

HDZero Video Transmitters



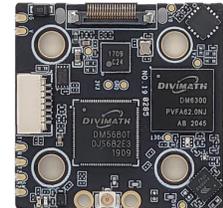
Whoop



Whoop Lite



Race V1



Race V2



Race V3



Freestyle V1



Freestyle V2

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.

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HDZero VTXes

VTX Name	Whoop (EOL)	Whoop Lite	Race V1 (EOL)	Race V2 (EOL)	Race V3	Freestyle V1 (EOL)	Freestyle V2
Dimension (mm x mm)	32x32	32x32	27x45	34x34	28x32	40x40	29x30
Mounting Pattern	25.5x25.5	25.5x25.5	20x20	20x20	20x20	30x30	20x20
	M2	M2 (Soft)	M4(Soft)	M4(Soft)	M4(Soft)	M3(Soft)	M2
Weight	5.3grams	4.5grams	7grams	6grams	5.5grams	28grams	22.3grams
Power Input	7V-17V (2S-4S)	1S-3S	7V-17V (2S-4S)	7V-17V (2S-4S)	4V-12V (2S-3S)	2S-6S (2 rd batch or later)	7-25V
Power Consumption	5~6W	5~6W	5~6W	5~6W	5~6W	6~15W	6~15W
RF Power Output	25mW,200mW	25mW,200mW	25mW,200mW	25mW,200mW	25mW,200mW	25mW,200mW (500mW, 1W if with HAM license)	25mW,200mW (500mW, 1W if with HAM license)
Secured U.FL	No	Yes	Yes	Yes	Yes	Yes	Yes
Antenna Included	Not included	Not included	Not included	Not included	Not included	Polarized(RHCP)	Polarized(RHCP)
Tramp/SmartAudio	No	SmartAudio	SmartAudio	SmartAudio	Tramp	SmartAudio	SmartAudio
Application	Whoop	TinyWhoop	Race	Race	Race	Freestyle	Freestyle

Caution: UFL Connectors Are Fragile

All HDZero VTXes use an 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:

- 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:
 - Hot glue or E6000 glue
 - 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
- 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.
- When removing the antenna, go very slowly and pull gently on the antenna so that one side of the UFL slides off first. 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 or VBAT

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.

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:

- **All HDZero VTXes, except Freestyle V1 Batch 2 VTX or later and Freestyle V2, do not support 6S VBAT.**
- 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, solder a capacitor between the +V and Ground on the VTX. Running on VBAT is always the last choice due to the challenging voltage environment in an aircraft.

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:

- 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.

HDZero Whoop Video Transmitter (EOL)

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

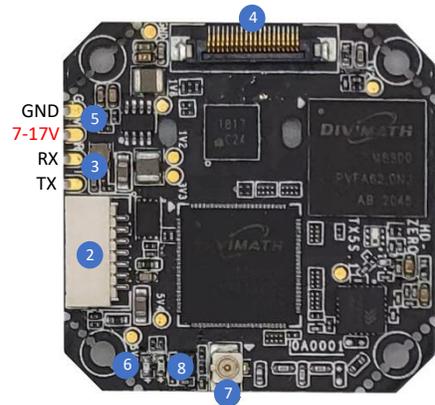
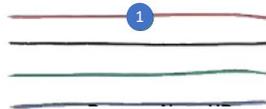
The power input range is 7V – 17V.

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 (V1 or V2) for such application.

This VTX does not support Smart Audio or Tramp

1	Power/UART Cable
2	FW Update Connector
3	UART
4	MIPI Connector
5	Power IN (7-17V)
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

HDZero Whoop Lite Video Transmitter

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 it is powered by a 5V pad of FC/BEC, make sure that 5V has 1.5A current output.
- When it is 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 it connects with FC/BEC or 1S battery. However, it is strongly suggested to put on a capacitor when powered by a 3S battery.

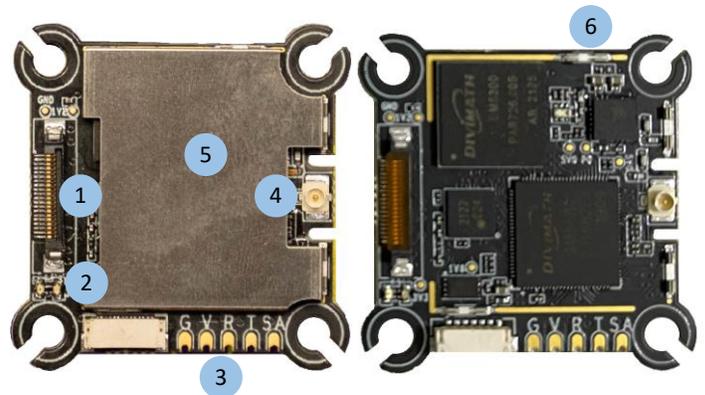
This VTX has protection cases mounted on both sides. These metal cases are grounded, and to provide protection from crash. They can be removed for any light weight build for which every gram matters.

This VTX includes M3/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 (V1 or V2) for such application.

