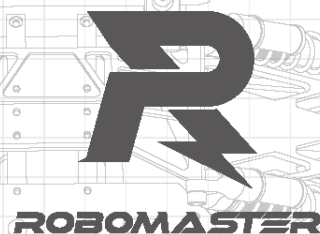


V1.2

Using a 38-46 motor driver chip and Field-Oriented Control (FOC), the RoboMaster G300 Brushless DC Motor Speed Controller enables precise control over motor torque.



Exclusively designed for the RoboMaster G300 750W Brushless DC Motor and G300 Brushless DC Motor Speed Controller, the G300 Accessories Kit includes several cables and a terminal block.

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

Size 18000 Accumulator Kit includes several cables and a terminal block, ensuring a complete accessible connection for the RoboMaster System.

ROBOMASTER2021

UNIVERSITY AI CHALLENGE

RULES MANUAL

Prepared by the RoboMaster Organizing Committee
Updated on April 2021

Statement



The RoboMaster Organizing Committee (hereinafter referred to as the "RMOC") encourages and advocates technological innovations and an open source of technology. We respect the intellectual property of the participating teams. All rights related to the intellectual property developed during the competition are owned by individual teams. The RoboMaster Organizing Committee will not participate in the handling of intellectual property disputes within the team. The participating teams must properly handle all aspects of intellectual property rights among internal school members, company members and other members of the team.

While using the robots, referee system and other competition materials provided by the RoboMaster Organizing Committee, all teams shall respect the ownership of all intellectual property. Teams are also prohibited from engaging in any behavior that violates intellectual property rights, including but not limited to reverse engineering, copying or translation.

Violators of the intellectual property rights of the RMOC or the organizer will be held legally accountable as requested by the owner(s) of the intellectual property.

Using this Manual

Legend

 Prohibitions	 Important notes	 Hints and tips	 Definitions and references
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Release Notes

Date	Version	Changes
2021.04.13	V1.2	<ol style="list-style-type: none"> Updated the battlefield drawings Updated the "Personnel Rules" Added instructions of the debugging area Updated the number of Pit Crew Updated the penalties for intentional collisions and sticking together Added instructions for HP Deduction Updated the scoring method for the Group Stage
2020.12.31	V1.1	<ol style="list-style-type: none"> Modified the height of some obstacles;

		2. Modified the sensor types that can be mounted on Outpost and fixing methods
2020.09.14	V1.0	First release

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Foreword

Robotics is currently one of the most mainstream cutting-edge technologies in the world.

Robots are not only the key supporting equipment for advanced manufacturing, but also an important carrier for improving human lifestyle. Whether it is an industrial robot applied in a manufacturing environment or a service robot applied in a non-manufacturing environment, its R&D and industrial application are important standards for measuring a country's technological innovation and high-end manufacturing development.

Since 2015, DJI has launched the RoboMaster University Championship (RMUC), hoping to cultivate a group of talented engineers and scientists. In this competition, the teams need to develop a group of ground robots and aerial robots to fire projectiles on the battlefield and fight each other. The data interaction of the robots is monitored by a special referee system. The referee system converts damage inflicted by projectiles into dynamic changes in HP, and finally presents it to the audience on a game-like viewing page. The competitive mode of modern robots is constantly evolving.

In recent years, deep learning technology has also been brought up in numerous fields, reshaping the frontiers of computer vision and other areas of artificial intelligence research. In robot research, deep neural network (DNN)-based reinforcement learning enables robots to make decisions autonomously. As well-known games such as Go, Warcraft, and StarCraft are used as research platforms, the potential for the application of robotic autonomous decision-making in our daily life is unlimited.

As an emerging robotics academic platform, RoboMaster Organizing Committee launched the ICRA RoboMaster AI Challenge, which enables global enthusiasts to research deep neural network (DNN)-based robotics. Research results are expected to be applied in industries such as field rescue, driverless vehicles, and automatic logistics to benefit our lives.

1. Introduction

This year, a standard robot platform will be provided by the competition. This standard platform is equipped with standard interfaces for features such as firing projectiles and attack detection. The teams entering the RoboMaster 2021 University AI Challenge (RMUA 2021) will be required to develop their own algorithms and cooperate with the equipped sensors and computing devices to enable robots to make independent decisions, move, and fire. It is not allowed to use unofficial robots. Only robots for RMUA 2020 are permitted for competition.

In the AI Challenge, each team needs to prepare one or two robots to perform fully automatic firing battles with the opposing team on a 5.1 m × 8.1 m competition area. During each round, a robot reduces its opponent's HP by recognizing and firing projectiles to hit the opponent's armor. At the end of each round, the team with the highest total damage output by the robots wins the round.

Due to the COVID-19 pandemic, RMUA 2020 was adjusted to the Online Assessment, so RMUA 2021 will largely follow the rules of RMUA 2020.

2. Competition Area

2.1 Overview



The error margin for the dimensions of all Battlefield Components described in the document is $\pm 5\%$. The dimension parameter unit is mm.

The core competition area of RMUA 2021 is called the “Battlefield”. Battlefield is 8080 millimeters long by 4480 millimeters wide, consisting of Protective Perimeter Wall Zone (A), Obstacle Zone (B), Starting Zone (C), Outpost Zone (D), Obstacle Vision Markers (E), Buff/Debuff Zone (F), etc.

