Using a 32-bit motor driver chip and Field-Oriented Control (FOC), the RoboMaster C620 Brushless DC Motor Speed Controller enables precise control over motor torque.

ROBOMASTER

Exclusively designed for the RoboMaster M3508 P19 Brushless DC Gear Motor and C620 Brushless DC Motor Speed Controller, this M3508 Accessories Kit includes several cables and a terminal board.

Referee System Specification Manual, Referee System User Manual, Introductions of Referee System Module

# ROBOMASTER 2019
## ROBOTICS COMPETITION
# REFEREE SYSTEM
# USER MANUAL

Prepared by the *RoboMaster* Organizing Committee
Updated on January, 2019
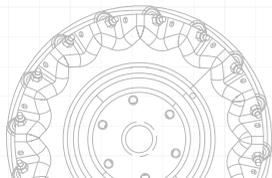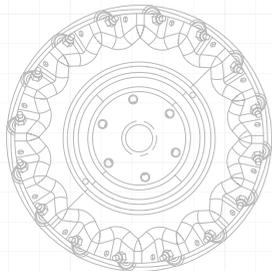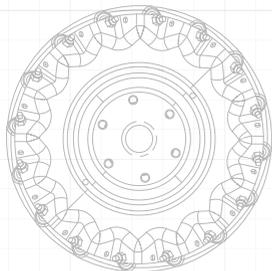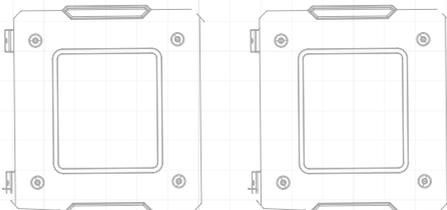
# Disclaimer

Please read this disclaimer carefully before using this product. By using this product, you hereby signify that you have read and agreed to all content herein. Please install and use this product properly and in strict accordance with the User Manual and product instructions, as well as any relevant laws, regulations, and policies. Users shall be responsible for the consequences resulting from their behavior while using this product. DJI™ Innovations (DJI[TM]) shall not be liable for any losses incurred from using, installing, or modifying this product improperly.

DJI[TM] and RoboMaster[TM] are trademarks of SZ DJI Technology Co., Ltd and its affiliates. Names of products, brands, etc. herein are trademarks or registered trademarks of their respective owner companies. This product, the manual, and the software and driver that work with the Referee System (RoboMaster Client, RoboMaster Server, RoboMaster Tool 2, and DJI WIN driver) are copyrighted by DJI with all rights reserved, and shall not be modified, reproduced, or transmitted in any form without the prior consent of DJI. DJI reserves the right of final interpretation of this disclaimer.

# Warnings

Read the ENTIRE user manual to become familiar with the features of this product before operating. Failure to operate the product correctly can result in damage to the product or personal property and cause serious injury. This is a sophisticated product. It must be operated with caution and common sense and requires some basic mechanical ability. Taking into account the importance of the various modules of the Referee System in the competition, the Referee System has been fully tested in the factory and each module cannot be damaged easily. A user should not disassemble or modify any parts of the Referee System without authorization. Damage to the Referee System resulting from unauthorized disassembly will void the warranty. This product is not intended for use by children without direct adult supervision. DO NOT use with incompatible components or alter this product in any way outside of the documents provided by RoboMaster. Install and use this product in strict accordance with the guidelines provided by RoboMaster. It is essential to read and follow all of the instructions and warnings in the user manual, prior to assembly, setup or use.

# Product Usage Precautions

1. Please ensure that the robot side of the Referee System is installed correctly and firmly before use.
2. Please ensure that the wiring connection between each module on the Referee System's robot side is correct before use.
3. Please ensure that the components are intact before use. Replace any worn or damaged components.

# Using This Manual

## Legend

⚠ Important      ☼ Hints and Tips      📖 Reference

## Related Documents

1. Specification of Each Referee System Module

It is recommended to read the aforementioned documents to understand the features and installation methods of each Referee System module. Reserve any necessary installation holes and spaces so that each module on the Referee System's Robot Side may be correctly installed, and then read the User Manual to explore the features of the Referee System.

Release Notes

| Date | Version | Changes |
|---|---|---|
| 2019.1 | V1.0 | Release |

# Contents

# Referee System Overview

The Referee System is a fully autonomous electronic penalty system that can detect projectile attack damage, display the robot's current HP and status, and monitor chassis movement power as well as other robot parameters. The Speed Monitor Module monitors a robot's projectile launching speed and rate; the Video Transmitter Module provides the user with a first-person perspective of the robot; the RFID Interaction Module interacts with the Battlefield; and the Positioning System Module provides a user with a real time high-precision mini-map. A user can use multiple Referee Systems to form a multi-robot combat system.

The Referee System is composed of the following:

1. The robot side of the Referee System (hereinafter referred to as "Robot Side")
2. The PC client (hereinafter referred to as "Client") and the PC server (hereinafter referred to as "Server")

### The Robot Side is composed of the following modules:

1) Main Controller Module (MC02): a key control unit of the Referee System that can monitor the running state of the whole system and integrates features of Human-Computer Interaction, wireless communication and status display.
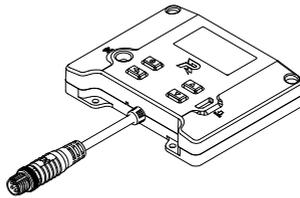


Main Controller Module (MC02)

2) Power Management Module (PM01): manage power supply of the Robot Side and have features of power management, data forwarding and power detection.
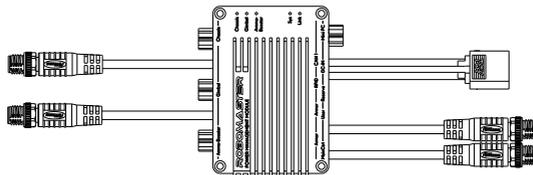


Power Management Module (PM01)

3) Light Indicator Module (LI01): a unit to display the robot's current HP and status. A user can directly see the robot's remaining HP and its status by observing the Light Indicator.
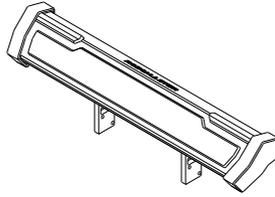


Light Indicator Module (LI01)

4) Armor Module (AM02&AM12): a damage perception system of the Robot Side and include the Small Armor Module and the Large Armor Module. The Armor Module can detect projectile attack and collision.
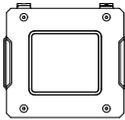


Small Armor Module (AM02)                    Large Armor Module (AM12)
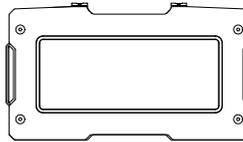


Armor Module Support Frame (AH02)        Armor Module Support Frame (AH12)
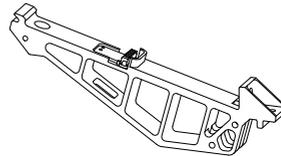
5) Speed Monitor Module (SM01&SM11): detect a robot's projectile initial firing speed and rate and include the Speed Monitor Module (17 mm projectile) and the Speed Monitor Module (42 mm projectile).
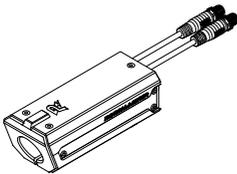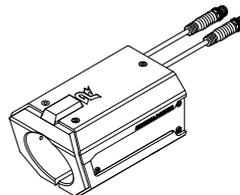


Speed Monitor Module (17 mm projectile)        Speed Monitor Module (42 mm projectile)

6) RFID Interaction Module (FI02): used by the Robot Side to interact with the Battlefield.