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:

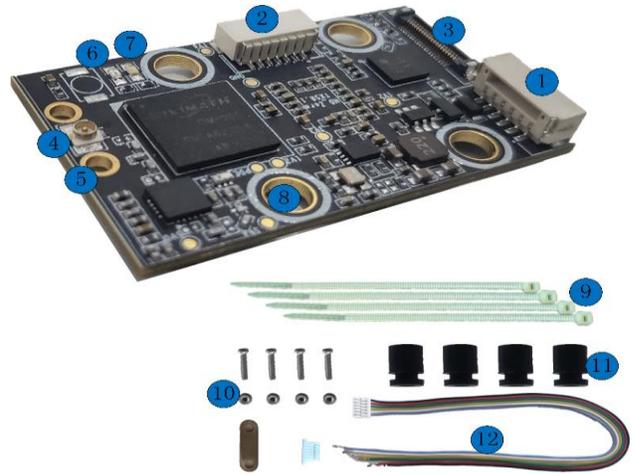
1. Read first: [General Consideration for VTX Installation](#)
2. This VTX does not support using a keypad to tune channel and RF output power level. It is designed to work with a flight controller.

HDZero Race V1 Video Transmitter (EOL)

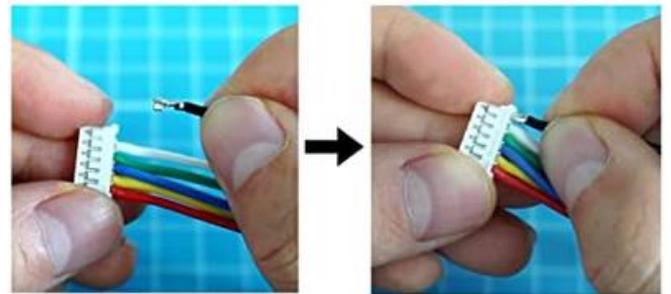
The HDZero Race VTX is a digital HD 720p 60fps video transmitter capable of delivering up to 200mW on 5.8GHz.

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:

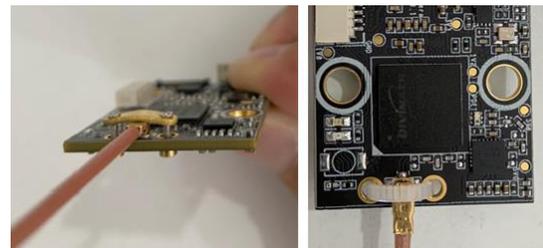
- Plug the included harness, cut the cables to appropriate length, and solder them on FC
- Use solder pads on the back of the connector
- For FCs having BEC and UART connector, install harness to the included PH2.0 connector (Shown above), and connect the harness with FC without any soldering.

Warning: Check that pinout matches the FC pinout before installing to be safe if plugging directly.

Mounting an 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.

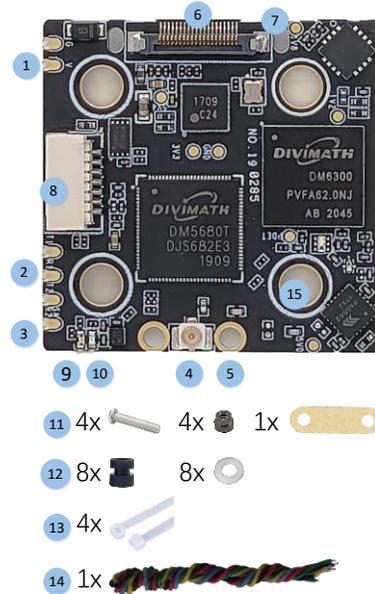


HDZero Race V2 Video Transmitter (EOL)

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



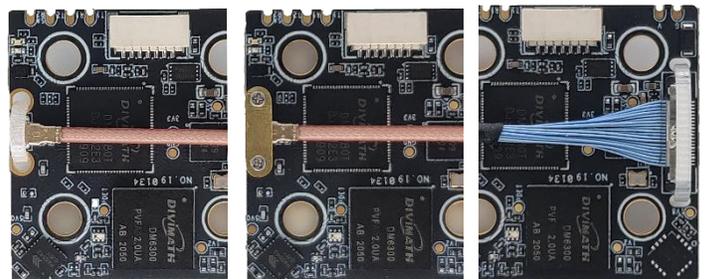
Mounting a u.FL antenna or pigtail

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.**

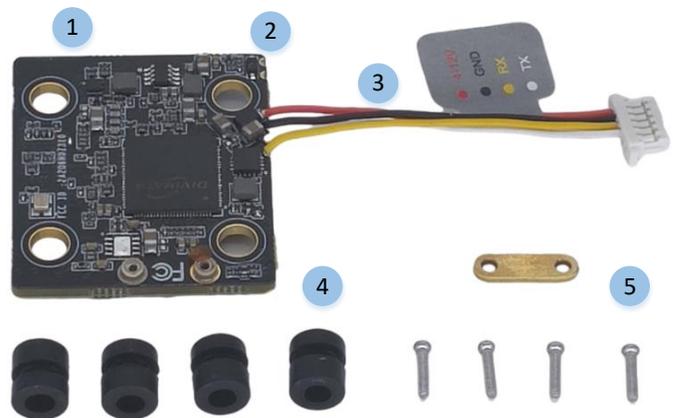
HDZero Race V3 Video Transmitter

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.

