

# FAT SHARK

## Byte Frost User Manual

REV 141019 (DDMMYY)

MODEL FSV1106

For more product information, please visit:

[www.fatshark.com](http://www.fatshark.com)

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### RF Warning:

**This is not a frequency hopping system. It occupies a portion of the RF band and thus (like analog) can potentially be knocked out by other users powering on in your channel. Likewise, if you turn on your transmitter on an occupied channel, you will knock that pilot out. Please turn on your RX first and scan for RF noise and ensure your last channel used is clean before powering transmitter.**

# Revision Tracking

Date format is DD/MM/YY for chronological tracking

09/10/19 – new manual, added revision tracking

14/10/19 – notes on 128Gb card, corrected VTX size, added known bugs section, added flip screen

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## Overview on how the system operates:

- Due to the nature of digital, the occupied portion of the band is very precise and thus adjacent channels can be stacked very close to each other with no cross talk. Pilots can fly maximum power in close proximity to each other.
- The system is not a bi-directional link. Missing or multipath canceled information is not resent. The receiver has two fully independent receiver circuits from which an FPGA rebuilds the signal.
- The left and right two SMA are dedicated to the two independent receivers and each of the two SMAs are diversity switched based on RSSI (well, much more complicated than that but this explanation will suffice). So essentially using only two antennas (one each RX) will be similar to using 4 similar antennas. Likely best performance will be achieved with a combination of omni and directional antennas on both receivers (left and right side will choose strongest signal, FPGA will stitch information).
- The camera is Analog HD but the system is fully digital. The AHD signal is only communicated from the camera to the TX, which is equipped with an AHD RX, that converts to digital prior to being transmitted. This allows the system to be used with conventional cameras as well. Using AHD between the camera and TX reduces wire count and increases system robustness.
- The camera has a Divimath hand shake key IC which is supplied to qualified camera vendors. The purpose is to ensure camera compatibility and performance quality.
- The OSD information for recording and scanning only shows on the receiver monitor and not on the HDMI out. This is because the graphic OSD utilizes the DVR chipset which also directly drives the panel. The HDMI out is split out via an FPGA so that the DVR latency isn't added. This also allows the system to output either 16:9 or 4:3 to HDMI while the DVR is dedicated to displaying and recording 16:9 (4:3 mode crops sides of HDMI image and is thus lower resolution).
- The extended channels can only be enabled on the VRX as receiving outside the FCC license is legal. However only race organizers can activate the VTX for extended channels when they have either acquired permission or paid for temporary exemption for an event.

## Antenna recommendation

Circular polarized antennas are recommended to minimize breakup as they naturally attenuate multi path reflections. Omni on the TX is a must, combination of Omni and directional on receiver is suggested (one of each on left and right side of RX).

## Known Bugs

- Only 32GB cards work natively. To use larger than 32Gb (up to 128Gb) the card needs to be formatted in a PC. Current VRX does not have format support
- VRX will record in 1280p if using V20 f/w and user selects RESET. Solution is to upgrade to latest F/W

- File format does not play well with Premiere. Need to re-encode with a utility like Handbrake. This may take some time to solve.

## VTX User Guide

### Channel setup (small LED dot off)

Short press right button, LED indicator will light up. Additional short presses will increment the cycle the channels 1-4 if in HQ mode and 1-6 if in LQ mode.

After 7s of not pressing, channel will be saved and LED will turn off.

Both HQ and LQ channels are evenly distributed between 5725 ~ 5850MHz.

### Power setup (small LED dot lit)

Long press and hold right button for 3 seconds, LED will flash the letter "C" 3 times then you can enter power setting mode. At this time, the TX output power is turned off. Additional short presses scrolls through power levels 1, 2 and 3 (25mW, 200mW and 450mW). To save new settings, press and hold button until display turns off (will flash "8," on confirmed change).

### Password setup

Warning: Currently too confusing to set and concerned may result in incorrect password. Please do not use this function until the procedure has been polished. Below is first draft only but do not attempt.

