

V1.0

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 P18 Brushless DC Gear Motor and C620 Brushless DC Motor Speed Controller, this M3508 Accessories VI1 includes several cables and a terminal board.

Refer to System Specification Manual, RoboMaster User Manual, Introduction of RoboMaster System Module

M3508 Accessories VI1 includes several cables and a terminal board, creating a complete and open system with four independent drives.

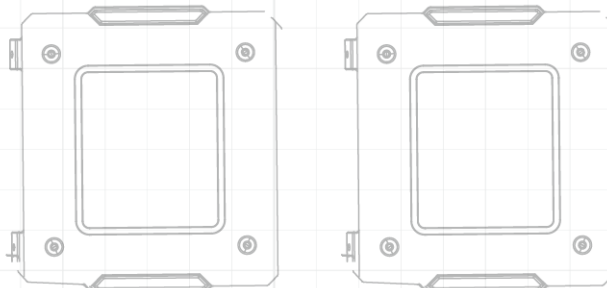
ROBOMASTER 2019

ROBOTICS COMPETITION

REFEREE SYSTEM

SPECIFICATION MANUAL

The RoboMaster Organizing Committee
September 20th, 2018



Disclaimer

Please read this disclaimer carefully before using this product. By using this product, you hereby signify that you have read and agree 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™ will not bear any legal responsibilities for any damages due to improper use, installation or modification. DJI and RoboMaster™ are trademarks or registered trademarks of Shenzhen 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 and the manual, including the RoboMaster Client, RoboMaster Tool, RoboMaster Server software, and DJI WIN driver for use with the referee system, are copyright of DJI and shall not be modified, reproduced, or transmitted in any form without the prior consent of DJI. The final interpretation of this document and all related documents of this product belongs to DJI. All content is subject to the latest version of the manual.

Product Usage Precautions

1. Please ensure that the referee system is properly and securely installed on the robot before use.
2. Please ensure that the wiring connections are correct before use.
3. Please ensure that the components are intact before use. Replace any worn or damaged components if necessary.

Reading Tips

Symbol Descriptions

 Important notes

Related Documents

1. RoboMaster Referee System User Manual
2. RoboMaster Referee System Module Instructions

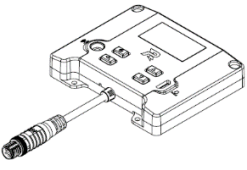
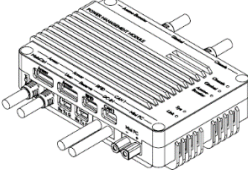
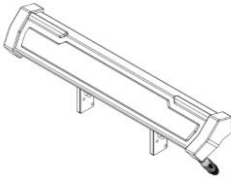
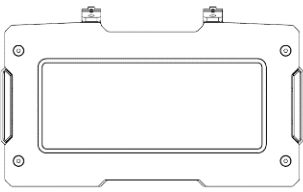
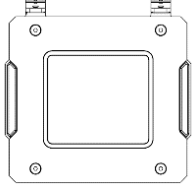
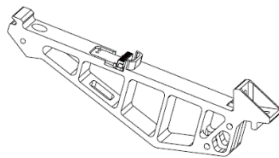
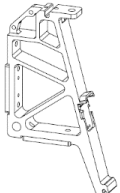
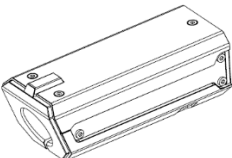
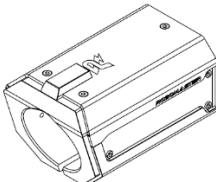
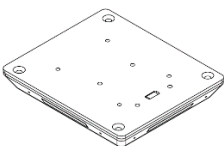

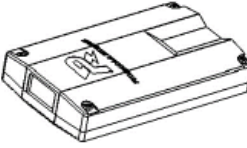

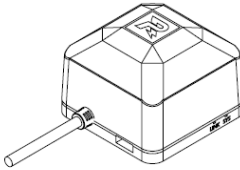
Revision Log

Date	Version	Revision Records
10/22/2018	1.0	

Table of Contents

Disclaimer	2
Product Usage Precautions	2
Reading Tips.....	2
Revision Log.....	3
Inventory List.....	5
Referee System Usage Specifications Overview.....	6
Configuration of the Robot Referee System.....	6
Installation Specifications.....	6
Main Control Module.....	6
Power Management Module.....	8
Light Indicator Module.....	11
Armor Module	13
Speed Monitor Modules.....	23
RFID Interaction Module.....	27
Video Transmission Module	29
Locating System Module	30
Battlefield Geo-Fence	33

Inventory List

<p>Main Control Module MC02</p>	<p>Power Management Module PM01</p>	<p>Light Indicator Module LI01</p>
		
<p>Armor Module (Large) AM12</p>	<p>Armor Module (Small) AM02</p>	<p>Armor Module Support Frame A</p>
		
<p>Armor Module Support Frame B</p>	<p>Speed Monitor Module (17 mm Projectile) SM01</p>	<p>Speed Monitor Module (42 mm Projectile) SM11</p>
		
<p>RFID Interaction Module FI02</p>	<p>RFID Interaction Module Card</p>	<p>Video Transmission Module (Transmitter) VT02</p>
		
<p>Video Transmission Module (Receiver) VT12</p>	<p>Locating System Module</p>	
		

*Note: The product code for each module will not be stated again later in the document. For example, the Main Control Module MC02 will directly referred to as the Main Control Module.

Referee System Usage Specifications Overview

In order to ensure the fairness and justness of the RoboMaster 2019 Robotics Competition, the robot's battle results are automatically evaluated by the electronic referee system. Each team must follow all the instructions and correctly install the referee system. In case of any violations, the team shall bear the consequences of failing the pre-match inspection.

Configuration of the Robot Referee System

Number of Modules Robot Type	Main Control Module	Power Management Module	Light Indicator Module	Large Armor Module	Small Armor Module	Video Transmission Module (Transmitter)	RFID Interaction Module	Speed Monitor Module (17mm Projectile)	Speed Monitor Module (42mm Projectile)	Locating System Module
Standard	1	1	1	1	4	1	1	1	0	1
Sentry	1	1	1	2	0	0	0	1	0	1
Hero	1	1	1	5	0	1	1	1	1	1
Aerial	1	1	0	0	0	1	0	1	0	1
Engineer	1	1	1	0	4	1	1	0	0	1

Installation Specifications

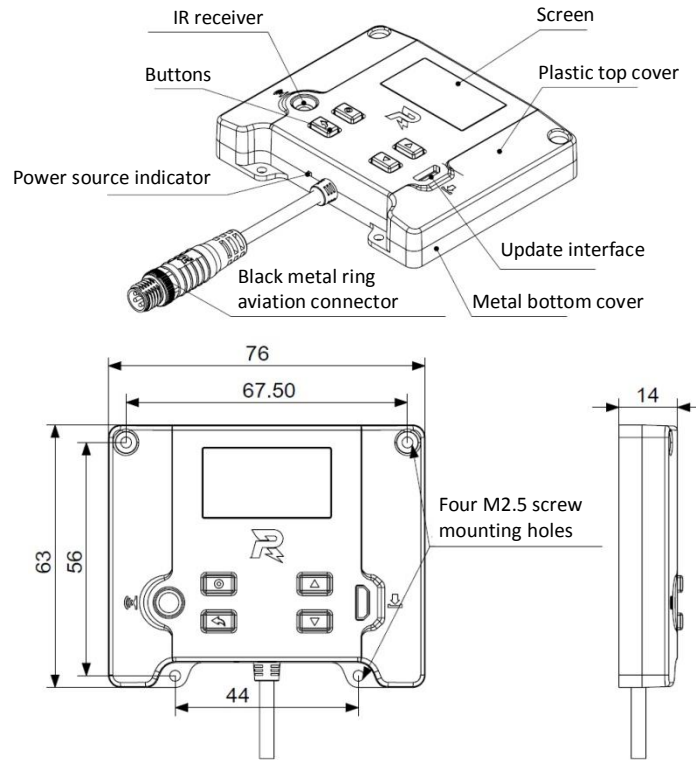
The Referee System is provided by the RoboMaster 2019 Organizing Committee. It records a robot's status, such as the robot's HP, projectile firing speed, and chassis power consumption. The Referee System sends status updates to the Operator Room and Referee System server to determine the result of each round and ensure fairness. Teams must reserve the mechanical and electrical interfaces for installing the various modules of the Referee System on their robots.

Main Control Module

Installation Procedure

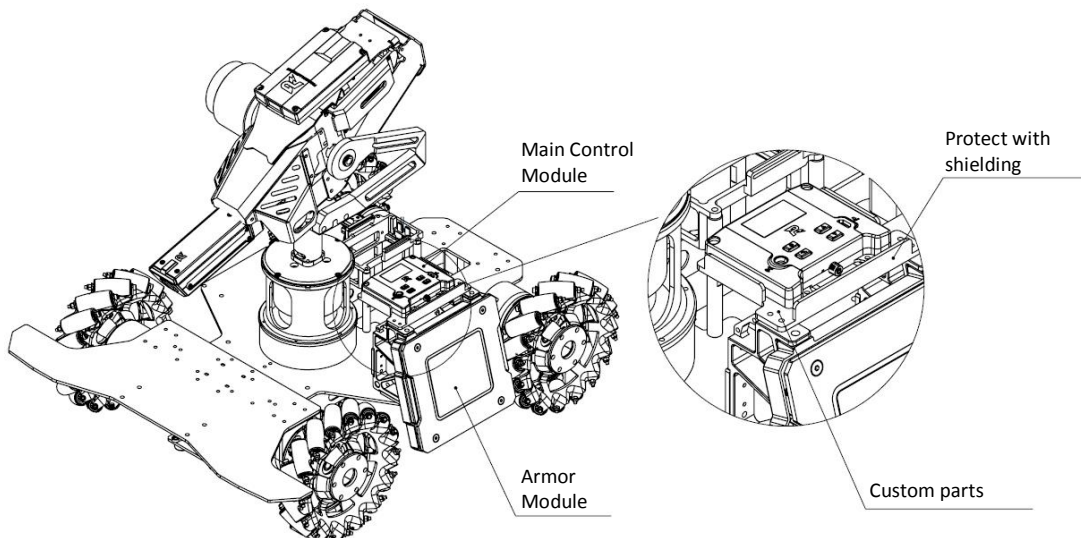
Standards, Heroes, Engineers, Sentries, and Aerials:

1. Refer to the size of the Main Control Module to reserve mounting holes in the specified positions on the robot.



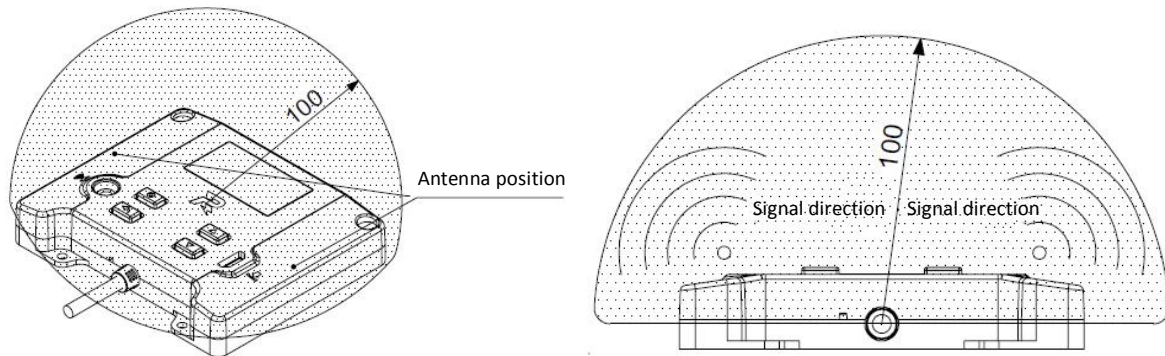
2. Use four M2.5 screws to fix the Main Control Module to the specified position on the robot, and ensure that the upper surface of the Main Control Module is level and faces up when the robot is operating.

Reference: The parts can be customized (excluding the items in the list), and are installed on the back of the Armor Module (the M3 threaded hole is reserved for the armor support frame). They must be shielded from projectiles on all four sides.

