

Orqa MRK-1-8 Aircraft Manual

Confidential

June 2024., Version 1.0



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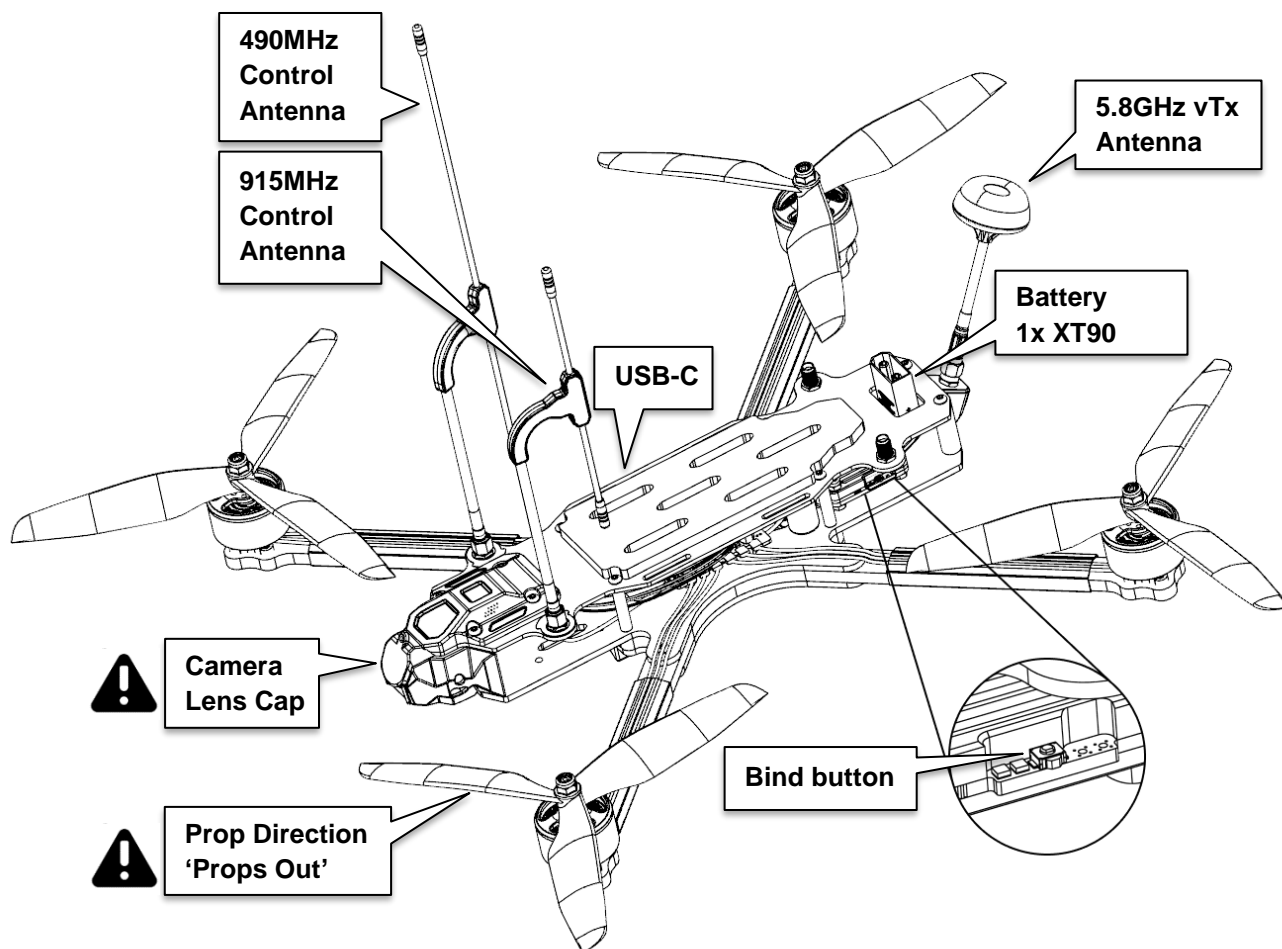
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1. Props		2. Antennas	3. Battery	4. Binding
Observe prop direction, Props Out		Control antennas are RP-SMA (not SMA). Ensure that they are fitted correctly.	1 x XT90 connector 6s4p Li-ion ~16000mAh battery is recommended, or LiPo equivalent.	New drones are in bind mode , no need for bind button. Press bind button once after power-up to bind to new Tx.
5. Channels		6. Video	7. Band Switch	8. Camera
Roll Pitch Throttle Yaw Arm Band * Video * * suggested	CH1 CH2 CH3 CH4 CH5 CH6 CH8	Setup vTx, assign switch, in ghost Tx Video Tx menu. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>VIDEO TX</p> <p>▶Channel 1 5740MHz</p> <p>Band IRC</p> <p>Power 25nW</p> <p>Send</p> <p>On/Off None ←</p> </div>	Configure the band switch in the ghost Tx Radio menu. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>RADIO</p> <p>▶Radio 1 ...</p> <p>Radio 2 ...</p> <p>Select Band 1</p> <p>Switch None ←</p> </div>	Ensure that the camera lens cap is removed before flight.
9. Firmware				
Betaflight v4.1 installed by default. Use Betaflight Configurator v10.9.0				

