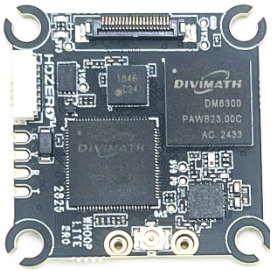
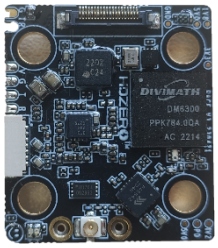
HDZero Video Transmitters

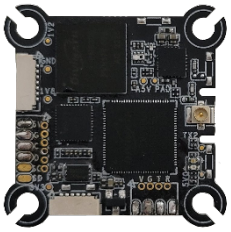


Whoop V2



Race V3

Freestyle V2



ECO

What is HDZero?

PUSH YOUR SKILLS TO THE LIMIT

HDZero offers industry-leading low latency, giving you more time to react and the best possible chance of hitting that next gap. With its smooth, consistent FPV video feed, you'll experience the same locked-in feeling you get with analog video–but with the clarity of HD.

MAKE IT AN EVENT

HDZero supports the standard 5.8ghz video channels, meaning you can have up to 8 simultaneous pilots flying either full-quality HDZero or analog video. When you're ready to take a break and spectate, you can tune in to any channel and view the pilot's feed with no loss of quality, giving you the same feeling of being in the air yourself.

UPGRADE YOUR FLEET

From 1S whoops to long-range wings, HDZero offers a variety of VTX and camera options to suit every build. You may even be able to use the gear you already have–the HDZero receiver will work with any FPV goggle with an HDMI input. HDZero can grow with your needs and fit perfectly into your preferred FPV craft.

RAPIDLY EVOLVING SYSTEM

HDZero is rapidly evolving. Please always use the latest firmware that is located at www.hd-zero.com/document.

Contents

What is HDZero? **1**

HDZero VTX Products **2**

VTX Installation Diagram **3**

General Considerations **4**
- Update VTX Firmware 4
- Caution: UFL Connectors Are Fragile 4
- Powering the VTX: BEC 4
- Mounting Considerations 5
- OSD/MSP Setup 5
- VTX Tables 7
- SmartAudio (Not Supported) 7
- Stick Command Gestures 7
- Using VTX Menu 8

VTX LED Pattern **10**
- Red LED 10
- Blue LED Pattern 10

Video Transmitters **11**
- Whoop V2 VTX 11
- Race V3 VTX 12
- Freestyle V2 VTX 13
- ECO VTX 14

VTX Firmware Update Guide **15**
- HDZero VTX Programmer 15
- Update VTX Firmware with HDZero Programmer 15
- Download VTX Firmware 16
- Update VTX Firmware with HDZero Goggle or HDZero Receiver 16
- Unlock RF Power Limit 18
- Unlock Low Band 18

FAQ **19**
- Discussion 19
- Troubleshooting 19

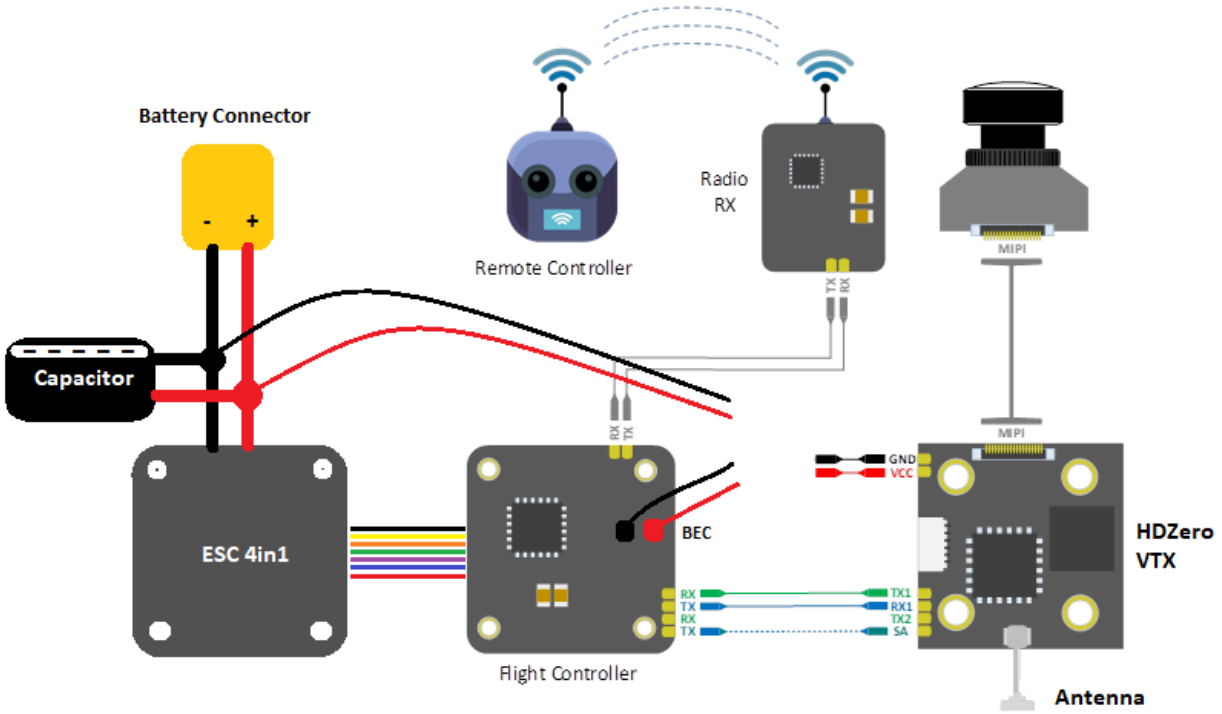
Discontinued Video Transmitters **22**

Warranty **29**

HDZero VTX Products

VTX Name	Whoop V2	Race V3	Freestyle V2	ECO
Dimension (mm x mm)	31x31	28x32	29x30	29x30
Mounting Pattern	25.5x25.5	20x20	20x20	25.5x25.5
	M2 (Soft)	M3 (Soft)	M2	M2 (Soft)
Weight	5.3grams	5.5grams	22.3grams	4.5grams
Power Input	3-12.6V	4V-12V	7-25V	4V-12V
Power Consumption	5~6W	5~6W	6~15W	5~6W
RF Power Output	25mW, 200mW	25mW, 200mW	25mW, 200mW (500mW, 900mW with HAM license unlock)	25mW, 200mW
Secured U.FL	Yes	Yes	Yes	Yes
Antenna Included	Not included	Not included	Polarized (RHCP)	Dipole
MSP OSD	Yes	Yes	Yes	Yes
Application	Whoop/Toothpick	Race	Freestyle	Whoop/Toothpick

VTX Installation Diagram



Notes:

- Use a BEC to power the HDZero VTX whenever feasible. Before connecting, verify the VTX's specific voltage and current requirements, as well as the BEC output capability of your flight controller.
- Whenever feasible, opt for the HDZero Halo FC—it enables a solder-free connection to the Race V3 VTX and Freestyle V2 VTX, simplifying assembly and minimizing setup errors.
- Don't use SmartAudio (deprecated). Use MSP instead;
- One UART is needed for OSD, Camera, VTX menu, MSP VTX;
- Never apply power on VTX without antenna installed and secured;
- The HDZero VTX itself has no inherent preference for antenna polarization. However, for optimal signal performance, its antenna polarization should be matched with that of the receiving device—such as the HDZero Goggle, HDZero receiver, HDZero monitor.

General Considerations

Update VTX Firmware

Please update VTX firmware to the latest version to ensure compatibility with the latest cameras, flight controller software, and video receivers. It is not required for VTX firmware version to match video receiver version, but it is recommended. See firmware update instructions below.

Caution: UFL Connectors Are Fragile

All HDZero VTXes use a U.FL connector for its smaller footprint and lighter weight. However, it is not a mechanically strong connector. Treat it as if it's made of glass. Here are notes for installing and uninstalling an antenna:

- Use the included brass or plastic retaining bar on VTXes that include it
- If retaining bar is not used, never run a cable from the UFL connector straight off the side of a board. Instead, run the antenna cable towards the middle of the board, and secure it in one of the following ways as a strain relief:
    - Temperature resistant glue like E6000
        - Avoid using glue on top of the hot components on the board.
        - Preferably, apply glue to the side of the board where the cable leaves the top of the board.
    - Kapton tape to secure it to the surface of the VTX
    - Zip tie it to a nearby standoff (be careful not to crush the coax)
- Unless you need maximum RF performance or minimum weight, consider a UFL->SMA pigtail for larger builds. This allows you to thoroughly secure the SMA connector to your aircraft to prevent movement of the antenna cable. Note: a common failure point with SMA connectors is where the coax cable is crimped to the SMA jack; if this joint snaps and is loose, RF performance will suffer greatly.
- When removing the antenna, use care not to apply too much stress in any one direction. It is best to use a tweezer at the base of the neck of the connector and then pull straight up (do not pry), away from the board, so that force is evenly distributed on each supporting leg of the U.FL jack. There are tools designed to remove/insert UFL connectors from their sockets, which can help avoid damage to the UFL connector or socket.

