

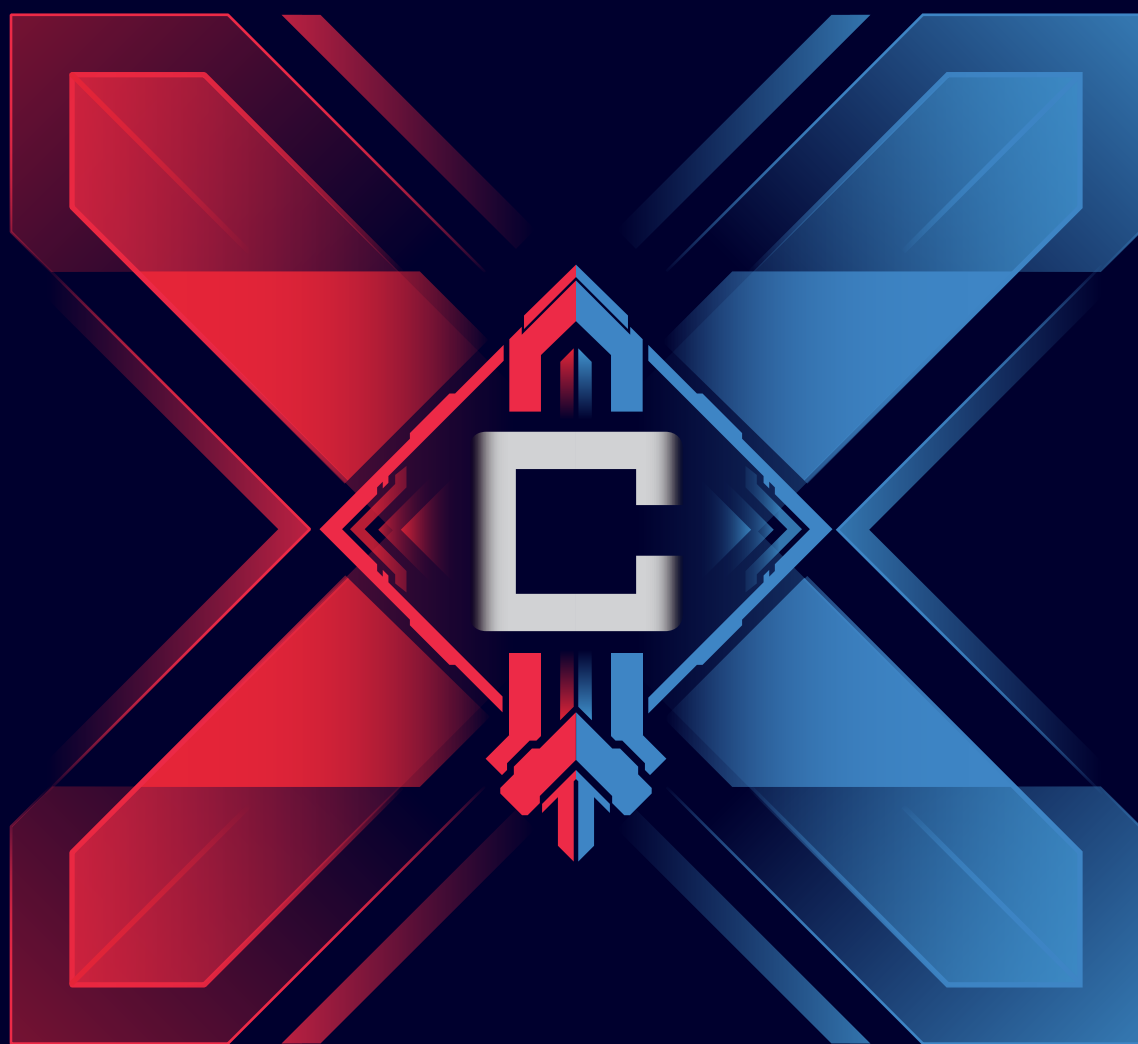
· 2019 ·

MAKEX

MakeX Robotics Competition

# Courageous Traveler

Technical Guide **V1.0**



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**MAKE X**

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# 1. Introduction

## 1.1 About MakeX

MakeX is a platform of robotic competitions for guiding the growth of young people. It aims at inspiring people's enthusiasm for creativity, sharing, and collaboration by Robotics Competition, STEAM Carnival, etc.

MakeX Robots Competition is hosted by the MakeX Robotics Competition Committee, organized by Shenzhen Hulu Maker Co., Ltd. and supported by Shenzhen Makeblock Co., Ltd. As the core activity of MakeX, it aims that through the competition, young people will discover the spirit of creativity, teamwork, fun and sharing. It is committed to promoting innovation in science, technology, education through high-level competition events, guiding young people to learn Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) and apply such knowledge in solving practical problems through the exciting and challenging competitions.

## 1.2 MakeX Spirit

**Creativity:** we advocate curiousness and innovation, encourage all contestants to create unique high-tech works with their talent, and challenge themselves for continuous progress!

**Teamwork:** we advocate solidarity and friendship, encourage all contestants to develop a sense of responsibility and enterprising spirit, and sincerely work with their partners for win-win development!

**Fun:** we encourage contestants to build a positive, healthy mindset in the competition. Enjoy the journey and grow in the process.

**Sharing:** we encourage contestants to have an open mind as a maker and share their knowledge, responsibility and joy with everyone including their teammates and competitors.

MakeX spirit is the cultural cornerstone of the MakeX Robotics Competition. We hope to provide a platform for all contestants, mentors and industry experts to exchange ideas, study and grow up, and help young people acquire new skills

during creation, learn to respect others in teamwork, gain an enjoyable life experience in the competition, take delight in sharing with the society their knowledge and responsibility, and work hard to achieve their grand aspiration of changing the world and creating the future!

### **1.3 About 2019 Season**

In 2019 season, MakeX will hold regional Robotics competition in more than 30 countries and regions around the world and will launch MakeX competition courses and organize various competition activities, worldwide spreading STEAM education among the teenagers.