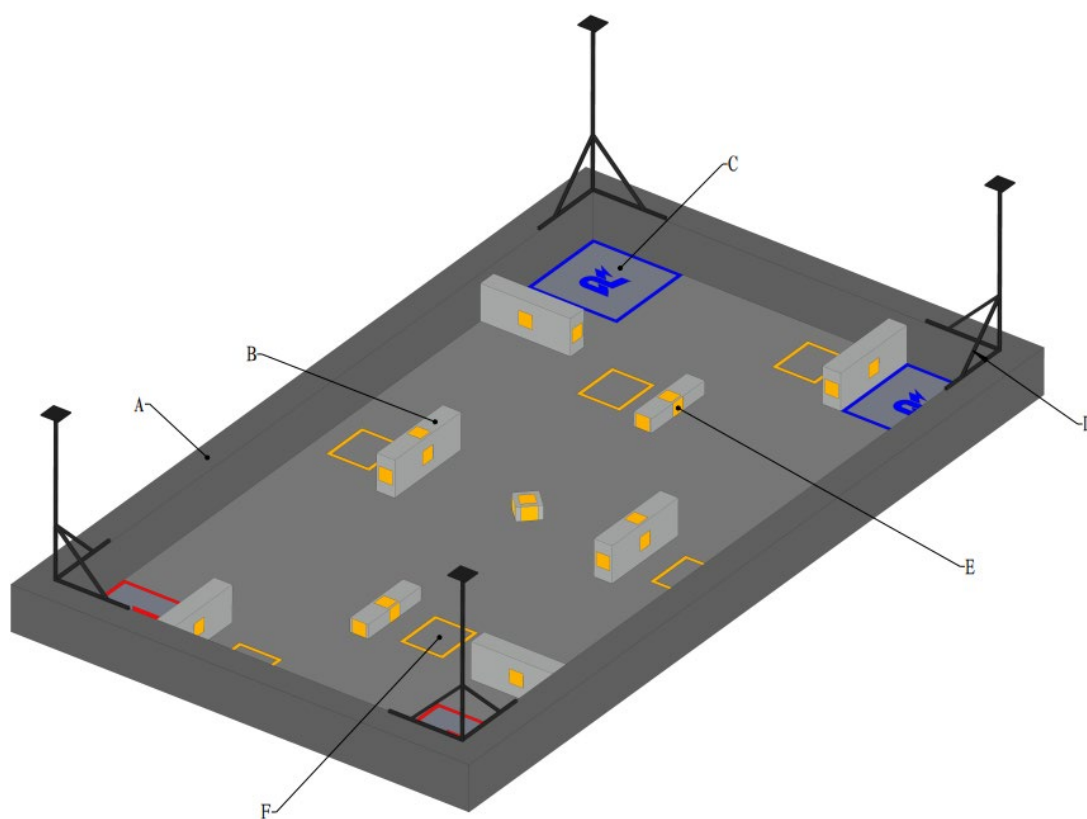


Figure 2-1 Oblique-view of Battlefield

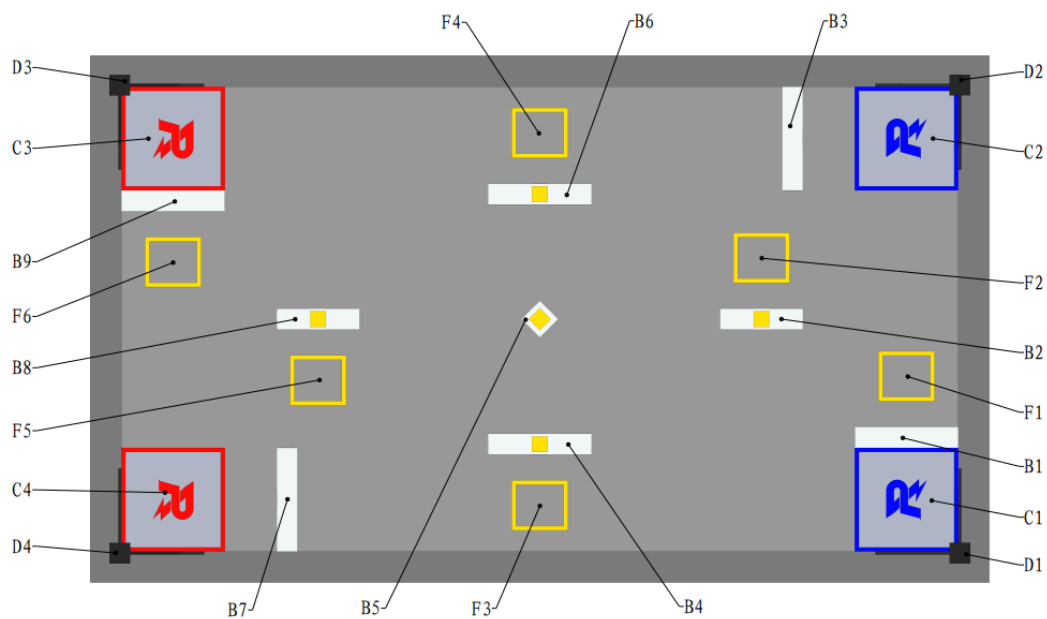


Figure 2-2 Element Number of Battlefield

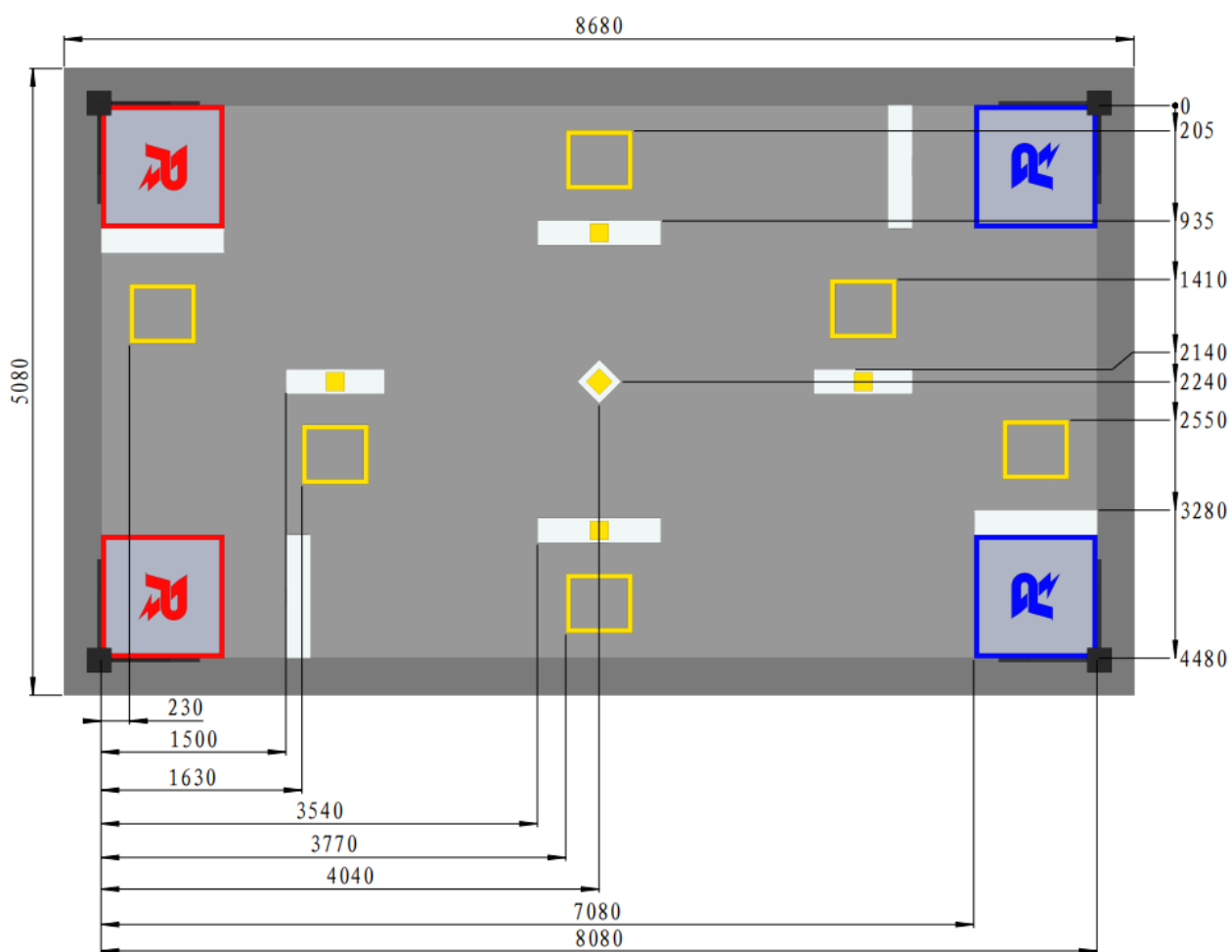


Figure 2-3 Main Dimensions for Battlefield

2.2 Starting Zone

The Starting Zone is where the robots are placed before the competition officially begins. The four Starting Zones from C1 to C4 are arranged in the four corners of the Competition Area. The blue team and the red team will have two Starting Zones of exactly the same size respectively, in each of which only one robot will be allowed. When the team only has one robot, it can be placed on either of its two Starting Zones. The Starting Zone will be marked by a red or blue sticker on the flooring adhesive. The starting zone will be marked by a red or blue sticker on the flooring adhesive.

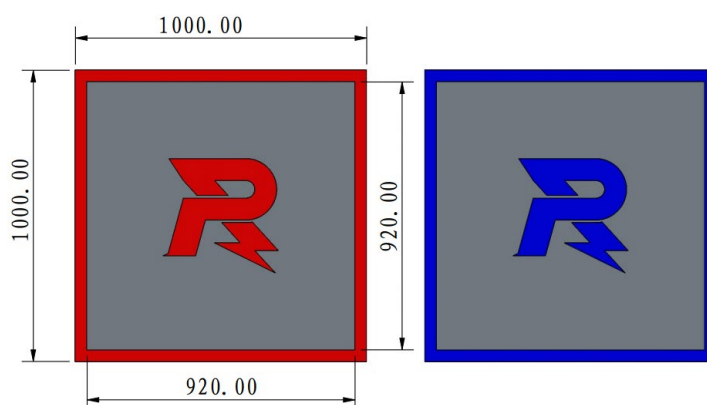


Figure 2-4 Starting Zone

2.3 Buff/Debuff Zones

Six Buff/Debuff Zones numbered 1-6 are located on site. All of them are surrounded by yellow lines and have a square area side length of 540 mm * 480 mm. The three Buff/Debuff Zones numbered F1, F2, and F3 and the three Buff/Debuff Zones numbered F6, F5, and F4 are symmetric with each other from the center.

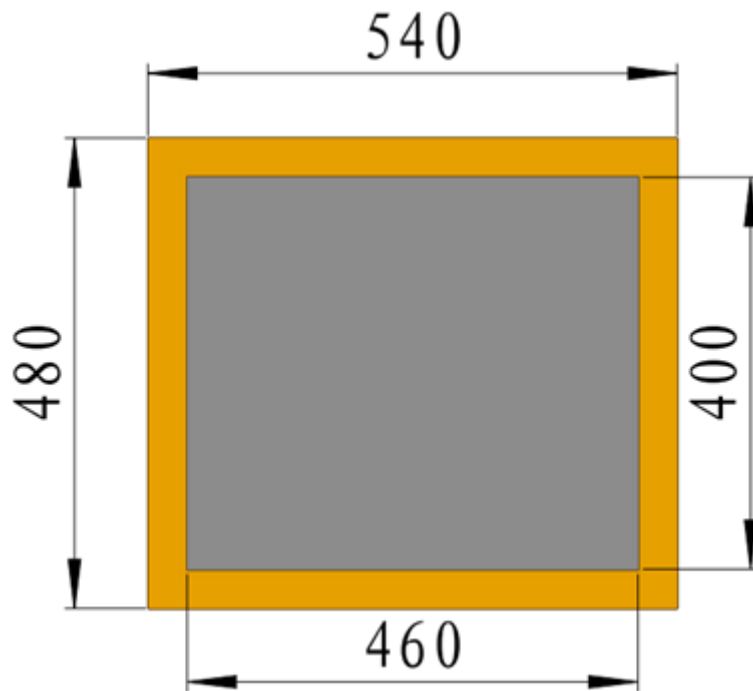


Figure 2-5 Single Buff/Debuff Zone

At the commencement of the Match, one minute after the start of the Match (i.e., 2:00 countdown) and two minutes after the start of the Match (i.e., countdown 1:00), the system will periodically reset the position distribution of the Buff/Debuff zone, and share the position and status information of the current Buff/Debuff zone with the robots which are then on the field through the referee system, and the sharing frequency is 1 Hz. The randomization rule ensures that the locations of the buff zones are symmetrical to the center.

For example: F1 - Red team Restoration Zone; F2 - No Shooting Zone; F3 - Blue team Projectile Supplier Zone; F6 - Blue team Restoration Zone; F5 - No Moving Zone; F4 - Red team Projectile Supplier Zone

Once a Buff/Debuff Zone is activated, the activation state will continue until next scheduled random reset, during which it cannot be activated again. If the debuff time of a certain robot is not over, the robot activates the same Debuff Zone again, then the robot continues to be penalized, with the debuff duration reset to 10 seconds.

For example: 55 seconds after the start of the Match, the No. 1 robot of the Blue Team activates the Debuff Zone forbidding all shooting. One minute after the start of the Match, the system randomly resets the Buff/Debuff Zone. At this time, the robot activates the Debuff Zone where there's no shooting, and the robot's no shooting penalty duration is reset to 10 seconds.