The HDZero Race V3 VTX offers high-quality video in 540p90, 720p60 and 1080p30 resolutions with 25/200mW switchable power on 5.8GHz.

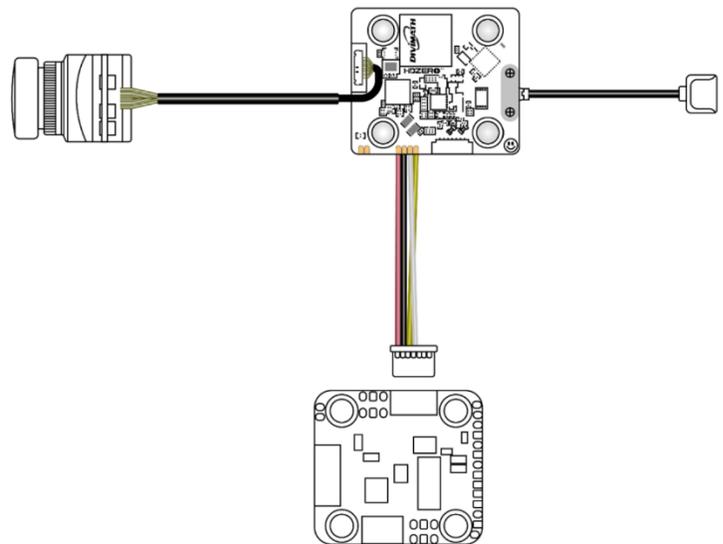
1	VTX-R3 board
2	SmartAudio/Tramp (Optional)
3	Wire harness to connect with FC Red = BEC 4-12V Black = GND White = VTX UART TX (Connect to FC.RX) Yellow= VTX UART RX (Connect to FC.TX)
4	Rubber Grommet (M4 to M3),
5	Metal bar and screws for securing antenna



Connection

The right figure shows the typical connection with FC supports MSP VTX protocol.

The Race R3 supports direct connect with Ghost RX via its SA/Tramp port (TBD)



HDZero Freestyle V1 Video Transmitter(EOL)

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.



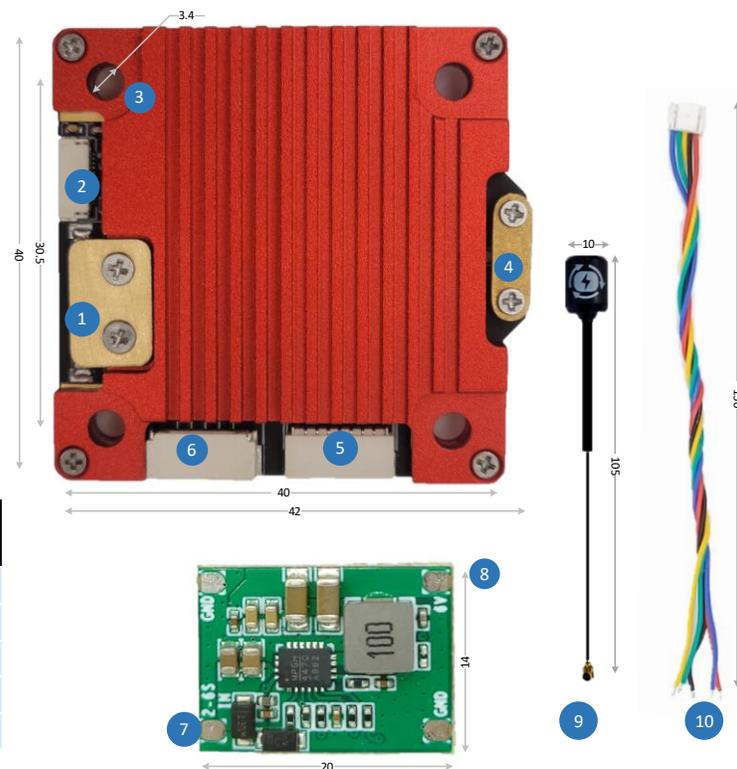
With a tested maximum range of more than 18 miles, the Freestyle V1 VTX will transmit a digital FPV feed as far as you're willing to fly. Not interested in long range? You'll also see better performance in urban environments and around obstacles, with none of the color noise or multipath interference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

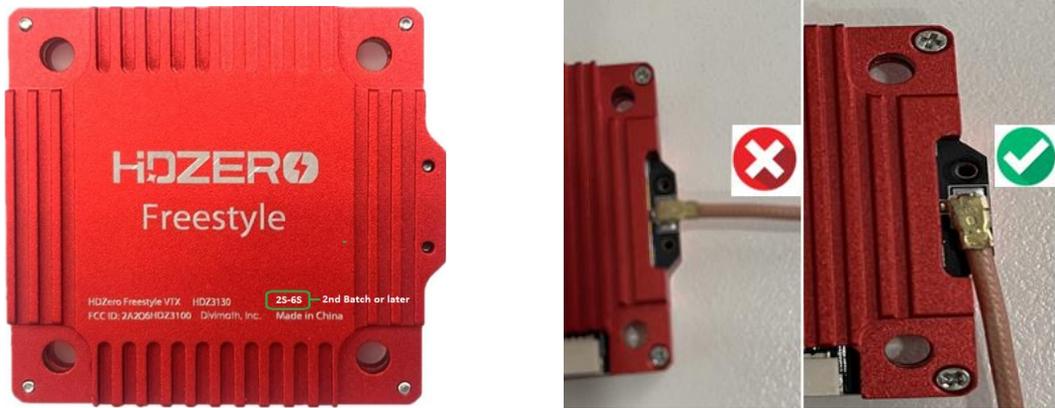
*: BEC is included for first Batch only.