Qualified teams can enter into 2019 MakeX World Championship and compete for the 2019 MakeX World Champion.

The theme of MakeX Challenge for the 2019 season is Courageous Traveler, which mainly tests the contestants' engineering technology, strategic teamwork and tactical execution.

In the cities where we live, there always have various safety problems that endanger people's safety, such as terrorist attacks that threaten national safety and food quality problems. To protect everyone on Earth, a group of Courageous Travelers will embark on a journey to protect human's life.

### **1.4 Participation Requirements**

MakeX Robotics Competition is dedicated to providing young people with a high-quality, high-impact and impressive viewing experience platform for Robotics competitions. Young people aged 11 to 18 (including) can register through the official website. The requirements are as follows:

2 to 8 contestants and 1 to 2 mentors per team. Each team must have a competition number as the unique identification symbol of the team. The competition number will be automatically generated after registration.

## 2. Terms

### 2.1 Arena

- **Arena element:** It refers to all parts and components that make up the competition arena. It is a general term that includes, but is not limited to maps, arena frame, arena props and so on.
- **Storage basket:** An iron basket placed on an arena frame for storing the controller in the competition.
- **Arena frame:** which is splice by flat beam and octagonal pillar.
- **Guide line:** The white lines and the red (blue) color ribbons in the competition map that can be used to guide the robots forward.
- **Mat:** Color spraying with necessary information such as competition mission, guideline and so on.
- **Ground:** It refers to the upper surface of the mat. Can be used to guide the robots forward.
- **Operation area:** The area where the operation teams are allowed to stay.

### 2.2 Roles

- **Referee:** A person who is responsible for managing the order of the competition, enforcing the competition rules and maintaining the spirit of the competition with a neutral manner.
- **Working staff:** Personnel who are responsible for maintaining the normal operation of the competition.
- **Contestant:** contestant who registered and participated in the MakeX 2019 Robots Competition Challenge: Courageous Traveler.
- **Mentor:** Mentor who registered and participated in the MakeX 2019 Robots Competition Challenge: Courageous Traveler.
- **Team:** Team are composed of contestants and mentors, who registered participating in the 2019 MakeX Robots Competition Challenge Courageous Traveler.
- **Captain of Alliance:** The two teams that form the Alliance shall designate one of the contestants on the venue as the captain of their Alliance.

- **Operator:** Contestants who operate the robots, which 2 operators from each Alliance and 2 teams of the same Alliance.
- **Observer:** Contestants who assist operators in observing the props' state and giving advice, which 2 operators of each Alliance are from 2 teams of the same Alliance.

## 2.3 Refereeing

- **Competition system:** Both the hardware and software are developed to ensure fair and honest competition.
- **Completely In:** The vertical projection of props or robots are completely located in the designated area.
- **Partially In:** The vertical projection of props or robots is partially located in the designated area or have contact with the designated area.
- **Completely Out:** The vertical projection of props or robots are completely outside the designated area.



## 3. The Competition

### 3.1 Introduction

Single-session time: 4 minutes and 30 seconds.

Each match is divided into two Alliances, Red and Blue. Each Alliance consists of two teams.

The competition is divided into four stages: Automatic stage, Manual stage, Modification stage and Final stage. In the competition, contestants will control robots to move the yellow bottles which symbolizing significant safety threat to the safe zone in their camp. They will use the ball to eliminate all safety threats (i.e., knock down any color bottle) in the opponent's camp. At the same time, the robot can insert the flag symbolizing a safety signal into the signal transmitting area during the full-strength stage. In the competition, the flag symbolizing a safety signal can be inserted into the signal transmitting area and back to the returning area before the end of the competition. After the end of the competition, the automatic scoring and manual scoring will be aggregated to judge the victory or defeat of both sides. If all the opponent's bottles are knocked down, it will be deemed as KO, and the competition will end ahead of time.

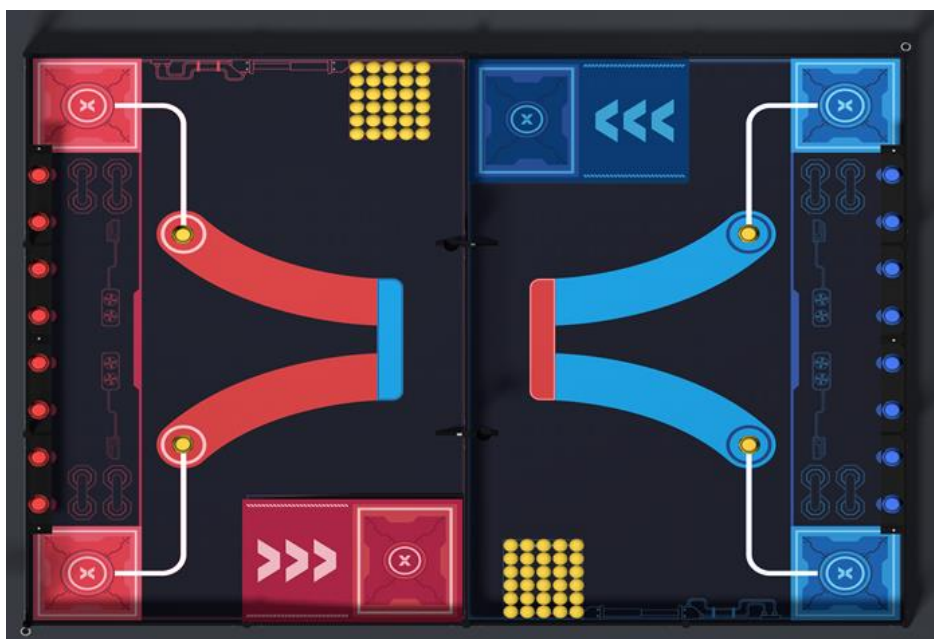


Fig 3.1 Top View of the Competition Arena

## 3.2 Arena

The rectangular area with a size of 3000 mm\* 4400 mm, (for the official competition arena of 2019 MakeX Robotics Competition Challenge Courageous Traveler), mainly includes starting area, highland, ammunition area, central barrier, urban living area, returning area, safe zone and signal transmitting area.

