ROBOMASTER

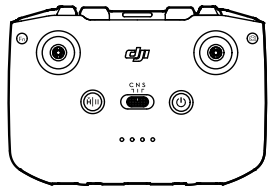
Video Transmission Module
图传模块

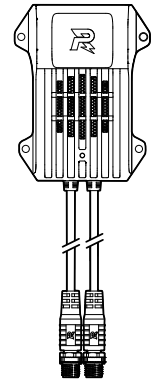
(VT03&VT13)

User Guide

使用说明

v1.0 2025.04





机甲大师 ROBOMASTER

Contents

目录

Disclaimer

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Introduction

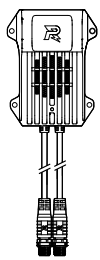
RoboMaster Referee System Video Transmission Module (including the transmitter and the receiver, hereinafter referred to as the "VTM") is an image capture and wireless transmission system featuring high resolution, high frame rate, and low latency. Multiple VTMs can work simultaneously.

As a component of the RoboMaster University Series Referee System (hereinafter referred to as the "Referee System"), the VTM provides a first-person view of robots. The VTM cannot be used independently.

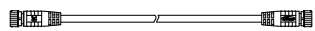
In the Box

For the transmitter's package:

VTM Transmitter × 1

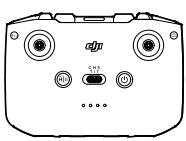


Aviation Connector Cable × 1



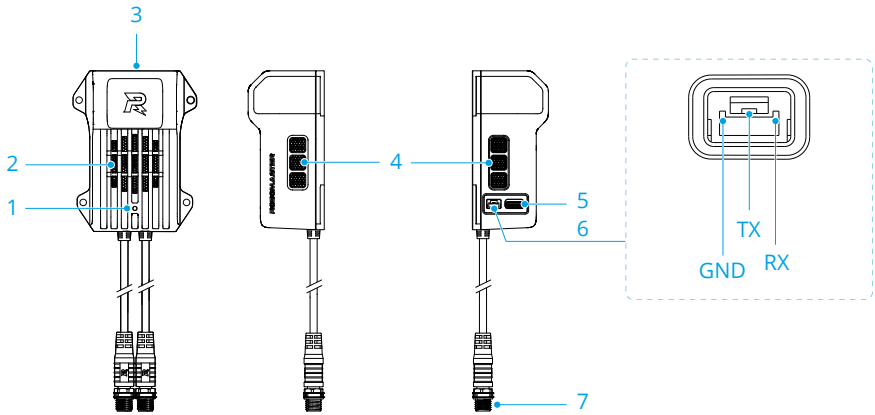
For the receiver's package:

VTM Receiver × 1



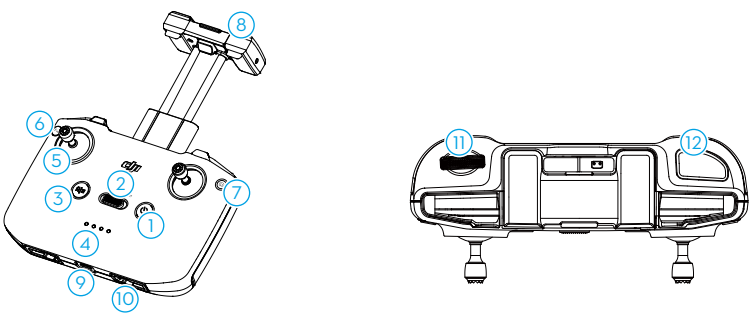
Overview

VTM Transmitter



1. Status LED
2. Air Inlet
3. Lens
4. Air Outlet
5. USB-C Port
6. UART Port
7. Aviation Connector Cable Port

VTM Receiver



1. Power Button
2. Mode Switch
3. Pause Button
4. Battery Level LEDs
5. Control Sticks
6. Customizable Button (Left)
7. Customizable Button (Right)
8. Antennas
9. USB-C Port
10. Control Stick Storage Slots
11. Dial
12. Trigger

- Certain button functions can be customized. For details, see the Remote Control Data section.

Using the Product

Downloading Software

Visit https://www.robomaster.com/en-US/products/components/referee to download the required software.