Short press to enter channel mode then press and hold 10 seconds until "P," flashes (it will flash "C," a few seconds in but continue to hold for 10 seconds).

Set first digit (1/4). Short press to change number (0-9). Press and hold 3 seconds to confirm (after confirm, moves to next digit).

Continue on through remaining 3 digits. On final confirm, password set and exits.

Reset: No idea how to do this, which is why do not attempt to set password.

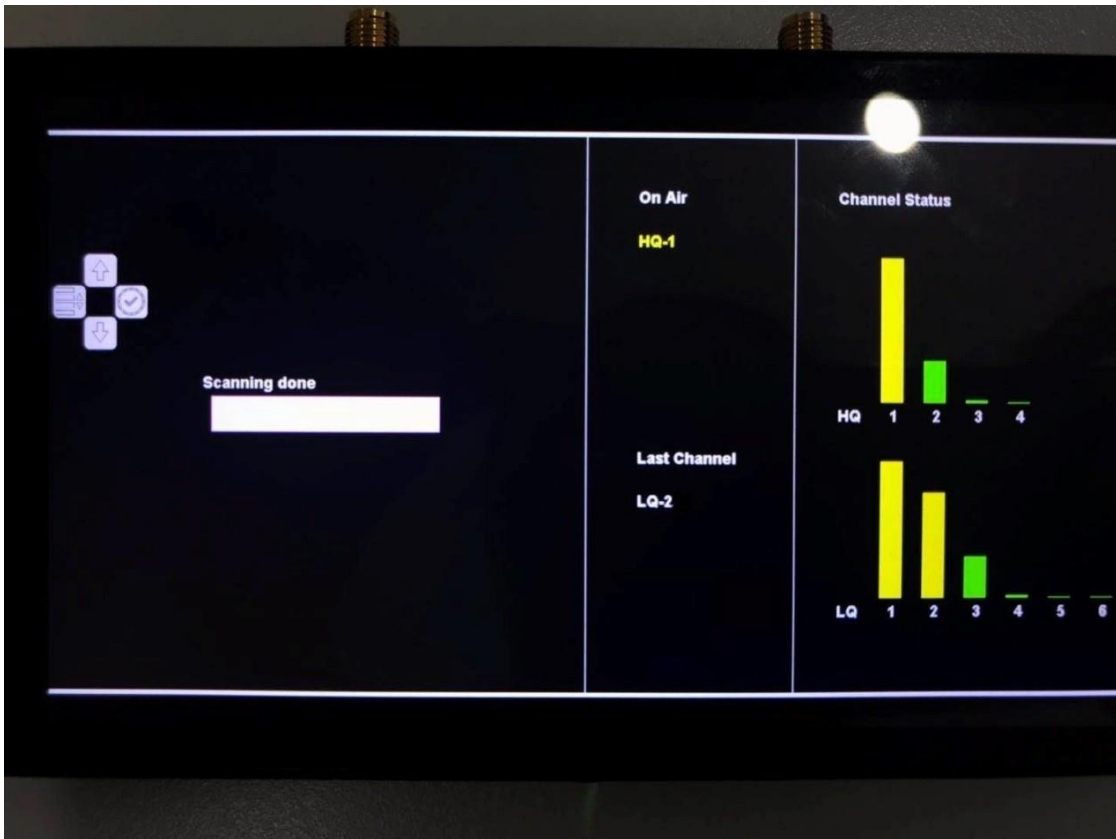
#### Timeout Exit

If there is no operation for 30 seconds, the operation will timeout and the LED will turn off.

## VRX User Guide

### POWER ON (Frequency Sweep)

The boot screen will be displayed after power on then the system will perform an automatic scan. The interface is divided into 3 segments as shown below:



**Left section** shows scan progress upon power up (or initiate scan).

**Center section** under “On Air” is the number of HDZero units found broadcasting and on which channels. Last Channel is channel last used when powered down. Verify that your last channel used corresponds to a low RF green bar before powering the TX.