The central barrier divides the arena into two parts: Red camp and Blue camp. Robots from both sides can only compete in their own camp.

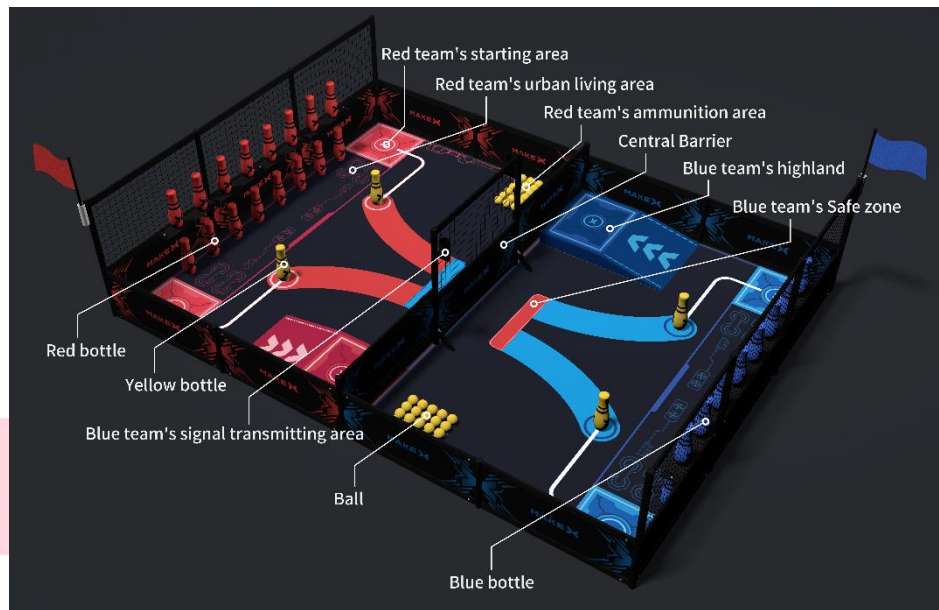


Fig 3.2 Axis Side Map of Arena

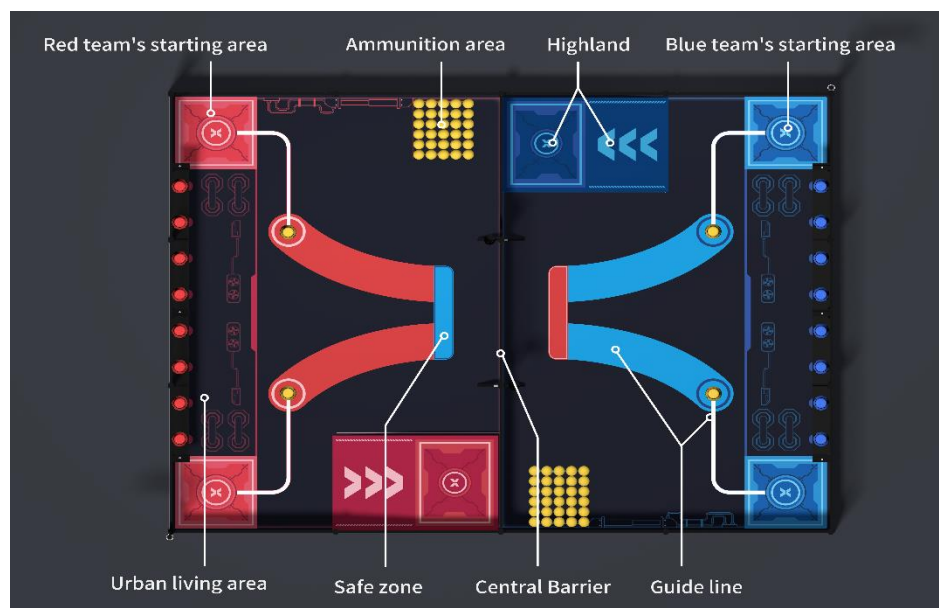


Fig 3.3 Diagram of Arena

- **Starting area:** Four areas in the arena are used for starting or stopping the motion of the robot in the competition. The dimension of the outer rims is 500mm \* 500mm.

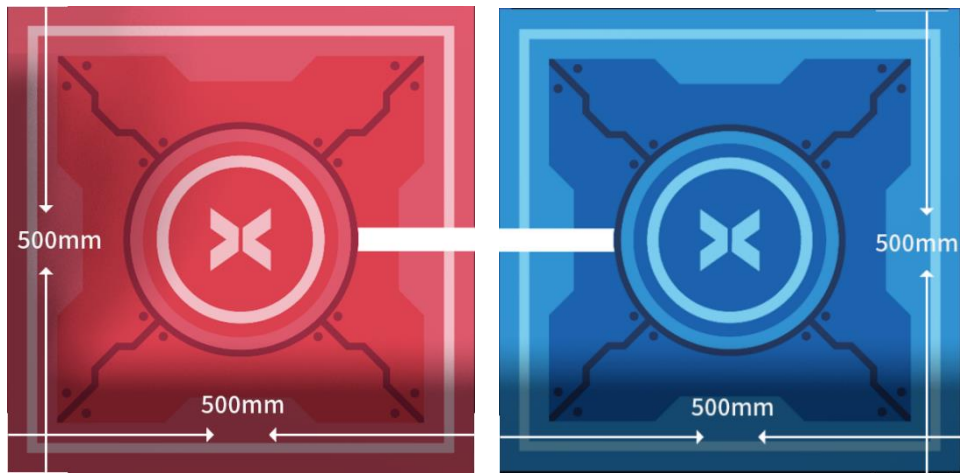


Fig 3.4 Starting Area

- **Highland:** Each camp has a highland, and the highlands are central-symmetric. The highland consists of slope and platform. The size of the platform is 650mm \* 500 mm, 100 mm from the vertical height of the ground, and the length of the bottom floor of the highland is 1000 mm. During the competition, a layer of stickers will be pasted to the surface and sides of the highland.