RFID Interaction Module (FI02)

RFID Interaction Module Test Card

7) Video Transmitter Module (VT01&VT11): provide the user with a first-person perspective and include the VTM Transmitter and the VTM Receiver. The VTM Transmitter is mounted on the Robot Side while the VTM Receiver is mounted on the Client.
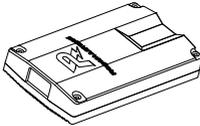
VTM (Transmitter) VT01

VTM (Receiver) VT11

8) Positioning System Module (UW01): provide the user with real-time mini-map data and the robot with coordinate information.
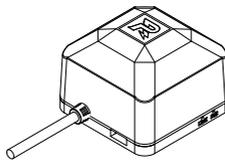
Positioning System Module (UW01)

Appropriate installation reference for each module on the Robot Side

The figure below is the installation instruction:

VTM Module Transmitter

Power Management Module

Positioning System Module

Speed Monitor Module (17 mm projectile)

Light Indicator Module

Main Controller Module

Armor Module

Armor Module

RFID Interaction Module
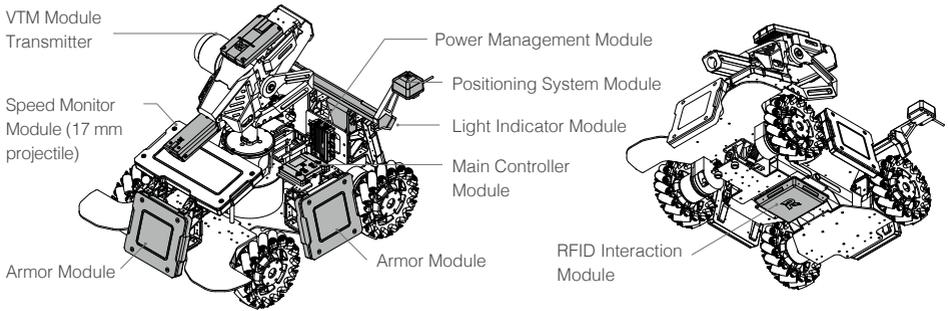
Connection reference for each module on the Robot Side

The figure below is the connection instruction:
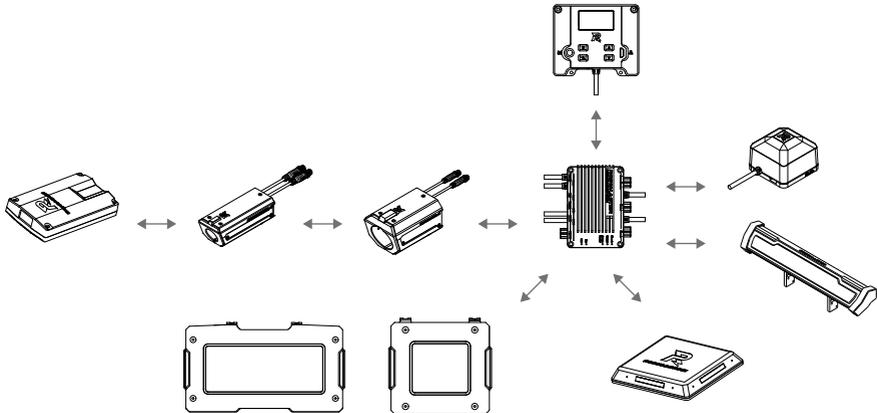
* Modules to be installed vary between robots. For details, please refer to the RoboMaster 2019 Referee System Specification Manual.

Download:https://www.robomaster.com/zh-CN/resource/download

# Client and Server Overview

## Client

Transmit keyboard and mouse data to a robot remote controller so that various features and motion of the Robot Side can be controlled via the keyboard and mouse. The video signal collected by the VTM displays a user's first-person perspective, with the Client software UI superimposed onto the display. After logging on to the server, a user can check the HP and status of all Robot Sides in real time and parameters such as a mini-map, the competition countdown and Battlefield information.

The following hardware and software should be installed to the Client to implement the features described above.

1. Recommended Hardware for Client

    a. VTM Receiver (output video signal)
    b. HD Video Capture Card (user-supplied; capture video signal from the VTM Receiver);
    c. Robot Remote Controller (user-supplied; only DT7 & DR16 RC System is supported);

2. Recommended Software for Client

    a. DJI WIN Driver (drive the robot remote controller)
       Download:

       https://www.robomaster.com/zh-CN/products/components/detail/122

    b. RoboMaster Client  Software
       Download:

       www.robomaster.com/zh-CN/products/components/referee?index=2&position=1332

## Server

Calculate competition time and the robot's HP, trigger the Battlefield switch, determine penalty, display and transmit Robot Side parameters including HP and Battlefield information to the Client, allow manual control of multi-level warnings, and automatically determine the outcome of the competition.

To implement the features above, the following software should be installed to the Server:

RoboMaster Server Software
Download:
www.robomaster.com/zh-CN/products/components/referee?index=2&position=1331

# Referee System Quick Start Guide

## Robot Side Configuration

Different types of robot can be set up on the Robot Side. At the same time, the type and quantity of robotic Referee System modules can be customized on the Server. The table below shows the configuration of a single robotic Referee System module. (The type and quantity of modules to be installed vary between robots. For details, please refer to the RoboMaster 2019 Referee System Specification Manual.)

| Module Name | Qty. |
|---|---|
| Main Controller Module | 1 |
| Power Management Module | 1 |
| Light Indicator Module | 0-1 |
| Large and Small Armor Module | 0-6 |
| Speed Monitor Module (17 mm projectile) | 0-1 |
| Speed Monitor Module (42 mm projectile) | 0-1 |
| RFID Interaction Module | 0-1 |
| VTM Transmitter | 0-1 |
| VTM Receiver | 0-1 |

## Robot Property Instruction

The property of different types of robots can be configured on the Server and synchronized to the Robot Side.