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.



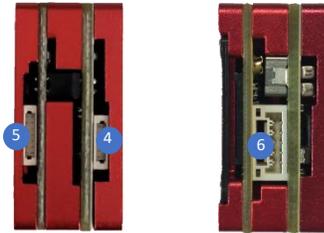
Important Notes:

- 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.

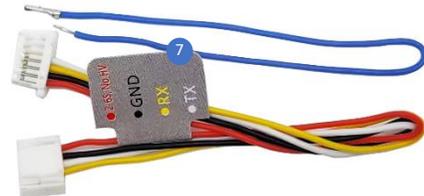
HDZero Freestyle V2 Video Transmitter

The HDZero Freestyle V2 VTX is our 2nd generation 5.8GHz digital video transmitter which can be fitted 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.

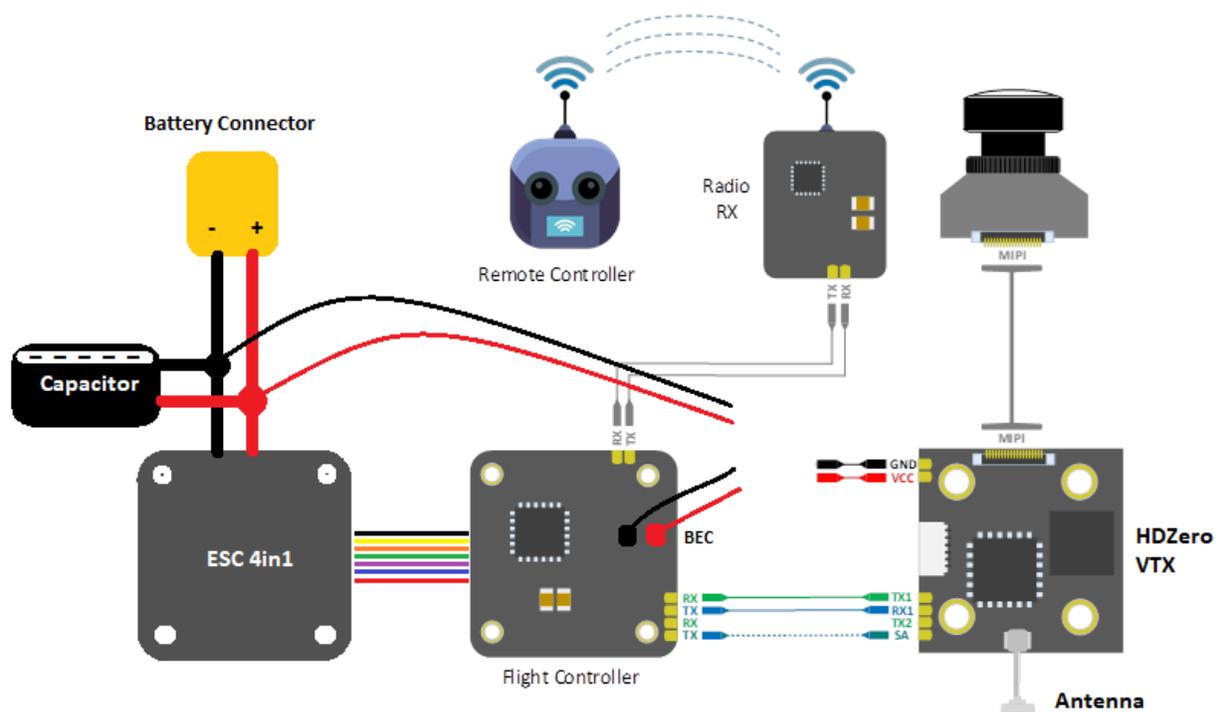
1	Secured MIPI Connector
2	M2 Mounting Hole
3	Secured U.FL Connector
4	Keypad Connector
5	FW Update Connector
6	Power(7-25V)/UART Connector
7	Power/UART Harness



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



HDZero VTX Installation Guide



Notes:

- VTX can be powered by VBAT or BEC. Check each VTX's power requirement above;
- Use of capacitor is mandatory for HDZERO VTX;
- One UART is needed for OSD, Camera, VTX menu, MSP VTX;
- Never apply power on VTX without antenna installed and secured;
- Use RHCP antennas to match with SharkByte VRX RHCP patch antennas;
- Some VTXes do not have an SA pin, and they don't support SmartAudio.