2.3.1 Buff Zones

The buff zone includes Restoration Zone and a Projectile Supplier Zone. Both Red and Blue Teams have a buff zone. This zone is activated by any robot passing through the buff zone. Buff only depends on the team the activated zone belongs to, and not related to the robot that active the zone.

For example: No.1 robot of the Red Team passes through and activates the Blue team Restoration Zone, both robots of the Blue Team receive the Buff of restoring 200 HP

- Blood return zone: 200 points of blood
- Projectile Supplier Zone: 100 rounds of Projectiles



The HP of a destroyed robot cannot be restored through activating the Restoration Zone.

2.3.2 Debuff Zones

The debuff zones include a no shooting zone and a no moving zone. The activation of the zone is achieved by the passage of any robot through the debuff zone. When a robot activates any debuff zone, the robot will receive corresponding debuff.

- No shooting zone: Robots cannot shoot for a duration of 10 seconds
- No moving zone: Robots cannot move for a duration of 10 seconds

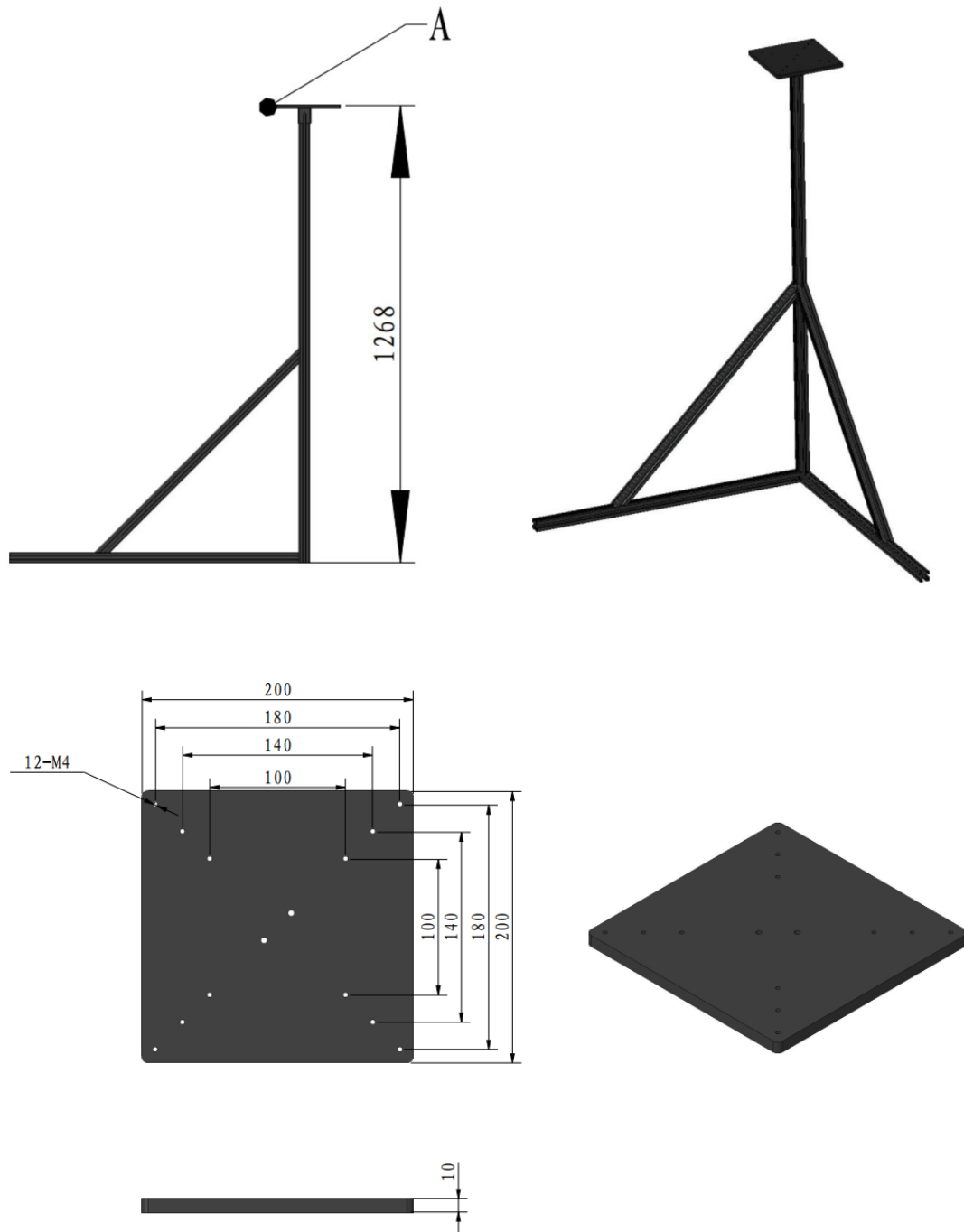
2.4 Outpost Zones

The four rooftops of the site from D1 to D4 are the Outpost Zones. Both the red and blue sides have two diagonally facing Outpost zones. The Outpost Zone provides an Outpost Perception System interface where the teams can mount an Outpost Perception System. D2 and D4 are Outpost Zones of the Red Team, D1 and D3 are Outpost Zones of the Blue Team. The Outpost Perception System is mounted 1786 millimeters high from the ground.

The Outpost Perception System should be mounted on a 200mm x 200mm platform, where 12 M4 threaded screws (excluding the two center threaded screws) along the diagonal lines are provided for fastening the Outpost Perception System.

The Outpost Perception System can include industrial cameras, LiDAR, depth cameras and other sensors, small onboard computing equipment, and fixing structural parts. Driving mechanisms are not allowed. It can be connected to the computing platforms of the red and blue operating areas through cables.

The entire Outpost Perception System needs to be fixed on the support frame (the participating teams shall design the fixing parts by themselves) for quick installation and disassembly during the preparation phase and the end of the competition. The overall system size must not exceed 200mm in length, 200mm in width, and 200mm in height, and its weight must not exceed 5kg.



A

A Adapter Panel

Figure 2-6 Dimensions of the support frame

The RMOC provides USB 3.0 extension cables and RJ45 network cable to the Red and Blue Teams' operating zones, connecting the computing platforms of the Red and Blue Teams. Other equipment such as routers, switches, camera power supply, etc. need to be provided by the participating teams themselves. Below the Outpost zone, there will be a local-sized power supply socket for the participating teams.

2.5 Obstacle Zone

There are 9 different size, non-movable wooden obstacle blocks numbered 1-9 in the obstacle zone. During the Match, both the Red and Blue Teams' robots should make every effort to avoid collisions with obstacles. See [R38](#) for relevant penalty mechanism for runaway collisions.

The specific dimensions of a single obstacle block are:

- Obstacle Blocks numbered B1, B3, B4, B6, B7, B9: Length * width * height = 1,000 * 200 * 400
- Obstacle Blocks numbered B2, B8: Length * width * height = 800 * 200 * 150
- Obstacle Block numbered B5: Length * width * height = 250 * 250 * 150

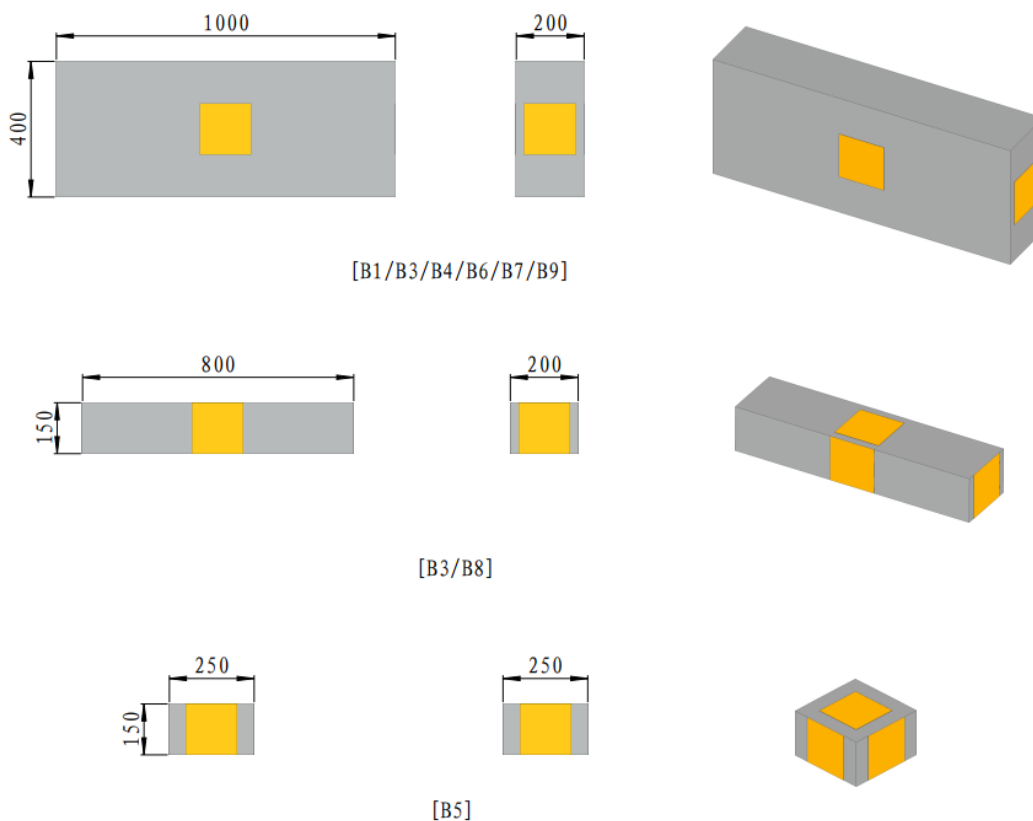


Figure 2-7 Dimensions of the Obstacle Block

To facilitate the positioning and localization of the Outpost camera, the exposed surfaces around all

obstacle blocks are affixed with visual tags to assist robot positioning, and the upper surfaces of the obstacle blocks numbered 2, 4, 5, 6, and 8 are additionally labeled with visual tags. The Vision Marker is located at the geometric center of the surface of the obstacle block. It is a yellow square marker with a side length of 150 millimeters. The patterns are different and are randomly selected from the “RoboMaster 2021 University AI Challenge Vision Marker Library”. Color code for vision marker is: RGB: R255 G179 B0; CMYK: C0 M30 Y100 K0; HEX: FFB300.