The table below shows the property that can be configured:

| Property Name | Property Information |
|---|---|
| Type and Quantity of Referee System Module | Refer to the "Robot Side Configuration" section |
| Initial HP | 0-65535 |
| Maximum HP | The maximum HP at a full level if the robot's level can be upgraded in competition: Initial HP - 65535 |
| HP Deduction from 17 mm projectile | HP deducted when the Armor Module receives attacks from 17 mm projectiles: 0 - Initial HP |
| HP Deduction from 42 mm projectile | HP deducted when the Armor Module receives attacks from 42 mm projectiles: 0 - Initial HP |
| Speed of Launch Limit of 17 mm projectile | HP will be deducted from a robot when it exceeds this limit. |
| Speed of Launch Limit of 42 mm projectile | HP will be deducted from a robot when it exceeds this limit. |
| Robot Barrel Heat Limit | HP will be deducted from a robot when it exceeds this limit. |
| Robot Important Module Offline | HP will be deducted from a robot when any important module goes offline. |
| Chassis Power Consumption Limit | HP will be deducted from a robot when it exceeds this limit and its energy. |

## Competition Configuration

Multiple Referee Systems can be combined to form a multi-robot combat mode. A user can choose to set up a local area network (LAN) for online combat according to the actual situation.

If a local area network (LAN) is set up, the Server must be used, and a user must be able to check the HP and the Referee System status of all Robot Sides on the Server. A user may also use the Client, paired with the VTM Receiver, to operate a robot from a first-person perspective, check the HP and status of all Robot Sides, and determine the outcome of the competition automatically with the aid of the server.

If a LAN is not being used, the outcome of the competition can be determined only by the HP displayed on the Light Indicator Module of the Referee System. Additionally, a user may use the Client paired with the VTM Receiver to operate a robot from a first-person perspective, but cannot check the HP of the Robot Side nor determine the outcome of the competition automatically.

Users may opt to use base robots or customize competition rules for a more personalized experience. The examples below describe these situations in ascending order of complexity:

### 1v1 Mode

1v1 Mode works as follows: A user may select any two sets of Robot Side configuration from the configuration table and install on two robots respectively. Robot Sides are set as Red Team and Blue Team respectively. A user is also free to choose whether to set up a LAN or use a Base robot for the competition.

The table below presents an example of an entrance lineup:

| Combatant | Robot Type | Qty. | Notes |
|---|---|---|---|
| Red Team | Standard | 1 | / |
| | Base | 0-1 | Optional |
| Blue Team | Standard | 1 | / |
| | Base | 0-1 | Optional |

The table below shows the configuration of Referee System modules required to set up the Combat System above:

| Module Name | Qty. | Notes |
|---|---|---|
| Main Controller Module | 2 | / |
| Power Management Module | 2 | / |
| Light Indicator Module | 2 | / |
| Large Armor Module | 0-2 | / |
| Small Armor Module | 0-8 | / |
| Speed Monitor Module (17 mm projectile) | 0-2 | Can be ignored if the speed of launch is not limited |
| Speed Monitor Module (42 mm projectile) | 0 | / |
| RFID Interaction Module | 0-2 | Can be ignored if no interaction with Battlefield is required |
| VTM Transmitter | 2 | / |
| VTM Receiver | 2 | / |

## 3v3 Mode

3v3 Mode works as follows: A user may select any six sets of Robot Side configuration from the configuration table and install on six robots respectively. Robot Sides are set as Red Team and Blue Team respectively. A user is also free to choose whether to set up a LAN or use a Base robot for the competition.

The table below presents an example of an entrance lineup:

| Combatant | Robot Type | Qty. | Notes |
|---|---|---|---|
| Red Team | Standard | 1 | / |
| | Hero | 1 | / |
| | Engineer | 1 | / |
| | Base | 0-1 | Optional |
| Blue Team | Standard | 1 | / |
| | Hero | 1 | / |
| | Engineer | 1 | / |
| | Base | 0-1 | Optional |

The table below shows the configuration of Referee System modules required to set up the 3v3 Combat System above:

| Module Name | Qty. | Notes |
|---|---|---|
| Main Controller Module | 6 | / |
| Power Management Module | 6 | / |
| Light Indicator Module | 6 | / |
| Large Armor Module | 0-12 | / |
| Small Armor Module | 0-16 | / |
| Speed Monitor Module (17 mm projectile) | 0-4 | Can be ignored if the speed of launch is not limited |
| Speed Monitor Module (42 mm projectile) | 0-2 | Can be ignored if the speed of launch is not limited |
| RFID Interaction Module | 0-6 | Can be ignored if no interaction with Battlefield is required |
| VTM Transmitter | 6 | / |
| VTM Receiver | 6 | / |

# Robot Side Feature Instruction

## Robot Side Interaction Instruction

The human-computer interaction interface of the Referee System consists of a display screen and four keys, as shown in the figure below. Press a key will enable a corresponding function.

Display

OK

Cancel

PgUp

PgDn
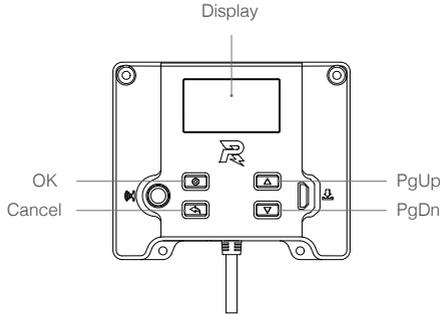
Main Controller Panel Illustration

## Homepage UI Instruction

### Homepage

Display the initialization status of the Referee System. If the initialization is completed, the RoboMaster logo is displayed, as shown in the figure below:

Otherwise, the quantity and name of offline modules are displayed, as shown in the figure below:

11 MODULES
FAULT
Armor Error[1]

The "❗" on the upper left indicates that the Robot Side is  not connected to the Server;

the "📶" on the upper right indicates the WIFI connection status and signal strength.

"11 MODULES  FAULT" in the middle indicates that currently 11 modules are offline or faulty.

"Armor1 Error[1]" below indicates that currently Armor 1 Module goes faulty and the error code is 1;

You can press the PgUp or PgDn key to display the next offline or faulty module.

## Key Feature Description

Press and hold the OK key: On the Homepage or Real-time Information Display page, press and hold the OK key to enter the Robot Feature page. The current settings can be saved on some feature pages.

Press the OK key: On the Homepage, press the OK key to enter the Real-time Information Display page. On the Feature page, if there is a page link in the selected line on the current page, press the OK key to jump to the link page; otherwise, press the OK key to select feature.

Press and hold the Cancel key: On a page other than the Homepage, press and hold the Cancel key to return to the Homepage. On the Homepage, press and hold the Cancel key to refresh the screen display.

Press the Cancel key: return to the previous page.

Press or press and hold the PgUp key: On the Feature page, press the PgUp key to move up one line. On other pages, press the PgUp key to move up one page.

Press or press and hold the PgDn key: On the Feature page, press the PgDn key to move down one line. On other pages, press the PgDn key to move down one page.

On a page other than the Homepage, if no keys are pressed during a 30-second period, you will be automatically directed to the Homepage.

## Feature Page

A page that is used to display and set the robot's attribute parameter such as robot type.