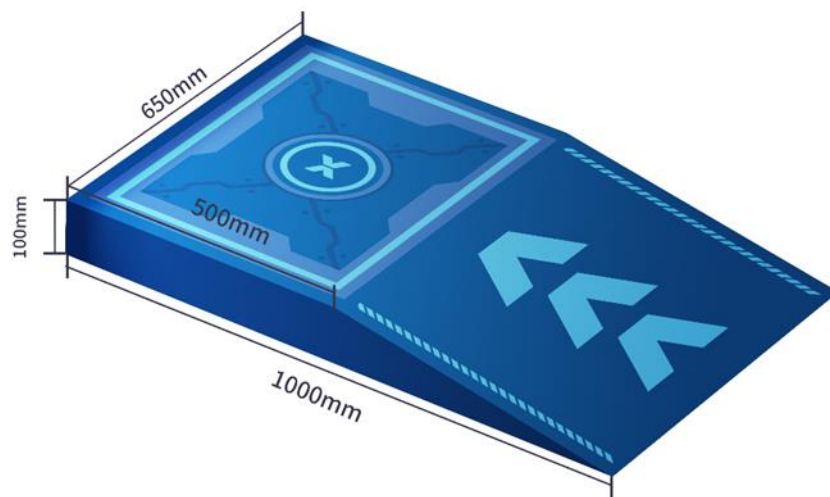


Fig 3.5 Highland



- **Ammunition Area:** There is an ammunition area on both sides of the camps of the Red team and Blue team, which consists of a rectangular area enclosed by Hook&Loop pasted on the competition map. 5 rows, 6 columns, a total of 30 balls are placed in this area.

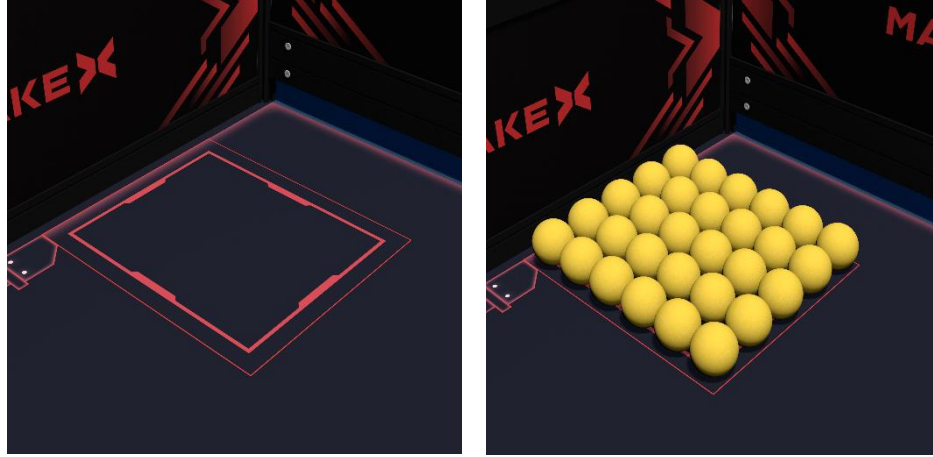


Fig 3.6 Ammunition Area

- **Central barrier:** Located in the center of the arena, partitioned the arena as red and blue camps. The central barrier is built by flat beam, octagonal pillar, metal net and PVC board. The height of central barrier are 960 mm, 500 mm and 500 mm respectively. (respect to Fig 3.7)



Fig 3.7 Central Barrier



- **Urban living area:** The area where blue or red bottles are placed. The urban living area is divided into upper and lower floors. The upper floor is composed of board and some arena frames, and the lower floor has a rectangular area of 1985mm\* 500mm. There are 8 bottles on each floor, totaling 16.

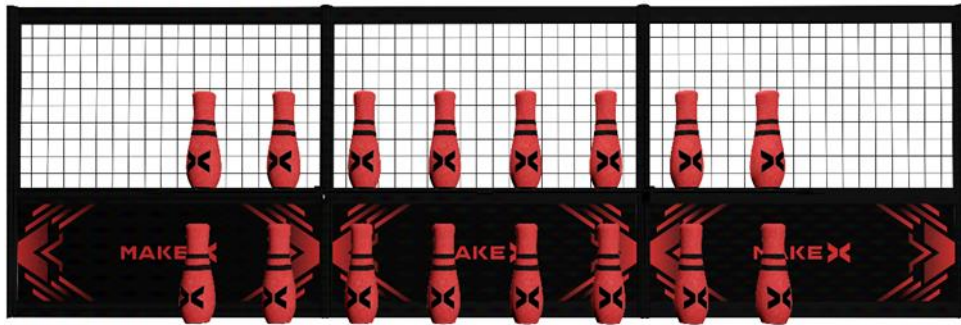


Fig 3.8 Front view of Urban Living Area

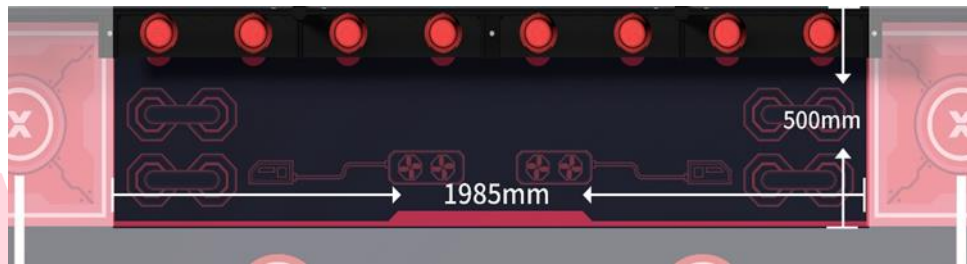


Fig 3.9 Top view of Urban Living Area

- **Safe zone:** The length and width of the rounded rectangular area near the central barrier is 660mm \* 120 mm, which is used for placing the yellow bottles.