**Right section** shows the RF occupancy of all 4 HQ channels and 6 LQ channels. This may consist of all digital and analog transmission and RF noise (including your transmitter if powered). The green bars indicate available channels with the smaller the bar, the less noise (and the best channel to use). Best to power and scan the RX before powering on the TX to ensure you are flying on the cleanest channel (for best results).

**5 Way Joy Switch.** The button directions correspond to the OSD Icons in the top left corner. Press right (check icon) to proceed to displaying image on screen (may need to change channels with the up/down channel keys to acquire your transmitter). The default channel is the channel last used.

## Image Interface

After exiting Sweep Screen, camera image will be shown on the screen (if transmitting and on correct channel) with the following OSD information on the top portion of the screen, from left to right:

Signal strength (0 to 5 bars)

Channel number (HQ1 through to LQ6)

DVR status (STBY/REC)

SD card (icon showing detected/not detected)

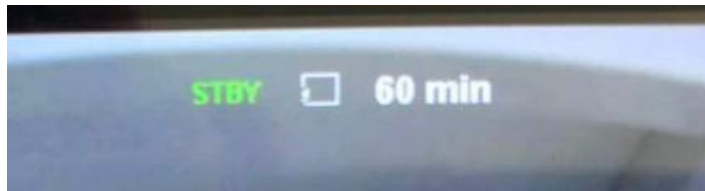


Remaining recording time available on SD card

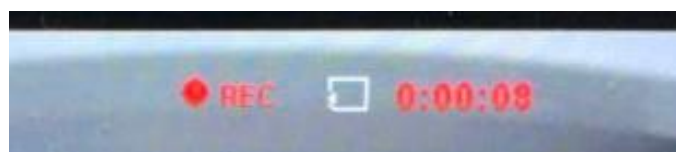
## OSD Navigation Icons

Note: OSD navigation icons will disappear after 7 seconds if no activity detected. Pressing the joy switch in any direction brings up the OSD navigation icons.

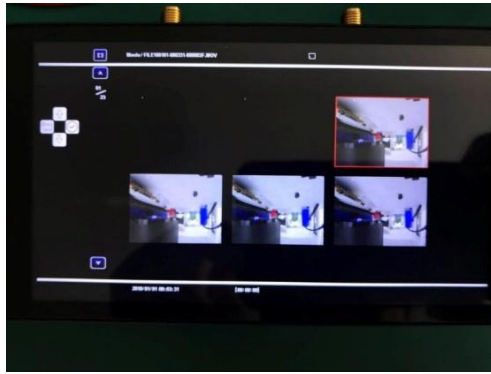
## DVR control



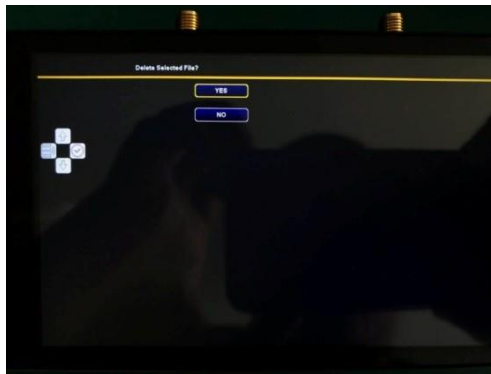
After the OSD navigation is called up (press joy switch any direction), press stick to right bto start recording. At this time, the middle position of the screen starts to record time, press the right button again to end the recording.



Press the down button to enter the video playback interface, Press the left button to return to the image interface, press the up and down keys to select, short press the right button to play.



Long press the right button to enter the delete interface, press the up and down keys to select whether to delete the current video, press the right button to confirm, press the left button to return to the video playback interface.