The Feature page is shown below:
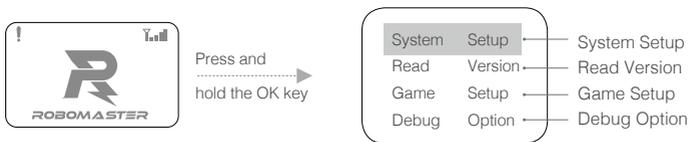


## Real-time Information Display Page

A page that is used to display the robot's real-time parameter such as robot chassis power.

The Real-time Information Display page is shown below:
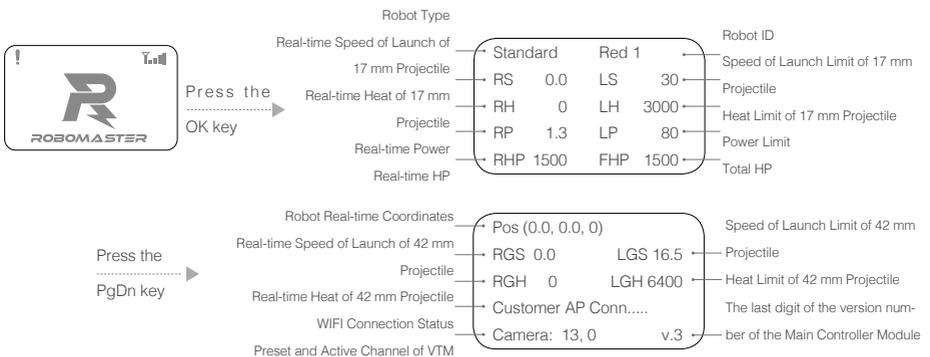
## UI Feature Instruction

This section introduces specific use related to the Main Controller UI, including system setup, version query, game setup, debugging, enabling setup and faulty module query.

### System Setup

Mainly introduces feature settings, method of use and operation steps of each module of the Referee System.

Robot ID Setup

The following example shows how to set the Robot ID to Red 1:

| Robot ID | Setup |
| --- | --- |
| Robot Type | Setup |
| Armor ID | Setup |
| Speed Mon | Setup |
| WIFI | Setup |

Press and hold the OK key

| System | Setup |
| --- | --- |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press the OK key

Robot ID Setup
Robot Type Setup
Armor ID Setup
Speed Mon Setup
WIFI Setup

Press the OK key

| RED 1 | Hero |
| --- | --- |
| RED 2 | Engineer |
| RED 3 | Standard |
| RED 4 | Standard |
| RED 5 | Standard |
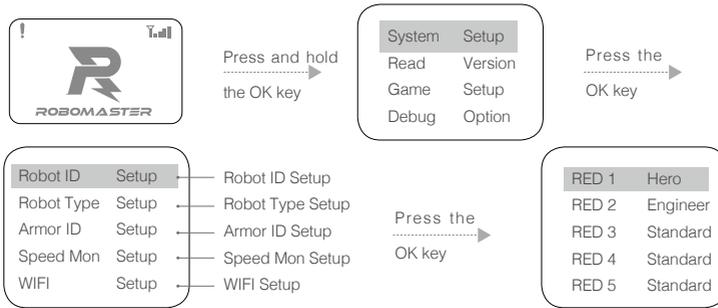
Robot Type Setup

The following example shows how to set the robot type to Standard:

Press and hold the OK key

| System | Setup |
| --- | --- |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press the OK key

| Robot ID | Setup |
| --- | --- |
| Robot Type | Setup |
| Armor ID | Setup |
| Speed Mon | Setup |
| WIFI | Setup |

Press the PgDn key

| Robot ID | Setup |
| --- | --- |
| Robot Type | Setup |
| Armor ID | Setup |
| Speed Mon | Setup |
| WIFI | Setup |

Press the OK key

| Robot | Standard |
| --- | --- |
| Robot | Hero |
| Robot | Engineer |
| Robot | Sentry |
| Robot | Aerial |

Standard
Hero
Engineer
Sentry
Aerial

Press the OK key

| Robot | Standard |
| --- | --- |
| Robot | Hero |
| Robot | Engineer |
| Robot | Sentry |
| Robot | Aerial |

Armor Module ID Setup

A Robot Side can have multiple armor modules that are numbered, so that it can easily identify which armor is being attacked and from which direction.

The following shows how to number armor modules:

a. On the Feature page of Main Controller Module, proceed as shown to enter the Armor ID Setup page:
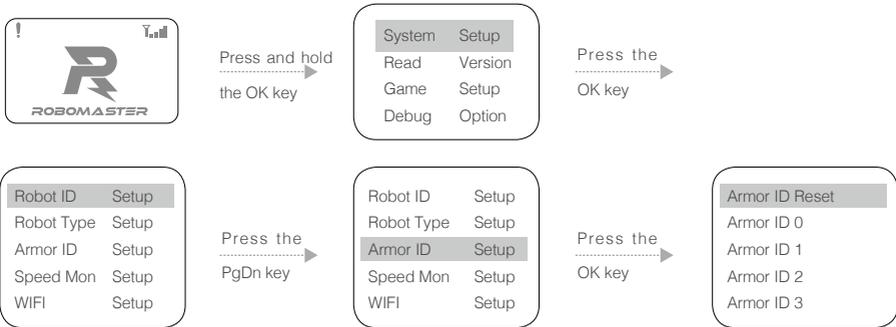


b. On this page, select "Armor ID Reset" to make the system enter the Armor ID Reset status. At this point, the Armor Panel Indicator flashes at a certain frequency (if the Robot ID is on the Red team, the red indicator light flashes; if the Robot ID is on the Blue team, the blue indicator light flashes).

c. Strike each Armor Module in turn with a certain degree of force. If the armor light goes off and then goes back on, the armor ID is set successfully. The ID number of the Armor that was struck first is 0, and the ID number is sequentially incremented according to the order in which the modules were struck.

d. After completing the above operation, check whether the Armor ID has been set successfully by looking up the version number of the Armor Module. If the number of effective Armor Module that is read is the same as the number of Armor Module that has been installed, the procedure is complete.

e. On the page of Step b, if you select "Armor ID 0", the IDs of all Armor Modules connected to the Main Controller Module will be set to 0.

⚠ Be sure to set the Armor Module ID before use, and ensure that the IDs of Armor Modules connected to the same Main Controller Module are not repeated. If not set properly, the Armor Module ID will be detected as missing during the Robot Side initialization, and be identified as Offline during use.

Speed Monitor Module Setup

Compass Calibration:

On the Interaction Interface, you can calibrate the compass on the Speed Monitor Module. The compass is mainly used to provide data for the Robot Side and server and helps to determine the slay detection.