Please visit the following link for more information:

https://www.facebook.com/groups/hdzero/permalink/448657693828864/

Powering the VTX: BEC

Using a battery eliminator circuit (BEC) is highly recommended to avoid voltage spikes, which can damage the VTX. Although you can power the VTX directly from the battery (VBAT), a BEC will provide more consistent power and will help absorb any voltage spikes, protecting your VTX from over-voltage conditions and under-voltage (brown-outs).

It is important to select a BEC that provides voltage that is within the range of what the VTX accepts, and that is capable of supplying enough current to power the VTX. Whether you are using a BEC that is built

into your flight controller or a standalone BEC, be sure to check its voltage and current ratings and compare them to the required voltage and current for your VTX.

All the FCs that include an integrated BEC for DJI VTXes should also work for HDZero VTXes.

To summarize:

- Check your FC specs to see if you can run your VTX from the FC's BEC;
- If not, you could run the VTX from a suitable standalone BEC;
- If not, running on VBAT is always the last choice due to the challenging voltage environment in an aircraft.
- All HDZero VTXes, except Freestyle V2**, *do not* support 6S VBAT.**

Mounting Considerations

It is very important to keep some distance between the VTX and ESC/FC boards for the following reasons:

- The RF portion of VTX is vulnerable to electronic noise caused by ESC/motors;
- The RF signal can be bounced back from surfaces of boards or carbon fiber plates, and fed back to the power amplifier in the VTX. This will deteriorate the RF signal integrity and could damage the amplifier.

To avoid these concerns, follow this guidance for mounting the VTX:

- ***Do not use* tape to mount VTX to drone frame** (except for Freestyle V2)
- If the VTX is mounted on the top of the stack, please keep 5mm distance from the top carbon fiber plates.
- Avoid mounting the VTX in the middle of the stack.
- If the VTX is mounted on the bottom of the stack, the VTX needs to be upside down (U.FL socket faces down) and needs to have a minimum of 5mm distance from the bottom carbon fiber plates.

OSD/MSP Setup

1. Pre-requisite

- Betaflight **>=** 4.4.0
- Inav **>=** 4.1
- KISS ULTRA >= 2.0.1-B35
- FlightOne **>=** 10.1.1.5576 | 10.1 Alpha 29

2. Update firmware VTX and VRX

Download the latest firmware: www.hd-zero.com/document

3. Solder/Connect VTX UART to an available UART on your FC board

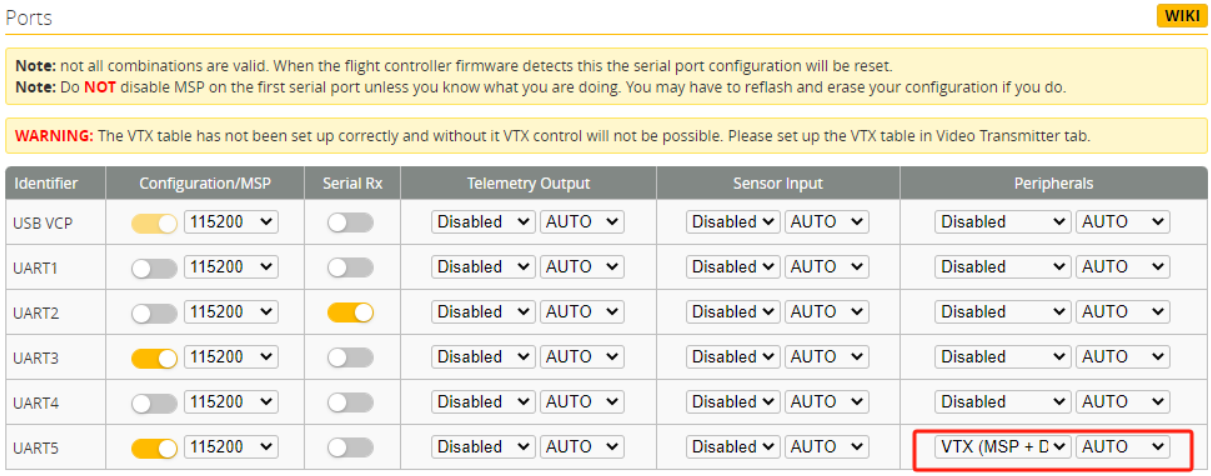
See installation diagram above

4. Flight controller Configuration (Betaflight)

- Connect the FC board to computer with a USB cable

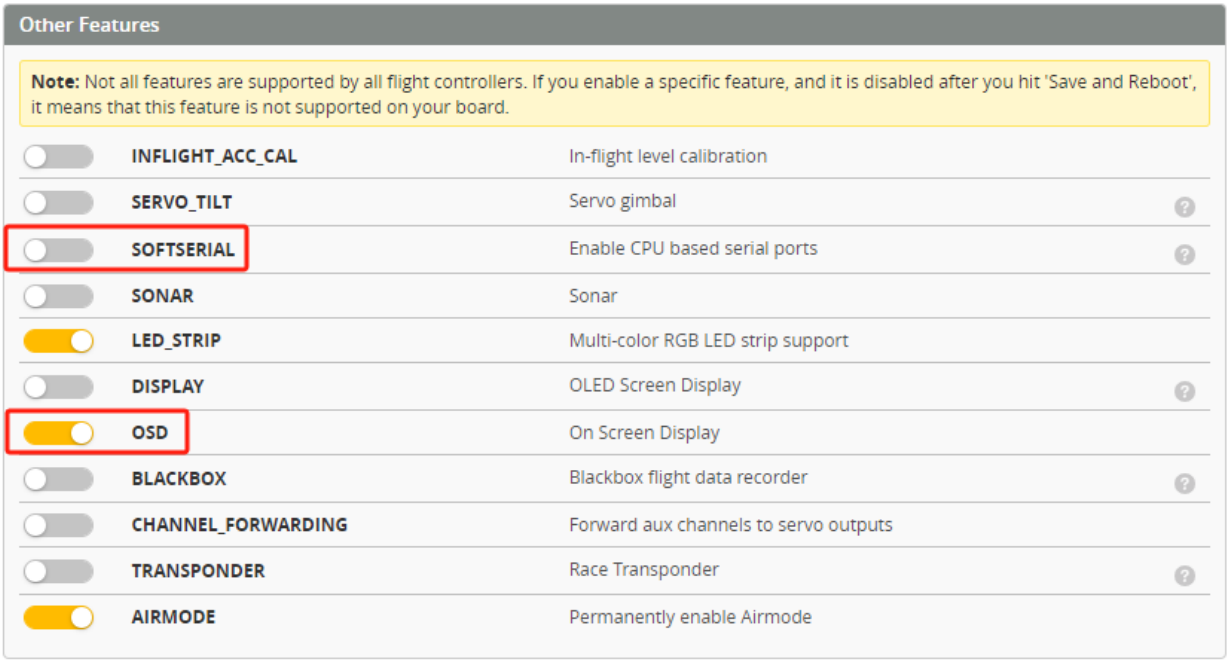
- Start Betaflight configurator
- Go to Port TAB
- Activate VTX (MSP + Displayport) on UART number that is used to connect the VTX
- **Save and Reboot**

Note: A soft serial UART is ***not*** supported for VTX (MSP + Displayport).
As an example: UART5 on picture below is used for VTX (MSP + Displayport).