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Radio Controller

The Dual Sub-GHz JR module should be inserted into a standard R/C radio. Protocol selection on the radio (any recent OpenTx/EdgeTx build) should be set to **GHST** (ghost).

Channel Mappings

When configuring the R/C radio, the following channel mappings should be set. Note that these may be reconfigured in Betaflight, but these mappings are the standard mappings used by all interceptor drones as shipped.

Function	Channel	
Roll	CH1	
Pitch	CH2	
Throttle	CH3	
Yaw	CH4	
Arm	CH5	
Band Select	CH6*	Used to switch between primary and shadow band
vTx On / Off	CH8*	Used to turn off the vTx until required

* suggested

To assign the band-select switch, enter the **Radio** menu, and select it in the **Switch** menu item.

To assign vTx On/Off switch, enter the **Video Tx** menu and select it in the **Switch** menu item.

Controller Battery

When selecting a battery for the radio controller try to use a high-capacity pack, either 18650, or 21700 cells, with the highest current rating possible.

21700 Molicels are recommended.

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Antenna Connections

When looking at the OLED side of the JR module, the low frequency (shadow band) antenna is installed on the left SMA, and the primary antenna (915MHz) is on the right SMA. Do not swap these, or at high power levels damage may occur.

 WARNING	<p>DO NOT OPERATE this high-power control link without suitable antennas connected. DAMAGE WILL OCCUR if 3W of RF is reflected back into the power amplifiers.</p> <p>The OLED on the JR module will show the required antenna locations at startup.</p>
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Drone Setup

Antenna Connections

The rear SMA connector is for the video transmitter antenna.

The two front connectors will be marked by the factory, one for the primary control band (915MHz for example), and one for the shadow band.

Ensure that both antennas are attached before the flight.

For early shipment drones that are not marked by the factory, when you look directly at the camera, from the front of the drone, the 9xx MHz antenna is on the right, the 4xx MHz antenna is on the left.

 NOTE	<p>Note that for early production units RP-SMA connectors are used on the radio controller, and standard SMA connectors are used on the drone.</p>
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Battery Selection

For optimal range, with most payloads, we recommend a 6s4p Molicel p45b or equivalent battery pack. If a LiPo is required, a Tattu 6s 16000mAh will work, but at the cost of some range.

Payload Mounting

When attaching a payload to the drone, try to keep the center of gravity near the center point of the drone. This keeps motor loads similar in flight.

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Prop Installation

The props are installed in a 'props-out' configuration, this means the front props spin out and away from the camera, and the rear props spin out and away from the tail of the drone.

Binding Rx and Tx

Binding not only connects the controller to the drone, but also informs the drone of the frequency choices made on the controller. On each of the bands (primary and shadow) there are at least 2 options, which are defaulted to 915MHz, and 490MHz from the factory. These are sent to the drone during this bind operation.

To bind, turn off the drone, enter the bind menu on the controller OLED, and select 'start bind', then power up the quad and wait < 30 seconds for bind to complete.

You can bind multiple drones to a single controller.

Be sure not to change the **RxID** unless you know what you are doing, this is the drone selection for multi-drone operations (known as 'Team Race' mode).