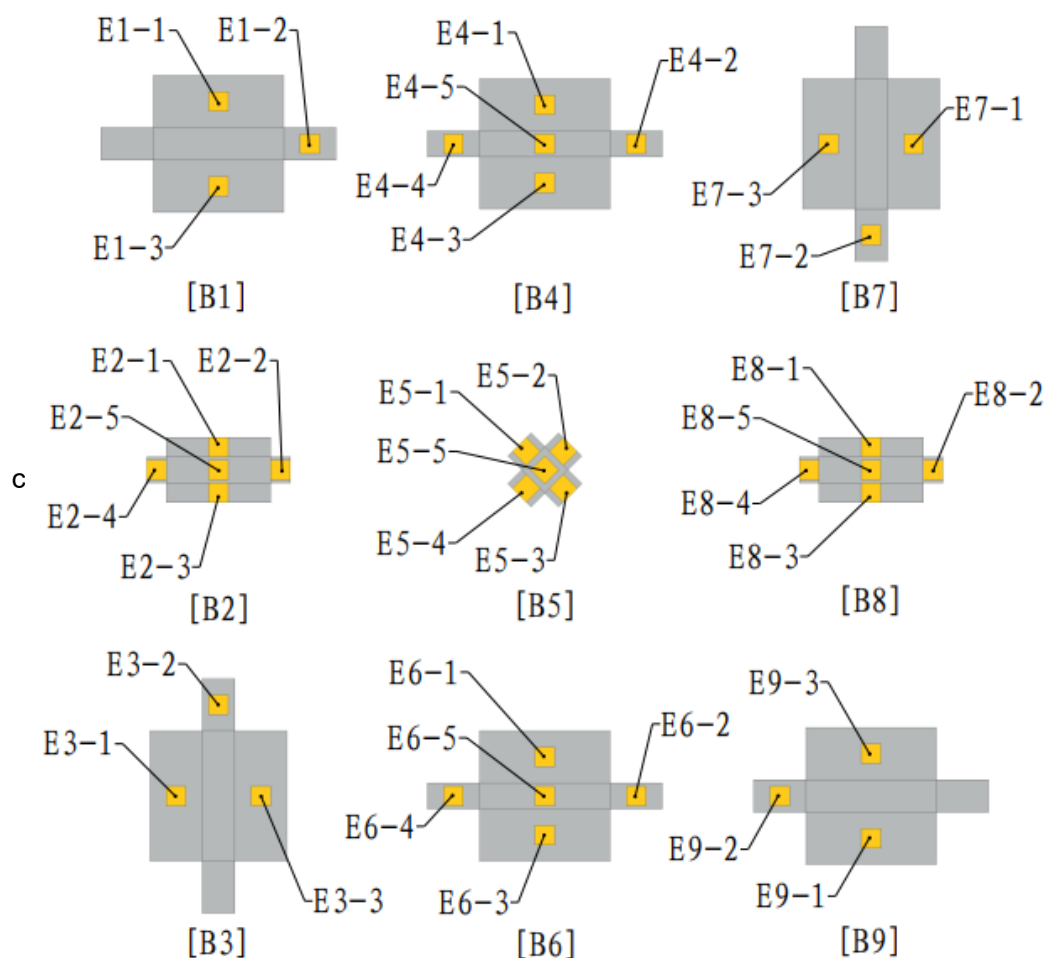


Figure 2-8 Diagram of Visual Tags

2.6 Protective Perimeter Wall Zone

A protective perimeter wall is set up around the Battlefield. Robots from both the red and blue teams should avoid colliding with the wall. See [R38](#) for relevant penalty mechanism for runaway collisions.



Figure 2-9 Dimensions for Protective Perimeter Wall Zone

2.7 Operation Area

The Operator Areas for both teams are located in the fixed areas on the same side outside the Competition Area.

2.8 Projectiles

Projectile is the only acceptable component to attack robots. Robots must use projectiles to hit the Armor Modules of the enemy robots, causing damage to their HP and defeat them. The parameters and scenarios of use for projectiles in the competition are as follows:

Table 2-1 Projectile Parameters and Scenarios of Use

Type	Version	Appearance	Color	Size	Weight	Shore Hardness	Material
17mm projectile	2019	Spherical	Yellow-green	16.8 mm \pm 0.2 mm	3.2 g \pm 0.1 g	90 A	Plastic (TPU)

3. Technical Specification and Shared Information

Rules with a serial number R# are rules that must be adhered to by participating teams, team members and robots.

3.1 General Technical Specifications

3.1.1 Energy Source



During the competition, if a battery becomes a safety hazard, the site technician will put the hazardous battery into the explosion-proof box and will not return it to the participating team until the safety hazard is eliminated.

R1 Robots can be powered only by electricity.

R2 Only lithium batteries (TB47D, TB48D) with power management and short circuit protection functions produced by SZ DJI Technology Co., Ltd. can be used.

3.1.2 Wireless Equipment

R3 The remote controller must be products produced by SZ DJI Technology Co., Ltd..

3.1.3 Optical Equipment

R4 It is forbidden to install any laser or device that emits visible light on robots.

3.1.4 Vision Feature

The armor module of the referee system is designed with clear lighting effects for the development of automatic identification and sighting algorithms. The environment in and around the Competition Area is relatively complex. The RMOC cannot guarantee that the Computer Vision features of the Battlefield will not cause visual interference. The Computer Vision algorithm should adapt to the changes of the lighting of the venue and other possible interferences around the venue.

The following specifications must be followed when designing a robot's computer vision features:

R5 Robotic sensors (such as LiDARs, cameras, ultrasonic sensors, etc.) should not be installed to obstruct the armor module.

- R6 Do not project light onto an Armor Module and do not mount any structure or device that interferes with Computer Vision feature recognition of the Armor Module by reflecting or refracting light on both sides of the Armor Module on the robot.

3.1.5 UWB Locating System

- R7 UWB Locating System is no longer set up in the Competition Area, and teams are not be allowed to use UWB locating devices.

3.1.6 Robot Numbering

During the pre-match inspection and the match, the RMOC staff will paste number armor stickers on robots that are to play. For number stickers, please refer to “Appendix 2 Reference Drawings”.

The following specifications must be followed when attaching armor stickers on robots:

- R8 Stickers must be applied properly with no visible air pockets and one Armor Module must be attached with one armor sticker.
- R9 Except for the exclusive armor stickers provided by the RMOC, no other stickers that resemble the exclusive armor stickers in their patterns may be attached on a robot’s Armor Module or its other external structures.

3.1.7 Aesthetic Design

- R10 Teams can appropriately increase the amount of paint on the robot, which does not interfere with computer vision recognition and fairness of the competition.

3.1.8 Launching Mechanism



Launching Mechanism: A mechanism capable of launching a projectile from a robot on a fixed trajectory to inflict damage on another robot (judge according to the mechanical structure, regardless of the power-on situation of the mechanism).

- R11 The modification of Launching Mechanisms is strictly prohibited.

3.2 Robot Technical Specifications

Table 3-1 Hero Specification

Item	Limit	Remarks
Initial HP	2000	-
Operating Mode	Fully automatic	-
Maximum Total Power Supply Capacity (Wh)	200	-
Maximum Power Supply Voltage (V)	-	-
Maximum Chassis Power Consumption (W)	No limit	-
Launching Mechanism	A 17mm Launching Mechanism	The installation of laser sight is prohibited
Projectile Supply Method	Activate the Projectile Supplier Zone	-
Initial Projectile Quantity (round)	Projectile Magazine	After game begins, only Robot#1 gains the right to launch 50 projectiles initially
Initial Firing Speed Limit (m/s)	25	-
Barrel Heat Limit	240	Refer to “4.4.1 Barrel Heat”
Maximum Weight (kg)	25	Include the battery weight, but not the weight of the Referee System
Maximum Expansion Size (mm)	600*600*500	Its orthographic projection on the ground should not exceed a 600*600 square

Item	Limit	Remarks
Referee System	Four Small Armor Modules, Speed Monitor Module (17mm projectile), RFID Interaction Module, Main Controller Module, Power Management Module, Light Indicator Module	-

3.3 Referee system's shared information



The specific communication specifications are available at [RoboRTS-Base](#).

Some of the Match information shared by the referee system with the robot on site is as follows:

- Robot status, blood volume, and number of Projectiles that can be fired on site
- Competition rounds and time
- Locations, activation statuses and other information of Buff/Debuff Zones

Information obtained for a single robot is as follows:

- The current launch speed, launch frequency and barrel heat of the Launching Mechanism
- HP deductions (including the reasons of deduction, serial numbers of hit Armor Modules, etc.)
- The power supply statuses of all current modules (Launching Mechanism, Gimbal, Chassis and Onboard Computer)
- Number of projectiles launched so far
- Current robot number

4. Competition Mechanism

The HP of robots will be deducted in any of the following situations: The Barrel Heat limit, Initial Firing Speed limit or Maximum Chassis Power Consumption of a Launching Mechanism is exceeded; an Armor Module is attacked by a projectile or hit; an important module of the Referee System goes offline; penalty for violation of rules; etc. The Referee System will round up the HP deduction when calculating the HP.