Calibrate the Speed Monitor Module by following these steps:

a. On the Feature page of Main Controller Module, enter the Speed Monitor Module Calibration Settings page by following these steps;
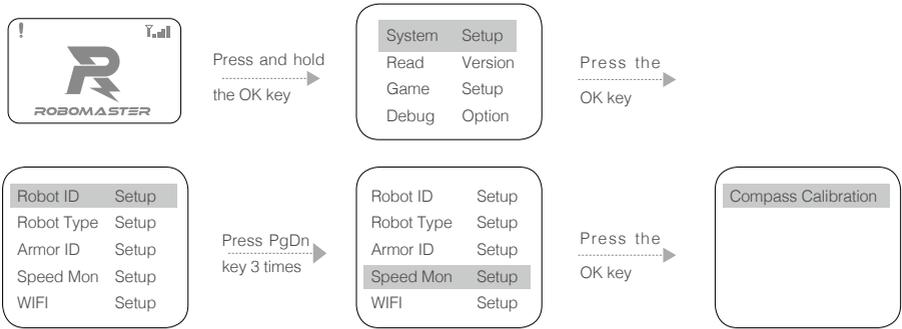
b. On this page, select "Compass Calibration" to enter the calibration status of the Speed Monitor Module and at that time the side LED on the Speed Monitor Module goes out:

c. Control the robot to keep the Speed Monitor Module in a horizontal level and make the robot spin 360° on the spot. During the process, the side LED of the Speed Monitor Module will display the calibrate progress bar until the LED is fully bright.

d. If calibration fails, repeat the above steps or refer to the RoboMaster 2019 Referee System Specification Manual to check whether the installation is standard.

WIFI Connection Setup

On the Interaction Interface, a Robot Side can choose a preset SSID (that is the WIFI name) to connect to and communicate with the Server, as shown below:
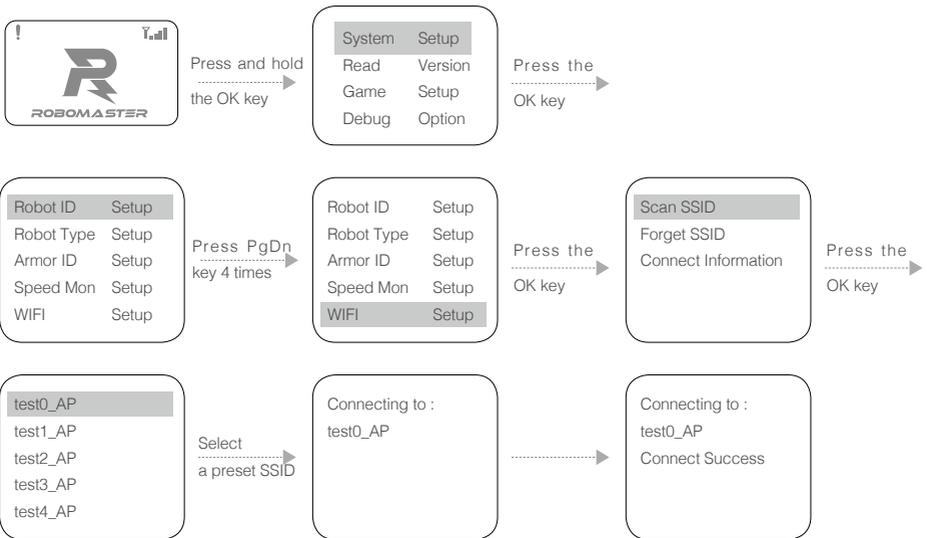
After the SSID is scanned, press and hold the OK key to remember this SSID. A Robot Side will automatically connect to this SSID upon startup. Click "Forget SSID" will ignore the remembered SSID;

After connection, the Homepage will display the WIFI signal strength as shown below.

Query WIFI Information

The following example shows how to check the information of currently connected WIFI of the Robot Side on the Interaction Interface:

| System | Setup |
|--------|-------|
| Read | Version |
| Game | Setup |
| Debug | Option |

Press and hold the OK key

Press the OK key

| Robot ID | Setup |
|----------|-------|
| Robot Type | Setup |
| Armor ID | Setup |
| Speed Mon | Setup |
| WIFI | Setup |

Press PgDn key 4 times

| Robot ID | Setup |
|----------|-------|
| Robot Type | Setup |
| Armor ID | Setup |
| Speed Mon | Setup |
| WIFI | Setup |

Press the OK key

Scan SSID
Forget SSID
Connect Information

Press PgDn key 2 times

Scan SSID
Forget SSID
Connect Information

Press the OK key

SSID : test0_AP ——— Currently Connected WIFI Name
Signal : -25dBm ——— Signal Strength
Rssi : 100.00% ——— Signal Quality
Rate : 72MBit/s ——— Sending Rate

PS: "SSID" is the WIFI name

## Read Version of All Modules

On the Interaction Interface, check the current version of each module on the Robot Side. The following example shows how to check the version information of Armor Module:

| | |
|---|---|
| System | Setup |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press and hold the OK key

Press the PgDn key

| | |
|---|---|
| System | Setup |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press the OK key

Main Controller Module →
Armor Module →
Power Management Module →
Speed Monitor Module →
RFID Interaction Module →

| | |
|---|---|
| Main | Control |
| Armor | Module |
| Power | Manager |
| Speed | Monitor |
| RFID | Module |

| | |
|---|---|
| Speed | Monitor |
| RFID | Module |
| Light | Indicator |
| Video | Transmitter |
| Locating | Module |

Light Indicator Module →
VTM Module →
Positioning System Module →

Press the PgDn key

| | |
|---|---|
| Main | Control |
| Armor | Module |
| Power | Manager |
| Speed | Monitor |
| RFID | Module |

Press the OK key

Module0 : 5.0.0.6
Module1 : 5.0.0.6
Module2 : 5.0.0.6
Module3 : 5.0.0.6
Module4 : 5.0.0.6

## Set up Offline Parameters

In the offline status, on the Interaction Interface, set up parameters such as the robot's maximum HP, projectile initial speed limit and heat limit and enter the Feature page of Main Controller Module.
The following example shows how to set the maximum power of robot as unlimited:

| | |
|---|---|
| System | Setup |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press and hold the OK key

Press PgDn key 2 times

| | |
|---|---|
| System | Setup |
| Read | Version |
| Game | Setup |
| Debug | Option |

Press the OK key

Reset HP →
Set Maximum HP →
Set Maximum Power →
Set Maximum Speed of Launch of 17 mm Projectile →
Set Maximum Speed of Launch of 42 mm Projectile →

| | |
|---|---|
| Reset | HP |
| MaxHP | Setup |
| MaxPower | Setup |
| MaxSpeed0 | Setup |
| MaxSpeed1 | Setup |

| MaxPower | Setup |
|----------|-------|
| MaxSpeed0 | Setup |
| MaxSpeed1 | Setup |
| MaxHeat0 | Setup |
| MaxHeat1 | Setup |

**Press PgDn key 2 times**

— Set Maximum Heat of 17 mm Projectile
— Set Maximum Heat of 42 mm Projectile

| Reset | HP |
|-------|-----|
| MaxHP | Setup |
| MaxPower | Setup |
| MaxSpeed0 | Setup |
| MaxSpeed1 | Setup |