HDZero Firmware Update Guide

The firmware can be downloaded from www.hd-zero.com/document

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

Firmware

Revision(d/m/y)	Release Notes	Download	Remark
Rev 13112023	1.VTX Support channel E1 and F1. 2.Optimize goggle 1080P display	Rev 13112023.zip	
Rev 22082023	1.Support low band 2. Support 540P60	Rev 22082023.zip	
Rev 26062023	1.VTX fixed Nano 90 camera shutter. 2.Goggle optimized analog performance.	Rev 26062023.zip	
Rev 13042023	1.Adding boot 0mw for VTX. 2.Goggle supports Wifi module. 3.Support 1080P30	Rev 13042023.zip	Support 1080p30, 9.0.12 for Goggle

Each revision contains firmware for all the VTX and VRX. The revision number is formatted as *revddmmyyyy.zip* where “*ddmmyyyy*” denotes its release date.

Rev_22032022.zip

Name	Type	Compressed size	Password ...	Size	Ratio	Date modified
Customize_logo.zip	Compressed (zipped) Fol...	23,215 KB	No	23,215 KB	0%	6/5/2022 3:34 PM
FreestyleVTX_Rev22032022.zip	Compressed (zipped) Fol...	22 KB	No	22 KB	0%	6/5/2022 3:34 PM
HDZeroVRX_4SMA_Rev22032022.zip	Compressed (zipped) Fol...	5,325 KB	No	5,325 KB	0%	6/5/2022 3:34 PM
ScoutHD_Rev22032022.zip	Compressed (zipped) Fol...	5,387 KB	No	5,387 KB	0%	6/5/2022 3:34 PM
SharkByteVRX_2SMA_Rev22032022....	Compressed (zipped) Fol...	5,395 KB	No	5,395 KB	0%	6/5/2022 3:34 PM
TX5M.1_Rev22032022.zip	Compressed (zipped) Fol...	19 KB	No	19 KB	0%	6/5/2022 3:34 PM
Whoop_TX5S.1_Rev22032022.zip	Compressed (zipped) Fol...	20 KB	No	20 KB	0%	6/5/2022 3:34 PM
WhoopLite_Race_Rev22032022.zip	Compressed (zipped) Fol...	22 KB	No	22 KB	0%	6/5/2022 3:34 PM

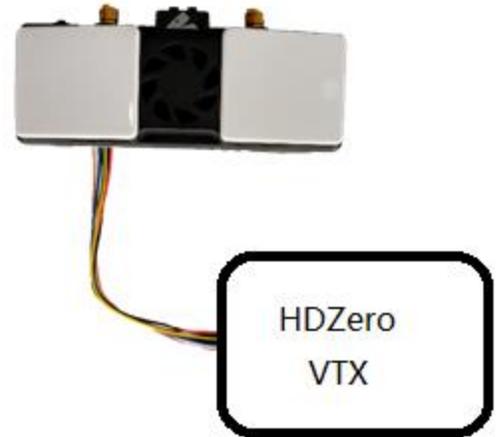
Products	Firmware
HDZero Goggle	HDZEROGOGGLE_Revddmmyyyy.zip
HDZero VRX	HDZeroVRX_4SMA_Revddmmyyyy.zip
Sharkbyte VRX	SharkByteVRX_2SMA_Revddmmyyyy.zip
ScoutHD	ScoutHD_Revddmmyyyy.zip
Frsky SkyVisionHD	FrskySkyVisionHD_Revddmmyyyy.zip
Emax Transporter	EmaxTransporter_Revddmmyyyy.zip
HDZero Freestyle V1 VTX	FreestyleV1VTX.Revddmmyyyy.zip
HDZero Freestyle V2 VTX	FreestyleV2VTX.Revddmmyyyy.zip
HDZero Whoop VTX	WhoopVTX.Revddmmyyyy.zip
HDZero Whoop Lite VTX	WhoopLiteVTX.Revddmmyyyy.zip
HDZero Race V1 VTX	RaceV1VTX.Revddmmyyyy.zip
HDZero Race V2 VTX	RaceV2VTX.Revddmmyyyy.zip
HDZero Race V3 VTX	RaceV3VTX.Revddmmyyyy.zip
FoXeer VTX	FoXeerVTX.Revddmmyyyy.zip

VTX update Guide

All the zip files for each VTX contains HDZERO_TX.bin.

Steps to update VTX firmware:

- (1) Format SD card (Choose FAT32 and Allocation Unit size to 4096 bytes);
- (2) Power off VRX if it is on;
- (3) Unzip content of corresponding VTX zip file onto SD-card, and insert SD to the VRX module;
- (4) Connect cable with module and VTX as shown right;
- (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.

VRX update Guide

Steps to update HDZero VRX

- (1) Disconnect the cable connecting VRX and VTX, if it is connected;
- (2) Unzip content of HDZeroVRX_4SMA_Revddmmyyyy.zip onto SD-card, insert SD into the module
- (3) Power on VRX, and waiting for “Success”.