4.1 Barrel Heat

The current initial speed is V (m/s), and the current barrel heat is Q .

4.1.1 Initial Firing Speed Exceeds the Limit

The Initial Launch Speed Limit is 25 m/s. If $V > 25$ m/s, when the referee system detects a projectile, the robot's HP is deducted by a value of L .

Table 4-1 Penalty Mechanism for Exceeding Initial Firing Speed Limit

V	L
$25 < V < 30$	200
$30 \leq V < 35$	1000
$V \geq 35$	2000

4.1.2 Barrel Overheating and Cooling

When a match starts, the initial barrel heat value for every projectile launching mechanism is 0. Each time a projectile with a velocity of V (m/s) is launched, the robot's barrel heat is increased by the value of V .

During a match, the robot's barrel heat upper limit is 240 and the cooling value per second is 120.

If the robot's HP is less than 400, then the cooling value per second is 240.

The barrel heat is settled at a frequency of 10 Hz (the cooling value of heat per period = cooling value per second / cooling settlement frequency).

- If $360 > Q > 240$, a value of $(Q-240)*4$ of HP is deducted per period, and then the HP is settled and cooled.
- If $Q \geq 360$, a value of $(Q-360)*40$ of HP is immediately deducted, and $Q=360$ after deduction.

4.2 Armor Attack



In an actual match, the normal speed of a projectile that touches the Armor Module attack surface is different from its initial firing speed due to the projectile's speed decay and its incident angle not being normal to the Armor Module attack surface. Damage detection is based on the normal component of the projectile's speed upon contact with the Armor Module attack surface.

An Armor Module detects projectile attacks using the pressure sensor combined with the Armor's vibration frequency.

The minimum detection gap for an Armor Module is 50 ms.

The projectile needs to come into contact with the impact surface of the Armor Module at a speed of 12 m/s or higher in order to be successfully detected.

A robot experiences damage when its Armor Module is struck. However, a robot is not allowed to cause HP damage to the other side's robots through striking (including collision with the robots or launching objects).

Below is the HP deduction under the situation of no buff.

Table 4-2 HP Deduction from Armor Attack

Attack Type	HP Deduction
Projectiles	<ul style="list-style-type: none"> ● Front armor module: 20 ● Left and right armor modules: 40 ● Rear armor module: 60
Collision	10

4.3 Referee System Going Offline

The stability of connection between each module and server of the referee system should be maintained during the matches. The Referee System server detects the connectivity of each module at a frequency of 2 Hz. If important modules, which are speed monitor module, positioning system module and armor module, go offline due to problems of design or structure, then a certain amount of HP will be deducted.

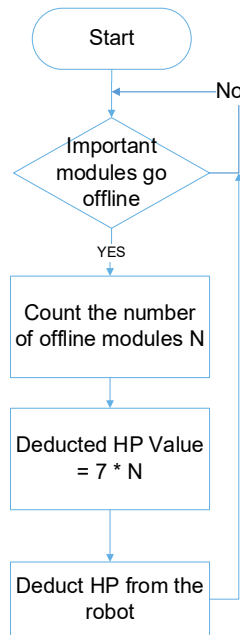
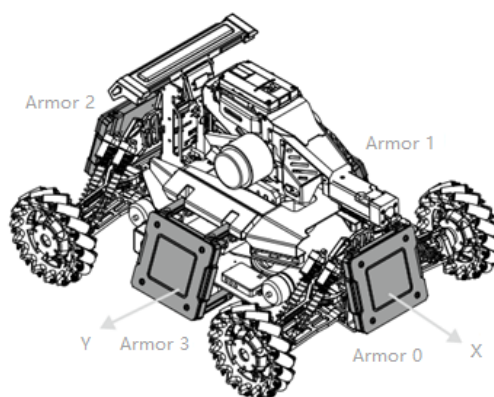


Figure 4-1 HP Deduction Mechanism for Important Referee System Modules Going Offline

4.4 Armor Module ID Setting

The Armor Module must be configured with the correct ID number before the Pre-Match Inspection. The specific requirements are as follows:

Establish the Robot Coordinate System according to the Armor Module installation requirements of Standard and Hero. In other words, after entering the armor ID setting mode, tap the Positive X axis, the Negative Y axis, the Negative X axis, the Positive Y axis, and the Negative Z axis in turn to complete ID settings as shown below. The ID configuration for Armor Modules is shown below:



[1] Armor #0 [2] Armor #1 [3] Armor #2 [4] Armor #3

Figure 4-2 Ground Robot Armor Module ID Setting

5. Competition Process

5.1 Pre-Match Inspection

To ensure that robots meet the required standard specifications, each team must undergo Pre-match Inspection in the Inspection Area 40 minutes before the start of each match.

A maximum of 7 team members for each team can enter the inspection area. A robot can be brought to the inspection area by a maximum of 3 team members. One team member is responsible for assisting the staff with the pre-match inspection. Without the permission of the Head Inspector, other team members are not allowed to enter the Inspection Area. Team members are prohibited from entering the Inspection Area before their robots have entered the Inspection Area.

During the Pre-Match Inspection, the inspection referee will stick a Pass Card on the robots that have passed the inspection. Only the robots having a Pass Card with a complete mark will be eligible to enter the Staging and Competition Areas. Teams must modify their non-qualifying robots in the Preparation Area until they meet the inspection requirements, before they can enter the stage.

When the Pre-Match Inspection is completed, the Captain shall sign and confirm that he/she agrees with the inspection results. After the Captain has signed and confirmed, no objections may be raised to the inspection results.

During each match, each participating team can carry at most two backup robots. When a backup Standard is required to play a match, Pit Crew must promptly get the corresponding armor sticker from the Technical Referee and attach it in accordance with Robot Numbering. Armor sticker applying should follow requirements stated in “3.1.6 Robot Numbering”.

After passing the Pre-match Inspection, backup robots cannot be replaced without permission.

5.2 Staging Area

The staff at the Staging Area will check the status of the participating robots and the team members' information.

If any team needs to repair its robots after entering the Staging Area, it must obtain the permission of the staff at the Staging Area. A robot of the applicant can only return to the Repair Area if a staff member at the Staging Area has removed the Pass Card on the robot. When repair is finished, the robot needs to be brought back to the Inspection Area for another Pre-Match Inspection before re-entering the Staging Area, and the Team Captain must sign a new Staging Area Statement. If a delay results in the failure for the robot to enter the stage, the team will bear its own consequences.

After leaving the Staging Area, the participating teams will enter the waiting area of the Competition Area to place their robots. When the previous match has ended and with the permission of the referee, the next pair of participating teams will wait at the entrance of the Battlefield with their robots for further instructions. After the referee has confirmed that both teams are ready, he or she will open the door and lead the team members into the Competition Area. The countdown for the Five-Minute Setup Period will begin when the door opens.

5.3 Five-Minute Setup Period

During the Five-Minute Setup Period, Pit Crew can enter the Battlefield to set up the Perception System attached to Outpost and start the related program. Pit Crew can use remote controllers, laptops or any other electronic device in the Battlefield or Operator Area to control the robot.

When the Setup Period is left with 30 seconds, all robots in the Battlefield must be powered up, and the staff in the Battlefield should leave the Competition Area in an orderly manner. Pit Crew must place remote controllers and laptops used for debugging in the designated Operator Area outside the Battlefield.

5.3.1 Official Technical Timeout

During the Five-Minute Setup Period, if a Referee System, equipment inside the Operator Room or other modules related to a Referee System experience any faults (for details see “Table 7-1 Descriptions of Technical Faults”), the Head Referee can announce an Official Technical Timeout and pause the setup countdown.

During an Official Technical Timeout, team members can only cooperate with the Technical Referee in eliminating the faults of the relevant Referee System modules and cannot repair other breakdowns. After the faults in the relevant Referee System modules have been eliminated and the Head Referee has resumed countdown, the team must comply with the rules for the Five-Minute Setup Period and leave the Battlefield at the required time.

5.3.2 Team Technical Timeout

If the mechanical structure of a robot, a software system, the keyboard or mouse in the Operator Room or other equipment experiences any faults, the team Captain may make a request to the referee in the Battlefield or Operator Room for a “Team Technical Timeout” before the 15-second countdown in the Five-Minute Setup Period, and indicate the requested timeout length and reasons for the request. Once a Team Technical Timeout request has been made and conveyed to the Chief Referee, the Technical Timeout cannot be revoked or revised.

After a team's Technical Timeout has been allowed by the Head Referee, the Head Referee will inform both teams of the timeout regardless of which team requested the Team Technical Timeout. Pit Crew Members can enter the Battlefield to inspect and repair robots, while members of both teams can only inspect, repair and commission their own robots at their respective Starting Zones and Landing Pads.

Even if the team did not enter the Battlefield or ended the Technical Timeout early, the opportunity used will still be the opportunity corresponding to the timeout length indicated by the team during its request. At this time, the Head Referee will continue the countdown of the Technical Timeout, or the Head Referee may end the Technical Timeout early after confirming that both teams are ready.