5. Restart/Connect Flight controller Configuration (Betaflight)

- Go to configuration tab
- Activate OSD function
- SAVE



- Go to OSD tab, and configure the items you want to show on your screen
- SAVE

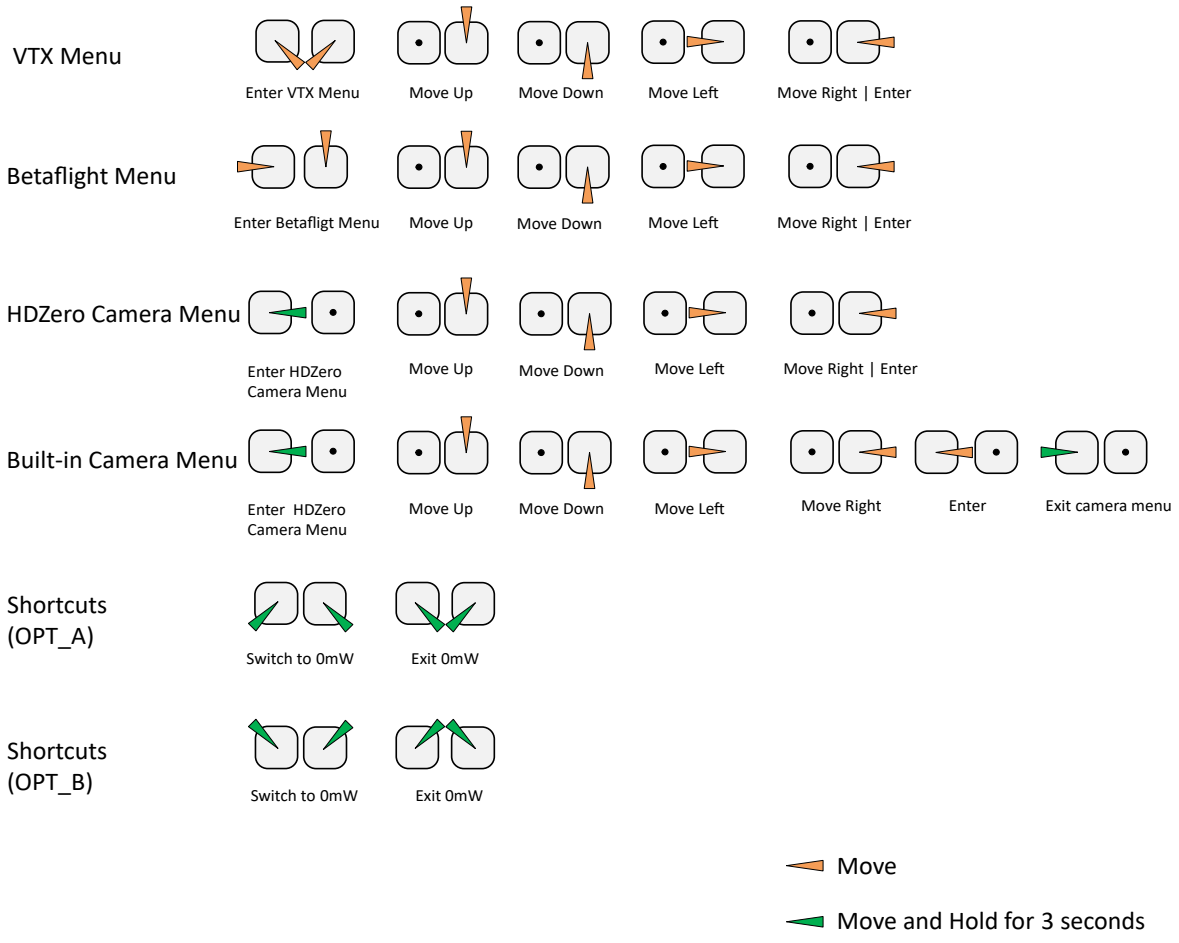
VTX Tables

The HDZero VTX tables have been integrated into the VTX firmware. It will automatically be configured if power on, which means you don't need to configure it manually.

SmartAudio (Not Supported)

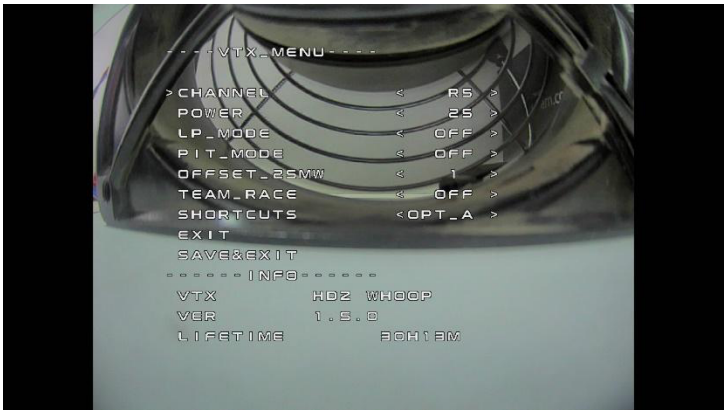
HDZero VTX does no longer supports SmartAudio. Use MSP OSD instead.

Stick Command Gestures



Using VTX Menu

All HDZero VTXes have the following settings for its RF power level management. These settings can be changed using the VTX menu.



CHANNEL:
All VTXes support R1-R8, E1, F1, F2 and F4 channels. You will get an additional 8 channels L1-L8 if you unlock the low band.

POWER:
The desired RF power level is selectable between 25mW, 200mW (and 500mW or MAX for certain VTXes). The actual RF power level depends on the following settings and FC status.

PIT_MODE: (Set to 'OFF' if you don't know how it works)
- **OFF**: The output RF power will be set to *POWER* setting.
- **P1MW**: The output RF power will be 0.1mW (in order to not interfere with other pilots) in this mode. If the aircraft is armed, RF output power will be automatically set to the *POWER* within seconds.
- **0MW**: There will be zero RF output in this mode. If aircraft is armed, RF output power will be automatically set to *POWER* within seconds.
  (Note that after first arm, the vtx will not enter pit mode again until vbat power is reset)

LP_MODE: (Set to 'OFF' if you don't know how it works)
- **OFF**: The output RF power will be set to *POWER* setting.
- **ON**: If *PIT_MODE* is OFF and the aircraft is disarmed, the RF power level will be forced to 25mW regardless of *POWER* setting. The output RF power will be set to *POWER* setting when aircraft is armed.
- **1ST**: If *PIT_MODE* is OFF, the RF power level will be forced to 25mW regardless of *POWER* setting when aircraft is power on, the output RF power will be set to *POWER* setting when aircraft is armed.
  (Note that after first arm, the vtx will not enter LP mode again until vbat power is reset)

OFFSET_25MW: (Set to '0' if you don't know how it works)
It is to fine tune the RF output power to be exactly 25mW. The range is [-10:10], and step size is about 0.1dB per step.

TEAM_RACE: (Set to 'OFF' if you don't know how it works)
- **OFF**: The RF power of VTXs after power-on is determined by other settings.
- **MODE1**: VTX RF remains off (0mW) after power-up, and exits 0mW under the following conditions: 1. Aircraft is armed. 2. Exit 0mw mode through stick command. 3. Configure VTX power to non-0mW through FC UART. If the UART communication between VTX and FC is disconnected, VTX will turn off the RF until UART communication is restored and repower the VTX.

- **MODE2**: VTX RF remains off (0mW) after power-up, and exits 0mW under the following conditions: 1. Aircraft is armed. 2. Exit 0mW mode through stick command. 3. Configure VTX power to non-0mW through FC.

SHORTCUTS: Two different stick commands are provided for switching or exiting 0mW. See the Stick Movement diagram (OPT_A and OPT_B) for details.

Notes:
- HDZero VTX will still become hot even on P1mW mode. It is better to keep VTX on 0mW when it will be idle for a while. Though the receiver will not have live video on this mode, it will come back as soon as the aircraft is armed.
- Use sticks shortcut to enter 0mW, and to exit 0mW mode.

Typical Setting for Racing or daily practicing

- *Channel*: Set to the assigned number
- *Power*: 25mW
- *PIT_MODE*: OFF
- *LP_MODE:* OFF
- *OFFSET_25MW:* 0
- *TEAM_RACE: OFF*
- *SHORTCUT: OPT_A*

- When you are waiting for ARM command from race director, Use Stick Command (OPT-A ↙↘) to enter into 0mW to avoid VTX overheats, no video in goggle
- Right before ARM command from director, use Stick Command (OPT-A ↘↙) to exit 0mW, you will have video in Goggle right away.

Typical Setting for Team Racing

- *Channel*: Set to the assigned number
- *Power*: 25mW
- *PIT_MODE*: OFF
- *LP_MODE:* OFF
- *OFFSET_25MW:* 0
- *TEAM_RACE: MODE1*
- *SHORTCUT: OPT_A*

- When VTX boots up, it is on 0mW. It will start to transmit when armed or Stick Command (OPT-A ↘↙) exit 0mW
- When you crash during the race, your VTX might continue transmitting, which will interference your teammate's video signal that is on the same channel as yours, you need to
    - Disarm, and use Stick Command (OPT-A ↙↘) to enter into 0mW, this will work only when your FC still functions,
    - VTX will automatically switch to 0mW after several seconds if VTX fails to communicate with FC (FC could be dead because of crash)

VTX LED Pattern

All HDZero VTXes have two LEDs: Red and Blue.