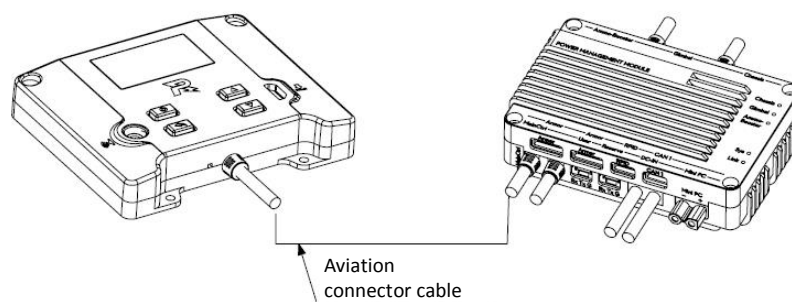


3. The installation of the Main Control Module must meet the following requirements.
 - a . It is necessary to ensure that the interactive surface (screen and buttons) of the Main Control Module has no metal shielding within 50 mm above it. It can be protected by

a piece of foam that can be flipped open, facilitating user access. It should be installed so that the logo is at the center, and there must be no motors or other devices with electromagnetic interference within a hemisphere of 100 mm to prevent the Wi-Fi signal from being blocked. If the protective shielding for the Main Control Module is made of metal, it cannot be higher than the upper edge of the bottom cover of the Main Control Module so as to avoid blocking the signals.



- b . It is necessary to ensure that the infrared receiver of the Main Control Module is not blocked, so that it is easy to manually connect to the server during the competition.
 - c . The Main Control Module should be installed in a position that is convenient for personnel to operate the buttons and view screen information. Also ensure that it is convenient to plug the cable into the upgrade interface so as to upgrade firmware.
4. Use the aviation connector cable inside the package to connect the Main Control Module to the aviation connector with the black metal ring on the Power Management Module.

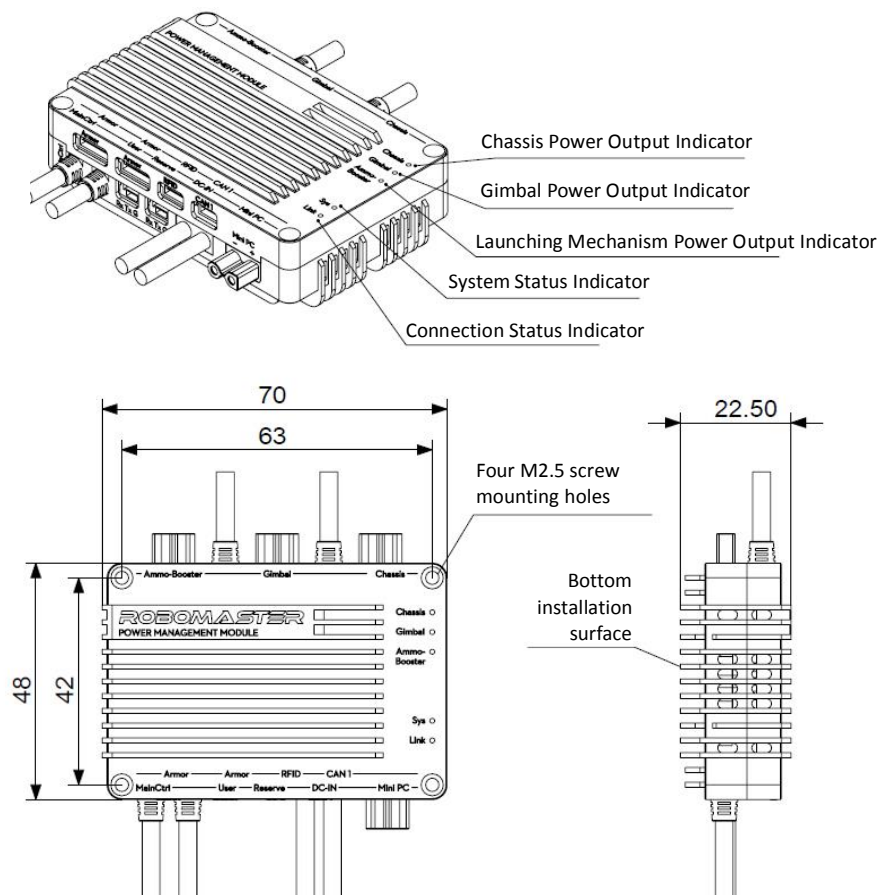


Power Management Module

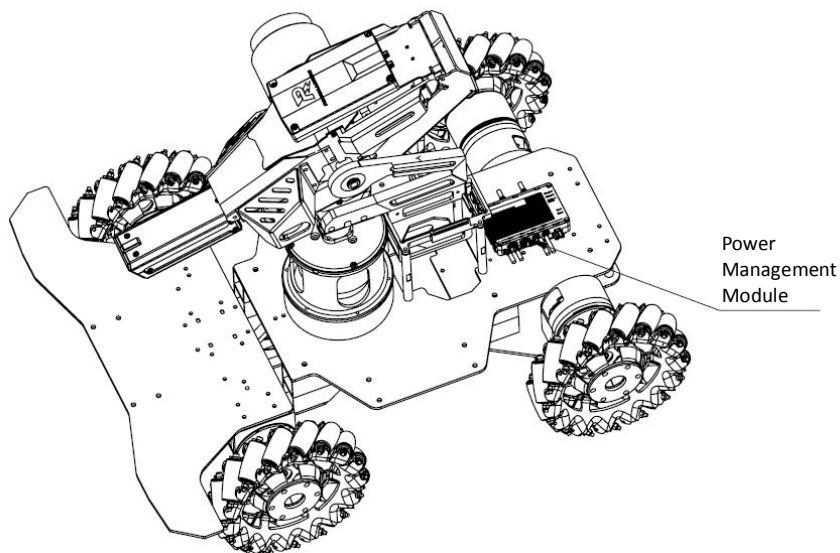
Installation Procedure

Standards, Heroes, Engineers, Sentries, and Aerials:

1. Refer to the size of the Power Management Module to reserve mounting holes in the specified positions. (Note: The size of the four M2.5 screw mounting holes in the figure may be adjusted)

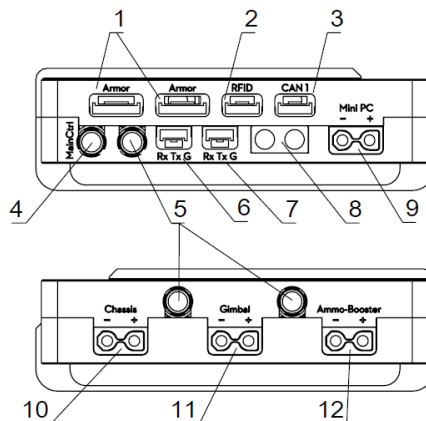


2. Secure the Power Management Module to the robot using four M2.5 screws.



3. The installation of the Power Management Module must meet the following requirements.
- a . Ensure that the status indicator of the Power Management Module is not blocked.
 - b . Ensure that the various sockets of the Power Management Module are shielded from projectiles. The outer casing cannot be completely covered to ensure good heat dissipation.

- Carefully distinguish the interfaces of the Power Management Module to ensure correct cabling.



Interface Description:

- Armor Module SM06B-GHS-TB interface
- RFID Interaction Module SM04B-GHS-TB interface
- CAN communication SM04B-GHS-TB interface
- Main Control Module interface (the metal ring of the aviation connector is black)
- Interfaces for other Referee System Modules (speed measurement, locating, video transmission, and Light Indicator; the metal ring of the aviation connector is silver)
- System upgrade SM03B-GHS-TB interface
- User SM03B-GHS-TB interface
- Referee System power supply XT60 interface (input)
- Mini PC power supply XT30 interface (output)
- Referee System power supply XT30 interface (output) - connects to the chassis
- Referee System power supply XT30 interface (output) - connects to the gimbal
- Referee System power supply XT30 interface (output) - connects to the Launching Mechanism

For robots with chassis power consumption limits, the chassis power must be directly connected to the "Chassis" interface on the Power Management Module.

The power source of the Launching Mechanism of Aerials must be connected to the "Ammo-Booster" interface on the Power Management Module.



- Power Management Module input voltage requirements: 22V-26V. In the figure, the power output interfaces of No. 10, No. 11, and No. 12 can be turned on and off by the Referee System. The maximum current of one channel's continuous output is 10A and the peak value is 60A. The total maximum continuous output current of the three power output interfaces is 20A. In the figure, the power output interface of No. 9 has a continuous output maximum current of 6A.

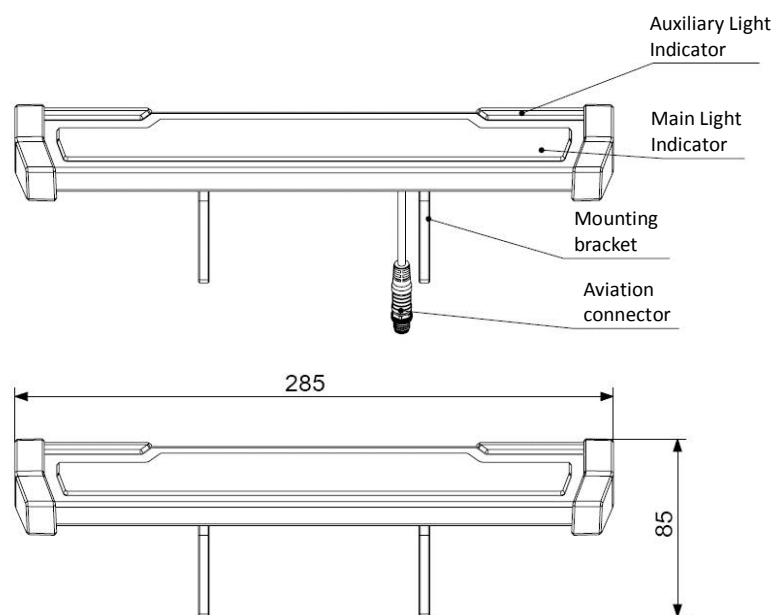
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- Powered devices with a continuous maximum current greater than 10A can be powered directly from the robot's battery and controlled by a relay. The relay must be powered by the corresponding interface to ensure that after the robot is destroyed, the Referee System can control the power to all devices connected to the "Referee System power interface (output)", otherwise it is considered cheating.
 - The case of the Power Management Module becomes hot under high power conditions. Do not touch it with your hands. The measured results are as follows: continuous current of 20A, working time of 30 minutes, and case temperature of about 70 degrees. It is therefore necessary to avoid installation on non-heat-resistant materials, such as 3D printed materials. It is forbidden to use glue such as 3M glue.
-

Light Indicator Module

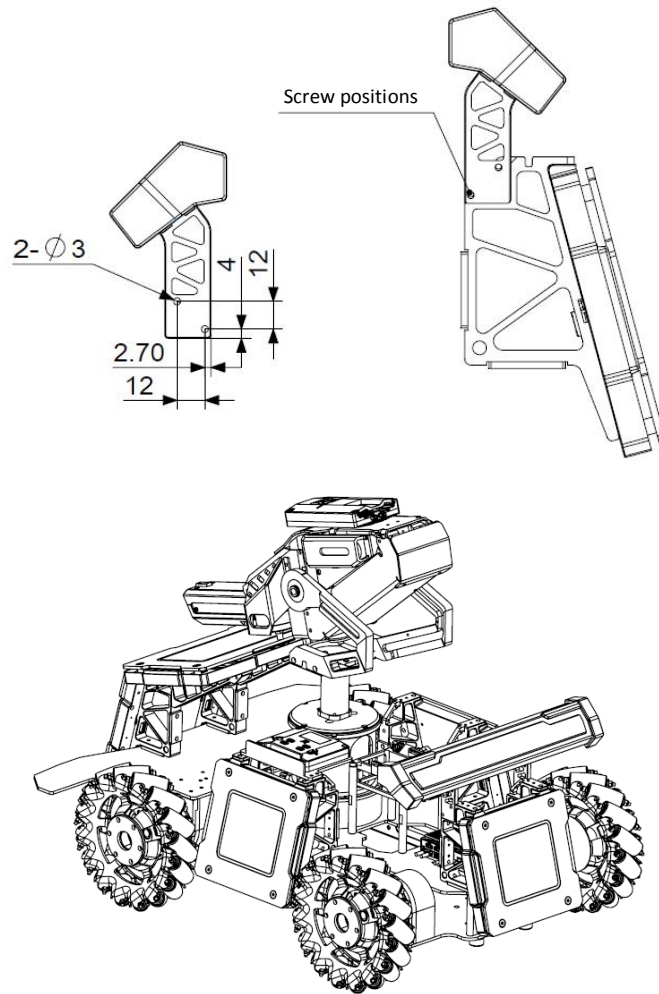
Installation Procedure

Standards, Heroes, Engineers, and Sentries:

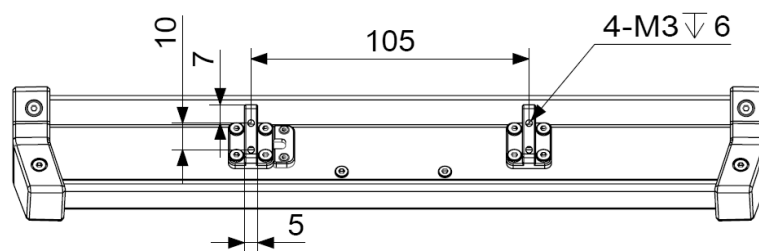
1. The dimensions of the Light Indicator module are as follows. The Light Indicator is mounted on the robot via a mounting bracket.