To ensure that subsequent matches begin on time, only one Team Technical Timeout is allowed for each Five-Minute Setup Period on a first-come-first-served basis. After the match, the Match Results Confirmation Form will state whether Technical Timeout opportunities have been used during the match. The type of Technical Timeout allowed is determined by the Head Referee based on the request of the team. The team cannot dispute the type of Technical Timeout allowed, and the Technical Timeout process cannot be the basis for any appeal after the match.

Each team will be allowed to initiate two team technical timeouts, which will last three minutes each. A team cannot request for more Team Technical Timeout opportunities once they have been used up.

5.4 Referee System Initialization Period

After the Five-Minute Setup Period, the match enters a 20-second Referee System Initialization Period. During the Initialization Period, the competition server will automatically detect the connection status of the client, the Referee System module status of the robot, the status of Battlefield Components and restore the HP of all robots, ensuring their HP are full when the match officially begins.

If the initialization does not meet the requirements of the start of the round, such as an offline robot or Battlefield Component, the countdown will be suspended. A Pit Crew member of each team is allowed to enter the Battlefield to check on the fault.

When the Referee System Initialization Period is left with 5 seconds, the RMOC staff will notify team members. When the countdown finishes, the match starts immediately.

5.5 Three-Minute Round

During the Three-Minute Round Period, robots from both teams will compete on the Battlefield of the stadium.

5.6 End of Competition

A round ends either when time has elapsed for the round or one team has fulfilled the conditions for winning. When a round ends, the match immediately enters the Five-Minute Setup Period for the next round. The match is over when a winner has emerged or all rounds have ended.

5.7 Match Results Confirmation

During a match, the referee will record on the Match Results Confirmation Form, the penalties issued for each round and the HP deductions of both sides at the end of the rounds, the Remaining HP of each Base, the winning teams, the use of Technical Timeout opportunities by teams, and other relevant details. After the end of each match, team Captains need to be at the Referee Area to confirm the results.

Within five minutes after a match ends, Captains of both teams must confirm the match results by signing at the Referee Area. If a team Captain is not at the Referee Area within five minutes to sign and confirm the results and has not requested an appeal, it is deemed that the team agrees with the match results.

The referee will not entertain any request for appeals on match results between rounds of an individual match.

Once a Team Captain has signed and confirmed the results, no further appeals can be made.

6. Competition Rules



Any penalty issued before the start of a competition will be executed after the competition officially starts. Penalty of violation stated in this chapter will be determined by the Chief Referee according to the actual situation.

To ensure the fairness and uphold discipline in the competition, teams and robots should strictly adhere to the competition rules. Referee will issue the appropriate penalty against any violation of rules.

Serious violations and appeals in the competition will be publicized.

6.1 Rules

This chapter sets out the Competition Rules and defines the relevant measures to be taken by the referee after issuing penalties.

6.1.1 Personnel Rules

6.1.1.1 Participating Teams/Personnel

R12 Teams are required to meet the requirements in the [RoboMaster 2021 University AI Challenge Participant Manual](#).

Penalty: The highest penalty that can be imposed on the offending party is disqualification.

R13 Except for emergencies, teams must be at the Inspection Area at least 40 minutes before the start of a match to undergo the Pre-match Inspection.

Penalty: Forfeiture of the current match.

R14 The team is not allowed to launch projectiles in the Preparation Area. If testing is required, it must be reported to the staff in advance and tested with a storage bag.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offending party shall be disqualified.

R15 The team is not allowed to turn on robots in the Staging Area, but they are allowed to turn on computers or sentry equipment for preparation or debugging.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offending party shall be disqualified.

R16 The participating teams can set up their own wireless network within the Five-Minute Setup Period, but the network should be set with a specific frequency band of 2.4 or 5.8 GHz, and the upper limit of the occupied bandwidth is 40 MHz.



Due to a large audience and a large number of devices used for live broadcast during the competition, there will be many unknown Wi-Fi signal sources. The RMOc does not guarantee the stability of Wi-Fi networks built by participating teams.

Penalty: The team will be issued a forfeiture for the round.

R17 Wireless network that setup by teams can only be used for the communication between its own robots and the Outpost host, or be used for debugging its own robots and the Outpost program during the Five-Minute Setup Period. The network should not intervene with the running of related referee system devices and the enemy robots.

Penalty: The offending party shall be disqualified.

R18 The computing device for processing the perception information of the Outpost or other debugging devices should be placed on the Operator Area. The team members are not allowed to operate related devices after the Referee System Initialization Period starts.

Penalty: The team will be issued a forfeiture for the round.

R19 During the Five-Minute Setup Period, team members must ensure their robots are operating safely and will not cause harm to any person or equipment in the Competition Area.

Penalty: The offending party must bear the relevant responsibility.

R20 Team member should not leave the Staging Area without the referees' permission.

Penalty: Any offending team member is forbidden from entering the Competition Area.

R21 The participating team is not allowed to destroy the equipment in the Operator Area.

Penalty: Verbal Warning, and the offending party is required to pay compensation as per the price.

R22 After a match is over, members from both teams must power off all their robots, remove them from the Competition Area and empty all projectiles inside the robots at the Projectile Unloading Area.

Penalty: The offending robot is detained at the Projectile Unloading Area.

6.1.1.2 Pit Crew



Pit Crew: Regular Member and Supervisor who have registered for this Season and have been entered into the registration system, can walk into the Preparation Area and Competition Area.

R23 During each match, up to 7 Pit Crew members per team (up to 6 Regular Members and 1 Supervisor or Advisor) can enter the Competition Area.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture

of the match.

R24 Pit Crew Members must meet the identity requirements.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the team shall be issued a Forfeiture of the match.

R25 During Five-Minute Setup Period, Pit Crew can only test the robot within the designated area.

Penalty: Verbal Warning. If a team member repeatedly fails to heed the warning, the robot that fails to comply with the rules will be banned from this round of the match.

R26 During Five-Minute Setup Period, the Pit Crew must not pick up the projectiles scattered on the floor of the Competition Area.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offending party shall be issued a Forfeiture of the round.

R27 During Five-Minute Setup Period, the Pit Crew must not pick up the projectiles scattered on the floor of the competition area and directly supply to their own robots.

Penalty: The robot is not allowed to play.

R28 During the final 30 seconds of the Five-Minute Setup Period or the final 20 seconds of a Team Technical Timeout, the Pit Crew must leave the Battlefield as quickly as possible.

Penalty: Verbal Warning

R29 After the end of the Five-Minute Setup Period, the Pit Crew must return to the designated area outside the Battlefield.

Penalty: The offender will be ejected from the Operator Area, and the team is forbidden from having a substitute member enter the Operator Area for all of the remaining rounds of the current match. If the offender does not obey the penalty order, the offending team shall be issued a Forfeiture of the round.

R30 When referee system initialization period starts, each team can send a maximum of two team members to watch the remote controls, computers and other electronic devices in the Operator Area, and observe the state of the robots. Pit Crew members are not allowed to operate the robots on the Battlefield in any form unless under special circumstances or with the consent of the referee. Other Pit Crew members must stay in the pit area outside the Battlefield.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, the offender will be ejected from the Operator Area, and the team is forbidden from having a substitute member enter the Operator Area for all of the remaining rounds of the current match. If the warning(s) is ineffective, the offending party

shall be issued a Forfeiture of the round.

R31 Each Robot can use at most one remote controller and one receiver. After Five-Minute Setup Period, it is not permitted to use remote controller.

Penalty: The offending party shall be disqualified.

6.1.2 Robot Rules



For example, If there are serious damages to a robot in the match and there are serious safety hazards such as short circuit, the robot must be immediately powered off and brought to the designated area to avoid safety risks in subsequent matches. The actual situation shall be determined by the Chief Referee.

R32 Robots entering a match must pass Pre-match Inspection.

Penalty: Forfeiture of the round.

R33 At least one robot must enter the stage.

Penalty: Forfeiture of the current match.

R34 Robots must be attached with their corresponding armor stickers that meet the specifications.

Penalty: The offending robot is not allowed to enter the stage.

R35 Before Five-Minute Setup Period, the robot must not launch a projectile or initiate any physical injury to the staff.

Penalty: Forfeiture of the current round and the offending party must bear the relevant responsibility.

R36 Before the match begins (from the Initialization Period), the robots shall not perform any movement beyond the Starting Area.

Penalty: The offending robot will be sent off after the start of the game.

6.1.3 Interaction Rules.

6.1.3.1 Between Robots

R37 Except for normal minor collisions or slowly pushing away a destroyed robot that is obstructing the path, a robot must not use any of its structures to actively and maliciously collide with the enemy's robots.

Penalty: According to the intention or the degree of collision and the consequences, eject the offending robot.

R38 A robot must not stick itself to any enemy robot through active interference, blocking or collision.

Penalty: According to the situation of getting stuck together or the influence imposed to the competition, the offending robot will be ejected. If the situation seriously affects the result of the game, the game will be rematch.

6.1.3.2 Robots and Battlefield Components

R39 During any match in RMUA 2021, participating robots can only use projectiles supplied by the RMOC.

Penalty: Verbal Warning. If the Verbal Warning is ineffective, according to the seriousness of the situation, the highest penalty that can be given to the offending party is disqualification.

R40 A robot can not voluntarily makes fast and repeated frontal collisions with obstacles, or collides with obstacles which forces them a long distance away or keeps moving the obstacles.

Penalty: Deemed as runaway collision and eject the offending robot.

6.2 Serious Violations

The following actions are considered serious violations of rules. To ensure fairness and proper regulation of the competition, any severe violation by an individual or a team will lead to the maximum penalty of disqualification from the competition. The team will be prohibited from participating in the RMUA 2021 and receiving any awards. The results of any match participated in by this team are documented for their opponents' reference.