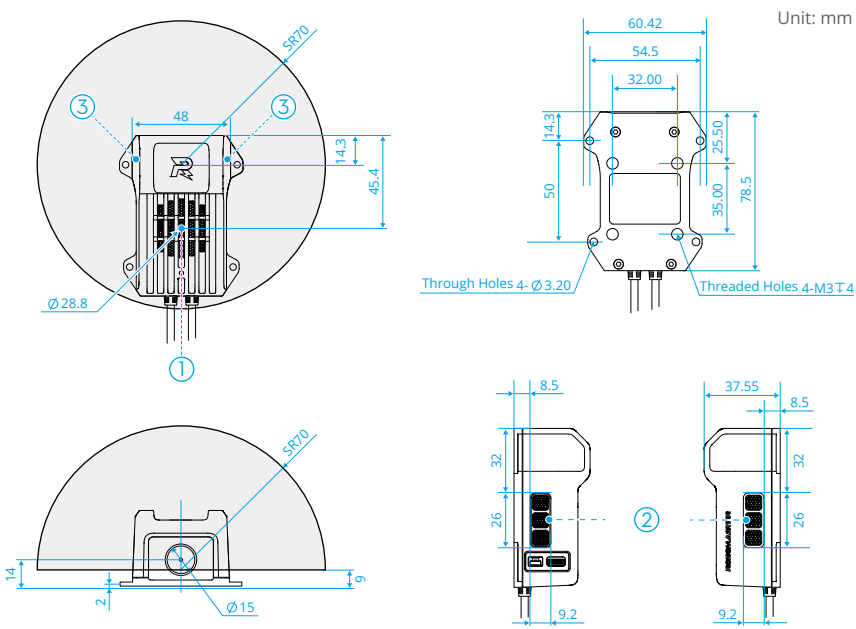
Software	Description
RoboMaster Tool 2	Used to update the transmitter firmware, set the running mode, and calibrate receiver channels
RoboMaster Client	Used to view the transmitted images
USB Driver*	Used to view the transmitted images
DJI Assistant 2 (RoboMaster Series)	Used to upgrade the core version of the transmitter and update the receiver firmware

* The driver will be automatically installed when you install the DJI Assistant 2 (RoboMaster Series) software. If the software is already installed on your computer, installing the driver is unnecessary.

Installation

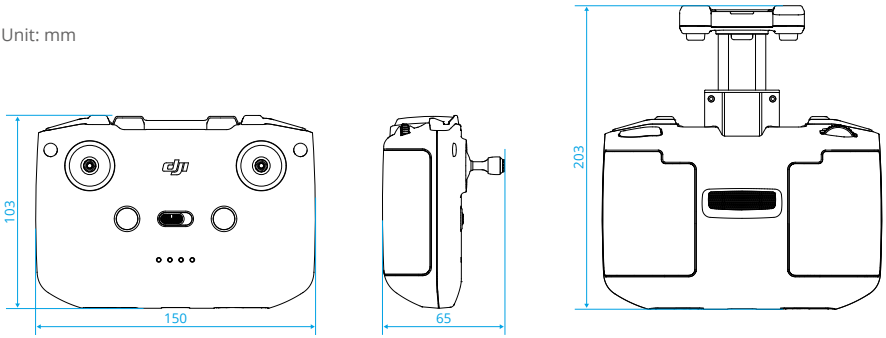
Refer to the following figure to install the transmitter based on your needs. Use M3 screws to mount the transmitter to an appropriate position.

⚠
- DO NOT block the air inlet (①) and air outlets (②) of the transmitter.
- Make sure the specified spherical area around the antennas of the transmitter (③) is free of metal obstructions.



The receiver does not require installation. The following size information is for reference.

Unit: mm



Linking

China and Other Non-Japan Regions

1. Ensure the Power Management Module is connected to the Main Controller Module in the Referee System.
2. **Power on the transmitter:** Connect the transmitter to the Power Management Module using the Aviation Connector Cable included in the package. Once the transmitter is powered on, the status LED flashes red once per second.
3. **Power on the receiver:** Press the power button once, then press and hold for 2 seconds.
4. **Start linking:**
   For the transmitter: Tap **Module Setup > VTM Linking** on the Main Controller Module. During the linking process, the status LED flashes blue once per second.
   For the receiver: Press and hold the power button until you hear a "beep" sound after about 2 seconds, briefly release the button, and then press and hold the button again for about 2 seconds. During the linking process, the receiver continues to beep.
   Once linked, the status LED of the transmitter flashes green once per second, and the receiver beeps twice. The linking operation is required only once.
5. Connect the USB-C port of the receiver to a computer and open the RoboMaster Client software. You can view the transmitted images.