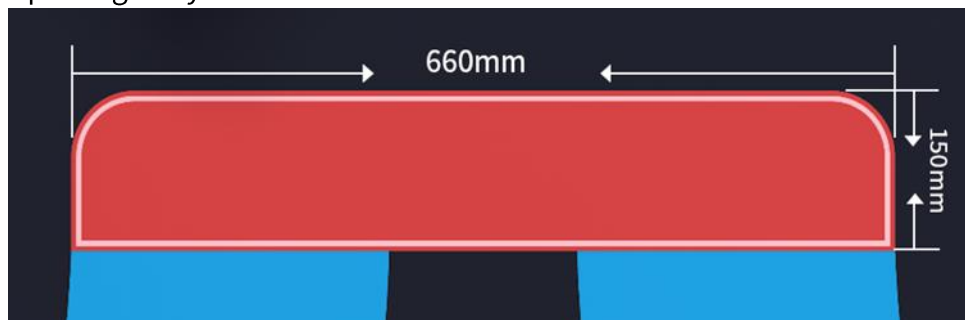


Fig 3.10 Safe zone

- **Signal transmitting area:** The shape is hollow cylindrical barrel structure, with an inner diameter of 68 mm and a barrel depth of 100 mm, which is fitted with 92mm flat beam on 960 mm octagonal pillar. The vertical distance between its top and the ground is 960 mm. Each camp has one and arranged in central symmetric, which is used to insert the flag symbolizing its own safety signal at the final stage.

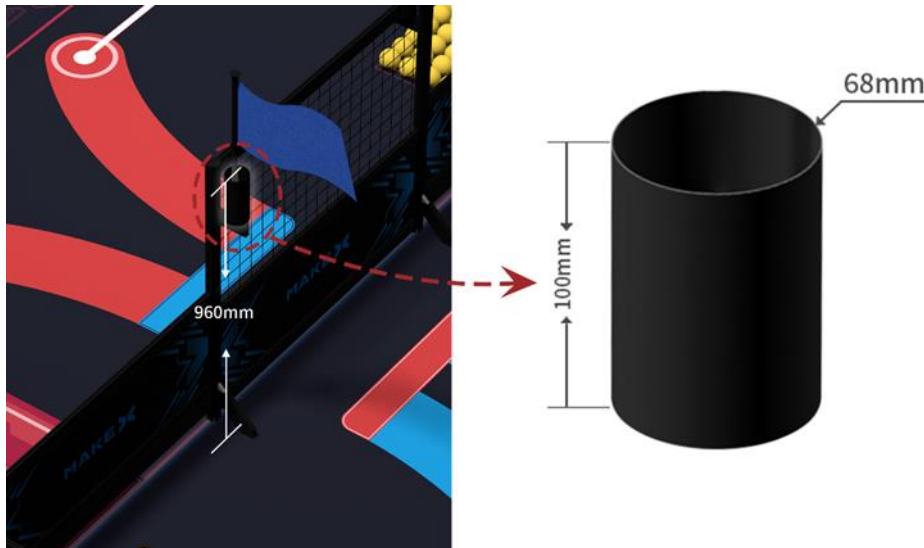


Fig 3.11 Signal Transmitting Area

- **Guide line:** As shown in Fig 3.3, it is composed of white lines and the red (blue) color ribbons, whose widths are 25mm and 260mm respectively.
- **Returning area:** Random determining 2 from 4 options from its own "2 Starting areas + 1 Ammunition area + 1 Highland (platform part)" as the returning area of the final stage, it will be determined and announced before the competition.

### 3.3 Props

- **Ball:** The ball is a yellow EVA ball with a diameter of 70 mm. It can be used for hitting the opponent's bottles through the robot, there are 30 balls for the Red team and for the Blue team respectively, totaling 60 balls. Before the competition, they will be placed in the ammunition area of both camps.



Fig 3.12 Ball

- **Bottle:** There are red (blue) and yellow EVA bottles in each alliance camp, which symbolize safety threats and significant safety threats respectively. There are 18 bottles for each side, among which 16 red (blue) bottles in the urban living area and 2 yellow bottles in the safe zone respectively. Dimensions: 280 mm high, 70 mm for bottom diameter, 100 mm for maximum diameter. The red, blue and yellow bottles will be used for reference below.



Fig 3.13 Bottle

- **Flag:** Alliance's flag is composed of flag surface and flagpole, which is made by the team itself, the size of the flagpole is limited 260-400 mm, and the diameter is 6~21 mm (both solid and hollow are acceptable). The flag surface must be regular rectangular; the length should within 180~240 mm and the width should within 120mm~160mm.

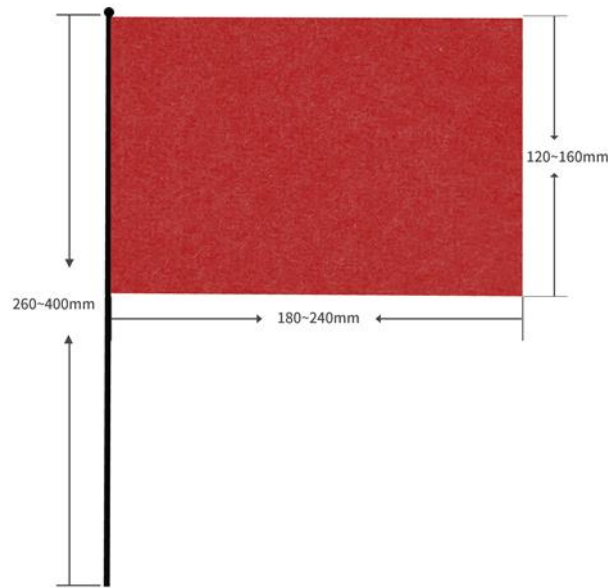


Fig 3.14 Flag

(Note: All arenas and props have a certain tolerance. If there are other adaptable props on site, contestants can apply for replacement before the competition)

## 3.4 Missions

### Automatic stage

The Automatic stage is 30 seconds.