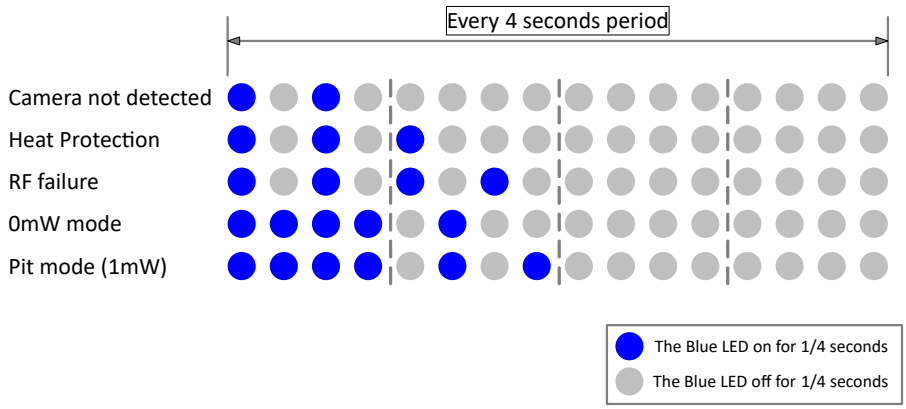
Red LED

The red LED serves as the power indicator. If it's off or flashing, this signals a VTX failure. A healthy unit should display a steady red light. If there is no red light, check if power wires to VTX are connected, and check if voltage is expected value with a multi-meter.

Blue LED Pattern

Working status indicator light.

- Upon boot, three rapid LED flickers confirm MSP communication with FC is active.
- Specific modes are represented with patterns of long (1 seconds) and short (1/4 seconds) pulses, within a 4 seconds timeframe.



BLUE LED pattern	What does it mean?	What to do?
2 short flashes	Camera not detected	Reseat MIPI cable on VTX and Camera Check if MIPI cable is damaged Check MIPI connector for damage Replace Camera
3 short flashes	Over-heating	Use a fan to cool VTX
4 short flashes	RF failure	Replace VTX
1 long 1 short flash	In 0 mW mode	Use Stick command (\ /) exit 0mW
1 long 2 short flashes	In 0.1mW mode	Turn off PIT mode

Note: The first three LED patterns indicate error conditions and take priority over all others. If an error is active—such as the VTX entering heat protection mode—it will override other settings. For example, setting the board to 0mW won't visibly change the LED if heat protection is engaged**.**

Video Transmitters

Whoop V2 VTX

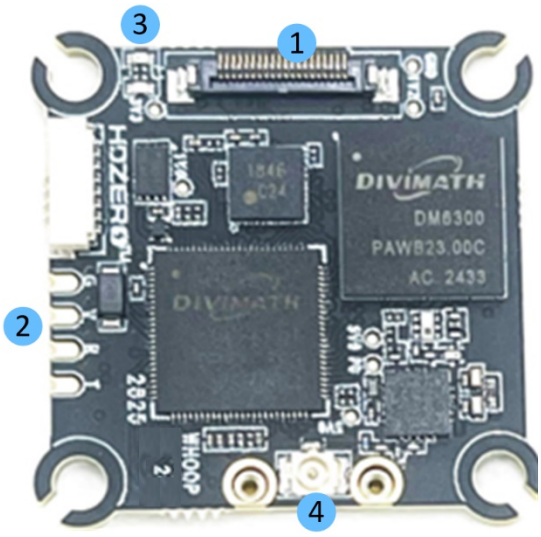
The HDZero Whoop lite VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz.

The power input range is 3V – 12.6V.

- **This VTX does not have reverse polarity protection circuit, it will be permanently damaged if voltage input is connected backwards. This is the number one failure cause**. Reverse polarity protection circuit would have prevented VTX from operating at 1S voltage range.
- When powered by a 5V pad of FC/BEC, make sure that 5V has 1.5A current output.
- When powered by a 1S battery directly, note that a rapid throttle up may cause voltage to drop below 3V instantly, and that will cause video drop.
- There is no need for an external capacitor when if connected with FC/BEC or 1S battery. However, it is strongly suggested to install a capacitor when powered by a 3S battery.

This VTX includes M2 rubber grommets for soft mounting, and a brass bar for antenna retention. Though the VTX can be mounted on racing and other high-speed aircraft, it is highly recommended to consider HDZero Race V3 VTX for such applications.

1	MIPI Connector
2	Status LEDs
3	Power/UART/SA solder pads
4	u.FL Connector



Solder pads:

G	Ground
V	3V -12.6V
RX	FC.TX
TX	FC.RX

Notes:

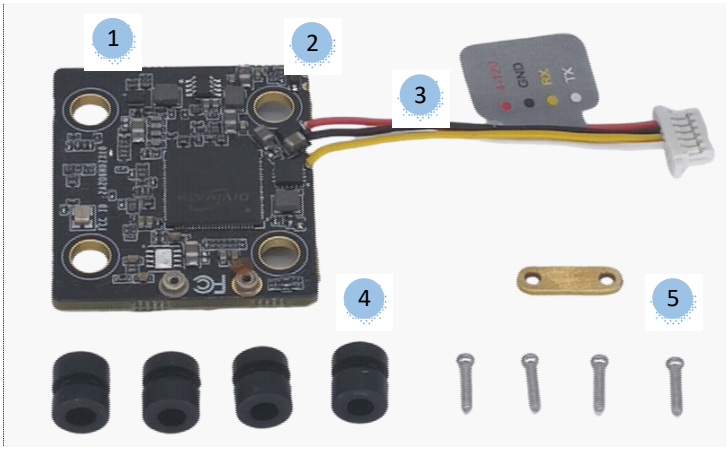
1. Read first: General Consideration for VTX Installation
2. This VTX does not support using a keypad to tune channel and RF output power level. It is designed to work with a flight controller.

Race V3 VTX

Designed for FPV racing, the HDZero Race V3 VTX is our 3rd generation digital video transmitter. With a voltage range starting at 4V, it can be powered by the 5V 1.5A regulator of most FC's or up to 12V for FC's that include a HD VTX plug. It is small (28x32x5mm) and light (5.5 grams). With a width of only 28mm, the VTX is now a similar width to many FC's, which improves durability and reduces weight. The antenna is securely attached with a metal bar and screws. No soldering needed – just plug the wire harness into a compatible HD-ready FC.

The HDZero Race V3 VTX is designed with durability in mind, rather than weight. It is made with a 1.6mm thick PCB, in comparison to the 1.0mm PCB used in the Whoop lite VTX. Moreover, it uses more large package size components for stability consideration. For the smaller components, an additional glue coating is applied to increase crash protection.

1	VTX-R3 board
2	SmartAudio/Tramp (Optional)
3	Wire harness to connect with FC Red = BEC 4-12V Black = GND White = VTX UART TX (Connect to FC.RX) Yellow= VTX UART RX (Connect to FC.TX)
4	Rubber Grommet (M4 to M3),
5	Metal bar and screws for securing antenna

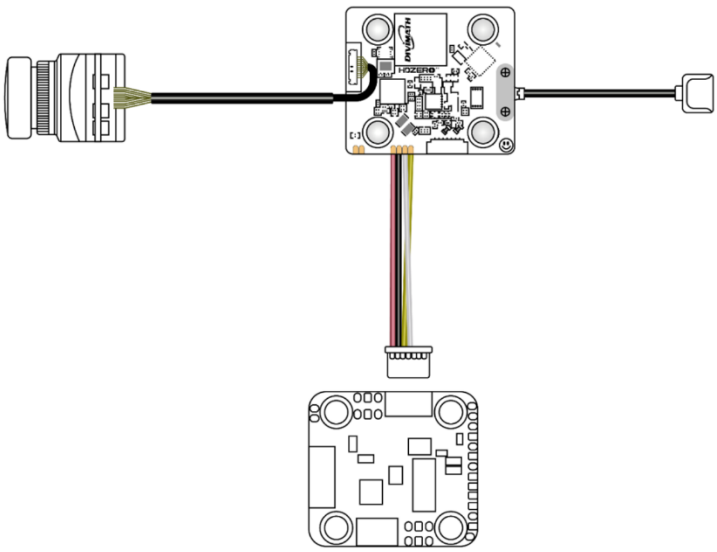


Installation

The right figure shows the typical connection with FC supports MSP VTX protocol. Do not power Race V3 VTX from VBAT, it is designed to be plugged into a digital VTX port on a FC which has a BEC (5V-12V). Race V3 can also be powered on most FC 5V pads if rated for at least 2A.

Install on top of a 20x20mm stack using the included M3 rubber grommets. Orient the VTX so that the MIPI or antenna connector faces the front of the drone. This ensures the most protection for the PCB.

Do not tape the VTX to the stack or frame, as this does not provide enough physical separation for the RF circuit to function optimally.