Japan

1. Ensure the Power Management Module is connected to the Main Controller Module in the Referee System.
2. **Power on the transmitter:** Connect the transmitter to the Power Management Module using the Aviation Connector Cable included in the package. Once the transmitter is powered on, the status LED turns solid orange.

3. **Power on the receiver:** Press the power button once, then press and hold for 2 seconds.
4. Correctly set the robot ID on the Main Controller Module.
5. Connect the USB-C port of the receiver to a computer. Open the RoboMaster Client software, select the corresponding robot ID, and click **Login** to view the transmitted images.

- The receiver will remain linked with the transmitter until the receiver is restarted. After a restart, you need to repeat the linking operation by following step 3 to 5.

Remote Control Data

Once linked with the transmitter, the receiver can function as a remote controller and send remote control data. The receiver can also send certain keyboard and mouse data (see the Data Frame Structure Table). To do so, connect the receiver to a computer, open the RoboMaster Client software, and log in to the corresponding robot. You can customize the functions of the control sticks and buttons (excluding the power button) on the receiver as well as the keys on your computer's keyboard and mouse.

Once linked with the receiver, the transmitter outputs a 21-byte data frame every 14 ms through the UART port. The communication parameters are listed in the following table.

Serial Port Parameters	Value
Baud Rate	921600
Data Bits	8
Stop Bit	1
Parity Bit	None
Flow Control	None

Data Frame Structure Table:

Domain	Offset	Length (Bits)	Sign Bit	Value	Description
Header 1	0	8	None	0xA9	Fixed value
Header 2	8	8	None	0x53	Fixed value
Channel 0	16	11	None	Minimum: 364 Central: 1024 Maximum: 1684	The horizontal position of the receiver's right control stick
Channel 1	27	11	None	Minimum: 364 Central: 1024 Maximum: 1684	The vertical position of the receiver's right control stick
Channel 2	38	11	None	Minimum: 364 Central: 1024 Maximum: 1684	The vertical position of the receiver's left control stick

Channel 3	49	11	None	Minimum: 364 Central: 1024 Maximum: 1684	The horizontal position of the receiver's left control stick
Mode switch	60	2	None	Minimum: 0 Maximum: 2	The position of the receiver's mode switch: C: 0 N: 1 S: 2
Pause button	62	1	None	Minimum: 0 Maximum: 1	Whether the receiver's pause button is pressed: Not pressed: 0 Pressed: 1
Customizable button (left)	63	1	None	Minimum: 0 Maximum: 1	Whether the receiver's customizable button (left) is pressed: Not pressed: 0 Pressed: 1
Customizable button (right)	64	1	None	Minimum: 0 Maximum: 1	Whether the receiver's customizable button (right) is pressed: Not pressed: 0 Pressed: 1
Dial	65	11	None	Minimum: 364 Central: 1024 Maximum: 1684	The position of the receiver's dial
Trigger	76	1	None	Minimum: 0 Maximum: 1	Whether the receiver's trigger is pressed: Not pressed: 0 Pressed: 1
X-axis mouse movement	80	16	Present	Minimum: -32768 Static: 0 Maximum: 32767	The left or right movement speed of the mouse (A negative value indicates left movement)
Y-axis mouse movement	96	16	Present	Minimum: -32768 Static: 0 Maximum: 32767	The forward or backward movement speed of the mouse (A negative value indicates backward movement)
Z-axis mouse movement	112	16	Present	Minimum: -32768 Static: 0 Maximum: 32767	The speed of the mouse's scroll wheel (A negative value indicates backward scrolling)

Left mouse button	128	2	None	Minimum: 0 Maximum: 1	Whether the left mouse button is pressed: Not pressed: 0 Pressed: 1
Right mouse button	130	2	None	Minimum: 0 Maximum: 1	Whether the right mouse button is pressed: Not pressed: 0 Pressed: 1
Middle mouse button	132	2	None	Minimum: 0 Maximum: 1	Whether the middle mouse button is pressed: Not pressed: 0 Pressed: 1
Keyboard	136	16	None	Minimum: 0 Maximum: 65535	Keyboard key status: Each bit represents a key, where 0 indicates the key is not pressed and 1 indicates it is pressed. bit0: W key bit1: S key bit2: A key bit3: D key bit4: Shift key bit5: Ctrl key bit6: Q key bit7: E key bit8: R key bit9: F key bit10: G key bit11: Z key bit12: X key bit13: C key bit14: V key bit15: B key
CRC	152	16	None	N/A	This Cyclic Redundancy Check (CRC) uses the standard CRC-16/CCITT-FALSE polynomial $P(x)=x^{16}+x^{12}+x^{5}+1$ (corresponding to 0x1021), with an initial value of 0xFFFF. Input and output data are not inverted, and no XOR operation is applied.