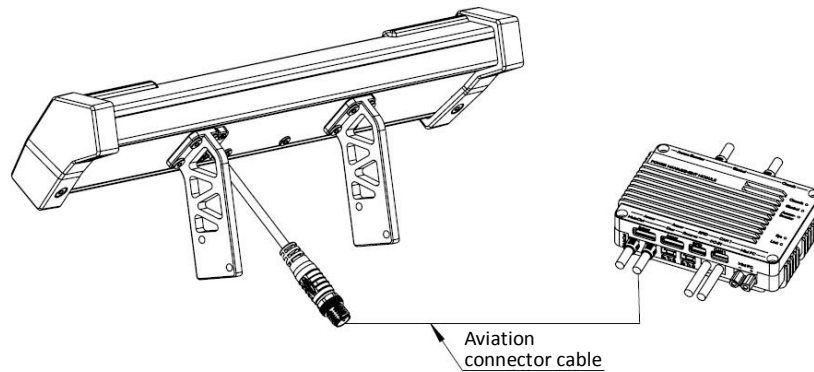
2. The Light Indicator module can be mounted on the armor module and secured to the armor support frame using ten M3 screws.



- Optional: The Light Indicator module can be fixed using the bottom screw hole of the mounting bracket and installed in a suitable position on the robot.



- The Light Indicator module must be installed so that the left and right auxiliary Light Indicators are parallel to the ground. The main Light Indicator and the auxiliary Light Indicators must be completely visible when looking at the robot from at least one horizontal direction.
- Use the aviation connector cable inside the package to connect the Light Indicator Module to the aviation connector with the white metal ring on the Power Management Module.

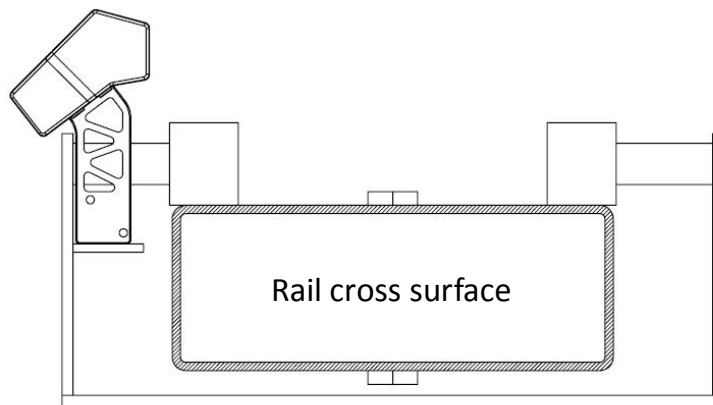


-
- When installing the Light Indicator module of a Standard, the main Light Indicator portion must be higher than the upper edge of the armor module.
-

Sentry:

Installing the Light Indicator module on a Sentry is different. A mounting bracket must be used to mount the Light Indicator module onto the Sentry through the mounting holes on the side or the screw holes on the bottom.

Sentries are mounted onto rails. It should be ensured that after the installation is completed, the Light Indicator module is on one side of the rail, and the illuminated part of the Light Indicators (the main Light Indicator and the auxiliary Light Indicators) is above the upper surface of the rail. The Light Indicator module does not count toward the overall size constraints.

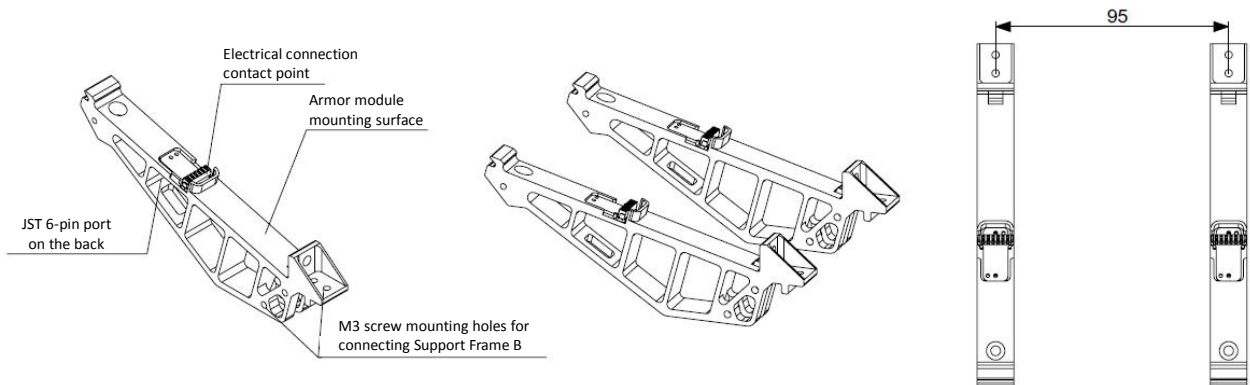


Armor Module

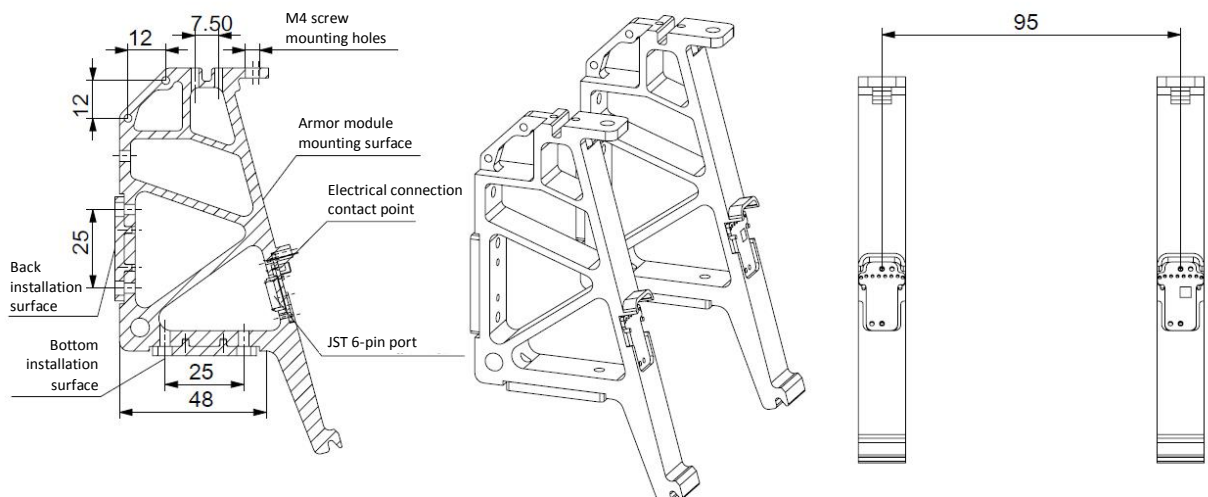
Installation Procedure

The armor module needs to be mounted to the robot via an armor module support frame. There are two types of armor support frames: Support Frame A and Support Frame B.

Armor Module Support Frame A is shown in the figure below:



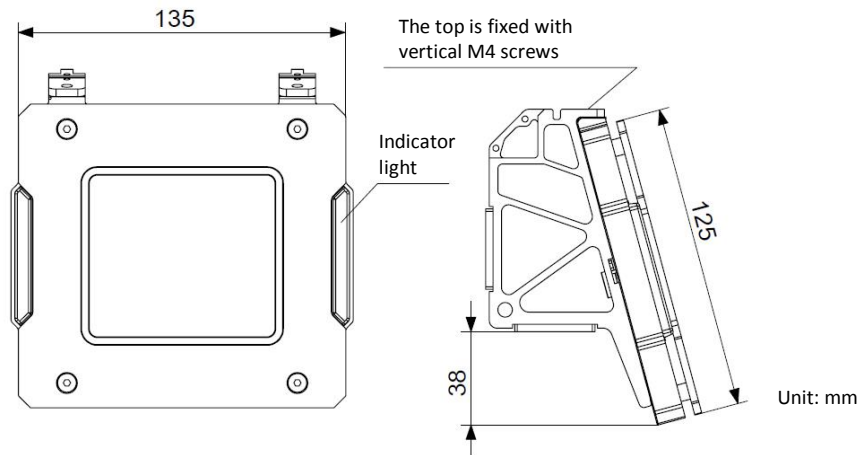
Armor Module Support Frame B is shown in the figure below:



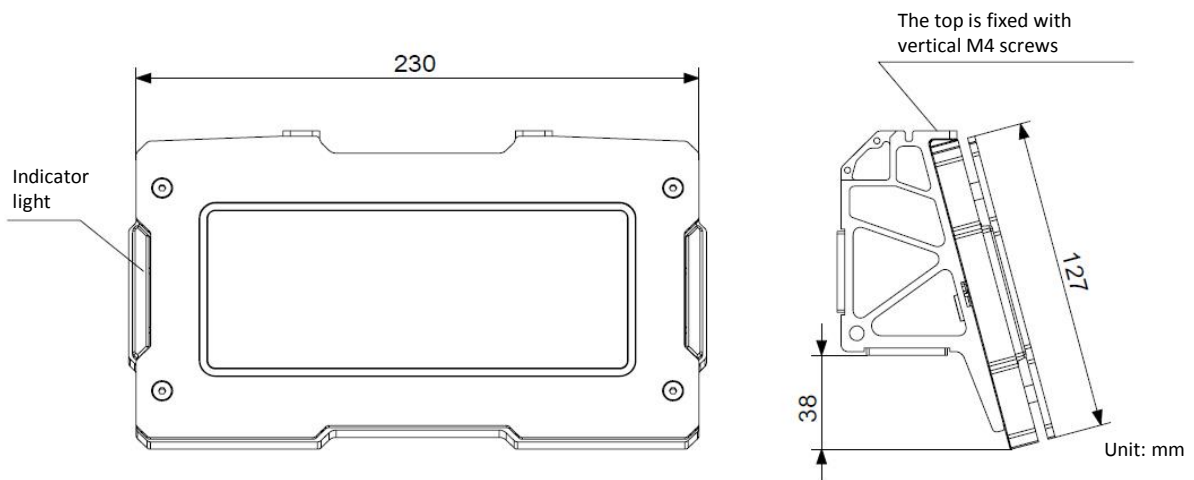
Armor modules are classified into small and large armor modules. Standards, Heroes, Engineers, and Sentries all require side-mounted armor modules. In addition, Standards and Heroes require an additional top armor module. The specific armor module types and quantities of each robot are as follows:

Robot type \ Armor type	Small armor module	Large armor module
Standard	4	1
Hero	0	5
Engineer	4	0
Sentry	0	2

The small armor module is shown in the figure below:



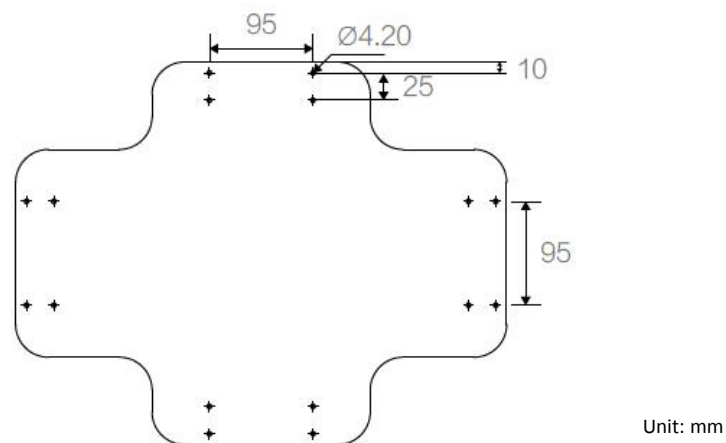
The large armor module is shown in the figure below:



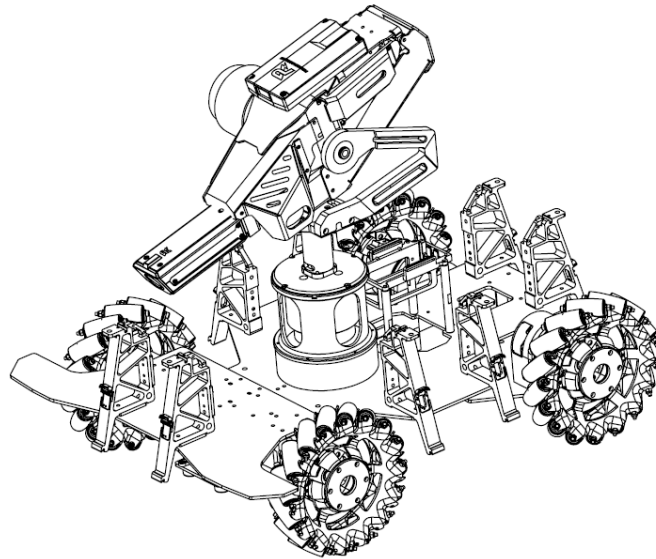
Installation Procedure

Side Armor of Standards and Heroes, Armor of Engineers:

- Using the dimensions shown in the figure below as a reference, reserve mounting holes on the chassis. Keep the sizes and the positions of the four mounting holes consistent.