To ensure the fairness of the competition, during the countdown of 5 seconds, before the start of the competition, the robots in the starting area will cooperate with the competition system to cut off the power. After the countdown, competition system will power on the robots, and the robots will run the automatic program.

At this stage, the robot can score through the following ways:

- (1) The yellow bottles are successfully moved from the initial position to the safe zone.
- (2) Automatically pick up the balls in the ammunition area and knock down the red (blue) bottles in the opponent side's urban living area.

Before the end of the automatic stage, the competition system counts down 5 seconds. At the end of the automatic stage, the competition system will automatically cut off the power supply of the robots.

Robots can use the guideline in the arena to score at automatic stage. In actual competition, the guide line partially uses the white lines in the black background. The arena is illuminated normally. The contestants can calibrate the sensor's parameters. The Committee does not guarantee that the light of the arena will never change. With the progress of the competition, the light of the arena may change.

### Manual stage

The Manual stage is 90 seconds.

After the scoring and state are confirmed for the automatic stage, the manual stage starts. After 5 seconds countdown of the competition system, the robots will be power on and the 90 seconds' manual stage started. In this stage, the operators can use the controller to operate the robots manually. The operator can manually control the robots to pick up the balls and hit all the opponent's bottles in his own camp. (including the highland).

Before the end of the manual stage, the competition system counts down 5 seconds and then it will automatically cut off the power supply of robots.

## Modification Stage

The modification stage is 60 seconds.

When the manual stage is over, the competition moves to the modification stage. Contestants can move the robots which is already return to the starting area before the modification stage starts. The flag of the alliance must not put on the robots before this stage. The length and width of the modified robot must conform to the size requirements, but the height is not limited.

When there are 30 seconds left in the modification stage, the competition system will remind. Before the end of the modification, there will be 10 seconds' countdown. Before the countdown over, contestants have to put the robot back in the starting area.

Note: Before the modification, contestants must take out all the balls stored in the robot and return them to their own camp at this stage. When the modification is finished, the robot shall return in the starting area and is not allowed to carry any ball.

## Final Stage

The final stage is 90 seconds.

When the contestants are ready and the state is confirmed, the competition moves to the final stage. After the 5 seconds' countdown, the 90 seconds' final stage will begin. The competition system will power on the robot and the robot will run the manual program.

In the final stage, besides continuing to hit the bottles to finish the scoring operation, the following two ways to score:

(1) Control the robot to successfully insert one flag of its own alliance into the signal transmitting area, and the corresponding points can be scored.

(2) At the end of the final stage, each alliance's robots will score the corresponding points for moving to the returning area.

At the end of the final stage, the competition system will cut off the power supply of robots, and the referee will confirm the scoring. All contestants should put the controllers into the storage basket and obviously stand far away from the arena's frame. Contestants should not be in contact with the arena.

