clockwise rotation

Some data may be unavailable without a strong and constant GPS signal, or when Heading Assist is set to OFF. To avoid potential corruption of data, data logging should be set to OFF before de-powering the MōVI Carbon. Data Logging exports a wide range of parameters and is currently available for use in a raw format.