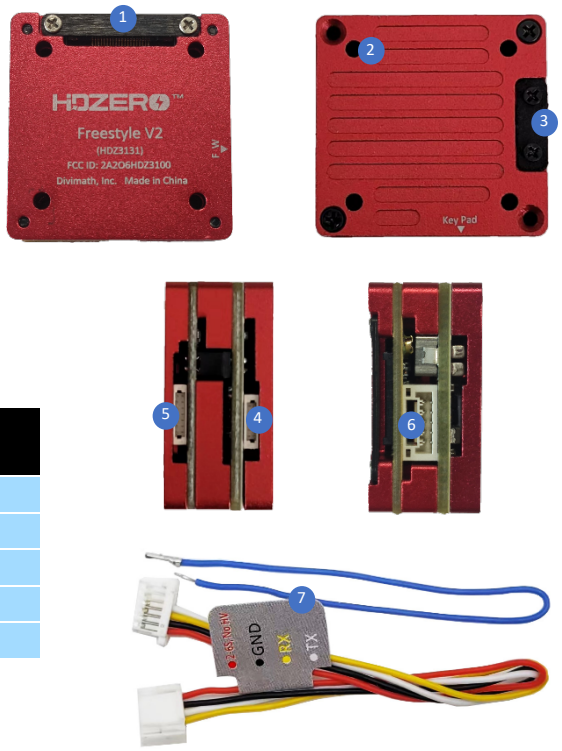


Freestyle V2 VTX

The HDZero Freestyle V2 VTX is our 2nd generation 5.8GHz digital video transmitter which can be installed into most 3-5-inch HD drones. All sockets are well protected by the CNC case that provides durability, RF shielding and improved signal integrity. A wire harness is included for solderless connection for power and MSP UART port. The antenna and MIPI cable are secured by the included retention bar and screws.

Freestyle V2 VTX is capable of 900mW RF output on channel R1 – output decreases as frequency increases. From the factory, the VTX is limited to 200mW output. To unlock full power, follow the instructions for unlocking power limit.

1	Secured MIPI Connector
2	M2 Mounting Hole
3	Secured U.FL Connector
4	Keypad Connector
5	FW Update Connector
6	Power(7-25V)/UART Connector
7	Power/UART Harness



Power/UART Connector	Cable Color	Connected with
Ground	Black	Ground
Power	Red	Power
RX	Yellow	FC.TX
TX	White	FC.RX
SA	Blue	Not used

Installation

Do not route VTX antenna cable over top of VTX, the antenna cable must exit straight out of the back of the VTX.

Freestyle V2 VTX can be mounted with M2 screws or the included double-sided tape. In some cases, it is necessary to mount the VTX with double-sided tape rather than screws to avoid electrical noise when the craft's motors are armed.

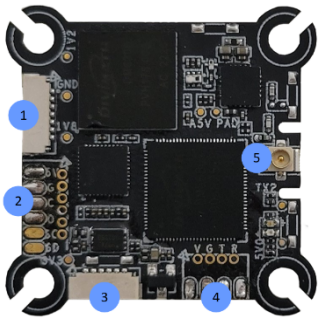
Freestyle V2 VTX consumes up to 15W. If it is connected with FC that has a built-in BEC output, make sure the BEC can provide enough current. For example, if the BEC provides 10V, it needs a minimum of 1.5A current output.

When using GPS, keep it physically separated from the Freestyle V2 VTX—especially the antenna—to minimize interference with the GPS signal.

ECO VTX

HDZero ECO Bundle is designed to bring digital FPV to more pilots by offering a low cost, light weight, and durable alternative to analog video. The digital video signal has stable color reproduction and 720p progressive scan video with the low latency HDZero is known for. This budget-friendly Air Unit is a groundbreaking product—it's the first VTX/camera combination that utilizes a HD composite video signal, eliminating the need for a delicate MIPI cable. The ECO FPV System was meticulously designed for ultra-lightweight drones like Tiny Whoops, where every fraction of a gram counts. The camera's huge 98deg vertical FOV is perfect for fast indoor proximity flying. The ECO VTX weighs approximately 4.5g, while the camera (including wires) comes in at about 1.6g. With the included 0.2g dipole antenna, the entire Eco Bundle weighs about mere 6.3g in total.

1	FW Update Connector
2	Camera Connector
3	Keypad Connector
4	Power(4-12V)/UART Connector
5	Secured U.FL Connector

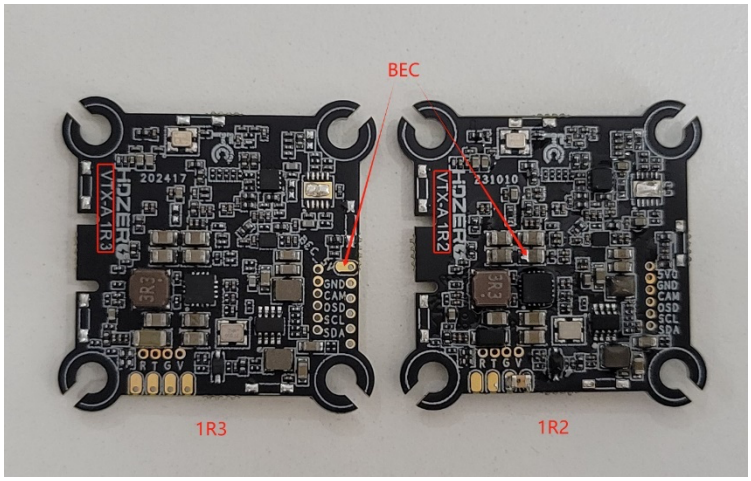


Camera Connector	Cable Color	Connected with
5V	Red	Camera Power
GND	Red	Camera Ground
CAM	Yellow	Camera Video
OSD	White	Camera Menu
SCL		NC
SDA		NC

Power/UART Connector	Cable Color	Connected with
V	Red	Power
G	Black	Ground
T	White	FC.RX
R	Yellow	FC.TX

Notes:

- The following connection methods are recommended when using BEC power supply:
  - **The BEC only support 5V, it needs a minimum of 2.0A current output.**
  - It is recommended to connect the BEC to the capacitor as shown for the 1R2 batch.
  - It is recommended to connect the BEC to the pad as shown for not 1R2 batch.
- Use VBAT (1S or 2S) for power supply when BEC is not available



VTX Firmware Update Guide

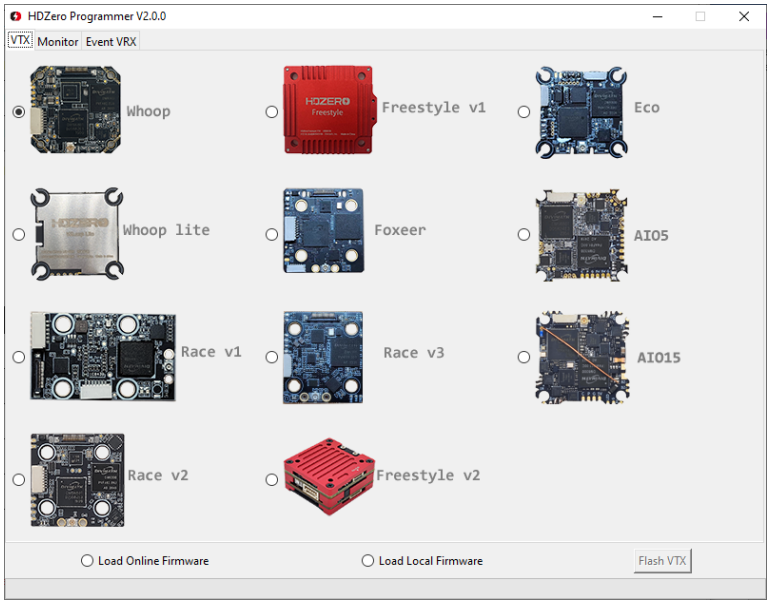
HDZero VTX Programmer

It is highly recommended to use HDZero VTX Programmer to update VTX. Only Windows system is supported for now.

(1) Download the HDZeroProgrammer.zip from HDZero Download.
(2) Extract HDZeroProgrammer.exe from the zip achieve to C:\HDZero

Update VTX Firmware with HDZero Programmer

Launch C:\HDZero\ HDZeroProgrammer.exe. All compatible HDZero VTX models eligible for firmware updates will automatically appear in the list shown below.



(1) Select the VTX type that you want to update
(2) “Load Online Firmware” will fetch firmware from GitHub, and select the one you want to use, or
(3) “Load Local firmware” to specify a local HDZERO_TX.bin,
(4) “Flash VTX” to start the updating process.

Download VTX Firmware

If you're behind a firewall that restricts access to GitHub, you'll need to manually download the VTX firmware and perform a local flashing process.