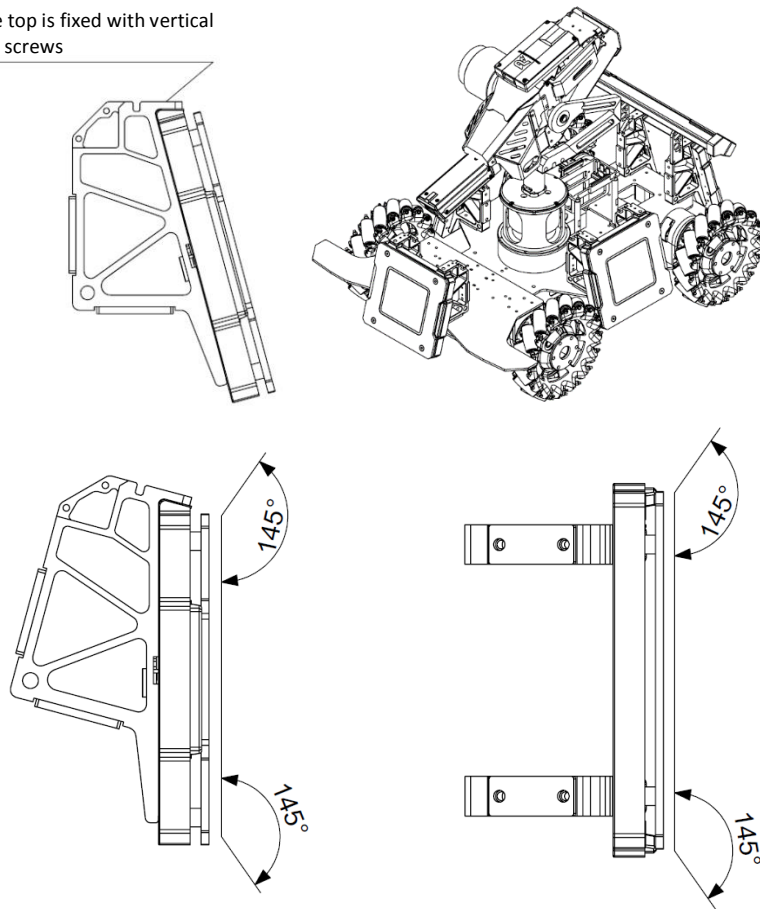


2 . Use M4 screws to secure Support Frame B to the chassis.

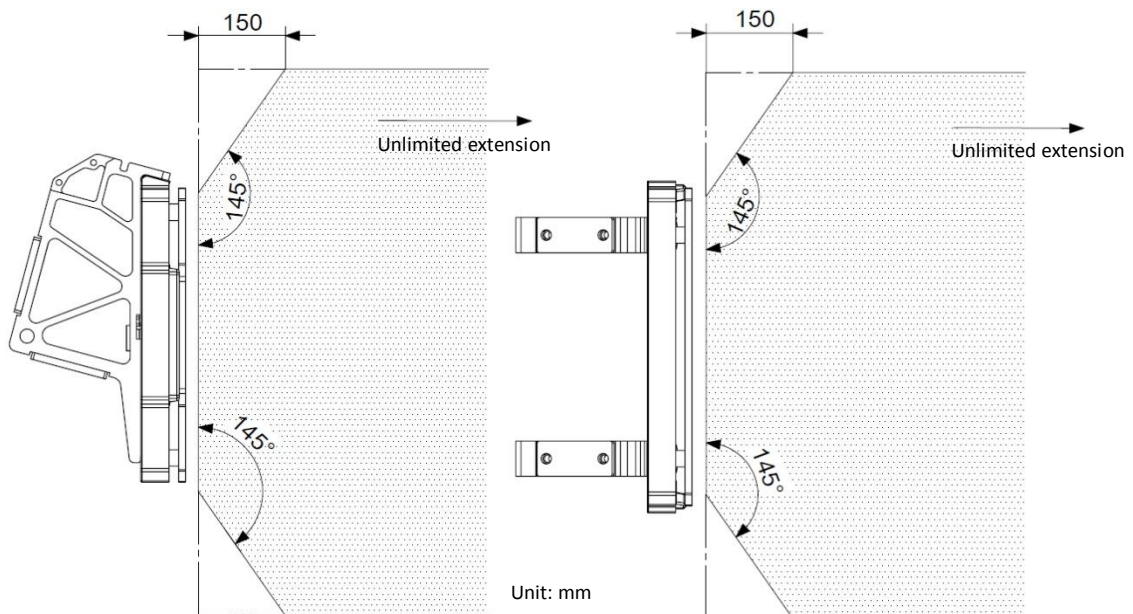


3 . Install the armor module to the support frame and fix it with M4 screws. Note that the threaded hole on the top of the armor support frame is not perpendicular to the top surface of the support frame. When the support frame is properly installed, the top threaded hole is perpendicular to the horizontal plane. The front 145° of the side armor module of Standards and Heroes should not be blocked.

The top is fixed with vertical M4 screws

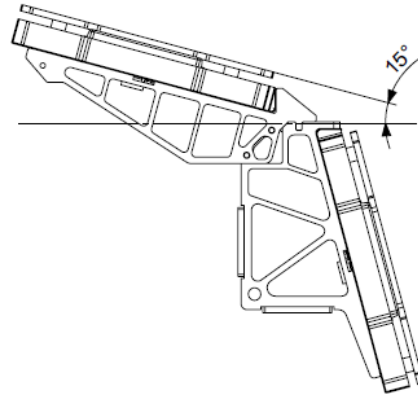
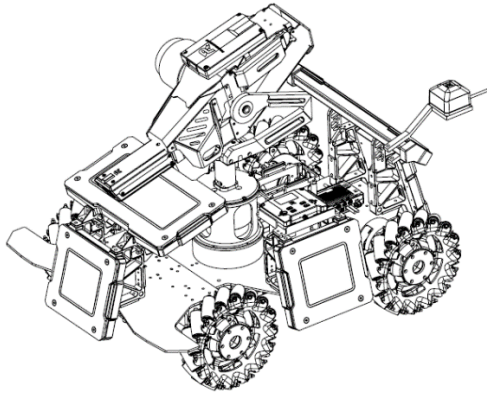


4 . The front 145° of at least 3 side armor modules of Engineers should not be blocked. The impact surface of at most one armor module is allowed a blocking restriction of only within 150 mm. The shaded part of the figure below cannot be blocked.

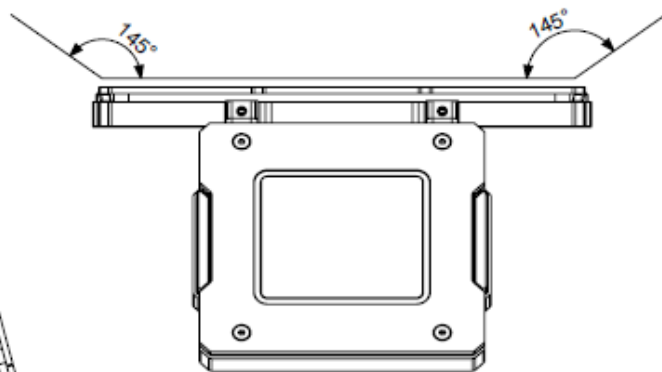
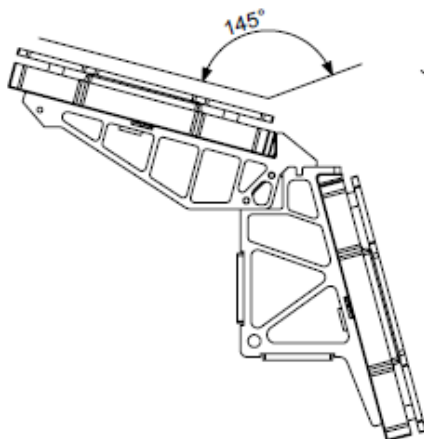
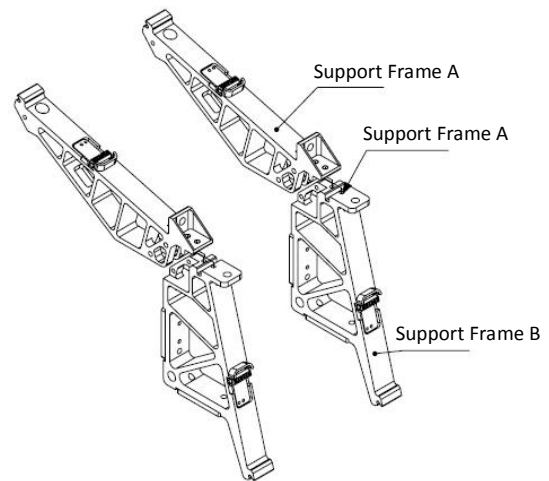
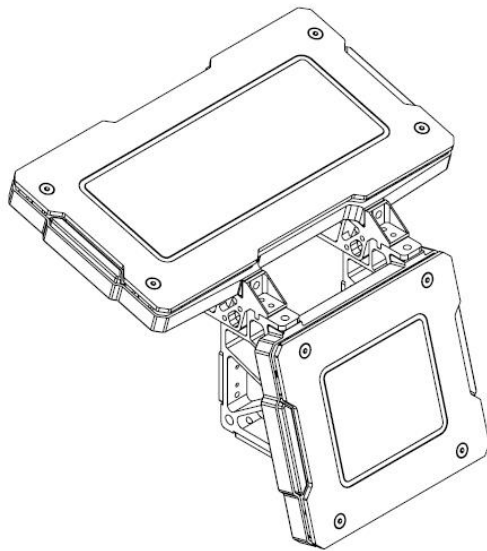


Top Armor of Standards and Heroes:

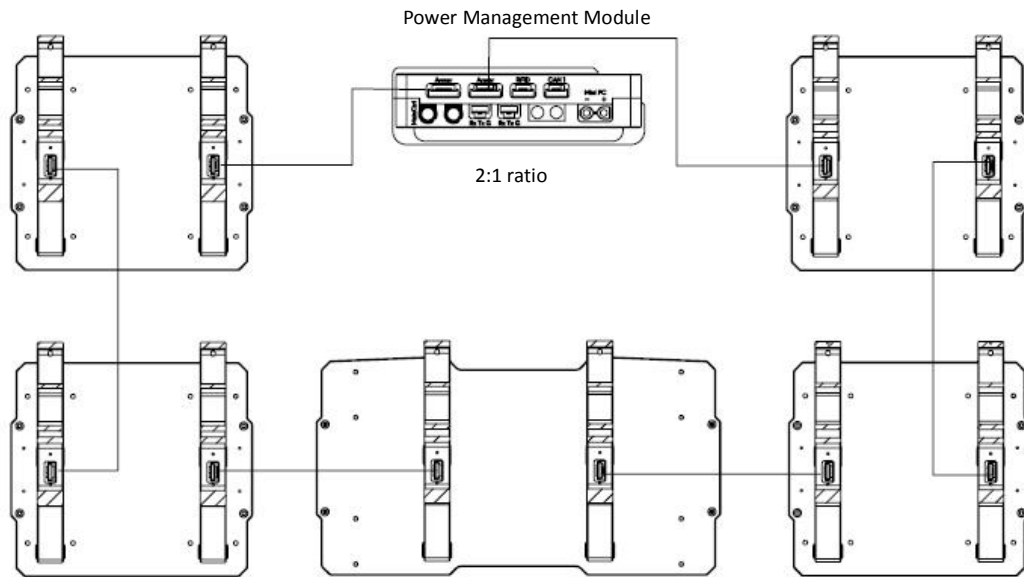
Both Standards and Heroes must be installed with a top armor module, specifically a large armor module. During installation, the top armor support frame is coupled to the forward armor support frame of the launching mechanism, and the armor impact surface forms an angle of 15° with the horizontal plane. The length and width of the rectangular area where the top armor of the Standard is blocked should not exceed 110 mm x 63 mm at any time, that is, it is limited to the blocking caused by the superimposed rectangular projection area of the Speed Monitor Module (17 mm Projectile) and the Video Transmission Module (Transmitter). The area of the Hero's top armor impact surface that is blocked at any time is no more than 120 mm x 74 mm, that is, it is limited to the blocking caused by superimposing the rectangular projection area of the Speed Monitor Module (42 mm Projectile) and the Video Transmission Module (Transmitter).