**Press the OK key**

MaxPower : 80
MaxPower : 120
MaxPower : Unlimited

**Press PgDn key 2 times**

MaxPower : 80
MaxPower : 120
MaxPower : Unlimited

**Press the OK key**

Set MaxPower Success

You can also set the following features according to the above steps:

1. Reset HP
2. Set Maximum HP
3. Set Maximum Power
4. Set Maximum Speed of Launch of 17 mm Projectile
5. Set Maximum Speed of Launch of 42 mm Projectile
6. Set Maximum Heat of 17 mm Projectile
7. Set Maximum Heat of 42 mm Projectile

## Debugging

On the Interaction Interface, from the "Debug Option" menu, modify the advanced settings of Referee System: Modify the Module Initialization Mode to ignore all modules or ignore the currently offline modes, so that it is easier to power on the chassis and gimbal when debugging. The following example shows how to ignore the initialization of the currently offline modules:

! ⛊
ROBOMASTER

**Press and hold the OK key**

| System | Setup |
|--------|-------|
| Read | Version |
| Game | Setup |
| Debug | Option |

**Press PgDn key 3 times**

| System | Setup |
|--------|-------|
| Read | Version |
| Game | Setup |
| Debug | Option |

**Press the OK key**

| Ignore | Cur Offline |
|--------|-------------|
| Ignore | All Offline |
| Function | Enable Mask |
| Module | State Info |

**Press the OK key**

Ignore Success
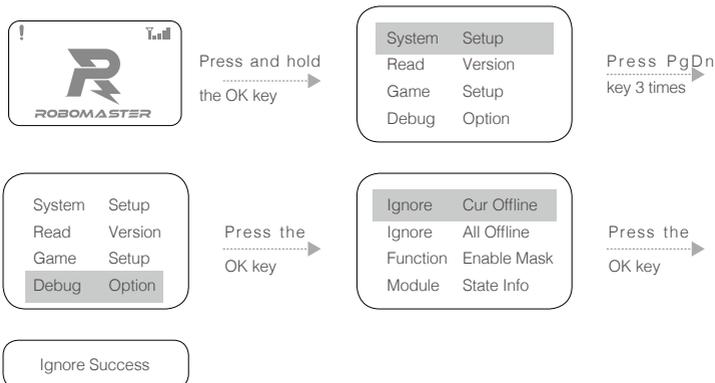
## Enabling Setup

Modify the VTM connection mode to "Manual Linking" or "Automatic Linking". A user is free to choose the VTM connection mode for easy debugging. Referee System is in "Automatic Linking" by default. After setting this parameter, press and hold the OK key to save and it remains valid when the robot is powered on again. For more information about the two modes, please refer to the "VTM Instruction" section.

The following example shows how to set the VTM connection mode as "Manual Linking":

| ! | ⓉＩＩＩＩＩＩＩＩＩ |
|---|---|
| **R** | |
| ROBOMASTER | |

Press and hold the OK key →

| System | Setup |
|--------|-------|
| Read | Version |
| Game | Setup |
| Debug | Option |

Press PgDn key 3 times →

| System | Setup |
|--------|-------|
| Read | Version |
| Game | Setup |
| **Debug** | **Option** |

Press the OK key →

| **Ignore** | **Cur Offline** |
|--------|-------|
| Ignore | All Offline |
| Function | Enable Mask |
| Module | State Info |

Press PgDn key 2 times →

| Ignore | Cur Offline |
|--------|-------|
| Ignore | All Offline |
| **Function** | **Enable Mask** |
| Module | State Info |

Press the OK key →

| √ | Offline Mode |
|---|---|
| √ | Auto Camera CHAN |

Press PgDn key 1 times →

| √ | Offline Mode |
|---|---|
| **√** | **Auto Camera CHAN** |

Press the OK key →

| √ | Offline Mode |
|---|---|
| ☐ | Auto Camera CHAN |

Press and hold the OK key →

| Save Success |
|---|

"Ignore Cur Offline" means ignore the currently offline modules.

"Ignore All Offline" means ignore all modules.

"Function Enable Mask" means enable masking function.

"Offline Mode" means whether to enable the Robot Side to be offline.

"Auto Camera CHAN" means whether to enable VTM to "Automatic Linking".

## Faulty Module Query

On the Interaction Interface, from the "Module State Info" menu, check the error code of all faulty modules and solve problems as shown below:
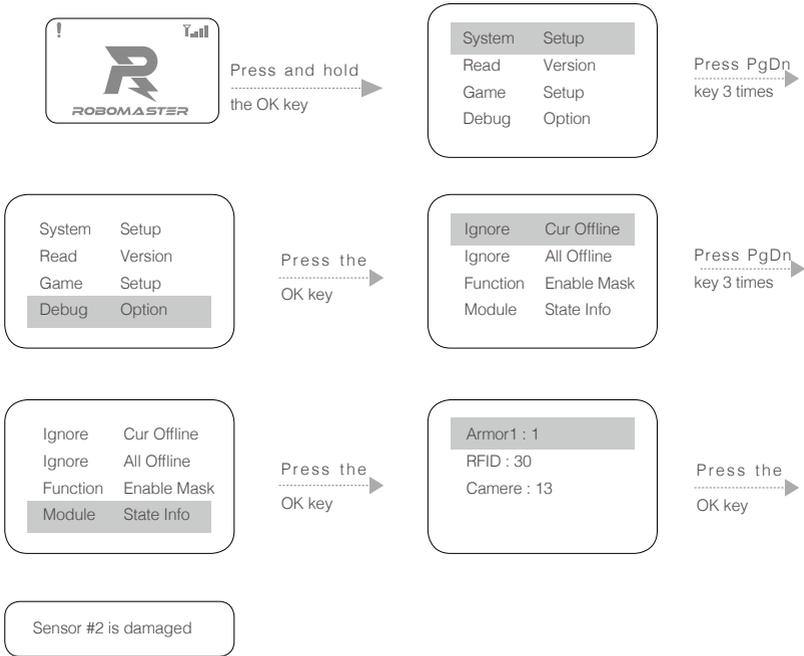


## Robot Side Module Initialization Instruction

To ensure fair competition, it is important that all Referee System modules are working properly. Therefore, a Robot Side will initialize each module after powering up. If the initialization process of important module fails, the Light Indicator Module will be solid yellow.

## VTM Instruction

Robot Side VTM is divided into the VTM Transmitter and the VTM Receiver, which use "Automatic Linking" and "Manual Linking" as their respective connection method.

### Automatic Linking

As the Transmitter ID is bound to the Robot ID, video and image can be properly transmitted only when IDs are matched between the Transmitter and the Receiver. The table below shows the matching relationship between the Transmitter and the Receiver:

| Robot ID (VTM Transmitter) | VTM Receiver ID |
|---|---|
| Red 1 | 1 |
| Red 2 | 2 |
| Red 3 | 3 |
| Red 4 | 4 |
| Red 5 | 5 |
| Red Aerial (corresponding to the VTM Transmitter ID of Red Team's Aerial) | 6 |
| Blue 1 | 7 |
| Blue 2 | 6 |
| Blue 3 | 5 |
| Blue 4 | 4 |
| Blue 5 | 3 |
| Blue Aerial (corresponding to the VTM Transmitter ID of Blue Team's Aerial) | 2 |

"Automatic Linking" works as follows:

1. From the "Debug Option" menu of the Main Controller Module, set the VTM connection mode to "Automatic Linking" (default). For details, please refer to the "Debugging" and "Enabling Setup" sections of "UI Feature Instruction".