## 3.5 Single-match Competition Process Chart

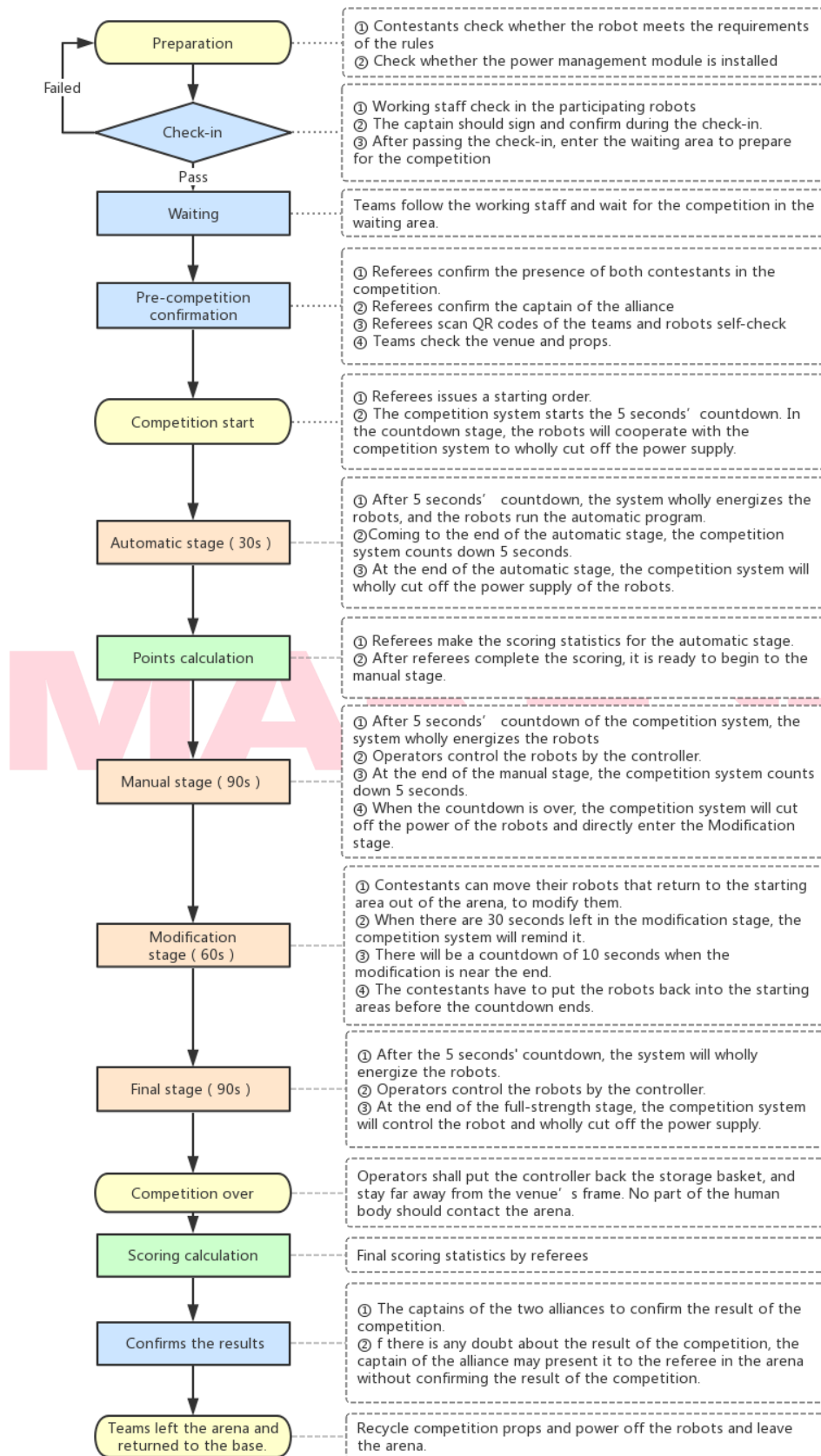


Fig 3.15 Single-match Competition Process Chart



## 3.6 Scoring Details

The referees count the automatic score at the end of the automatic stage and the manual score at the end of the final stage respectively. The scoring details are as follows:

**R01. Automatic scoring:** In the automatic stage, for every successful moving of a yellow bottle to the safe zone, the alliance scores 20 points and then two bottles 40 points; the bottom of the bottle must completely in safe zone; otherwise it will be deemed as invalid moving, no point will be scored. In this stage, the robot can also automatically collect the balls to knock down the blue or red bottle of the opponent. 10 points will be scored for per knock-down bottle.

**R02. Manual score:** At the end of the final stage, The referees will count the number of bottles that your robots knocked down on the opponent's camp, 20 points for each red (blue) bottle, 50 points for each yellow bottle, 80 points for successful flag insertion, 20 points for each robot successfully moving back to the returning area (the status judgment part will be explained in detail), 40 points for two robots.

**R03. Automatic score =** Successful moving score + knockdown bottle score - deduction score for violation. The automatic score is calculated at the end of the automatic stage.

**R04. Manual score =** knock-down bottle score + successful flag insertion score + successful returning score - deduction score for violation. Manual score is calculated at the end of the final stage.

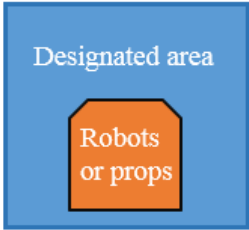
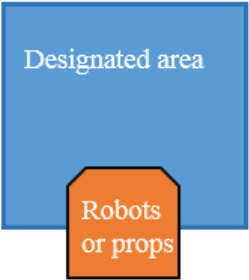
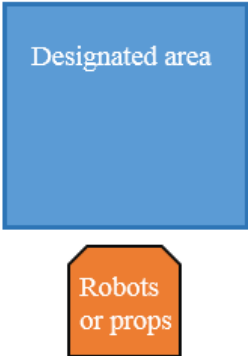
**R05. Total score =** Automatic score + Manual score.



## 3.7 Status judging

### Boundary state judging

E01. During the whole course of the competition, when the position status of the robots or props and are not very clear, the following statement can be used to judge:

Status	Completely In	Partially In	Completely out
Explanation	 <p>Designated area</p> <p>Robots or props</p>	 <p>Designated area</p> <p>Robots or props</p>	 <p>Designated area</p> <p>Robots or props</p>

### The judgment of scoring state of the urban living area

E02. The urban living areas are divided into two floors, with 16 red (blue) bottles placed by each floor. If the second-floor bottles in its own urban living area are completely separated from the upper partition plate, it is deemed as being knocked down, that is, the opponent's effective scoring state; the upright, inclined and leaning on the upper frame, etc. are not counted as being knocked down, and the opponent does not score.

E03. In case the first-floor bottles of are in an upright state and the bottom of the bottles are completely in or partially in the urban living area, it will be deemed as the opponent's invalid scoring state. Otherwise, it will be counted as opponent's scoring state.

### The judgment of scoring state of the safe zone

E04. At the end of the automatic stage and the final stage, if the yellow bottles are in an upright state and the bottom of the bottles are completely in the safe zone, it will be deemed as the scoring state of its own alliance.

### The judgment of scoring state of the signal transmitting area

E05. When the alliance's robots successfully insert the flags into the signal transmitting area, that is, when the referees count the score,

the flag does not need any external force to stay inside the cylinder barrel. Successful insertion of one flag, it is scoring state.

### The judgment of scoring state of the returning area

- E06. At the end of the final stage, once the subsystem 1 of the robot is partially in returning area, that is, it has returned successfully and is deemed as the scoring state of its own alliance.
- E07. If the ammunition area is selected, the boundary of the ammunition area is the outer rim of the ammunition area.



Fig 3.16 the boundary of Ammunition Area

- E08. If the highland is selected, the boundary of the highland is the external square on the platform of highland. (shown in fig 3.17)

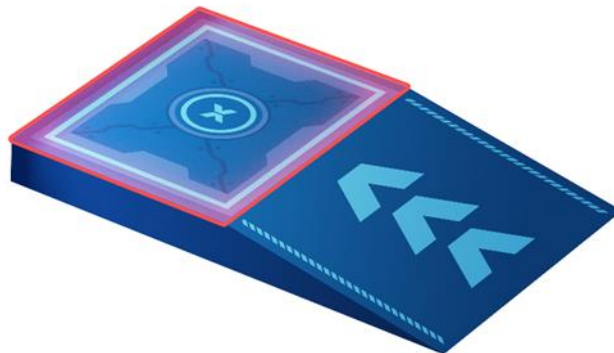


Fig 3.17 the boundary of highland

### Upright state judgment

- E09. The bottom of the bottles is fully contacted with the ground or the surface of the upper partition plate of the urban living area is deemed as an upright state.