Sample code for data frame and CRC:
Visit https://www.robomaster.com/en-US/products/components/referee to download.

VTM Sync Mode

- This feature is not supported in Japan.

When using multiple VTMs at the same time, you can enable sync mode to enhance video transmission performance and reduce mutual interference.

1. **Set up a sync anchor:** Connect a VTM transmitter to a computer using the Main Controller Module. On the computer, open the RoboMaster Tool 2 software, click **Sync Anchor Setup**, and configure the transmitter as a sync anchor.
2. **Enable sync mode:** Choose **Debug Settings > VTM Sync Mode** on the Main Controller Module.

Firmware Update

Transmitter Core Version/Receiver Firmware

Use the DJI Assistant 2 (RoboMaster Series) software to update the transmitter core version and the receiver firmware separately.

1. Power on the device and connect it to a computer using the USB-C Port.
2. Launch DJI Assistant 2 (RoboMaster Series), log in with your DJI account, and enter the main interface.
3. Select the device and click **Firmware Update** on the left side of the screen.
4. Select and confirm the firmware version to update to.
5. Wait for the firmware to download. The firmware update will start automatically.
6. Wait for the update to complete.

- Make sure to follow all the steps; otherwise the update may fail.
- Make sure the computer is connected to the internet during the update.
- DO NOT unplug the USB-C cable during an update.
- Before performing an update for the receiver, make sure the receiver is sufficiently charged.

Transmitter Firmware

Use RoboMaster Tool 2 to update the transmitter firmware. The operation is the same as the other modules of the Referee System. For details, refer to the User Manual of the Referee System.

Other Precautions

1. Make sure each port is properly connected according to the instructions to prevent malfunctions or damage.
2. When the VTM is in use, keep it away from wireless devices operating in the 5 GHz frequency band to ensure video transmission quality.
3. A maximum of eight VTMs can be used simultaneously in the same area. Exceeding this limit may lead to poor image quality, image freezing, or even disconnection. It is recommended to enable sync mode when using multiple VTMs simultaneously.

LEDs

Transmitter

Activation and power status		
Purple light	Solid	Not activated
Purple light	Flashing once per second	Not powered on
Purple light	Flashing 5 times per second	Not connected to the Referee System's Main Controller Module
Linking status (China and other non-Japan regions)		
Red light	Flashing once per second	Not linked with the receiver
Blue light	Flashing once per second	Linking with the receiver
Green light	Flashing once per second	Linked with the receiver
Yellow light	Flashing once per second	Operating in sync mode but no sync anchor is found
Linking status (Japan)		
Orange light	Flashing once per second	Not linked with the receiver
Orange light	Flashing once per second	Linking with the receiver
Cyan light	Solid	Linked with the receiver
Cyan light	Flashing once per second	Operating in sync mode but no sync anchor is found
Operating status as a sync anchor (China and other non-Japan regions)		
Cyan light and red light	Flashing alternately	Error
Cyan light	Flashing 5 times per second	Normal

Receiver

Blinking Pattern	Battery Level
●●●●	76-100%
●●●○	51-75%
●●○○	26-50%
●○○○	0-25%

During the linking process, the four battery level LEDs blink in sequence. After successful linking, the LEDs stay lit.

Specifications

VTM	
Operating Temperature	-10° to 40° C (14° to 104° F)
Operating Frequency (China and other non-Japan regions)	5150-5250 MHz (indoor use only) 5732-5829 MHz
Operating Frequency (Japan)	5150-5250 MHz, 5650-5755 MHz
Video Resolution	Maximum: 1920×1200
Video Frame Rate	Maximum: 60 Hz
End-to-End Latency	<90 ms (laboratory environment)
Max Transmission Range	100 m (without any obstruction)
Transmitter	
Weight	Approx. 121 g
Input Voltage	12 V
Operating Current	665 mA
Image Sensor	1/1.3-inch CMOS sensor
Lens	Field of View (FOV): approx. 139° Equivalent focal length: 12 mm Aperture: f/2.8 Focus: 0.6 m to ∞
ISO Range	100-25600 (Auto)
Receiver	
Weight	Approx. 375 g
Max Operating Time	6 hours
Charging Temperature	5° to 40° C (41° to 104° F)
Charging Time	2.5 hours
Charging Method	5 V/2 A charger (recommended)
Battery Capacity	18.72 Wh (3.6 V, 2600 mAh×2)
Battery Type	18650 Li-ion