The firmware can be downloaded from VTX Firmware sector of [HDZero Download](). The revision number is formatted HDZEROVTX_RevYYYYMMDD.zip where "YYYYMMDD" denotes its release date.

https://www.hd-zero.com/document

VTX Firmware

Revision(Y/M/D)	Release Notes	Download	Remark
Rev 20240422	1.Add vtx eco firmware. 2.New Led diagnostic framework	HDZEROVTX_Rev 20240422.zip	
Rev 20240201		HDZEROVTX_Rev 20240201.zip	
Rev 20231113	1.VTX Support channel E1 and F1.	HDZEROVTX_Rev 20231113.zip	

HDZEROVTX_RevYYYYMMDD.zip file includes firmware for all compatible HDZero VTX and AIO models listed below. Inside each ZIP archive, you'll find a HDZERO_TX.bin file, which contains the specific firmware for that VTX type.

C:\Users\CarlZhou\Downloads\HDZEROVTX_Rev20240923.zip\

Name

- Aio5.Rev20240923.zip
- EcoVTX.Rev20240923.zip
- FoxeerVTX.Rev20240923.zip
- FreestyleV1VTX.Rev20240923.zip
- FreestyleV2VTX.Rev20240923.zip
- RaceV1VTX.Rev20240923.zip
- RaceV2VTX.Rev20240923.zip
- RaceV3VTX.Rev20240923.zip
- WhoopLiteVTX.Rev20240923.zip
- WhoopVTX.Rev20240923.zip

Update VTX Firmware with HDZero Goggle or HDZero Receiver

Steps to update VTX firmware with HDZero Goggle

The HDZero goggle can flash firmware to a HDZero video transmitter via its FW port. Here are the steps:

1. Copy HDZERO_TX.bin to root directory of a SD card that is formatted as FAT32
2. Power on the goggle
3. Connect the VTX and HDZero goggle with the included programming cable
4. Go to Main menu | Firmware |Update VTX, the display will show the status of the flashing process
5. Disconnect the VTX
6. This VTX is now flashed with the latest firmware

Steps to update VTX firmware with HDZero Receiver

(1) Format SD card (Choose FAT32 and Allocation Unit size to 4096 bytes);
(2) Power off VRX if it is on;
(3) Unzip HDZERO_TX.bin from the corresponding VTX zip file onto SD-card, and insert SD to the VRX module;
(4) Connect cable with module and VTX;
(5) Power on VRX module;
(6) If “Wait to Connect VTX…” or “Check cable …”, make sure (4) is secured;
(7) If “Firmware update failed”, Repeat steps from (1);
(8) If “Firmware update successful”, VTX is updated;
(9) The HDZERO_TX.bin file is removed from the SD card automatically.

Note: Putting an empty file named as “DONOTREMOVE.txt” file on SD card root directory will prevent HDZERO_TX.bin from being removed. It is useful when updating multiple VTXes.

Unlock RF Power Limit

HDZero Freestyle V1/V2 VTX is compliant with FCC 47 CFR 97.215(c). It is limited to 25mW/200mW out of the box, but it is capable of up to 900mW if you have the required HAM radio license to use this power output. Download the special firmware from Utilities section on HDZero Download to enable higher RF output modes.

Here are the steps:

1. Download firmware Unlock_FreestyleVTX.zip.
2. Unzip it to the root directory of SD Card.
3. Flash this firmware to the VTX.
4. Power on the VTX **with main battery power**, BLUE LED will flash 3 times after it is done. This step unlocks VTX.
5. Power the VTX off.
6. Unzip normal VTX firmware to the root directory of SD Card.
7. Flash this firmware to the VTX.
8. The higher RF output options will now be available.

Notes:

(1) Follow the above step strictly. DO NOT skip the step 4.
(2) Once the VTX is unlocked, there is no need to unlock it again when there is newer firmware available.

Unlock Low Band

The VTX low band option needs to be unlocked before it can be used. Make sure your region allows low band before unlocking.

Here are the steps:

1. Download Unlock_Lowband.zip from www.hd-zero.com/document
2. Unzip and flash as a firmware update to your VTX.
3. Power on the VTX **with main battery power**. The BLUE LED should flash 5 times and then goes out, to indicate that the unlock has completed.
4. Flash the latest release firmware to your VTX. When you switch channels in the VTX menu you will see additional channels from L1 to L8.

Note: Follow the above step strictly. DO NOT skip the step 3.

FAQ

Discussion

HDZero Facebook Group: www.facebook.com/groups/HDZero
HDZero Discord Server: https://discord.gg/JPesSHpmCU

Troubleshooting

Q1. What causes the red LED on my VTX to blink, or not show up at all?

A1: The RED LED should be on and not blinking. Please check the following:

(1) Check power connection to your VTX;
(2) Make sure input voltage is within range, see Power Input;
(3) Ensure the power source can provide sufficient current. A 200mW VTX draws around 5 watts, while a Freestyle VTX can require up to 15 watts. Keep in mind, some flight controllers (FCs) may not be capable of supplying adequate amperage.
(4) The VTX's power circuit may be damaged, which can result in no red LED or a blinking red LED indicator.

Q2. What causes the blue LED on my VTX to blink, or not show up at all?

A2: The blue LED reflects the current status of the VTX as follows:

(1) Absence of the blue LED suggests a critical failure—your VTX may be completely non-operational.
(2) Upon boot, three rapid blue LED flickers confirm MSP communication is active, if it is connected with a flight controller
(3) The blue LED should remain steadily lit under normal operating conditions.
(4) Check LED pattern table if the blue LED blinks

Q3. Why am I experiencing snow noise at minimal range?

A3: Under normal conditions, video quality should remain clear at short distances. Please verify the following:

(1) Check if the VTX is set to P1MW mode—this is indicated by one long flash followed by two short blue LED flashes.
(2) The VTX is configured for high RF power output, and placing the goggles or receiver too close causes signal saturation.
(3) Position the radio receiver (RX) and its antenna away from the video transmitter (VTX) on the drone to minimize signal interference.
(4) Lower the transmit (TX) RF power and increase the separation between the TX and your HDZero goggles or receiver.
(5) Do not place VTX next to ESC board.

(6) VTX (antenna side) must have 5mm vertical clearance.
(7) Replace VTX antenna or pigtail to ensure proper signal transmission.
(8) Verify if another VTX (analog, DJI, HDZero) is operating on the same channel.
(9) Identify potential Wi-Fi interference; overlapping frequencies typically produce diagonal noise patterns.
(10) Faulty RF circuit on the VTX

Q4: My video feed is working but why is no OSD displayed?

A4: Here is how HDZero OSD works: HDZero VTX communicates using the MSP protocol to retrieve telemetry data from the flight controller, then transmits this data wirelessly to the goggles or receiver, where it's overlaid onto the video stream.

Ensure proper VTX–FC connection by checking the following:

(1) VTX/Goggle/Receiver Firmware mismatch: Update both VTX/Goggle/Receiver to the latest firmware
(2) Wire connection: UART TX/RX of FC board should be connected with RX and TX pads of VTX respectively.
(3) Betaflight setting: See OSD instruction
(4) The UART port on the FC could be damaged. Try another UART port on FC (avoid using soft-serial and SA ports),
(5) Try another FC

Q5: Why does my video signal become noisy when I arm the quad and apply throttle?

A5: This might be caused by noisy/insufficient power to VTX. Verify the following:

(1) If VTX is powered by a BEC of FC, make sure the BEC is capable of supplying adequate amperage.
(2) Install a large capacitor (≥350µF, 50V) across the battery leads.
(3) It may be due to the radio transmitter affecting the video receiver. Lower TX power and place well away from the goggles or video receiver.

Q6: Why can't I receive video with my goggle?

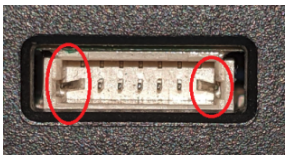
A6: It's a complex issue that could involve multiple components—namely the camera, MIPI cable, VTX, or goggles. Verify the following

(1) Blue LED is not solid on:
    (a) If the blue LED is completely off, it means VTX is bad;
    (b) If the blue LED flashes one long and one short periodically, the VTX is in 0mW mode. Use stick command to exit 0mW mode
    (c) If the blue LED flashes 2 shorts periodically, it indicates that the VTX is unable to detect the camera, it could be (1) damaged camera; (2) bad MIPI cable; (3) loose MIPI cable connection; (4) damaged MIPI connectors on camera and/or VTX; (5) damaged VTX
    (d) Check other blue LED patterns

(2) Blue LED is solid on:
    (a) Verify whether the VTX is set to Low Band while the goggles are configured differently, or vice versa.
    (b) If the Nano90 camera is configured to 540p60 mode, the goggles must be set to **HDZero BW = Narrow** via the following path: *Goggle Menu → Source → HDZero BW*.

Q7. Why does the VTX fail to flash properly?