For the installation of the top armor module, two M4 screws and four M3 screws are required to connect Support Frame A with Support Frame B, and there must be no obstructions within 145° in at least three directions of the top armor module.



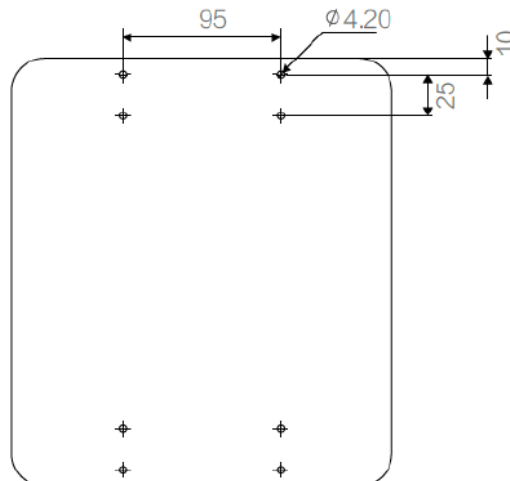
5. Use the 6-pin cable provided in the package to connect the armor modules in series to the armor module interface of the power management module. The two 6-pin interfaces of the armor support frame are equivalent interfaces. It is recommended to divide the number of series armor modules on the two 6-pin interfaces in the power management module to evenly divide the current of the interface when connecting.



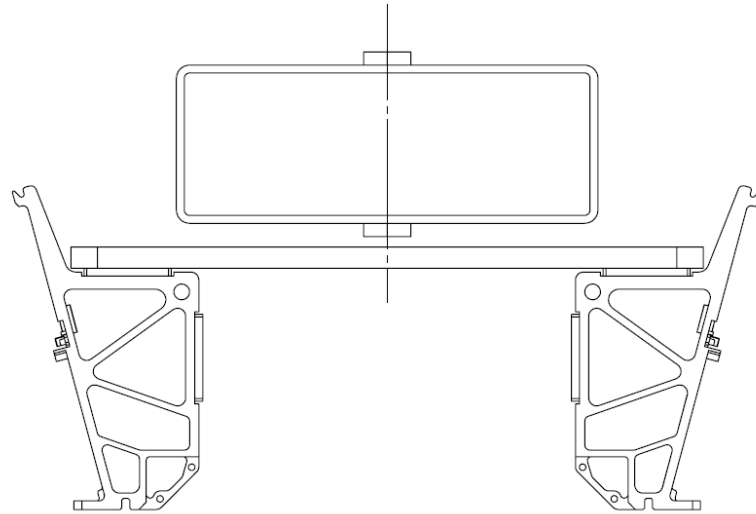
- The lower edge of the Standard's side armor module must be between 60 mm and 150 mm above the ground.
- The lower edge of the Engineer's side armor module must be between 60 mm and 400 mm above the ground. The height difference between the lower edge of any two armor modules in the Z-axis direction should not exceed 100 mm.
- The lower edge of the Hero's side armor module must be between 60 mm and 200 mm above the ground. The height difference between the lower edge of any two armor modules in the Z-axis direction should not exceed 100 mm.

Sentry:

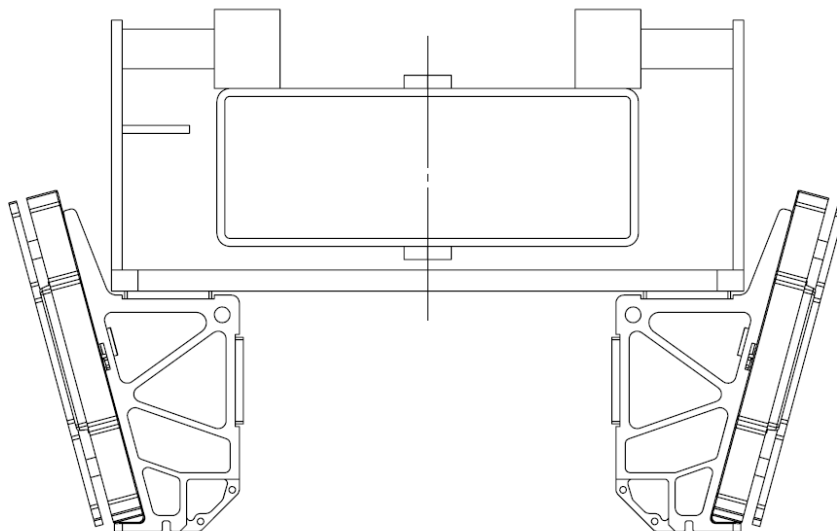
1. Using the dimensions shown in the figure below as a reference, reserve mounting holes on the chassis. Keep the sizes and the positions of the four mounting holes consistent.



2. Use M4 screws to secure Support Frame B to the chassis. Note that the threaded hole is on the bottom.



3. Install the large armor module to the support frame and fix it with M4 screws. Note that the threaded hole on the top of the armor support frame is not perpendicular to the bottom surface of the support frame. When the support frame is properly installed, the bottom threaded hole is perpendicular to the horizontal plane. The front 145° of the armor module's impact surface should not be blocked.

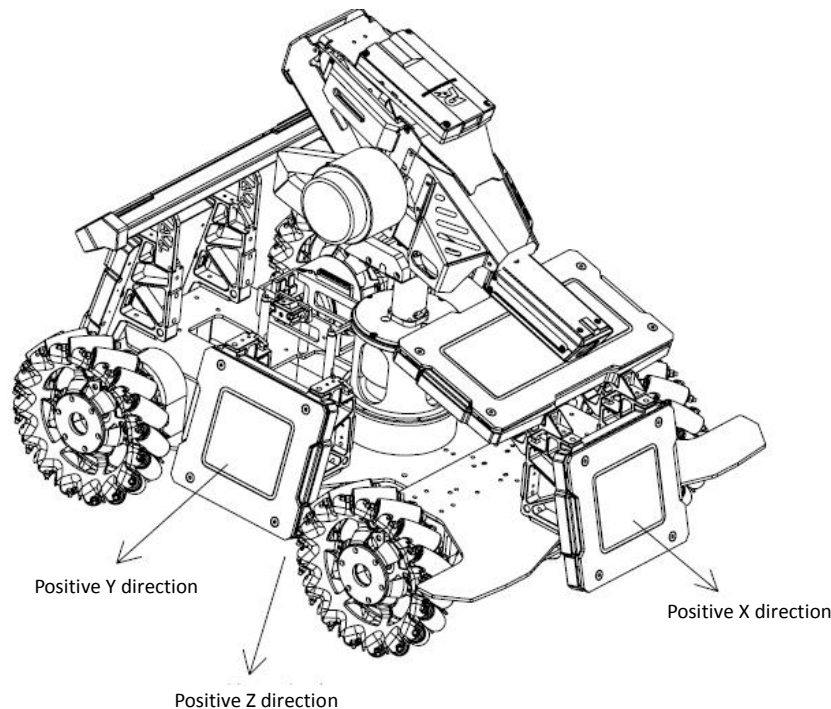


- The maximum size of Sentries below the upper surface of the Sentry Rail should be no more than 450 mm (this size limit applies to the robot at any time). When the Sentry is mounted onto the linear section of the Sentry Rail, the long edge of its large armor module should be parallel to the linear section of the Sentry Rail; the upper edge of the armor module falls into the range of ± 100 mm on the plane where the top surface of

the Sentry Rail is located. The impact surface of the armor module is at an angle of 75° to the horizontal plane of the battlefield ground, and the normal line of the armor module's impact surface points towards the battlefield ground.

Installation Specifications and Requirements

In the following section, the robot body coordinate system is a standard X, Y, Z Cartesian coordinate system, and the coordinate origin is the robot's center of mass, as shown in the following figure:



The kinematics equation of the robot should be based on the Cartesian coordinate system. If the participating robot establishes a kinematic model using a non-Cartesian coordinate system, the body coordinate system is defined as the following: The direction vector of a projectile launched by the robot's largest caliber launching mechanism in its initial state projected onto the XY plane is the X-axis. Based on the X axis and the Z axis that points towards the center of the earth, the Y axis is generated according to the right hand rule, and the origin is the robot's center of mass.

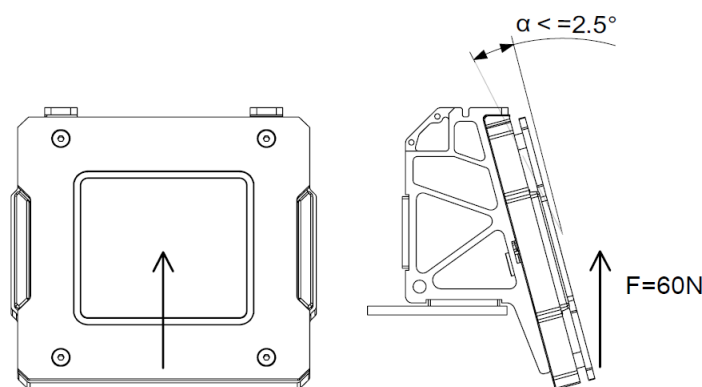
Installation on the Sides

When an armor module is mounted on the side, its impact surface must be firmly connected to the support frame. The bottom connecting surface of the armor module support frame must be parallel to the XY plane, so that the acute angle between the normal vector of the plane on which the force-bearing surface of the armor module lies and the straight line in the negative direction of the Z-axis is 75° . The two sides of the armor module without the

indicator light should be parallel to the XY plane. Define the projection of the normal vector of the plane (forming an acute angle with the negative Z-axis) of the mounted armor module on the XY plane as the mounted armor module's direction vector. The unit vectors of the direction vectors of the four armor modules must be equal to the positive X-axis, the negative X-axis, the positive Y-axis, and the negative Y-axis of the robot body coordinate system (the angular error between the direction vector and the corresponding coordinate axis vector cannot exceed 5°). The kinematics equations of the robot should also be based on the Cartesian coordinate system in this case. Armor modules must use the same reference coordinate system as the robot's own structural or kinematic characteristics. The geometric center point line of the armor module mounted on the X-axis and the geometric center point line of the armor module mounted on the Y-axis should be perpendicular to each other, and the lines should pass through the geometric center of the robot. The armor modules mounted on the X- and Y-axes are allowed to deviate from the geometric center by ± 50 mm.

Rigid Connections of Armor Modules

After the armor module is installed, it must be rigidly connected to the chassis. The armor module and the chassis must not move relative to each other during the competition. The rigid connection of the armor module is defined as shown in the figure below. A vertical upward force of 60N is applied to the midpoint of the lower edge of the armor module. Angle α of the armor module's impact surface must not change by more than 2.5° .



Robot Transformation

In principle, after the competition starts, any armor module should not actively move relative to the robot body's center of mass. If a robot's shape is transformable due to its structural design, the requirements for the armor module are as follows:

1. At no time can any armor module move continuously and reciprocally with respect to the robot's center of mass as a whole, and the short-term movement speed should not exceed 0.5 m/s.