Steps to update Shark Byte VRX

- (1) Disconnect the cable connecting VRX and VTX, if it is connected;
- (2) Unzip content of SharkByteVRX_2SMA_Revddmmyyyy.zip onto SD-card, insert SD into the module
- (3) Power on VRX, and waiting for “Success”.

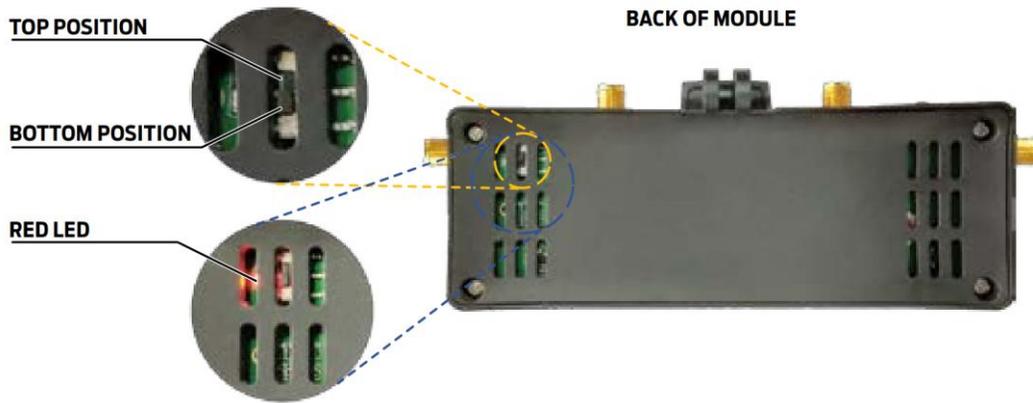
The firmware will be automatically deleted from the SD card after updating.

Note: Do not power off VRX while updating firmware until “Update Completed”. Otherwise VRX will not be able to boot up next time.

Steps to flush VRX in case of not booting up

- (1) Power off VRX;
- (2) Unzip content of the file below onto SD-card, insert SD to the module;
 - a. - HDZeroVRX_4SMA_Revddmmyyyy.zip for HDZero VRX, or
 - b. - SharkByteVRX_2SMA_Revddmmyyyy.zip for Shark Byte VRX

- (3) Move the switch to Bottom position with tweezers (not included);
- (4) Power on goggle module, the red LED will be lit;
- (5) Wait for red LED to turn off, on, and then off again (it may take over 10 min to complete);
- (6) Power off, and move the switch to TOP position with tweezers;
- (7) Repower goggle module, it should now boot up normally.



Setup and Getting Started with HDZero

OSD Setup

1. Prerequisites

- Betaflight >= 4.4.0
- Inav >= 4.1
- FlightOne >= 10.1.1.5576 | 10.1 Alpha 29

2. Update firmware VTX and VRX

- Download the latest firmware: www.hd-zero.com/document
- Firmware package (Rev_ddmmyyyy.zip) contains the firmware for all the VTX and VRX

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

see installation diagram above

4. Flight controller Configuration (Use Betaflight as example)

- Connect the FC board to computer with an 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).

Ports WIKI

Note: not all combinations are valid. When the flight controller firmware detects this the serial port configuration will be reset.
Note: Do **NOT** disable MSP on the first serial port unless you know what you are doing. You may have to reflash and erase your configuration if you do.

WARNING: The VTX table has not been set up correctly and without it VTX control will not be possible. Please set up the VTX table in Video Transmitter tab.

Identifier	Configuration/MSP	Serial Rx	Telemetry Output	Sensor Input	Peripherals
USB VCP	<input checked="" type="checkbox"/> 115200	<input type="checkbox"/>	Disabled AUTO	Disabled AUTO	Disabled AUTO
UART1	<input type="checkbox"/> 115200	<input type="checkbox"/>	Disabled AUTO	Disabled AUTO	Disabled AUTO
UART2	<input type="checkbox"/> 115200	<input checked="" type="checkbox"/>	Disabled AUTO	Disabled AUTO	Disabled AUTO
UART3	<input checked="" type="checkbox"/> 115200	<input type="checkbox"/>	Disabled AUTO	Disabled AUTO	Disabled AUTO
UART4	<input type="checkbox"/> 115200	<input type="checkbox"/>	Disabled AUTO	Disabled AUTO	Disabled AUTO
UART5	<input checked="" type="checkbox"/> 115200	<input type="checkbox"/>	Disabled AUTO	Disabled AUTO	VTX (MSP + D) AUTO