## System Setup



### 2.4.1 The instruction of the left 4-way key

- (1) Up and Down : select setting
- (2) Right : confirmation

(3) Left : exit, and return back to image interface

## System settings

Movie Quality: Set the image quality of recording video

Flip Screen: Flips vertically to be used with Transformer viewer (requires restart)

Note: Monitor has latency over the HDMI as its outputted through the DVR chip.

Password: Set 4-bit password which should be same as transmitter's password, Only when the password match with TX , can the receiver display the image

Format SD-Card Card must be pre formatted to FAT32 in order for cards higher than 32Gb to be used (32Gb cards are typically FAT32 by default, larger cards not always).

HDMI Format: 16:9 or 4:3 (changes HDMI only, recording and monitor remain 16:9);

Record Mode:

In Manual mode, start and stop the video recording on the image interface;

In Auto mode, the DVR will automatically record whenever a valid signal is present.

Note: you cannot manually stop recording in auto mode. Pressing record in auto mode will just start a new file (also useful).

Channel Ext: expand HQ and LQ channel number to 12. This will be enabled by race directors only that have purchased or been given permission to transmit outside the FCC license free band.

About: check the current firmware information

## Update firmware

The firmware of VTX and VRX are both updated by VRX, there are four firmware files for updating

- (1) HDZERO\_TX.bin
- (2) HDZERO\_RX.bin
- (3) HDZERO\_VA.bin
- (4) BYTE\_FROST.bin

The first one is used to update VTX, the last three are used to update VRX. When updating VTX, the VTX FW port needs to be connected to the VRX FW port via the supplied cable.

Copy the f/w to your SD card, and inset the SD card into VRX, it can update firmware automatically once you power on. If there are all 4 F/W, it means need update 4 times to finish updating all firmware. After each updating succeed, the corresponding file in the SD card will be deleted automatically and you need to power it on again to execute the new firmware. The following figure is the process of updating after power-on. When update the above four files, the words above the progress bar are as below:

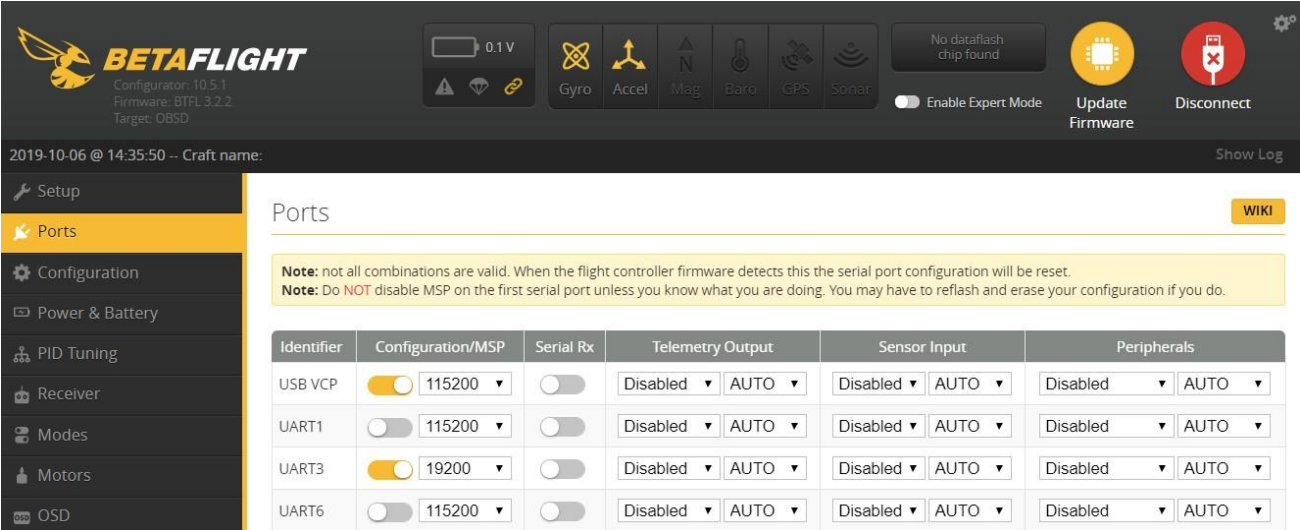
- (1) "HDZERO\_TX"
- (2) "HDZERO\_RX"
- (3) "HDZERO\_VA"
- (4) "Read File"、"Write File"