2. For Engineers, the height of the lower edge of the side armor before and after transformation must be within the range of 60 mm - 400 mm.
3. For Heroes, the height of the lower edge of the side armor module must be within the range of 60 mm – 200 mm before and after transformation, and the relative position between the geometric center point of the four side armor modules and the horizontal plane of the center axis of the barrel of any launching mechanism when it is horizontal cannot be changed during the competition.
4. For Sentries, the upper edge of any armor module before and after transformation must be at a height of 100 mm above and below the plane of the upper surface of the Sentry Rail. The height of the armor plate relative to the rail plane should not be changed; horizontal movement relative to the structure used to mount the robot to the rail is also not allowed.



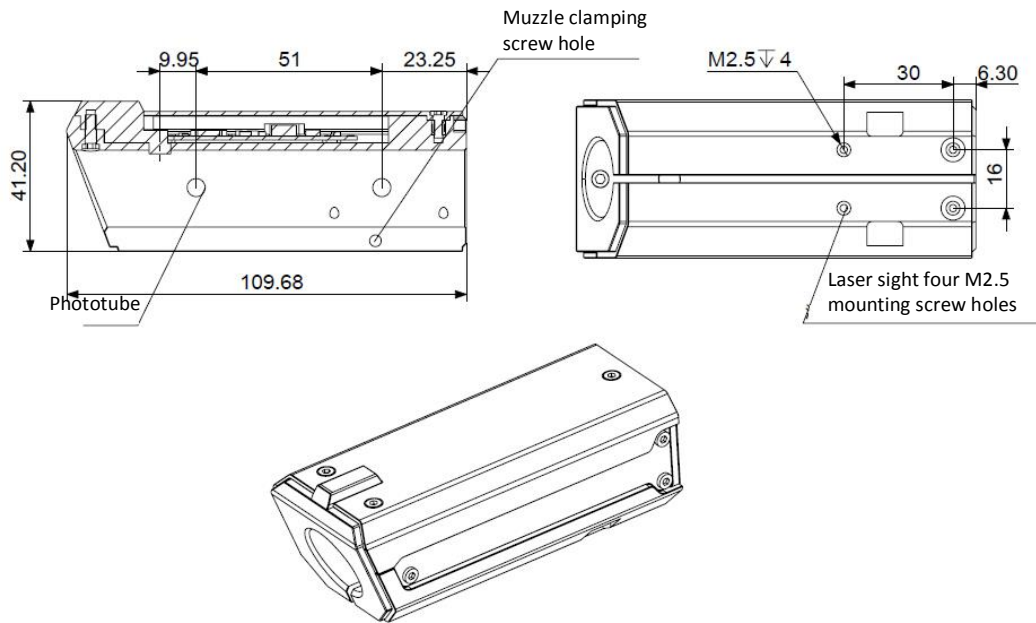
-
- Custom protective cases must not have any contact with the armor modules provided by the RoboMaster 2019 Organizing Committee.
 - Do not modify or decorate the armor modules provided by the RoboMaster 2019 Organizing Committee.
 - Wire the robot reasonably based on its design and ensure that the wires are connected securely to prevent damage and wear.
-

Speed Monitor Modules

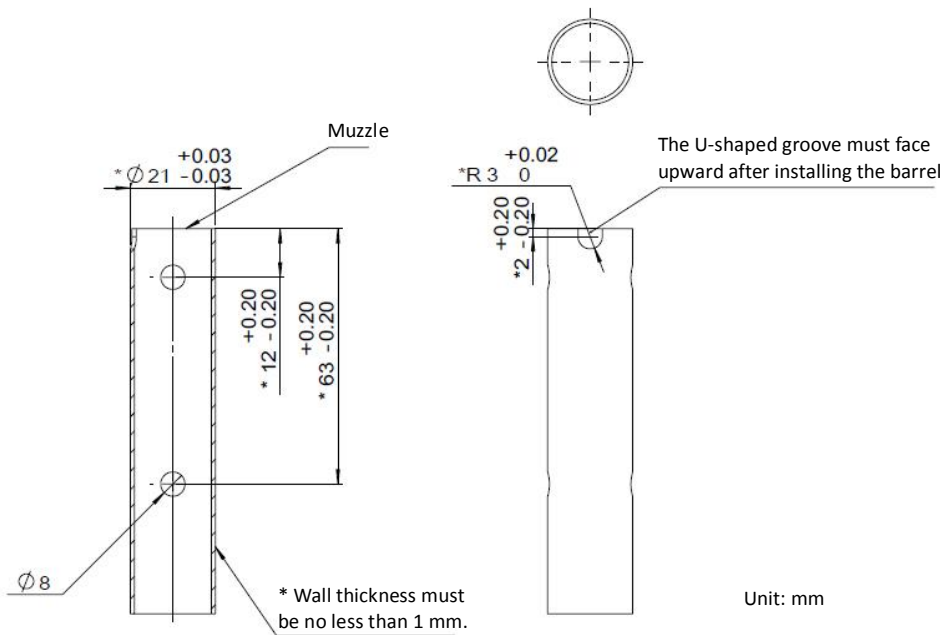
Installation Procedure

There are two versions of the Speed Monitor Module: 17 mm and 42 mm.

17 mm Speed Monitor Module:



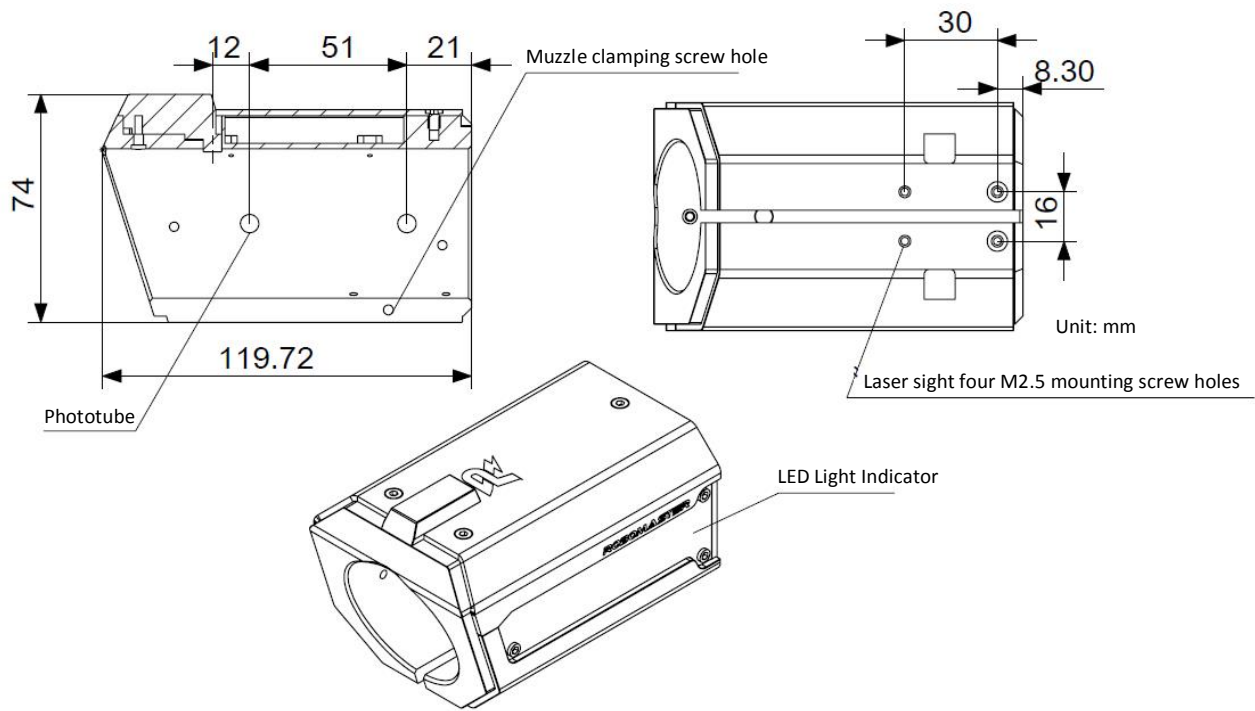
17 mm barrel size restrictions:



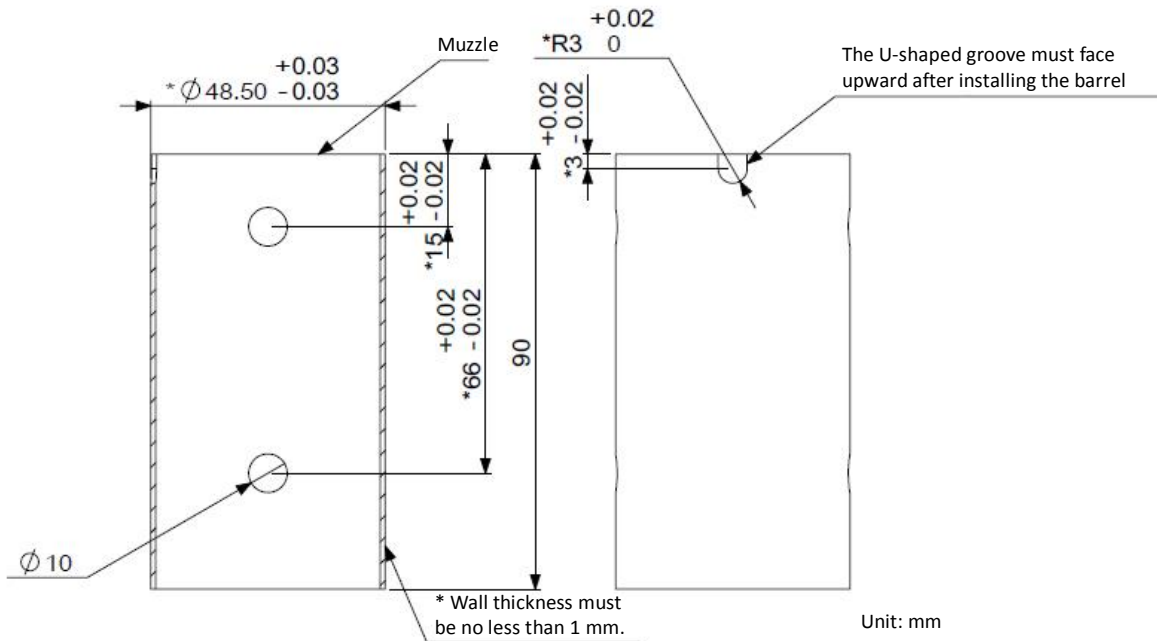
17 mm barrel requirements:

1. The barrel length must be greater than 90 mm.
2. Pay special attention to maintaining dimensions marked with the * sign.
3. Ensure that the phototubes are not blocked.
4. The use of transparent materials and luminescent materials is prohibited.

42mm Speed Monitor Module:



42mm barrel size restrictions:

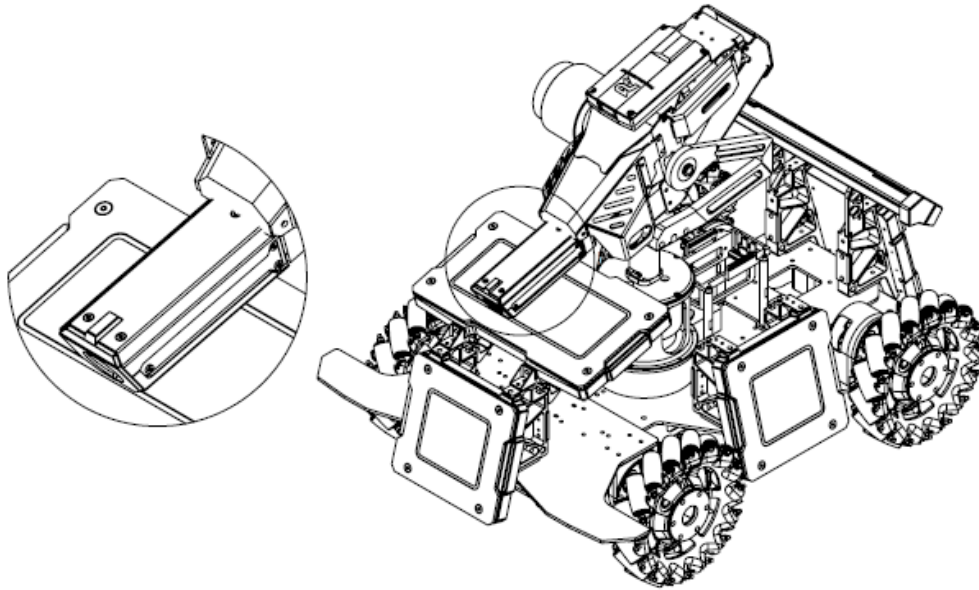


42mm barrel requirements:

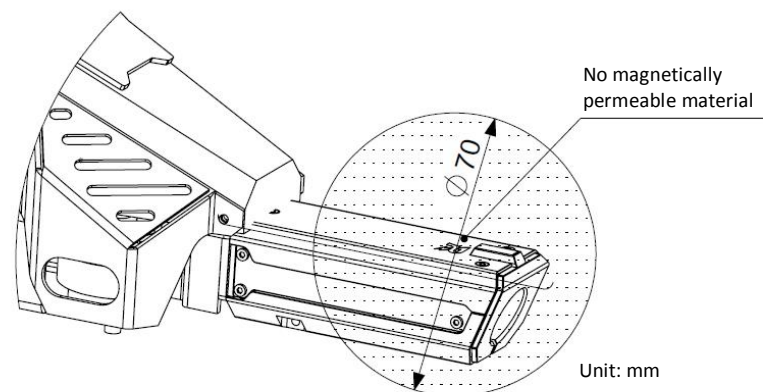
1. The barrel length must be greater than 90 mm.
2. Pay special attention to maintaining dimensions marked with the * sign.
3. Ensure that the phototubes are not blocked.
4. The use of transparent materials and luminescent materials is prohibited.