免责声明

使用本产品前，请您仔细阅读本文、访问 https://www.robomaster.com 阅读本产品相关的所有指引。使用本产品视为您已经阅读并接受本文与本产品相关的全部条款。

简介

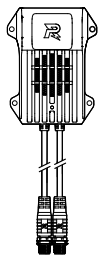
RoboMaster 裁判系统相机图传模块（包括发送端和接收端，以下简称为“图传模块”）是一套实时高清图像采集和无线传输系统，具有高清晰度、高帧率、低延迟的特点，并且支持多套图传模块同时工作。

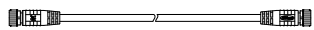
图传模块是 RoboMaster 高校系列赛裁判系统的组成部分，可以为用户提供机器人的第一人称视角。图传模块不可独立使用。

物品清单

发送端物品清单：

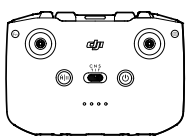
相机图传模块发送端	× 1
航空转接线	× 1





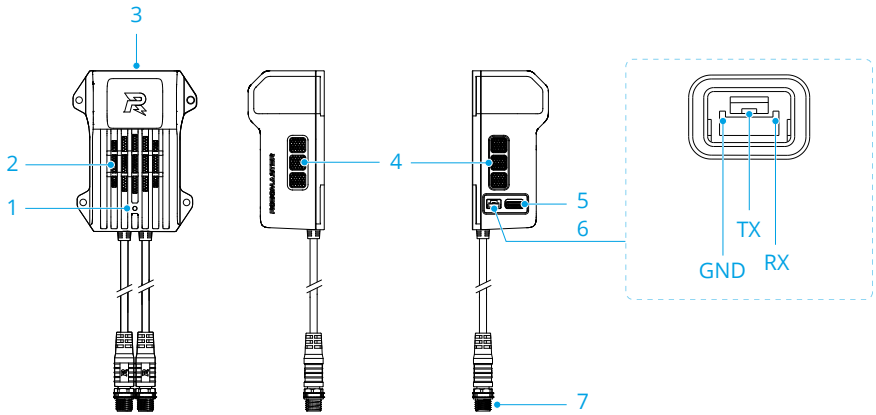
接收端物品清单：

相机图传模块接收端	× 1



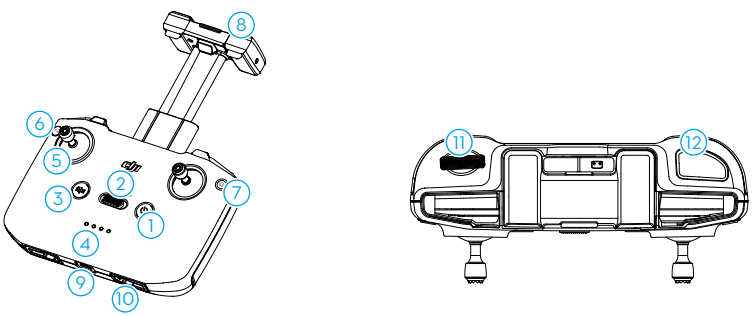
部件名称

发送端



1. 状态指示灯
2. 进风口
3. 镜头
4. 出风口
5. USB-C 接口
6. UART 接口
7. 航空转接线接口

接收端



1. 电源按键
2. 挡位切换开关
3. 暂停按键
4. 电量指示灯
5. 摇杆
6. 自定义按键（左）
7. 自定义按键（右）
8. 天线
9. USB-C 接口
10. 摇杆收纳槽
11. 拨轮
12. 扳机键

• 部分按键功能支持自定义。详见“遥控数据”章节。

产品使用

下载软件

请前往 https://www.robomaster.com/zh-CN/products/components/referee 下载所需软件。

软件	描述
RoboMaster Tool 2	用于发送端固件升级、运行模式设置、接收端通道校准等
RoboMaster Client	用于显示图传画面
USB 驱动 *	用于显示图传画面
DJI Assistant 2（RoboMaster Series）	用于发送端核心版本升级、接收端固件升级等