## BetaFlight OSD Set Up (requires soldering)

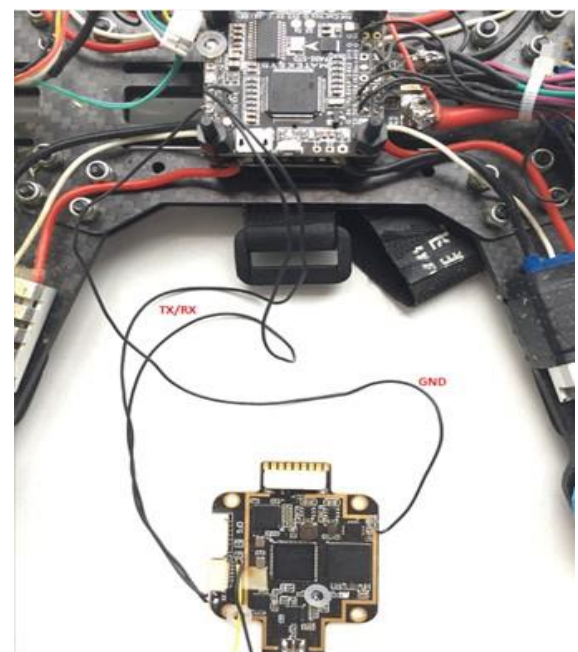
Modern FC (flight controller) uses MSP connection for VTX to retrieve its telemetry data. Byte Frost has implemented MSP to fetch the following data from FC at current release: Armed/Disarmed, Current, Voltage, RSSI. VTX transmits these data through its data channel to VRX, and VRX display the data using its built-in OSD engine.

1. In the Betaflight Configurator, choose an available UART port number for communication between FC and VTX. Set speed to 19200. The below screen shot shows an example of selecting UART3.



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
UART3	<input checked="" type="checkbox"/> 19200	<input type="checkbox"/>	Disabled   AUTO	Disabled   AUTO	Disabled   AUTO
UART6	<input type="checkbox"/> 115200	<input type="checkbox"/>	Disabled   AUTO	Disabled   AUTO	Disabled   AUTO

2. Refer to your FC manual to determine where the chosen UART ports are. Hard wire the specified UART port on the FC to TX/RX ports on VTX; i.e.
  - FC.UART3.TX to VTX.RX,
  - FC.UART3.RX to VTX.TX,



3. If connected correctly, OSD will have Armed/Disarmed, Current, Voltage, RSSI and Timer. Timer will restart when FC is changing from disarmed to armed state.



