FPV Systems Essentials

Set up your FPV system quickly and easily!

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THE VIEWING GEAR : MONITORS AND FPV GOGGLES

Monitors are extremely useful in a variety of situations where goggles fall short. For example, if you want to frame a shot for aerial photography, you need to know where your drone is and have situational awareness. Unless you have a spotter, this is impossible with goggles as they completely handicap you in terms of situational awareness. Here's what to keep in mind while purchasing monitors:

- Screen size and resolution
- Viewing angle : Wider the better
- Make sure it is non blue screen
- Antenna bay : Ideally, the monitor should have the capability to mount two different antennas at the same time. As we shall see in the subsequent sections, different types of antennas have different strengths and weaknesses. You need to be able to harness the strength of both types.
- DVR capability : DVR capability is the ability to record the flight. This allows for a "backup footage" of your flight. It is especially useful if you have crashed your craft crashed somewhere. The backup footage is then for example, immensely valuable in finding out where it crashed, making it easier to recover your craft.
- Storage capacity : Higher the better
- Sun protection capabilities are a BIG bonus.

Note

Montiors come in a variety of sizes and configurations. You can get a dedicated monitor for your FPV or rely on your phone or tablet. If you are get a dedicated monitor, you of course get more flexibility and a better FPV experience

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If you want full immersion, go for the FPV goggles instead of a monitor. Here are some specifications you need to keep in mind:

Resolution: Higher the resolution, the better. Keep in mind that the camera should also be high resolution for this effect to be noticed.

Field of view (FOV): Larger the field of view, the more immersive experience you get. If you look inside an FPV goggle that has a large field of view, you'll find the screen closer to the eye. Higher end models like the Fatshark Dominator HDV2 has an FOV spec of 50 degrees, giving a really immersive experience.

Screen aspect ratio: Some FPV goggles like the Fatshark Dominator V3 comes with an aspect ratio of 16:9 (which is great if you are an aerial photographer piloting something like the DJI Phantom) while other googles come with a 4:3 aspect ratio. It is important that it matches with the camera or else everything in the video will look shrunken down. Most board cameras support 4:3 aspect ratio, so if you are planning to get a Dominator V3, best match it with a camera that supports a 16:9.

IPD (Inter pupillary distance): This factor is really important so do not overlook this, especially if you are getting a cheaper FPV goggle that doesn't have an adjustable IPD. We all have eyes that are spaced differently so there is no one size fits all. With an adjustable IPD, you can adjust the FPV goggle to fit the spacing of your eyes. Especially if you are considering a goggle that doesn't come with this feature, it is important to try it out before purchasing it.

DVR: DVR capability is the ability to record the flight in the goggles in a Micro SD card that is placed inside the goggle. This allows for a "backup footage" of your flight. It is especially useful if you have crashed your craft crashed somewhere. The backup footage is then for example, immensely valuable in finding out where it crashed, making it easier to recover your craft.

Head tracking: Head tracking is a feature that'll increase your immersion experience. It 'tracks' the motion of your head and make the camera on-board to move accordingly. Talk about "being one" with your craft!

FPV antenna, modularity and range: Yet another consideration to keep in mind is the type of the FPV receiver antenna and whether or not the goggle has a modular receiver bay. Some goggles like the Fatshark Dominator V3 and HDV2 do not come with a receiver but it has a modular receiver bay, meaning you can attach a variety of different (supported) antennas to the goggles while others may not come with this feature.

Vent fan – whether or not the goggle comes with a vent fan, which is important to counter- act 'fogging' during summer and winter.

HDMI Port

Overall quality of the build

FPV CAMERAS

Obviously, any FPV system needs a camera. This is what captures what your drone sees, which is then transmitted to your viewing device (monitor or goggles) via a transmitter. There are a variety of different options here but we'll classify the cameras into two main types – Dedicated FPV cameras and other cameras (like GoPro).

Here are some of the considerations you must keep in mind while picking a dedicated FPV camera:

CMOS vs CCD: Cmosc cameras are cheaper, but offer less in terms of quality. If you want the best quality in light, go for a CCD camera. One experiment you can do to check the difference is to let both cameras point slightly to a bright enough sky. With CCD cameras, you'll notice that the vision of the ground remains intact. With the CMOS however, the ground tends to go black.

Light handling: Most cameras work well when the sun is up and the sky is clear. However, different cameras have different light handling capabilities in low light conditions (think cloudy days) and high light conditions. CCD cameras outperform CMOS in terms of light handling. You should do your due diligence and research what cameras have the best light handling capabilities for your particular purpose. Make sure that the camera you get also has IR block (infra red blocking) capabilities so it also functions in high light conditions optimally, if that is what you want. If you want better performance in low light conditions, get a camera without IR blocks. CMOS cameras perform well in low light conditions.