Installation Steps (the 17mm speed monitor module is used as an example):

1. Place the speed monitor module on the barrel so that the cylindrical step is aligned with the U-shaped groove of the barrel, and the connecting end faces the Main Control Module.
2. Use M3 screws through the screw holes in the rear of the speed monitor module to clamp the barrel.
3. Connect the speed monitor module to the aviation connector on the main control panel's speed monitor interface. The completed installation is shown in the figure below:



4. The speed monitor module contains a magnetometer, which is sensitive to the electromagnetic environment. Therefore, no large-area magnetic conductive material (such as iron barrels, heat transfer fans, friction wheel motors, etc.) should be placed within an area measuring 70 mm in diameter with the logo at the center.



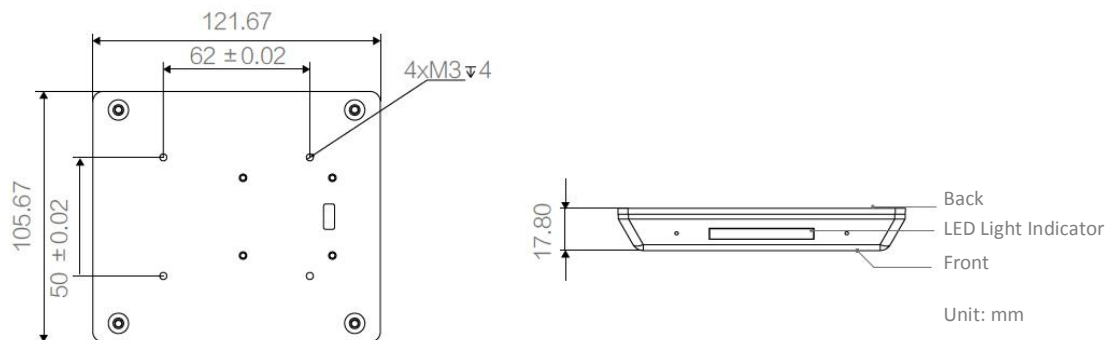
- Four M2.5 threaded holes are provided for installation of RM laser sights or custom laser sights.

- Do not look directly at the laser without eye protection. Safety goggles are recommended during operation.
- Do not block the mounting holes for the infrared LEDs. Otherwise, the speed monitor module will be unable to initialize.
- Note that the speed monitor module should be firmly secured to ensure that it and the barrel do not move relative to each other during movement of the robot.
- The aviation connector cable of the speed monitor module is close to the friction wheel, and the cable should be protected from wear when used.

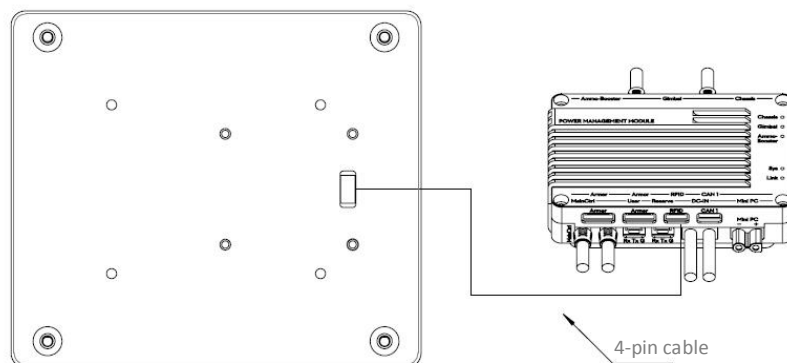
RFID Interaction Module

Installation Procedure

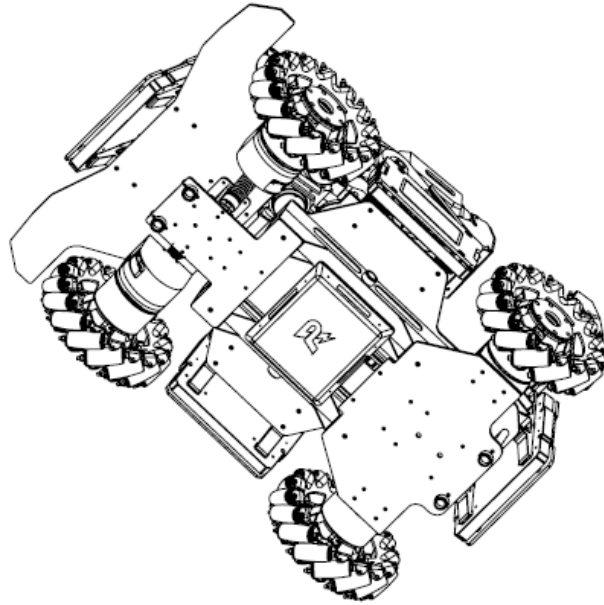
1. Refer to the RFID Interaction Module structure size and installation interface to reserve mounting holes in the chassis.



2. Connect the Referee System RFID Interaction Module to the RFID interface on the power management module using the 4-pin cable provided in the package.

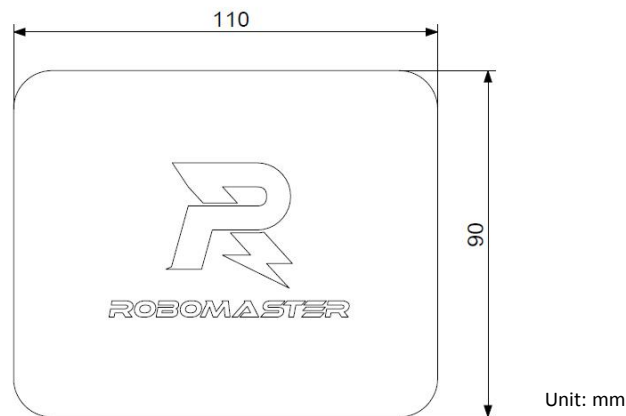


3. Use M3 screws to secure the Referee System RFID Interaction Module to the chassis. Do not press the cable during installation, and ensure to keep the module at an appropriate distance from the ground.



4. RFID Interaction Module Card

The RFID Interaction Module Card is a function card of the Battlefield Elements and is buried in corresponding locations on the battlefield. During the competition, the robot will obtain the corresponding gains after detecting the RFID Interaction Module Card through its installed RFID Interaction Module. The dimensions of the RFID Interaction Module Card are as follows:

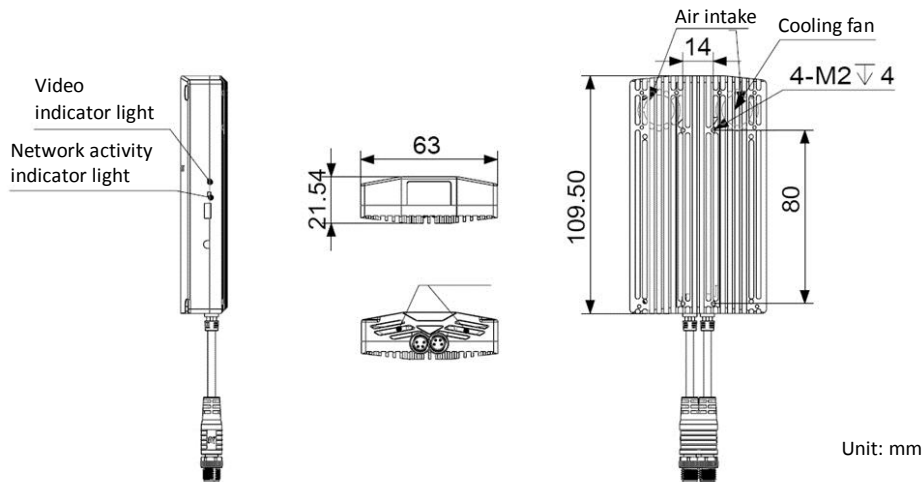


- Ensure that the logo side of the RFID Interaction Module is not blocked by any metal objects, and that the side without a logo is free of current interference (such as a motor cable or RM center plate). The effective detection distance of the RFID Interaction Module is 100 mm ($\pm 5\%$). The actual detection distance after installation is subject to testing. If the effective detection distance is decreases, please check whether the module is installed properly.

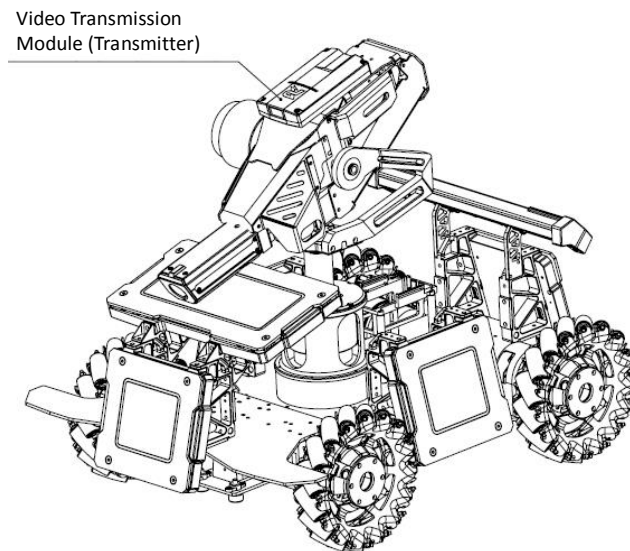
Video Transmission Module

Installation of the Transmitter

1. Refer to the transmitter structure size and installation interface to reserve mounting holes in the desired positions.



2. Secure the transmitter to the appropriate position with four M2 screws. The installation position cannot block the air inlet and outlet of the transmitter. The transmitter antenna is at the top of the module, so there must be no metal shielding at the top. Failure to install the transmitter as required will result in abnormal operation.

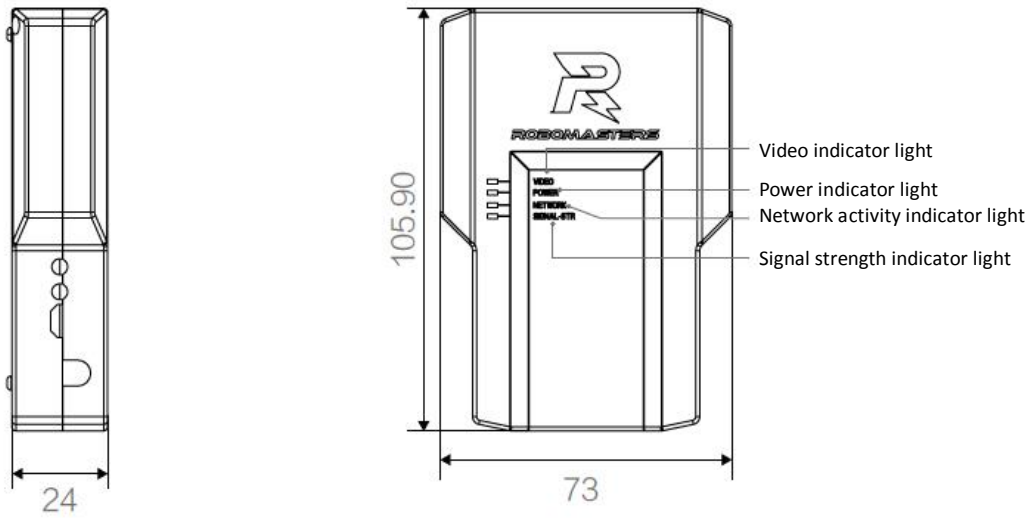


3. Connect the aviation connector plug on the transmitter to the aviation connector plug of the video transmission interface on the power management module.