# Byte Frost Camera user guide

## Main menu

Press the 5way-joystick, can display main menu



1.1. Scenario (Scene setting): there are five scenes for user to setting

- (1) Default
- (2) Indoor
- (3) Outdoor
- (4~5) Custom1~2

1.2. AE (Exposure setting)

1.3. Image Enhance (Image enhancement Settings)

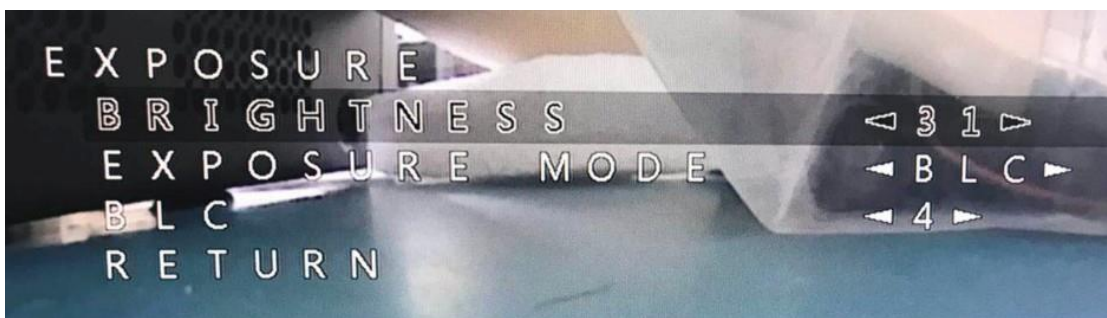
1.4. Video Setting

1.5. RESET (Factory Reset)

1.7. Save & Exit

1.8. Exit(Do not save and exit)

## 2. AE Menu (Exposure)



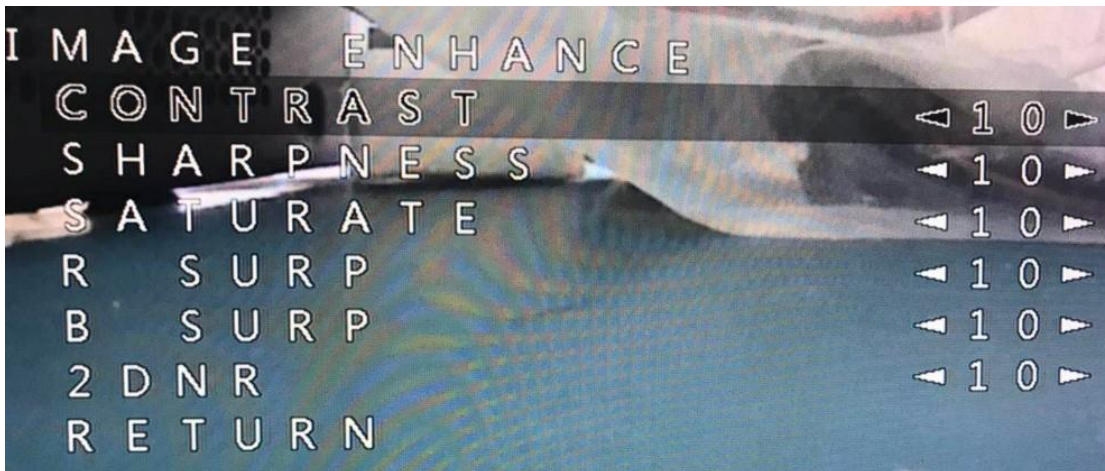
2.1. brightness :1~100

2.2. Exposure mode: There have 5 modes

- (1) BLC: Backlight Mode There is a first level sub-option: BLC value selection (0~7)
- (2) FLC: Follow light mode
- (3) GND: Ground mode (when adjust exposure, can make the bottom image clearer)
- (4) Global: Global Mode

(5) Center: Center mode (when adjust exposure, can make the center of image clearer)

## 2. Image Enhance menu (Adjustable values 0~20)



3.1. contrast

3.2. sharpness

3.3. saturate

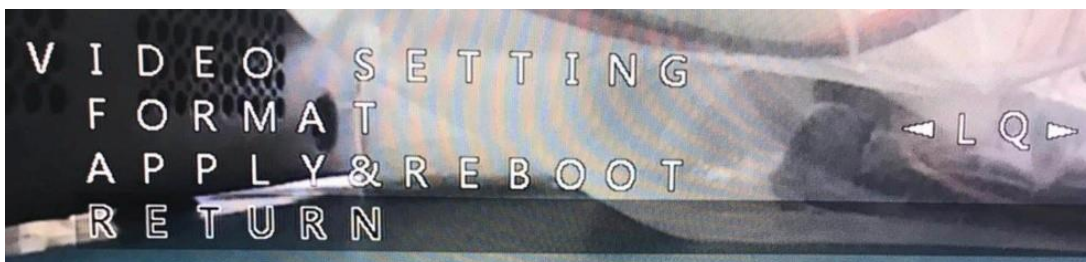
3.4. R surp R(RED) weight component gain

3.5. B surp B(RED) weight component gain

3.6. 2 DNR (2D Noise Reduction Level)

## 4. Video Setting menu

Used to switch HQ(720P) and LQ(NTSC) mode, while switch mode ,there has one more choice "APPLY & REBOOT", select this option to make the switch take effect.