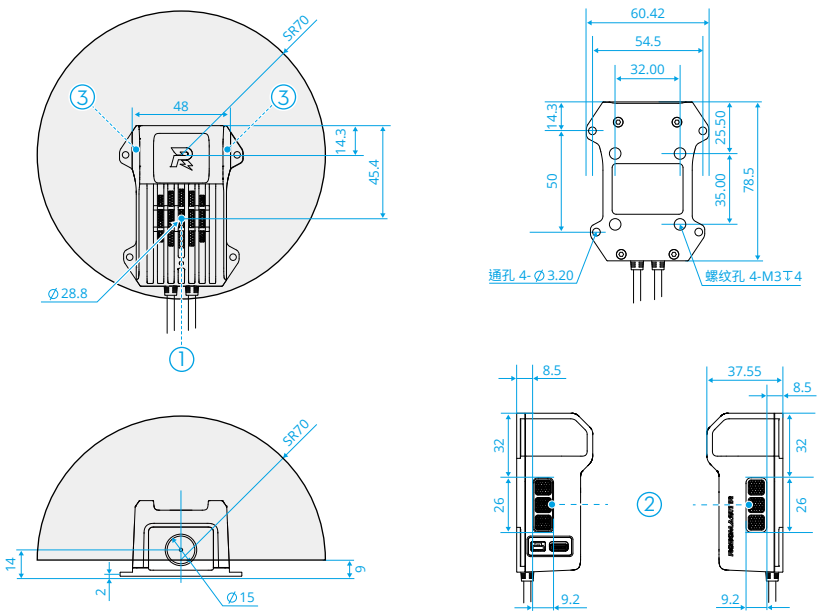
* 安装 DJI Assistant 2（RoboMaster Series）软件时会自动安装该驱动。如果电脑已安装该软件，无需重复安装该驱动。

安装

参考如下发送端结构尺寸图，按需选择孔位进行安装。安装时，请使用 M3 螺丝固定发送端至适当位置。

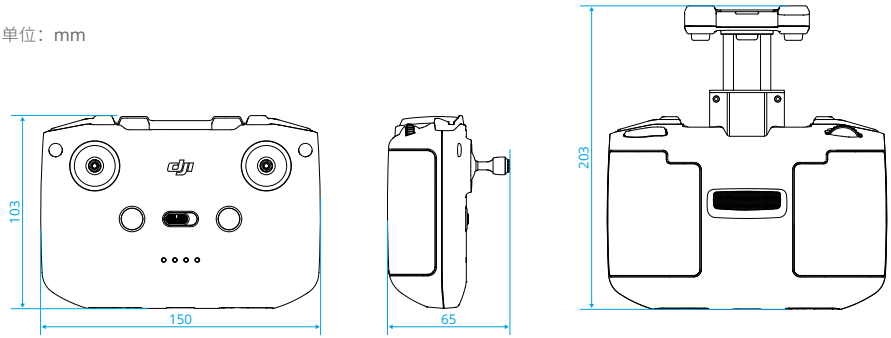
⚠ • 不能遮挡发送端的进风口（①）与出风口（②）。
• 发送端的天线（③）周围不能有任何金属遮挡。

单位：mm



接收端无需安装，以下尺寸信息作为参考。

单位：mm



对频连接

中国及其它非日本地区

1. 确保裁判系统的电源管理模块已连接至主控模块。
2. **启动发送端：**使用包装内附带的航空转接线将发送端连接到裁判系统的电源管理模块。成功启动后，发送端状态指示灯变为红灯闪烁（每 1 秒闪 1 次）。
3. **启动接收端：**短按 1 次电源按键，再长按 2 秒。
4. **触发对频：**

   发送端：在裁判系统主控模块上点击**模块设置 > 图传对频**。触发对频后，发送端状态指示灯变为蓝灯闪烁（每 1 秒闪 1 次）。

   接收端：先长按电源键直至听到“嘀”的一声（约 2 秒），短暂松开后再次长按电源键（约 2 秒）。触发对频后，接受端会持续发出“嘀…嘀…嘀”的提示音。

   当发送端状态指示灯变为绿灯闪烁（每 1 秒闪 1 次）、接收端发出“嘀嘀”两声后静音时，代表对频成功。后续使用无需再次对频。
5. 连接接收端的 USB-C 接口至电脑，打开 RoboMaster Client 软件，即可查看图像画面。