Table 6-1 Categories of Serious Violations

Rule	Type
1	Violate rules mentioned in this document but refuse to accept penalties, for example, Pit Crew member intervenes with the referee, etc.
2	Causing delays deliberately or refusing to immediately leave the Competition Area after a match has ended, thereby disrupting the schedule of the competition
3	Installing explosives or other prohibited materials on robots
4	Team members using robots to collide with or attack other people deliberately, putting themselves and other people at risk of injury
5	Team members deliberately damaging the opponent's robots, Battlefield Components and related equipment.

Rule	Type
6	Team members engage in a physical confrontation with the referee, their opponents, or the audience
7	Team members do not cooperate in inspections or cause delays deliberately when the RMOC is handling an appeal
8	Other serious actions that disrupt the competition's schedule and violate the spirit of fair competition will be penalized accordingly by the Head Referee and Chief Referee based on the actual acts of violation
9	During the competition, violation of local laws and regulations inside the Competition Area, Audience Area, or dormitories. In addition to being disqualified from the competition at the highest extend, the RMOC will fully cooperate with the relevant authorities to pursue appropriate legal action against the offender
10	Tampering with or damaging the Referee System, or interfering with any detecting function of the Referee System through technical means.
11	Other behavior that violates the game spirit or is determined to be cheating by the Chief Referee

6.3 Winning Criteria

The official matches of RMUA 2021 consist of the Group Stage and the Knockout Stage. The competition format of Group Stage is BO1 or BO2 (according to the actual number of participating teams.); the format of Knockout Stage is all BO3.

The following are the criteria for winning in a single round:

1. The match ends immediately when all the robots of a team are destroyed, and the team with surviving robot(s) wins.
2. When the entire time of a round is up, if robots of both teams have survived, the team with the higher damage output wins.

If neither team fulfills these criteria, the round is considered a draw. A draw in the Knockout Stage leads to an immediate tie-breaker round until a team wins.



HP Deduction: The total HP damage caused by one team's attack of the other team's robots or other reasons

- HP deducted as a result of a robot being ejected is counted as HP Deduction.
- HP deducted as a result of exceeding the Initial Firing Speed limit, Barrel Heat limit and of the Referee System going offline or collisions is counted as HP Deduction.
- HP restored as a result of activating the Buff Zone is not counted as HP Deduction.

For example: The Blue Team causes a total of 720 HP Deduction to the Red Team though attacking the Armor Module. At the same time, the Red Team has been caused a total of 60 HP Deduction due to collisions, a total of 120 HP Deduction due to exceeding the Barrel Heat limit, and a total of 400 HP Restoration in the Buff Zone. The total HP Deduction of the Blue Team causing to the Red Team is $720 + 60 + 120 = 900$

6.4 Points

The below shows the points for Group Stage:

Table 6-2 Points for Group Stage BO1

Competition Format	Competition Result	Points	Remarks
BO1	1:0	1:0	(draw for one round): The team winning one round gains 1 point
	0:0	0:0	(draw for two rounds): Each team gains 0 point

Table 6-3 Points for Group Stage BO2

Competition Format	Competition Result	Remarks
BO2	2:0	The team winning two rounds gains 3 points, while the team losing two rounds gains 0 point
	1:1	One point for each team
	1:0	(draw for one round): The team winning one round gains 1 point, and the team losing one round gains 0 point
	0:0	(draw for two rounds): Each team gains 0 point

6.5 Ranking

6.5.1 Group Stage

The ranking for the Group Stage is determined by the total points for each match. Teams are ranked based on the following order, in descending order of priority:

1. The team with the higher total match points ranks higher.
2. If the total Outpost HP of teams are the same, the team with the higher total HP Deduction from all rounds ranks higher.
3. If two or more teams are still tied for the same place according to these criteria, the RMOC will arrange a playoff match on the basis of two extra rounds.

6.5.2 Knockout Stage

A team wins the Knockout Stage if it has won the most number of rounds: BO3 requires the winning of two rounds.

7. Technical Fault and Irregularities

7.1 Technical Fault

The faults that will trigger an Official Technical Timeout during the Five-Minute Setup Period are set out as follows:

Table 7-1 Descriptions of Technical Faults

Rule	Description
1	The official devices are malfunctioning.
2	During the Five-Minute Setup Period, there is a malfunction with the referee system modules at the robot end. For example, the robot cannot be connected to the server of the referee system.
3	Key Battlefield Components are found with structural damages or malfunctions (Outpost structure has damages or moves obviously, Obstacle Block moves, etc.)
4	Other situations determined by the Chief Referee as requiring an Official Technical Timeout.

If the malfunction referred to in Rule 2 occurs during a Five-Minute Setup Period between rounds or during a Five-Minute Match Period, it will be categorized as “Regular Battle Damage”, as it cannot be determined whether the malfunction was caused by the Referee System module, a flaw in the robot’s mechanical or electrical system designs, or robot combat from previous matches. Regular battle damage will not trigger an Official Technical Timeout. Technical Referees will provide backup Referee System modules. Teams may request for a “Team Technical Timeout” to repair their robots.

7.2 Irregularities

Any irregularities that occurs during the competition should be handled as follows:

- When a robot safety hazard or exception in a robot has occurred on the Battlefield, such as battery explosion, stadium power outage, explosion of a compressed gas cylinder, or interpersonal conflict), the Head Referee will notify both teams through the Operator’s Room Referees after discovering and confirming the emergency, and kill all robots through the Referee System. The result of the round will be invalidated. The round will restart after the safety hazard or exception has been eliminated.
- If the general Battlefield Components are damaged during a match (damage to the ground rubber, ground lighting, or Base lighting), the match will proceed normally. If the key battlefield components are structurally damaged or functionally abnormal (for example, the RFID in the Buff/Debuff Zone has shifted or is unable to be activated, or an obstacle block is so poorly adhesive to the floor that a

slight push easily shifts it), the head referee will inform both teams and kill all the robots through the referee system after he/she discovers and confirms the situation. The result of the round is invalidated. Referees will enter the Battlefield to perform repairs. The round will restart once the Battlefield Component resumes its normal function.

- If certain Battlefield Components experience logical or structural faults that are not caused by participants in the process of the match, for example where no bonus is gained after a Power Rune is hit or a Base cannot open its shield normally, the Referee will solve the problem manually through the Referee System. If the problem cannot be solved manually through the Referee System and after determining that the issue cannot be eliminated, the Referee will notify both teams' Operators and eject all robots through the Referee System. The round ends immediately and its result is invalidated. The round will restart after the issue has been solved.



Resolving issues manually will cause delays, and the RMOC will not be responsible for any resulting consequences.

- During a match, if the fairness of a match has been affected by the malfunction or structural damage of a key Battlefield Component, and the Head Referee has not confirmed the situation and end the game in time, causing a Round that should have been ended to continue and thereby produce a winner, the result of the round will be deemed invalid once confirmed by the Chief Referee, and one rematch will be given.
- If a serious violation has taken place that clearly warrants a Forfeiture, but the Head Referee has not confirmed the situation or issued a Forfeiture in a timely manner, the original match result will be invalidated once confirmed by the Chief Referee or an appeal decision after the match, and the offending team will be issued a Forfeiture penalty.
- If an issue has occurred during the competition that affects the fairness of the competition, the Chief Referee will make a determination according to the actual situation.

8. Appeals

Every team has one appeal opportunity during the Regional Competition. Appeal opportunities cannot be used cumulatively across competitions. If an appeal is successful, the team involved retains its right to appeal again in future matches. If it is unsuccessful, the team will have exhausted its one opportunity to appeal. When a team has exhausted its opportunity to appeal, the RMOC will no longer accept any appeal from the team. When processing an appeal, an Arbitration Commission will be formed by the Chief Referee and heads of the RMOC. The Arbitration Commission has the final right of interpretation on all appeal decisions.

8.1 Appeal Process

Teams lodging an appeal must follow the procedure below:

1. Within three minutes after a match ends, the appealing team's Captain submits an appeal request and signs an Appeal Form at the Referee Area. If the reason for the appeal is related to the robots of any team in the competition, the appealing party shall propose that the relevant robots be isolated and tested, which will be implemented after confirmation by the Arbitration Commission. By signing, the appealing party confirms that it is initiating the appeal process, and the Appeal Form cannot be modified after it has been signed. Any appeal made three minutes after a match has ended will be deemed invalid. No appeals are allowed before and during the competition.
2. The Captains of both teams will be brought by the staff to the Arbitration Room. The Arbitration Commission will determine whether the appeal request can be accepted.
3. If either team needs to collect evidence or defense materials, the period of time granted is one hour. The materials collected will need to be submitted to the Arbitration Commission, which will further communicate with the team members involved in the appeal. If neither side needs to collect evidence or defense materials, proceed to the next step.
4. After the Chief Referee has accepted the appeal request, the staff will invite the Captains of both teams to meet in the Arbitration Room. Each team can only send three members to the Arbitration Room, and one of them must be the Captain, Project Manager, key team members or the supervisor. The presence of either the Captain or the Project Manager is mandatory.
5. The Arbitration Commission will make a final decision, and the Captain of both teams will sign the Appeal Form to confirm the decision. Once signed, both teams cannot question the appeal decision any further.