5. Restart/Connect Flight controller Configuration (Use Betaflight as example)

- Go to configuration tab

- Activate OSD function
- SAVE

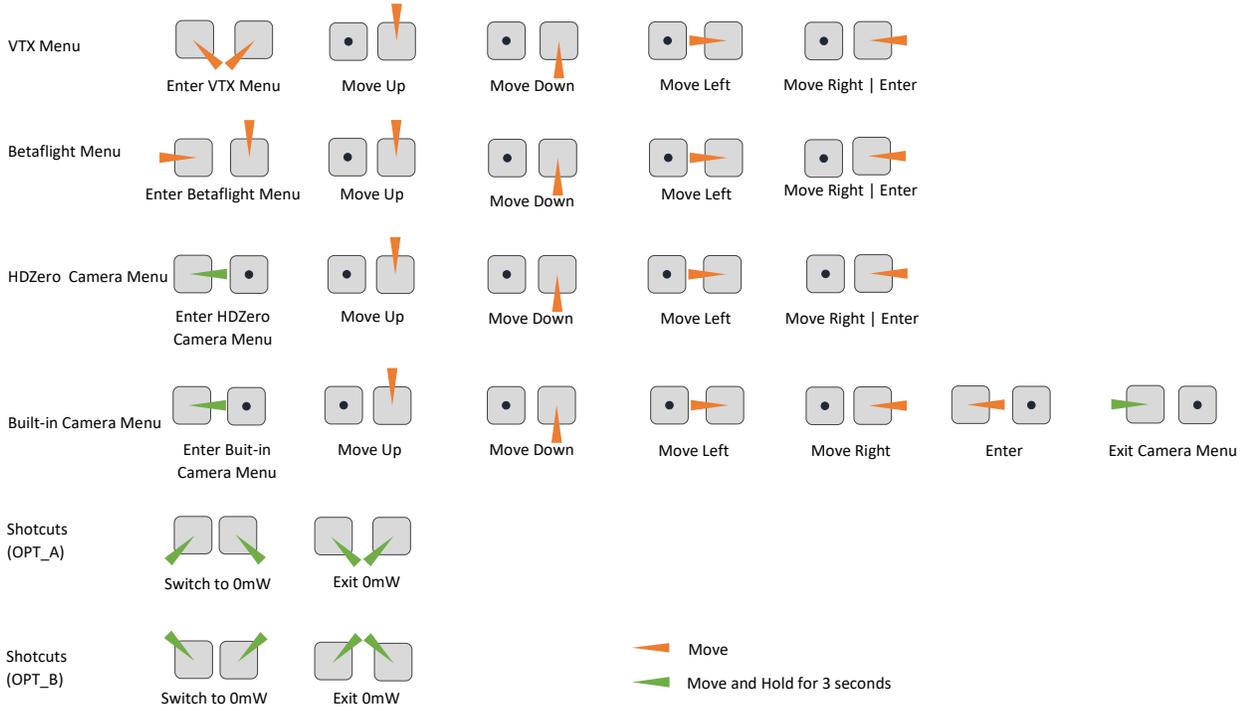
Other Features

Note: Not all features are supported by all flight controllers. If you enable a specific feature, and it is disabled after you hit 'Save and Reboot', it means that this feature is not supported on your board.

<input type="checkbox"/>	INFLIGHT_ACC_CAL	In-flight level calibration	
<input type="checkbox"/>	SERVO_TILT	Servo gimbal	?
<input type="checkbox"/>	SOFTSERIAL	Enable CPU based serial ports	?
<input type="checkbox"/>	SONAR	Sonar	
<input checked="" type="checkbox"/>	LED_STRIP	Multi-color RGB LED strip support	
<input type="checkbox"/>	DISPLAY	OLED Screen Display	?
<input checked="" type="checkbox"/>	OSD	On Screen Display	
<input type="checkbox"/>	BLACKBOX	Blackbox flight data recorder	?
<input type="checkbox"/>	CHANNEL_FORWARDING	Forward aux channels to servo outputs	
<input type="checkbox"/>	TRANSPONDER	Race Transponder	?
<input checked="" type="checkbox"/>	AIRMODE	Permanently enable Airmode	

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

Stick Movement



Using VTX Menu (Applicable to all VTXes)

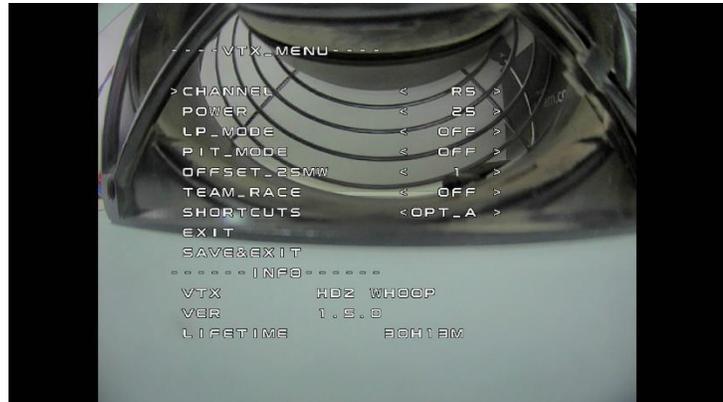
All HDZero VTXes have the following settings for its RF power level management. These settings can be changed using the VTX menu.

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.



LP_MODE:

- **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)**

PIT_MODE:

- **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)**

OFFSET_25MW:

It is to fine tune the RF output power to be exactly 25mW. The range is [-10:10], and step size is about 0.3dB per step.

TEAM_RACE:

- **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 or SmartAudio. 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 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.

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 1W if you have the required HAM radio license to use this power output. Download the special firmware from www.hd-zero.com/document 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. Use the VRX to flash this firmware to the VTX.
4. Power on the VTX, 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. Use the VRX to flash this firmware to the VTX.
8. The higher RF output options will now be available.