A7: Make sure all pins on the VTX and the firmware (FW) port of your goggles are perfectly straight—any bent or misaligned pins can disrupt the flashing process. Even a single crooked pin on the VRX module has been known to trigger flashing failures.



Q8: Why is my FC dropping to bootloader when connected to a HDZero VTX?

A8. It has been reported that some flight controllers may randomly enter bootloader mode when connected to early-production HDZero VTX modules. To resolve this issue, add a **200-ohm resistor** in-line between the **FC UART.TX** and **VTX UART.RX** wires.

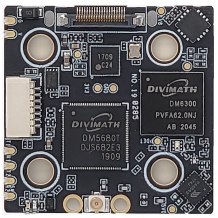
All HDZero VTX units produced **after 2023** already include this resistor by default, eliminating the need for manual fixes on newer hardware.

Discontinued Video Transmitters

The following VTX models have been discontinued and will no longer be manufactured. Each has a successor version now available.

Whoop

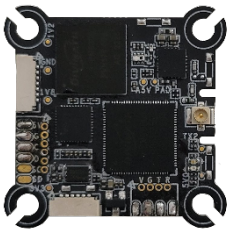
Race V1



Race V2

Freestyle v1

Whoop Lite



ECO

VTX Name	Whoop (EOL)	Race V1 (EOL)	Race V2 (EOL)	Freestyle V1 (EOL)
Dimension (mm x mm)	32x32	27x45	34x34	40x40
Mounting Pattern	25.5x25.5	20x20	20x20	30x30
	M2	M4(Soft)	M4(Soft)	M3(Soft)
Weight	5.3grams	7grams	6grams	28grams
Power Input	7V-17V ~~(2S-4S)~~	7V-17V ~~(2S-4S)~~	7V-17V ~~(2S-4S)~~	2S-6S (2rd batch or later)
Power Consumption	5~6W	5~6W	5~6W	6~15W
RF Power Output	25mW,200mW	25mW,200mW	25mW,200mW	25mW,200mW (500mW, 900mW if with HAM license
Secured U.FL	No	Yes	Yes	Yes
Antenna Included	Not included	Not included	Not included	Polarized(RHCP)
MSP	Yes	Yes	Yes	Yes

Whoop VTX

The HDZero Whoop VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz.

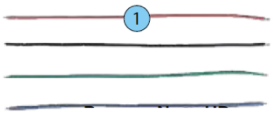
The power input range is 7V – 17V.

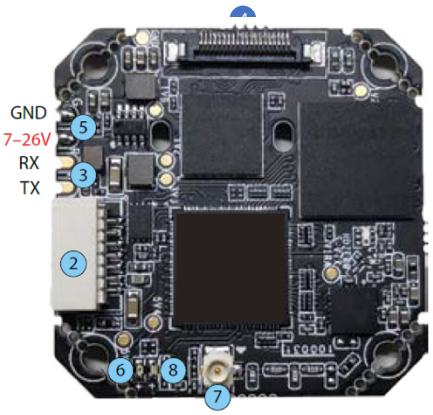
Due to the small clearance of mounting holes, make sure the mounting nuts or gummies will not overlap into the small components around the holes.

This VTX is designed for low-speed whoop application. Compared to the other HDZero VTXes, it is more vulnerable to be damaged by crash due to: (1) the UFL connector is easily peeled off due to no antenna retention, and (2) it is not easy for soft mounting. Though the VTX can be mounted on a racing and other high-speed aircraft, it is highly recommended to consider HDZero Race V3 for such applications.

This VTX does not support Smart Audio or Tramp

1	Power/UART cable
2	FW Update Connector
3	UART (3.3V)
4	MIPI Connector
5	Power IN (7-26V)
6	Power LED (red)
7	u.FL Antenna Connector
8	Status LED (blue)





Notes:

1. Read first: General Consideration for VTX Installation
2. Soft mount
3. Pay extra attention not to damage the small components when trying to remove the serrate corner

Whoop Lite VTX

The HDZero Whoop lite VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz.

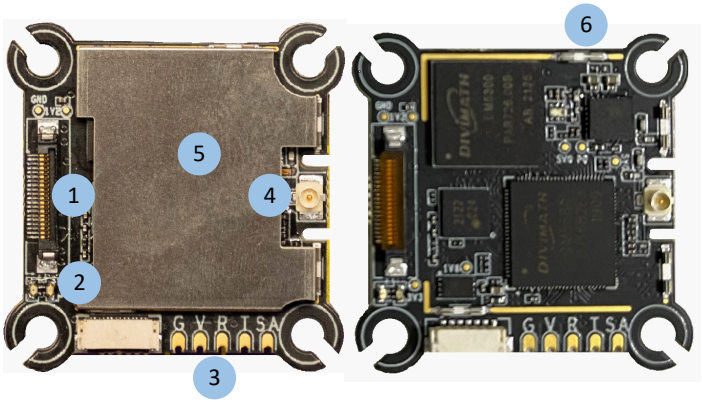
The power input range is 2.8V – 13V.

- **This VTX does not have reverse polarity protection circuit, it will be permanently damaged if voltage input is reversely connected. This is number one failure cause**.
- When powered by a 5V pad of FC/BEC, make sure that 5V has 1.5A current output.
- When powered by an 1S battery directly, note that a rapid throttle up may cause voltage drop below to 2.8V instantly, and that will cause video drop.
- There is no need for an external capacitor when connected with FC/BEC or 1S battery. However, it is strongly suggested to install a capacitor when powered by a 3S battery.

This VTX has protection cases mounted on both sides. These metal cases are grounded, and to provide protection from crash. They can be removed for any light weight build for which every gram matters.

This VTX includes M2 gummies for soft mounting, and zip ties for antenna retention. Though the VTX can be mounted on a racing and other high-speed aircraft, it is highly recommended to consider HDZero Race V3 for such applications.

1	MIPI Connector
2	Status LEDs
3	Power/UART/SA solder pads
4	u.FL Connector
5	Protection Case
6	Protection case clipper



Solder pads:

G	Ground
V	2.8V -13V
RX	FC.TX
TX	FC.RX
SA	FC.SA (TX), Optional

Notes:

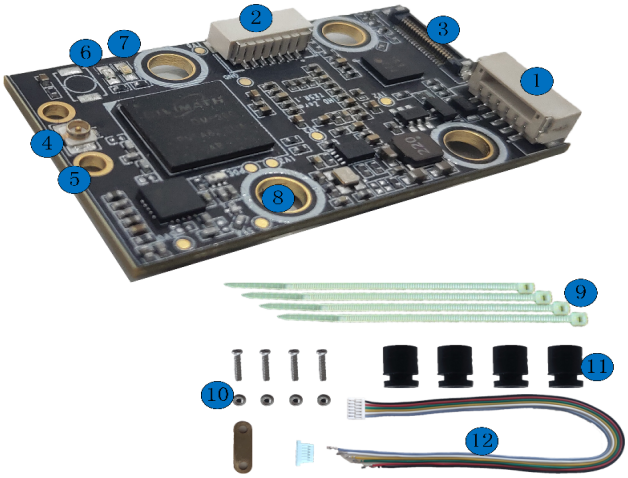
3. Read first: General Consideration for VTX Installation
4. This VTX does not support using a keypad to tune channel and RF output power level. It is designed to work with a flight controller.

Race V1 VTX

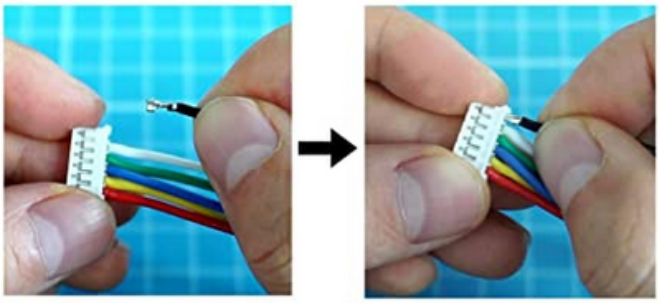
The HDZero Race VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz.

The power input range is 7V – 17V.