## RunCam Camera user guide

In addition to the OSD accessed functions, the RunCam has some direct mode controls for LQ/HQ, 50/60 FPS.

5s press and hold left – camera goes into HQ mode (TX power needs to be cycled)

5s press and hold right – camera goes into LQ mode (TX power needs to be cycled)

5s press and hold down – camera alternates between 50 and 60 fps. RX supports only 50FPS

Note 1: HQ mode is 50 FPS, LQ mode is 60 FPS. To change to LQ mode, need to change mode and FPS (first gen issues). Best to not experiment with LQ immediately and just leave in HQ mode otherwise may need trouble shooting.

Note 2: green LED flashes when modes change at 5s point.

Note 3: no green light after mode change indicates the camera isn't communicating with TX and the TX power needs to be cycled. Green LED indicates communication successful.

Warning: It is possible that the camera can be put into unintended mode by accidentally pressing and holding the stick. If it appears the camera isn't working (blank screen) with or without a green LED and you are on the right channel, do the following; Press and hold 5s stick to left (ensures its in HQ mode). Power cycle TX, power cycle RX. Ensure on same channel (an HQ channel). Image should be re-acquired. If still no image and LED is GREEN, press and hold down direction for 5s (change FPS – no need to cycle TX power).

### Troubleshooting

#### No image

- no image, green LED on – likely RX on wrong channel (or right channel, wrong LQ or HQ mode). Press and hold camera joystick to left for 5s and cycle TX power. Ensure VRX is on correct channel and in HQ mode.
- No image, green LED off – likely camera mode change. Cycle power on TX.
- 64Gb, 128Gb SD card not working. Format to FAT32 on a PC before inserting.



## Specifications

### VTX

Power supply:	8-28V
Power consumption:	500mW @3S (@200mW RF output)
Power output for CAM:	5V
Antenna connector:	MMCX
RF Power:	25/200/450 mW
Video input:	HQ (720P50) / LQ (NTSC), Auto-detect
Dimensions:	55x40mm
Weight:	14.1g
Channel:	

\* 4 HQ channels and 6 LQ channels (under FCC)

	1	2	3	4	5	6
<b>HQ</b>	5743	5779	5815	5851		
<b>LQ</b>	5737	5761	5785	5809	5833	5857
<b>Interferes with</b>						

\* 12 HQ channels and 12 LQ channels (channel expansion)

	1	2	3	4	5	6	7	8	9	10	11	12
<b>HQ</b>	5491	5527	5563	5599	5635	5671	5707	5743	5779	5815	5851	5887
<b>LQ</b>	5593	5617	5641	5665	5689	5713	5737	5761	5785	5809	5833	5857

### VRX

Power supply:	8-28V (DC Port) / 5V (USB Type-C)
Power consumption:	0.9A@12V
Screens size:	5.5-inch
Screen resolution:	1280x720
HDMI output :	5V@150mA
DVR:	MicroSD card support to 128 GB(Fat32) H.264 codec, 60fps, Mov Video quality selectable Support playback on screen
USB Type-C:	Only for power supply
User controls:	Channel scan and selection Record video, playback (by MicroSD)
Firmware update:	By using MicroSD
Dimensions:	143x82x21 mm
Weight:	156.2g

## RUN CAMERA

Power supply:	DC 5-36V
Current:	200mA@5V
Interface:	6Pin Compatible HDZero VTX
Image Sensor:	Super WDR CMOS Sensor
Resolution:	HQ: 1280*720@50fps / 60fps    LQ: PAL / NTSC
Lens:	FOV 150°
Shutter:	Rolling Shutter
Dimensions:	19x19x21 mm
Weight:	9g