6. If a rematch has occurred for a round due to an arbitration decision requiring a “Rematch between Both Teams”, both teams can appeal again after the rematch. In this scenario, if the original appealing team appeals again (known as a “Continued Appeal”), the team’s opportunity to appeal will be exhausted regardless of whether the appeal is successful. As a continued appeal will cause serious delays to the competition schedule, the continued appeal must be initiated together by both the Team Captain and Supervisor within five minutes after the match ends (both signing on the Appeal Form at the same time).
7. The time for submission of evidence and materials is shortened to within 30 minutes of making the appeal. The RMOC will announce the outcome of the appeal on the Appeal Form within 60 minutes of the continued appeal being made.

8.2 Appeal Validity

Teams must file their appeal within the validity period. Below are the appeal validity periods for different stages:

- Validity period for appeal requests: Appeals must be made within three minutes after the end of a match and recorded on the Appeal Form. The Arbitration Commission will not accept any appeal request that has exceeded the validity period.
- Validity period for both teams to meet at the Arbitration Room: Within 30 minutes of being notified by the Arbitration Commission. If a team is absent during the validity period when both teams meet in the Arbitration Room, the absent team is deemed to have given up its right to the arbitration. If more than three members of a team are present in the Arbitration Room or the attendees do not meet the specified identity requirements, the team is also deemed to have given up its right to the arbitration.
- Validity period for submission of evidence or defense materials: Within 60 minutes of making an appeal. The Arbitration Commission will not accept any new materials beyond this 60-minute limit.

8.3 Appeal Materials

Appeal materials submitted by teams must follow the below specifications:

- Material type: Only materials stored on a USB flash drive and the robots themselves will be accepted as appeal materials. Materials submitted in other forms will not be accepted by the Arbitration Commission.

- USB flash drives: The edited video (the video materials should be prepared by the team itself - the organizing committee will not provide any videos in order to stay impartial) and the text files for the appeal should be placed according to the directory.
- Material format: No video can exceed one minute in length or 500MB in size. The name of the video must indicate the specific Round of the match and the time it was taken. Videos should be compatible with the latest version of Windows Media Player, photos must be in JPG format, and text documents must be in MS Word format and not exceed 1,000 words in length.
- Material naming: The file name of each video and photo must be within 30 Chinese characters.
- Text requirements: One text file can only correspond to one video or a photo, which must be indicated in the text. Text files only need to explain the violations reflected in the corresponding materials.
- Robot evidence: The Arbitration Committee has the authority to isolate any relevant robot from both teams after an appeal has been made. These robots will not be isolated for more than three hours and will be returned to the teams at the latest when the arbitration decision itself is announced.

8.4 Appeal Decision

The Arbitration Commission will release their final decision in the Appeal Form within three hours of the appeal being made. This decision has one of three possible outcomes: Original Result Upheld, Forfeiture Issued against the Respondent, or Rematch between Both Teams. Neither team may appeal against the final decision of the Arbitration Committee.

If the Arbitration Committee requires both teams to hold a rematch, the RMOC will inform both teams of the rematch time when the arbitration decision is announced. If both teams refuse to hold a rematch, the appeal is deemed failed and the original match results are maintained. If only one team refuses the rematch, the refusing team is deemed to have forfeited and lost the round.

Appendix 1 Safety Instruction

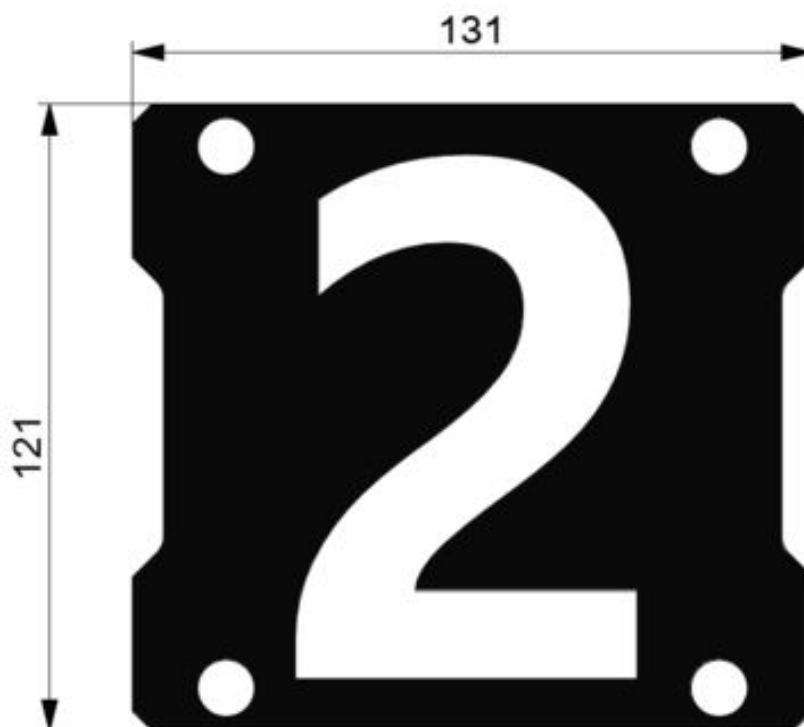
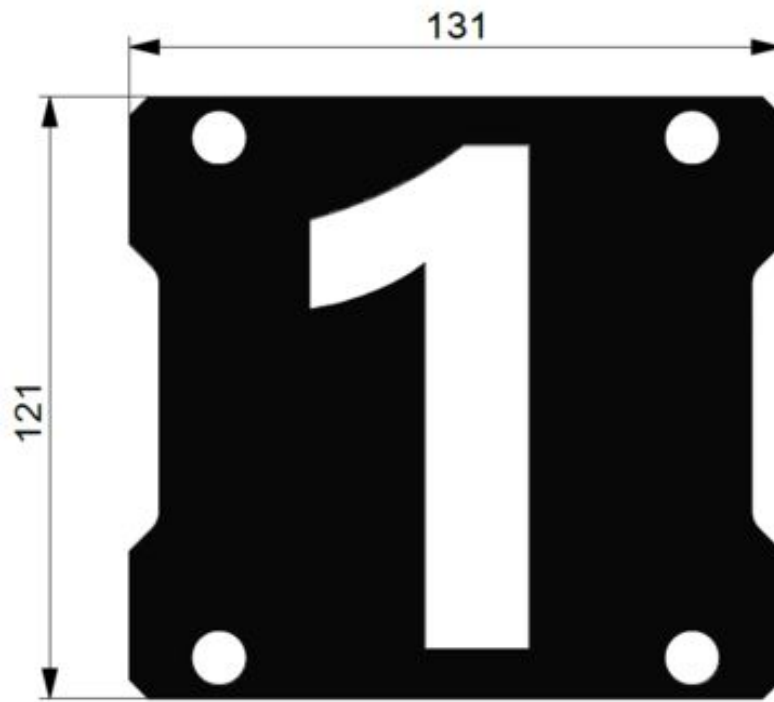
Every team and all its members of the RMUA 2021 must fully understand and accept that safety is the most important issue for the sustainable development of the RoboMaster Robotics Competition. To protect the rights and interests of all those who participate in the competition, as well as the rights and interests of the event organizers, everyone who enters the RMUA 2021 must make the following commitments, uphold and abide by the following safety clauses in accordance with applicable laws and regulations:

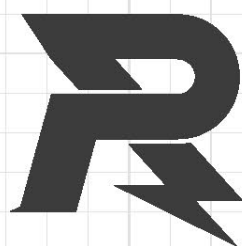
1. All participants shall state that they are fully capable of civil conduct and can independently manufacture and operate robots. Prior to using the robots made by the undertaking organization SZ DJI Technology Co., Ltd., all participants shall ensure they have carefully read relevant documents such as the Registration Guide and Rules of ICRA 2021 RoboMaster University AI Challenge.
2. During the competition, all participants should make sure that their actions including the creation, testing, and use of robots will not cause any injury or damage to his or her teammates, members of the opposing teams, staff, audience, equipment, or the competition venue.
3. All teams must ensure that the structural design of their robots will not hinder safety inspection during Pre-match Inspection, and agree to fully cooperate with the Pre-match Inspection carried out by RoboMaster's organizers.
4. The team guarantees that it will not use any internal combustion engines, explosives, use high-pressure gas as the working gas, or any dangerous materials.
5. During any stage of the R&D, preparation or competition period, all team members must be fully aware of any potential safety issues, and the team's Supervisor is responsible for instructing and supervising the team on safety issues.
6. All teams must guarantee the safety of all robots. This includes ensuring the projectile launchers installed on robots are safe, and that they will not cause any harm either directly or indirectly to any Operator, referee, staff member or audience member.
7. All teams will take sufficient and necessary safety measures during the R&D, training and competition periods regarding any hazardous situations that may occur. These include but are not limited to: preventing the control system from becoming unstable; anticipating every operation step prior to execution to avoid errors or collisions between team members or between robots and team members; prohibiting team members from engaging in solo training and making sure personnel are available as emergency responders to any situation; wearing goggles and helmets; applying the spotlight lock function and adding an emergency stop function other measures in a robot during debugging.

8. The team will be held responsible for all accidents and losses that occur as a result from robot failures, loss of control, and any other unexpected circumstances during training or competitions.
9. The materials bought from or provided by the organizer SZ DJI Technology Co., Ltd., such as batteries and the Referee System, must be used in accordance with their instructions. SZ DJI Technology Co., Ltd. will not be held responsible for any injuries that arise from improper use of these materials. Teams will be held responsible for any injuries caused to their own members or any third party and for any property loss arising from creating and operating any robots.
10. All team members must remain in strict compliance with the laws and regulations of the country or region. All team members pledge that their robots will only be used for the RoboMaster competitions and that their robots will not be illegally modified or used for any illicit purpose.

Appendix 2 Reference Drawings

Unit: mm





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