日本地区

1. 确保裁判系统的电源管理模块已连接至主控模块。
2. **启动发送端：**使用包装内附带的航空转接线将发送端连接到裁判系统的电源管理模块。成功启动后，发送端状态指示灯变为橙灯常亮。
3. **启动接收端：**短按 1 次电源按键，再长按 2 秒。
4. 在裁判系统主控模块上正确设置机器人 ID。
5. 连接接收端的 USB-C 接口至电脑。打开 RoboMaster Client 软件，选择对应的机器人 ID，点击**登录**，即可查看图像画面。

- 接收端在断电重启前会保持与发送端的连接状态，断电重启后需要与发送端重新对频连接，即重复步骤 3 至步骤 5 的操作。

遥控数据

与发送端对频连接后，接收端可作为遥控器发送遥控数据。将接收端连接至电脑，打开 RoboMaster Client 软件并登录对应机器人后，开放的键鼠数据（详见下方数据帧结构表）也会通过接收端发送。遥控器按键（电源键除外）和摇杆、电脑键鼠数据的功能均支持自定义。

与接收端对频连接后，发送端每间隔 14ms 通过 UART 接口输出一帧 21 字节的数据，通信参数如下表所示。

串口参数	数值
波特率	921600
数据位	8
停止位	1
校验位	无
流控	无

数据帧结构表：

域	偏移	长度（位）	符号位	取值	描述
帧头 1	0	8	无	0xA9	固定值
帧头 2	8	8	无	0x53	固定值
通道 0	16	11	无	最小值：364 中间值：1024 最大值：1684	接收端右摇杆水平方向的位置
通道 1	27	11	无	最小值：364 中间值：1024 最大值：1684	接收端右摇杆竖直方向的位置
通道 2	38	11	无	最小值：364 中间值：1024 最大值：1684	接收端左摇杆竖直方向的位置
通道 3	49	11	无	最小值：364 中间值：1024 最大值：1684	接收端左摇杆水平方向的位置
挡位切换开关	60	2	无	最小值：0 最大值：2	接收端挡位切换开关位置： C：0 N：1 S：2
暂停按键	62	1	无	最小值：0 最大值：1	接收端暂停按键是否按下： 未按下：0 按下：1
自定义按键（左）	63	1	无	最小值：0 最大值：1	接收端自定义按键（左）是否按下： 未按下：0 按下：1
自定义按键（右）	64	1	无	最小值：0 最大值：1	接收端自定义按键（右）是否按下： 未按下：0 按下：1

拨轮	65	11	无	最小值：364 中间值：1024 最大值：1684	接收端拨轮位置
扳机键	76	1	无	最小值：0 最大值：1	接收端扳机键是否按下： 未按下：0 按下：1
鼠标 X 轴	80	16	有	最小值: -32768 静止值：0 最大值：32767	鼠标左右移动的速度 （负值表示向左移动）
鼠标 Y 轴	96	16	有	最小值: -32768 静止值：0 最大值：32767	鼠标前后移动的速度 （负值表示向后移动）
鼠标 Z 轴	112	16	有	最小值: -32768 静止值：0 最大值：32767	鼠标滚轮的滚动速度 （负值表示向后滚动）
鼠标左键	128	2	无	最小值：0 最大值：1	鼠标左键是否按下： 未按下：0 按下：1
鼠标右键	130	2	无	最小值：0 最大值：1	鼠标右键是否按下： 未按下：0 按下：1
鼠标中键	132	2	无	最小值：0 最大值：1	鼠标中键是否按下： 未按下：0 按下：1
键盘按键	136	16	无	最小值：0 最大值：65535	键盘按键信息，每个 bit 对应一个按键，0 为未按下，1 为按下。 bit0：W 键 bit1：S 键 bit2：A 键 bit3：D 键 bit4：Shift 键 bit5：Ctrl 键 bit6：Q 键 bit7：E 键 bit8：R 键 bit9：F 键 bit10：G 键 bit11：Z 键 bit12：X 键 bit13：C 键 bit14：V 键 bit15：B 键

CRC 校验	152	16	无	N/A	循环冗余校验（Cyclic Redundancy Check, CRC）。使用标准 CRC-16/CCITT-FALSE 多项式 $P(x)=x^{16}+x^{12}+x^5+1$（对应 0x1021），初始值为 0xFFFF，无输入输出反转，无异或。