See the 'Multi Drone Operation' later in this document.

Note that when binding a receiver to a transmitter, a firmware update may be suggested. If confirmed, then the update will be performed in < 60 seconds over-the-air, with no cabling required to the receiver other than power.

Video Transmitter

The video transmitter in the MRK-1-8 is part of the hybrid, which also contains the dual sub-GHz uplinks.

The video transmitter channel is set in the **Video Tx** menu of the JR module OLED. Set the channel and band, plus the output power, and select **Send** to send to the drone.

Match the channel on the rapidFIRE in the goggles.

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EW Resilience

A complex topic, but to keep things simple:

1. Even the primary band of the Dual SubGHz radio can ignore the more common jammers, even when on the same band. This performance is not expected against more complex jamming technology.
2. It is good practice to switch to the shadow band only when absolutely necessary (in the presence of jamming), the radio never sends packets on this shadow band until the pilot requests it.
3. The radios used in the Dual SubGHz system are extremely flexible and may be continuously updated in firmware to provide better EW resilience
4. Firmware versions v1.0.1.1 and later include a 'Hi Band' vTx option to push the video transmitter above 6.0GHz. The maximum usable frequency for now is about 6.02GHz, but this is outside of the range of most common jammers.
To select this on the rapidFIRE receiver, use the **favorites** mode, and increase frequency past 6GHz.
5. Monitor LQ and RSSI during flights that may involve EW. RSSI will generally stay similar, but LQ will drop during jamming attempts.

How to Maximize Range

For the control link, 20km+ is possible with standard omnidirectional antennas.

Range (and penetration through buildings, etc.) may be increased with the use of directional antennas. For larger antennas, mount the JR module on a tripod, power it (up to 6s power is fine), and run just the S.Port, and GND wires to a dummy module mounted in the R/C radio.

For the video downlink, use a high-gain receiver antenna. These have narrow beams, so need to be carefully aimed. The TrueRC Sniper 5.8GHz antennas are highly recommended.

For optimal range from a battery point of view, we ship with a value 'mAh/km' enabled in the Betaflight OSD. If maximum speed is not a requirement, optimize this mAh/km value (lower values are better) by varying flight speed.



WARNING

When using omnidirectional antennas on the controller, be sure not to point them directly in the direction of the drone. The radiation pattern of these antennas is like a doughnut on top of the antenna. Where there are holes in the doughnut, there is no transmission/reception.

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When testing range, you can set each of the radios to 100mW, and then scale the range achieved mathematically.

100mW is 20dBm, 3W (max power of the JR module) is ~35dBm, a difference of 15dB. 15dB corresponds to a range increase of 5.62 times, so if you achieve 4km on 100mW, you will achieve ~22km on 3W mode.

Note that it is also possible to independently set the power of each of the radios, primary and shadow. Using 1W on 915MHz, and 3W on the shadow band will give extra security during jamming attempts.

Video Goggles

A micro-SD card may be inserted to record video. The small button with the red dot on the top of the goggles is used to start and stop recording.



WARNING

Be sure to stop recording before powering down the goggles, or removing the battery. Failing to do this will result in a corrupted video file.

It is a good idea to start the de-fogging fan before flight, especially when goggles are cold, and placed on a hot face.

Be sure to correctly set the IPD and Focus adjustments on the goggles before flight. This can be done looking at the 'snow' noise from the video receiver, and doesn't require the drone to be powered up.

Multi-Drone Operations

To operate multiple drones from a single pilot, when they are powered on at the same time (for swarming for example), the 'Team Race' functionality in the controller may be used.

During binding, give each drone a different receiver ID (**RxID**), and use the 'Multi-Drone' menu to configure one or more switches on your R/C controller to select the active drone.

Up to 12 drones may be used in multi-drone operations, and the pilot doesn't need to lift his goggles to switch to another drone, and launch.

Note that firmware version v1.0.1.2 or later is required for multi-drone operations.

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Connecting to a Distant Drone

Unlike similar control links in this same market, the ghost link can connect to a drone at the limit of control range the same as it connects to one a few meters from the pilot.

For long range testing, a safe way to do these tests is to launch from range (20km for example) and fly towards the pilot. This way both primary and shadow bands, plus the video connection, may be fully tested before launch.