2. Connect the VTM Transmitter to the Main Controller Module and set the Robot ID. For details, please refer to the "Robot ID Setup" section of "UI Feature Instruction".

3. The VTM Receiver ID must be set with "RoboMaster Tools" on the PC side, as follows:

   a. Install the VTM driver:

   Use a power adapter to power the VTM Receiver. Wait about 20 seconds until the POWER indicator is solid green and the SIGNAL-STR indicator is solid red, which indicates that the Receiver has started up. Use a USB cable to connect to the Receiver.



Receiver Indicator
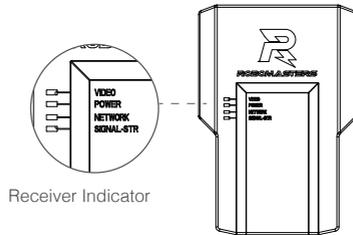
   b. Open the Device Manager of PC and expand the Network Adapter submenu to check for a "Remote NDIS based Internet Sharing Device", as shown in the figure below:
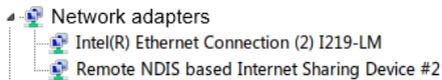
In general, for Windows 7 and Windows 10 operating systems, this driver will be automatically installed. If it is not, check the PC network settings or look for a third-party driver;

c. Open "RoboMaster Tools" and select the "VTM Setup" page, as shown in the figure below:



Download the "RoboMaster Tools" software:

https://www.robomaster.com/zh-CN/products/components/detail/145

d. Click "Connect" to receive a "Connected" message, and then select the ID and click the "Set ID" button to receive an "ID Set Successfully" message.

e. Use an HDMI cable (user supplied) to connect the output from the VTM Receiver to a monitor that supports a 1920*1080@60 Hz monitor or a PC with a video capture card.

f. The Transmitter is successfully connected to the Receiver when their Network Activity indicators are solid green. If they are not connected for a prolonged period of time, please reboot the VTM and repeat Step d for relinking.

## Manual Linking

In this mode, image can be transmitted only when the Transmitter is connected to the Receiver via manual linking. Linking steps are as follows:

1. From the "Debug Option" menu of the Main Controller Module, set the VTM connection mode to "Manual Linking". For details, please refer to the "Debugging" and "Enabling Setup" sections of "UI Feature Instruction".

2. Connect the VTM Transmitter to the Main Controller Module. Wait about 20 seconds after the VTM Transmitter is powered up until the Network Activity indicator is solid green, which indicates that the Transmitter has been started up.



VIDEO Indicator
NETWORK Indicator
USB Port
Link Button

Link Button 1
Link Button 2
USB Port
3.5 mm Power Outlet

Receiver

Transmitter
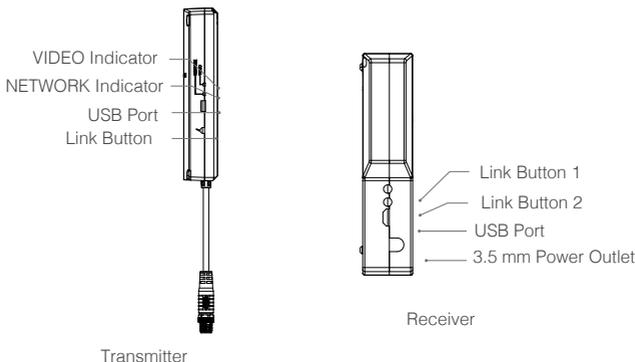
3. Use a power adapter to power the VTM Receiver. Wait about 20 seconds until the POWER indicator is solid green and the SIGNAL-STR indicator is solid red, which indicates that the Receiver has started up. Use an HDMI cable (user-supplied) to connect the output from the VTM Receiver to a monitor that supports a 1920*1080@60 Hz monitor or a PC with a video capture card.

4. After the VTM Receiver is started up, ensure that it is less than 2 m away from the VTM Receiver. Press the Link Button on the Transmitter and the Link Button 1 on the Receiver (The order does not matter. On the Receiver, Link Button 1 is equivalent to Link Button 2). After the Link Button is pressed, the Network Indicator on the Receiver and Transmitter will be solid red.

5. The Transmitter is successfully linked with the Receiver when their Network Indicator become solid green. If they still have not been linked after a prolonged period of time, please reboot the VTM and repeat Step 4 to link them again.

⚠️　• To receive video and image via the Client, the PC side should be installed with a video capture card. If no card is available, the VTM Receiver can be directly connected to a monitor via an HDMI cable for display.

　• Only seven VTM channels are open for user debugging. When more than seven VTMs work at the same time, transmission interference may occur. Therefore, you can select only the Red team or only the Blue team for debugging. During combat, it is recommended to set to Red 1-Red 3 and Blue 1-Blue 3 to avoid conflict.

## Referee System User Interface Instruction

To allow users to better carry out automatic control and obtain real-time competition data, a UART interface is open on the Robot Side to output Robot Side data.

Output data includes the remaining competition time, the robots' remaining HP and the real-time power output from the chassis. In addition, user-customized data can be uploaded to the Client and will be displayed on the operator UI. A user can check the interface protocol instruction to implement this feature according to different competition specification manuals or official designated positions.

Referee System UI is on the Power Management Module as shown below:
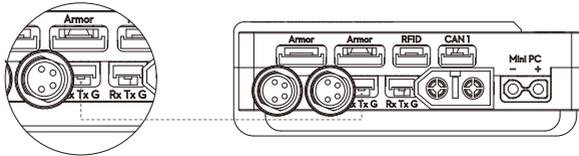


Student Serial Port

Descriptions of line sequence:

1. Rx: data receive line for serial communication
2. Tx: data transmit line for serial communication
3. G: GND line for serial communication

## Robot Side Feature Detection

After a Robot Side is installed, follow the instruction to connect each module and read and understand all feature instructions mentioned above.