1	Power/UART Connector
2	FW Update Connector
3	MIPI Connector
4	u.FL Antenna Connector
5	u.FL Antenna Retention Holes
6	Power on LED (red)
7	Status LED (blue)
8	Mounting Holes (20x20 M4)
9	Zip Ties (4x)
10	u.FL Antenna Retention Screws(4x)/Nut(4x)/Plate
11	Rubber Grommet (M4 to M3 4x)
12	Power/UART harness (20cm) and a PH2.0 connector (6P)



Power/UART Connector	Cable Color	Connected with
Ground	Black	Ground
Power	7-17V	Power
T1	Green	FC.RX
R1	Yellow	FC.TX
T2	White	DO NOT CONNECT
R2/SA	Gray	FC.SA (TX)



Connection between Race V1 VTX and FC

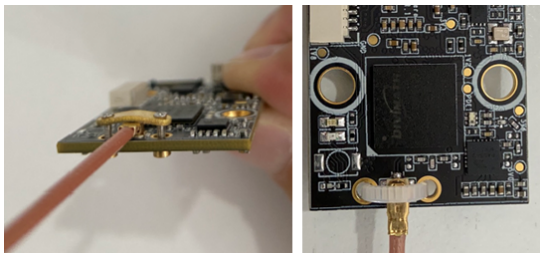
There are 3 methods to connect the VTX and flight controller:

- Plug the included harness, cut the cables to
- appropriate length, and solder them on FC
- Use solder pads on the back of the connector
- For FCs having BEC and UART connector, install harness to the included PH2.0 connector (Shown above), and connect the harness with FC without any soldering.
  Warning: Check that pinout matches the FC pinout before installing to be safe if plugging directly.

Mounting a u.FL antenna or pigtail

There are 2 methods to mount antenna on VTX:

- Use included retention screws, nuts and plate;
- Use included zip-ties.

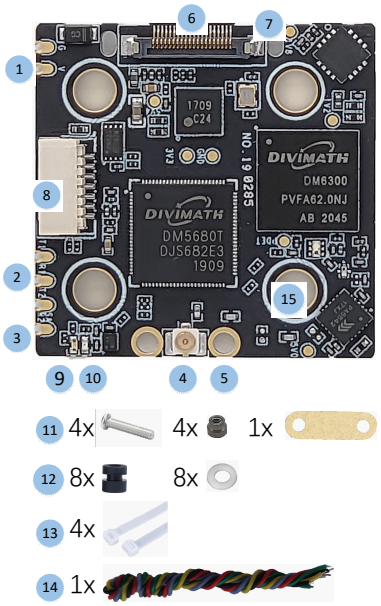


Race V2 VTX

The HDZero Race VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz. It works with the Shark Byte RX5.1 goggle module to transmit video, and with a remote controller to wirelessly control the parameters for the transmitter and camera.

The power input range is 7V – 17V.

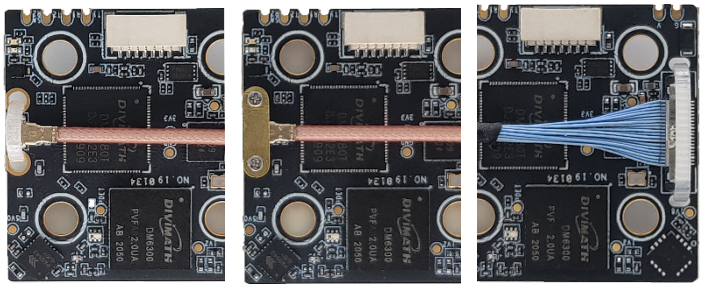
1	Power In (G=Ground, V=7-17V)
2	T1/R1 UART Connection to FC
3	T2, Reserved, R2/SA, SA Pin
4	u.FL Antenna Connector
5	u.FL Antenna Retention Holes
6	MIPI connector
7	MIPI connector retention Holes
8	Firmware Update Connector
9	Power on LED (red)
10	Status LED (blue)
11	u.FL Antenna Retention Screws/Nut/Plate
12	Rubber Grommet (M4 to M3), 1mm O-Ring
13	Zip ties
14	Connecting wire
15	20x20 M4 mounting holes



Mounting a u.FL antenna or pigtail

There are 2 methods to mount the antenna on VTX:

- Use included retention screws, nuts and plate;
- Use included zip-ties.



Connecting MIPI cable

Use the included zip-tie to secure MIPI cable and protect MIPI connector.

Notes:

- Read first: [General Consideration for VTX Installation]
- **Make sure to use a wider top plate to fully cover this VTX for protection.**

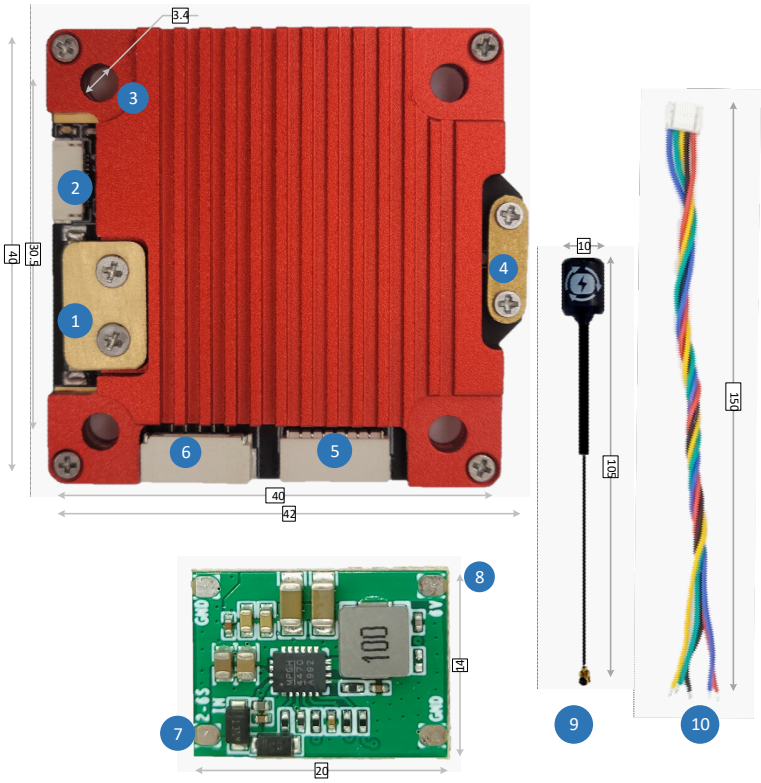
Freestyle V1 VTX

The HDZero Freestyle V1 VTX offers unprecedented range and performance for the HDZero 5.8GHz digital FPV system. With its high maximum output power and robust construction, this VTX is perfect for freestyle and long-range builds.

With a tested maximum range of more than 18 miles, the Freestyle V1 VTX will transmit a digital FPV feed as far as you're willing to fly. Not interested in long range? You'll also see better performance in urban environments and around obstacles, with none of the color noise or multipath interference issues of analog video.

1	Secured MIPI Connector
2	Keypad Connector
3	M3 Mounting Hole
4	Secured U.FL Connector
5	FW Update Connector
6	Power/UART Connector
7*	BEC Power in (2S-6S)
8*	BEC Power Out Pad
9	RHCP Antenna
10	Power/UART Harness

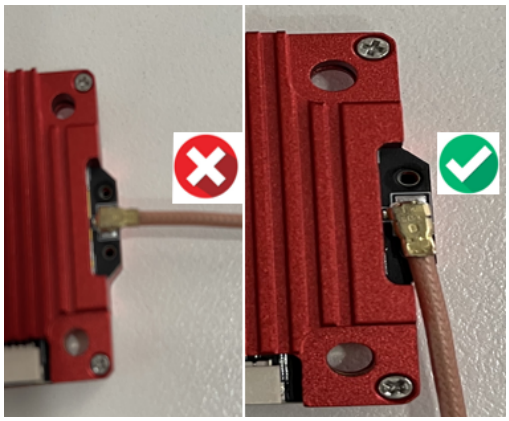
*: BEC is included for first Batch only.



Power/UART Connector	Cable Color	Connected with
Ground	Black	Ground
Power	Red	Power*
RX	Green	FC.TX
TX	Yellow	FC.RX
SA	Blue	FC.SA (TX), Optional

*: The 1st batch supports 4S MAX.

The 1st batch of Freestyle V1 VTX, supports 2S-4S, A BEC supporting 2S-6S is included.
The 2nd batch and later, supports 2S-6S, and the BEC is *not* included.



Important Notes:

- Do not directly power this VTX with a 5S/6S battery for the 1st batch.
  - Use 2S-4S VBAT, or included BEC, or FC with built-in BEC
  - The Freestyle VTX consumes up to 15W. If it is connected with FC that has a built-in BEC output, make sure the BEC can provide enough current. For example, if the BEC provides 10V, it needs a minimum of 1.5A current output.
- Removing the heat sink is not recommended because it is part of the design.
- Rotate the antenna as shown above before detaching it to reduce the risk of peeling off the UFL connector.

Warranty

Due to the nature of this hobby, warranty claims are accepted **only** for items determined to be *Dead on Arrival (DOA)*.

Please note that we **do not cover any damages** resulting from crashes, misuse, or improper handling under any circumstances. This includes but is not limited to:

- Minor or major crashes
- Hard landings
- Faulty soldering
- Incorrect polarity connection
- Insufficient cooling
- Powering the device without an antenna

If you experience any issues or have questions, feel free to reach out to us at: support@divimath.com