Installation of the VTM Receiver

The receiver of the VTM Receiver can be fixed using the mounting clip that is provided. The transmitter can be fixed on a display or other structure and must be no less than 1 m from the

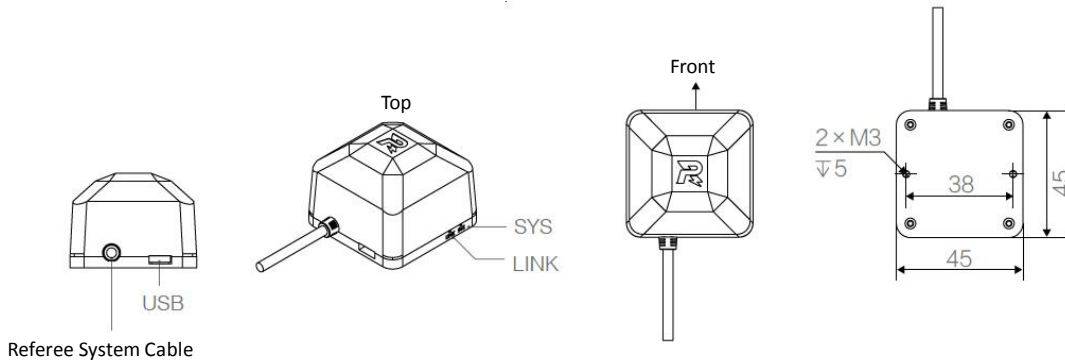
ground with no metal shielding. The suitability of the installation position can be checked by confirming the quality of the received image. The VTM Receiver is shown in the figure below:



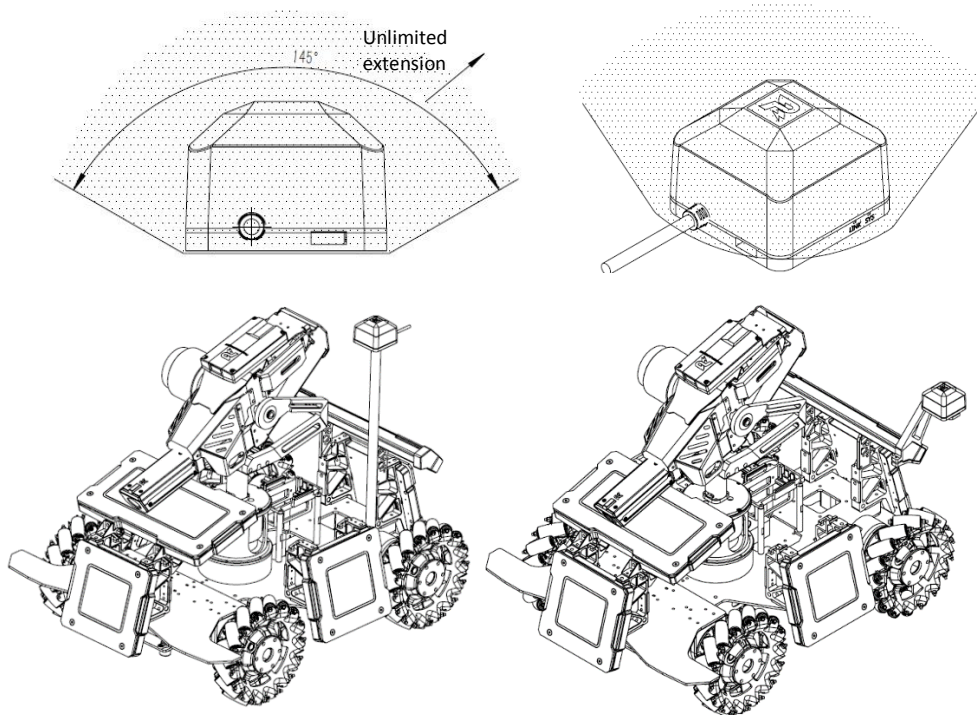
Locating System Module

Installation Procedure

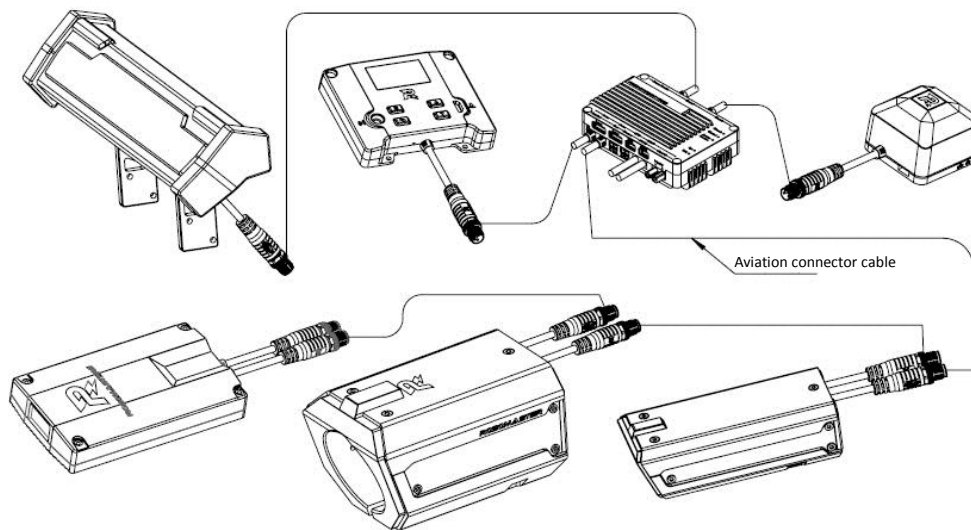
1. Refer to the size of the Locating System Module to reserve the mounting holes in the specified positions.



2. Secure the Locating System Module to the specified positions with two M3 screws. The front of the Locating System Module must be in line with the front of the robot, horizontally installed with the top facing up. The area within 145° above the Locating System Module must not be blocked, as shown below:



- Use the aviation connector cable inside the package to connect the Locating System Module to the aviation connector head with the white metal ring on the Power Management Module.



- The Light Indicator module, VTM transmitter, speed monitor module, and locating system module's aviation connector plug are all equivalent interfaces, and can be serially connected to each other.
- The locating base station is fixed at the top of the four surrounding columns of the site. During the movement of the robot, it is necessary to ensure that there is no metal shielding along the straight line between the Locating System Module and each base

station. It is recommended to install the Locating System Module at the highest point on the robot.

- It is recommended to maintain a distance of greater than 20 cm between the installation position of the motor, Video Transmission Module, magnetic components or components that generate strong magnetic fields during operation, and the minimum distance should be no less than 10 cm.
 - The Locating System Module of the Sentry is not included in the overall dimension limitations.
-

Battlefield Geo-Fence

Purpose

Preventing robots not involved in the competition from connecting with the game system, which will interfere with the normal operation of the competition.

Introduction to the Operating Principle

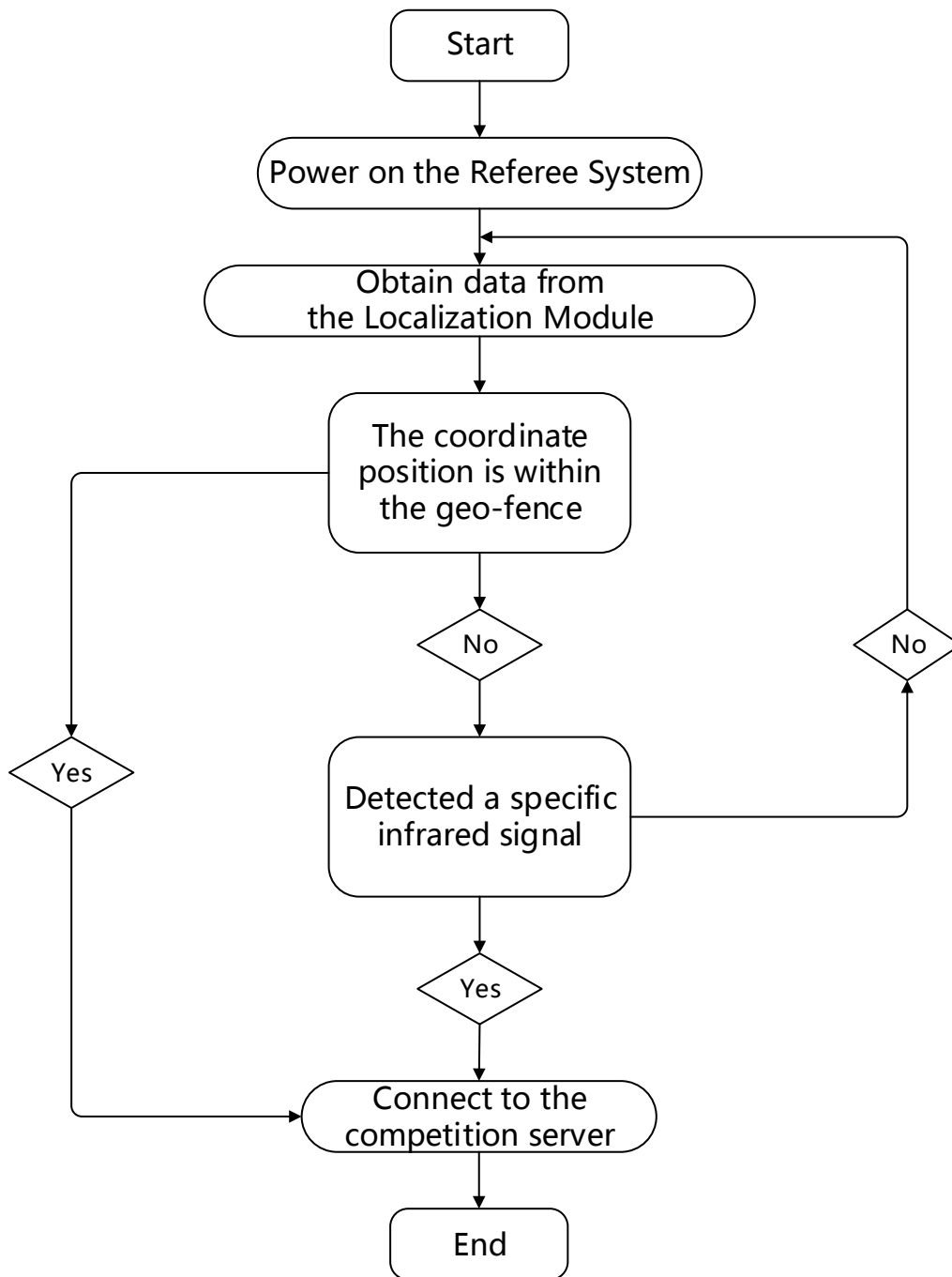
The geo-fence defines the battlefield. A robot can be connected to the competition server only within the geo-fence. Both the Locating System Module and the main control module of the Referee System are used to check whether a robot works within the geo-fence.

1. Locating System Module identification of the geo-fence zone

According to the description of Locating System Module in the "Referee System Installation" section, the Locating System Module installed on the robot can calculate the position of the robot relative to the battlefield by communicating with the Locating System Module base station installed around the battlefield. This location information can be a basis for accurately judging whether the robot is located inside or outside the geo-fence. If it is located inside the geo-fence, the Referee System mounted to the robot will automatically connect to the competition server. Note that the Locating System Module should only be installed in strict accordance with the installation instructions to ensure the accuracy when calculating the location relative to a robot.

2. Main control module identification of the geo-fence area

For this function, the infrared receiver on the main control module can receive the specifically encoded infrared signal, and the main control module will automatically access the competition server after receiving the signal. This method can be used only before the competition, within the three-minute preparation phase or the 20-second Referee System Initialization Period preceding the competition. During this period, if the robot in the battlefield cannot connect to the competition server, the staff will use a custom remote control to help the robot access the competition server. The following chart shows the workflow of how the Referee System uses the geo-fence feature to connect to the competition server:



- The geo-fence relies on the Locating System Module. If the Locating System Module is installed correctly, during the competition, when the robot unexpectedly loses power and restarts, the robot can re-access the competition system within 20 seconds to continue the match. If the Locating System Module is not installed correctly, during the competition, when the robot unexpectedly loses power and restarts, the Locating System Module cannot generate the correct locating information within 20 seconds, which causes the robot to be unable to access the competition system, and the server will immediately deduct the remaining HP of the robot.



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