数据帧及校验示例代码：

前往 https://www.robomaster.com/zh-CN/products/components/referee 下载。

同步运行模式

- 日本地区不支持该功能。

同时使用多套图传模块时，可以开启同步运行模式以提升图传性能、减小图传间的干扰。

1. **准备同步桩：**将一台发送端通过主控模块连接至电脑，打开 RoboMaster Tool 2 软件，选择**同步桩设置**，将发送端配置为同步桩。
2. **开启同步运行模式：**在裁判系统主控模块上勾选**调试设置 > 图传同步运行模式**。

固件升级

发送端核心版本 / 接收端固件

使用 DJI Assistant 2（RoboMaster Series）软件分别升级发送端与接收端。

1. 开启设备，将设备通过 USB-C 接口连接至电脑。
2. 启动 DJI Assistant 2（RoboMaster Series）软件，用 DJI 账号登陆并进入主界面。
3. 点击设备图标，然后点击左边的**固件升级**选项。
4. 选择并确认需要升级的固件版本。
5. 软件将自行下载并升级固件。
6. 等待升级完成即可。

- 确保按步骤升级固件，否则可能导致升级失败。
- 确保整个升级过程中电脑能够访问互联网。
- 升级过程中请勿插拔 USB 数据线。
- 升级接收端固件时，确保接收端电量充足。

发送端固件

发送端固件通过 RoboMaster Tool 2 升级。升级方式与裁判系统其它模块相同，详见《RoboMaster 裁判系统用户手册》。

其它注意事项

1. 相机图传模块在使用过程中，请确保各接口按照说明正确连接，以免模块工作异常，甚至导致模块损坏。
2. 相机图传模块在使用过程中，请注意避开 5 GHz 频段无线设备的干扰，以免影响图像传输质量。
3. 同一环境下最多可同时使用 8 套相机图传模块，否则可能导致图像质量下降，甚至发生卡顿或断连。多套图传模块同时工作时，建议使用同步运行模式。

指示灯

发送端

激活与启动状态		
紫灯	常亮	未激活
紫灯	每 1 秒闪 1 次	未启动
紫灯	每 1 秒闪 5 次	未连接裁判系统主控模块
连接状态（中国及其它非日本地区）		
红灯	每 1 秒闪 1 次	未连接接收端
蓝灯	每 1 秒闪 1 次	与接收端对频中
绿灯	每 1 秒闪 1 次	已连接接收端
黄灯	每 1 秒闪 1 次	已进入同步运行模式但未找到同步桩
连接状态（日本地区）		
橙灯	每 1 秒闪 1 次	未连接接收端
橙灯	每 1 秒闪 1 次	与接收端对频中
青灯	常亮	已连接接收端
青灯	每 1 秒闪 1 次	已进入同步运行模式但未找到同步桩
作为同步桩的工作状态（中国及其它非日本地区）		
青灯与红灯	交替闪烁	状态异常
青灯	每 1 秒闪 5 次	同步正常

接收端

闪灯方式	电量
◉◉◉◉	76%-100%
◉◉◉○	51%-75%
◉◉○○	26%-50%
◉○○○	0%-25%

对频过程中，接收端的 4 颗电量指示灯循环闪烁；对频成功后，接收端电量指示灯变为常亮。

参数

图传模块	
工作环境温度	-10℃至 40℃
工作频段（中国及其它非日本地区）	5150-5250 MHz（仅限室内使用） 5732-5829 MHz
工作频段（日本地区）	5150-5250 MHz，5650-5755 MHz
传输图像分辨率	最大 1920×1080
传输图像帧率	最大 60 Hz
端到端延时	< 90 ms（实验室环境）
最远传输距离	100 m（无遮挡时）
发送端	
重量	约 121 g
供电电压	12 V
工作电流	665 mA
影像传感器	1/1.3 英寸影像传感器
镜头	视角范围（FOV）：约 139° 等效焦距：12 毫米 光圈：f/2.8 对焦点：0.6 米至无穷远
ISO 范围	100 至 25600（自动）
接收端	
重量	约 375 g
最长续航时间	6 小时
充电环境温度	5℃至 40℃
充电时间	2.5 小时
充电方式	建议使用 5 V/2 A 的充电器
电池容量	18.72 Wh (3.6 V, 2600 mAh×2)
电池类型	18650 锂离子电池

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