Please note 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 needs to be unlocked before it can be used. Make sure your region allows low band before unlocking. To unlock low band for VTX:

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 VTX. The BLUE LED should flashes 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.

Using SmartAudio (Not recommend)

HDZero VTX can be controlled by FC using the TBS SmartAudio V2.1. In this case, the VTX will output RF power and channel commanded by FC directly. To avoid conflict, If SmartAudio is enabled, only OFFSET_25MW and SHORTCUTS are available in the VTX menu.

Notes:

- HDZero VTX outputs 0.1mW when SmartAudio PIT mode is ON.
- HDZero VTX does not support SmartAudio out range PIT mode.
- When HDZero Race VTX boots up, it will automatically detect the existence of a valid SmartAudio link with FC within 10 seconds. If the link exists, FC will fully control race VTX's RF output power and working frequency.

You don't need to set up the vtx table manually for betaflight, VTX will set it up automatically via uart port.

With SmartAudio, the user can change channel number and power level even when aircraft is in the air.

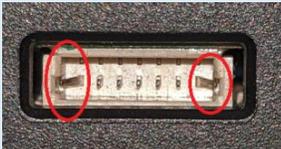
Help and Troubleshooting

FAQ

1	Facebook Group and Discord Server?	www.facebook.com/groups/HDZero https://discord.gg/JPesSHpmCU
2	Does VRX have low voltage alarm?	VRX does not have a low voltage alarm. We recommend using an in-line battery alarm (not included) between the battery and DC cable
3	How does VRX power cable work?	DC cable has an integrated DC regulator which converts from 3S-6S to fixed 7.8V output. (Manual says 3S-4S) It is very important to unplug the DC cable from battery after flight. Otherwise, DC cable will suck up battery power and cause permanent damage to the battery.

Troubleshooting

1	Video feed is working but no OSD	<p>(a) VTX/VRX Firmware mismatch: Update both VTX and VRX from the same firmware release.</p> <p>(b) Wire connection: TX and RX of FC board should be connected with RX and TX pads of VTX respectively.</p> <p>(c) Betaflight setting: Instruction on Page 18.</p> <p>(d) Try another UART port of FC (avoid to use soft-serial and SA ports).</p>
2	No Blue LED on VTX	<p>Blue LED works as the following way:</p> <p>(1) Flashing at 1HZ periodically if VTX heat protect.</p> <p>(2) Flashing at 2HZ periodically if VTX is on pit mode.</p> <p>(3) Flashing at 4HZ periodically if VTX is on 0mW.</p> <p>(4) Flashing 4 times if MSP connection is established with FC after VTX is powered up.</p> <p>(5) Going off if the camera is not detected.</p> <p>If a camera is attached, and get NO blue LED, please:</p> <p>(a) Check if MIPI cable is secured on both end of camera and VTX, and check if cable itself is fine.</p> <p>(b) Carefully check VTX MIPI connector if there is any bent pin.</p> <p>(c) If it is Foxeer Digisight camera, make sure it is NOT on analog mode.</p> <ul style="list-style-type: none"> - Digisight goes to analog when pressing left for 3 sec. - Use stick commands blindly or disconnect mipi and use external joystick. - Joystick does not work in digital mode. Must use stick commands (Thr mid, yaw right) to enter cam menu (BF OSD disappears).
3	Snow noise even in short distance	<p>(a) Add a big capacitor (350+ uF 50V) in parallel to battery leads to smooth the power supply of the whole aircraft.</p> <p>(b) Move Radio RX and its antenna away from VTX.</p> <p>(c) Do not place VTX next to ESC board.</p> <p>(d) Try another pigtail (if there is).</p>

		<p>(e) Try another antenna.</p> <p>(f) Ensure U.FL connector of VTX has at least 7mm vertical clearance.</p> <p>(g) Check if there is other VTX (analog, DJI, HDZero) working on current channel.</p> <p>(h) Check if there is WIFI interference.</p>
4	Recording files are zero byte length	<p>There are two recording file format: TS and MOV format</p> <p>On TS format, VRX ensures video will be recorded until last second before VRX is powered off.</p> <p>On MOV format, VRX will not have enough time to close the recorded file if VRX is powered off. Therefore, it is important to manually close the file by switching to setting mode (Long press Left key) or switching channel (press Right key) before powered down VRX</p>
5	SD card not working	<p>(a) An 8G-32G SD card Recommended</p> <p>(b) Format SD card before using:</p> <ul style="list-style-type: none"> - Use VRX to format SD card. - Use Windows to format (Choose FAT32 and Allocation Unit size to 4096 bytes).
6	No Red LED	<p>(a) Make sure input voltage is within range.</p> <p>(b) The VTX consumes about 5W, make sure power source has enough max current.</p>
7	Flashing VTX fails	<p>Check if any pins on VRX or VTX update port are bent. Pins should all be straight. Example of crooked pin on the VRX causing flashing problems:</p> 
8	FC dropping to bootloader	<p>Add a 200ohm resistor between the wire from FC UART.TX to VTX UART.RX</p>