Note

Video transmitters and receivers are the ones that ultimately decide the upper limits of your FPV video quality, no matter what quality camera you have. For example, you could buy a 1000 TVL camera and still be limited to the specifications provided by the transmitter and receiver of your FPV setup. Same goes for resolution.

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Consider getting wide angle lens: For a few extra bucks, you could get a wide angle lens for the camera you purchase and have a whole difference experience flying. If you are flying multirotor drones then this is going to be really important.

Voltage : Make sure that the battery you use matches the voltage limits on your camera. Failing to do so can be disastrous (speaking from experience!). If you absolutely need to use a battery with higher voltage rating, use a regulator and step it down.

ANTENNA

FPV antennas come in different shapes and sizes. Here, we'll look at the two main types of antennas and the benefits of using each.

Linear antennas: Linear polarized antennas shoot out information in a straight path. These are ideal for sending signals over really long distances. However, if your craft is flying through objects, the signal that the antenna sends is going to bounce back. Linear antennas are poor equipped to handle these bounces causing "muti-path interference". If you use linear antennas other than for long distances in really open areas, you are going to get messed up, disturbed double-images on your video.

Circular polarized antennas: With circular polarized antennas, there is no multi-path interference. The signall is sent in concentric circles (either clockwise or anti-clockwise) and when it hits any object and returns, it comes back in circles that rotate in the other direction cancelling it out with the signals that are sent by the antenna.
This is why you see circular polarized antennas being used in FPV racing and obstacle course flight. They are ideal for short distance, clear image unhindered by objects.

Note

With circular polarized antennas, you get two versions - right handed circular polarized and left handed. If you use right handed antenna on your transmitter, use a right handed antenna on your receiver as well. If you are flying with a friend and he or she is going to fly his/her craft near you, then it would be best if they used the version that you are not using to minimize interference.

VIDEO TRANSMITTERS

VIDEO LINK BANDS

Legality: Before you decide on what band you want to set your video to, you need to know if it is legal in your country. Check your local laws for what frequencies you are allowed to use. You might also need a radio license for tapping into certain bands, depending on where you are.

The different frequencies, power and penetrating power: There are four different frequency bands used for FPV – 900 Mhz, 1.2 or 1.3 Ghz, 2.4 and 5.8 Ghz. 900Mhz setup will have the best penetrating power, meaning objects around you will not cause that much interference. Also, it will enable you to go longer distance with less power consumption.
That means that if you buy a 900 Mhz transmitter with a lot of power, it will give you the best results. However, you have to be careful with high power transmitters if you are flying with others because there will be interference. "Video bleed" is highly unideal and is the reason why high power transmitters are banned from FPV racing events. Many transmitters come with the option of switching power.
The higher you go up in terms of frequency, the less penetrating power it will have and the more power it will need to consume to enable long distance FPV. However, the drawback with lower frequency setup is that the antennas tend to be very large. There is also a potential for interference with your transmitter with the 1.2 Ghz and 1.3 Ghz setup, but this can be solved with using a filter.
With many RTF drones, you get the 5.8 Ghz FPV out of the box. This is because most government laws recommend the use of this band. Moreover, the 5.8Ghz will cause little to no interference with your transmitter. Also, users do not have to get a radio license.
The 2.4 Ghz is used the least because this is the frequency that your drone transmitter taps into. If the video link uses the same frequency, there will be interference.

Note

Never power up your video transmitter without having the antenna plugged in. The exception to this is if the transmitter comes with the ability to toggle transmission on or off.

SMA VS RPSMA

The connector on the video transmitter (the one that you connect antenna to) comes in two different version – SMA or RPSMA where RP stands for reverse polarization. Most transmitters come in the SMA version, but you have to nevertheless make sure that the connector on your transmitter complements the antenna. With SMA, the transmitter will have the female end while with RPSMA, it will have the male end.

Also note that if your transmitter comes with an extended SMA/RPSMA connector, then it is going to be better for durability. Otherwise, you may have to build an extension on your own

AUDIO

Some video transmitters come with a built-in microphone while others do not. If you want to record everything downlink and use only a dedicated FPV camera without a built-in microphone, then this feature might come in handy.

Other types of video transmitters come with the ability to connect the audio transmission to the camera (which will have the built-in microphone) via a wire.

BANDS

The more bands your video transmitter is capable of tapping into, the better. If the transmitter comes with a "race" band, then it is a bigger bonus because the frequencies are more spread out. This is a huge plus if you are going to fly with your friends. .