The steps to detect features are as follows:

1. Ensure that the supply voltage is correct and that the polarity of the power supply is not reversed (rated input voltage for the Referee System is 24 V).
2. Ensure that wires are firmly connected to each module and that they will not be tangled into a motion mechanism.
3. Turn on the battery power, wait until the Main Controller Module of the Referee System has started up (startup may take about 20 seconds), and then check the color of the indicator. If the Main Controller Module of the Referee System is powered on for the first time after installation, a yellow light is displayed after startup. As the Armor Module ID has not been set, the Main Controller Module is not connected to the Server.
4. Set the Armor Module ID (for details, refer to Armor Module ID Setup).
5. In general, after the above operations have been completed, the Light Indicator of the Main Controller Module will change from yellow to red or blue, and voltage will be output from the chassis, gimbal and Launching Mechanism ports. If the yellow light does not change color, view the message on the interaction OLED screen to check whether the faulty module is properly connected. Refer to the "Robot Side Interaction Instruction" and "Robot Property Instruction" to set the correct robot type. The features of the Referee System can be further checked once the Referee System displays normally.
6. Strike armor modules in turn and check whether the deducted HP value on the real-time data display page of the Main Controller Module interaction OLED screen is correct.
7. Launch a projectile and check whether the values of speed/frequency of launch are displayed on the Main Controller Module interaction screen.
8. Use an RFID Interaction Module test card to test the features and detection distance of the RFID Interaction Module. If the RFID Interaction Module data can be correctly read, its indicator will flash in red or blue depending on the robot. The direct effect of the RFID Interaction Module test card is to restore a robot's HP. (Pay attention to the detection distance. If the RFID Interaction Module and test card come into contact with a magnetic object, the detection distance and detection accuracy will be affected.)
9. Set the VTM Receiver and the VTM Transmitter (for details, refer to the VTM Instruction). After setup is complete, check the video data of the VTM Receiver.
10. Read the UI data of the Main Controller Module on the Referee System and check whether the data is normal (for data protocol, please refer to the attachment "Referee System Interface Protocol Instruction").

After the Robot Side is installed, you may proceed to debugging of the Referee System.

## RoboMaster Tool 2 Upgrade

RoboMaster Tool 2 is used to upgrade the Referee System modules.
Download:
www.robomaster.com/zh-CN/products/components/referee?index=2&position=1334
(On the webpage, select the download link below the "Robomaster Tool 2" icon and download the tool)

Download the Main Controller USB driver:
https://www.robomaster.com/zh-CN/products/components/detail/122
(PS: "RoboMaster Remote Controller driver" is Main Controller USB driver)

Introduction to the Upgrade Homepage:

[1]   [2]



[3]

[4]          [5]        [6]

[1] Auto Upgrade Checkbox

[2] Upgrade Button

[3] Serial Device Management Area

[4] Network Connection Status Indication

[5] Firmware Upgrade Indication

[6] Firmware Download Button

## Upgrade steps are as follows:

1. Ensure that modules are connected normally. Use USB cable to properly connect the USB port for PC and the Main Controller Module upgrade and power on robots.
2. Open RoboMaster Tool 2 upgrade tool to check whether the status indication of network connection is normal.
3. Enter the left side Serial Device Management Area on the Homepage, select the proper serial device number and then click Open.
4. At this point, the Upgrade page will display the robot's basic information and the information of all modules as shown below.



Upgrade page

5. If the Firmware Upgrade Indication at the bottom of the interface prompts "Remote server finds the latest firmware", click Firmware Download to download locally.
6. After downloading, the APP version number of the module that needs to be upgraded will turn red and the Upgrade button will become available as shown below.

Auto Upgrade    Upgrade
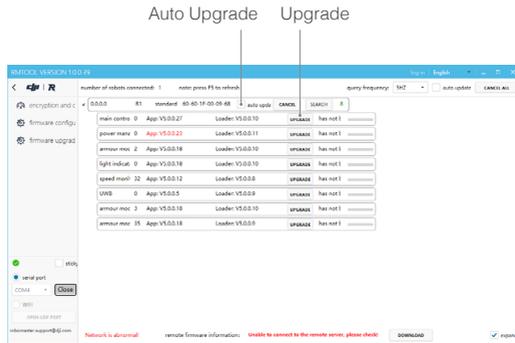


⚠ [Auto Upgrade] checkbox means the currently connected modules that need to be upgraded can be automatically upgraded.

7. The Upgrad page will display the robot's basic information and the information of all modules as shown below.



8. When the upgrade progress bar is completed, it indicates that this module firmware has already upgraded.

# RoboMaster Server

Server is the service center of the entire Referee System. It collects data from all robots and Clients during the competition and visualizes it for users, and automatically determines the outcome of the competition.

Download the Server:www.robomaster.com/zh-CN/products/components/referee?index=2&position=1331

When running "RMServerStart.exe", the system will also open RoboMaster Server, log system, mini-map and Robo-Master Server UI.

The full RoboMaster Server UI page is shown in the figure below:



## Server Configuration

The computer host on which the RoboMaster Server is running must have two static IP address set to 192.168.1.2 or 192.168.0.8 and the firewall must be disabled. For other configurations, please refer to "Set up a LAN".

# RoboMaster Client

The Client is the first-person perspective application for an operator. With a capture card installed and a self-built Server connected, robot-related data uploaded from the Referee System can be viewed from a first-person perspective. The data include a robot's current HP, real-time projectile speed/frequency of launch, the Battlefield mini-map, real-time chassis power output and teammate information.

Download the Client:www.robomaster.com/zh-CN/products/components/referee?index=2&position=1332

The full UI page is shown in the figure below:

## Client Configuration

To connect the Client to the competition Server, the PC host on which the Client is running must work in the same LAN as the Server. Therefore, the static IP address of the PC host on which the Client is running is 192.168.0.100–200. If you run multiple Clients, a unique IP address should be used for each one.

# Set up a LAN

When the Main Controller Module on the Robot Side and the Server are using the same LAN, the Robot Side can be connected to the server for online combat. The following steps demonstrate how to set up a LAN:

1. Use a 2.4G (the Referee System supports only 2.4G) wireless AP with a LAN port (a home router can be used). Set the AP's IP address to 192.168.1.1, customize the SSID, set the password to 12345678, select WPA2 for the encryption method, and enable the DHCP function.
2. Connect the host on which RoboMaster Server is running to the wireless AP via a network cable and set the static IP address of the host to 192.168.1.2.
3. Under "Advanced Settings", click "Add" and add the IP address 192.168.0.8. See the figure below:
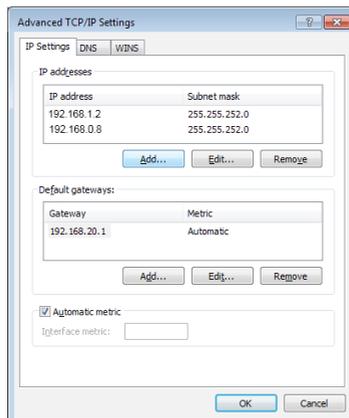
4. Connect the host on which the RoboMaster Client is running to the wireless AP via a network cable and set the static IP address of the host to 192.168.0.100–200.

5. Power a robot on to supply power to the Referee System. Refer to the "WIFI Connection Setup" of "System Set-up" to connect the Robot Side to the wireless AP. After connection, the Robot Side will be in the same LAN as the Server via WIFI.

6. The RoboMaster Server runs on the Server PC. You may check the connection status of the robot on the Server side. If a LAN is set up, you can check Robot Side related data on the Server side.

⚠ • Client IP address: 192.168.0.100-200.
   • Robot Side IP address: 192.168.1.20~230