### **Contact state judgment**

- E10. When the referees confirming the score, if the scoring prop contacted the robot, the prop will be deemed as invalid scoring state.

### **KO state judgment**

- E11. During the competition, if all bottles from one camp are knocked down, it will be deemed as KO state, so that the competition will be ended in advance.
- E12. The KO state can only happen in the manual stage and the final stage.
- E13. If all bottles from one camp are knocked down, during the automatic stage or the modification stage, it will be judged as KO at the start of the corresponding next stage of the competition.

### **The judgment of the state for robot's entry into the starting area**

- E14. The vertical projection of the robot should completely in the starting area before the start of the competition.
- E15. At the end of the manual stage, in other words, at the start of the modification stage, if subsystem 1 of the robot can partially in the starting area can be considered as into starting area.
- E16. The vertical projection of the robot should completely in the starting area at the start of the final stage.

## 4. Robot Technical Requirements

When the teams are designing their robots to participate in the 2019 MakeX Robotics Competition Challenge Courageous Traveler shall comply with the following technical requirements. It is suggested that the teams shall read and get familiar with all the Technical Requirements before designing and constructing robots. The Technical requirements provide a fair and safe competition platform for all teams and encourage teams to make innovative designs of their robots on the prerequisites of meeting technical requirements.

### 4.1 Robot General Technical Requirements

The General Technical Requirement explains and defines the requirements for Subsystem, Quantity, Size and Weight of Robot.

#### Subsystem of the Robot

- T01.** Subsystem 1: The mainboard and mobile robot chassis (including wheels, tracks or other mechanisms) that makes the robot move on the flat surface. For a stationary robot or a robot without any moving mechanism, the structure which has direct contact with the Competition Mat is deemed as Subsystem1. High-power dangerous equipment shall not be used by teams in the process of the competition and the related preparation.
- T02.** Subsystem 2: The power system includes the motors or servos which empower the Subsystem 1 and the battery that supplying energy to power system.
- T03.** Subsystem 3: The function system includes the functional structure of the robots, including but not limited to the function as identification of the external environment, operation for competition props, crossing of obstacles. Subsystem 3 includes mechanical parts and electronic parts.
- T04.** In case a subsystem has the functions of multiple subsystems, it will be deemed the subsystem with highest level. The hierarchy of the subsystem levels from high to low is subsystem 1, subsystem 2 and subsystem 3.

## Numbers of the Robots

- T05.** Each team is allowed to use only one robot to participate in the competition. Teams can only modify the subsystems 2 and 3 of the robot during the competition and the subsystem 1 cannot be modified. In case a team modify the subsystem 1, it will be deemed as the team uses the second robot. The team will be disqualified.
- T06.** In case the replacement of the same part is caused by the failure of parts (such as wheels defect, motors defect, etc.), it will not be deemed as replacing the subsystem.
- T07.** One team can only use one robot in the competition. It is not allowed to use one robot to compete in the arena, while another robot is assembling or modifying outside the arena.
- T08.** Teams are not allowed to use multiple robots alternatively during the competition.
- T09.** Teams are not allowed to use multiple robots alternately in one Regional Competition, Points Race or MakeX World Championship.
- T10.** Robots are not allowed to have a structure which can separated on purpose. During the competition, all subsystems of the robots need to be connected directly.

## Size of the Robot

- T11.** The Size of Robot is defined by its length, width and height. The vertical projection of the robots on the horizontal plane must not exceed the specified dimension of the square area, and the height of the robots must not exceed the specified dimension. This is considered that the robot's size conforms to the Robot Size Requirements. Robot's height is measured from the horizontal plane of the arena (contact with robots) to the furthest structure of the robot respect to the arena plane.
- T12.** Robot's length and width are defined in the Inspection and are not allowed to be redefined after Inspection.
- T13.** During the competition, the maximum initial size means that the size of the robot must not exceed the limit during the competition and before the modification stage.
- T14.** During the competition, the maximum modification size means that the robot's size must not exceed the limit after the modification stage.
- T15.** If the robot uses flexible materials (including but not limited to

cable ties, stickers, foam or Team Number), the flexible materials must comply to the size requirements of the robot without being affected by external forces when measuring the size of the robot.

**T16.** The following table presents the Robot Size Requirements:

	Requirements	Remarks
Maximum Initial Size	500 mm (Length) 500 mm (Width) 500 mm (Height)	1. The height should not exceed 500 mm and the vertical projection of the robot on the arena should not exceed 500 mm by 500 mm square area. 2. Before the start of the Modification Stage, the robot's size must comply with the Maximum Initial Size requirement.
Maximum Modification Size	500 mm (Length) 500 mm (Width) Unlimited (Height)	1. Without limitation on height, the orthographic projection on the ground should not exceed the square area of 500 by 500 mm. That has no limitation and the vertical projection of the robot on the arena should not exceed 500 mm by 500 mm square area. 2. After the Modification Stage, the robot's size must comply with the maximum modification size requirement.

### Weight of the Robot

**T17.** Weight of the Robot refers to the net weight of the robot at any time during the competition (excluding the props from the arena).

**T18.** Weight of the Robot must be less than 8 KG.

### Notice for Construction

**T19.** The teams should take into account the allocation of internal structure during the robot construction to ensure the operation of the robot subsystem 2.

## 4.2 Electrical Requirements for Robot

The Electrical Requirements for Robot applies to the mainboard, sensors, batteries, or other part which has electronic signals transmission with the mainboard. (Not apply to motor, servo or other kinds of actuator)

### Power System

- T20.** Teams can only use Li-Po battery from competition kits or the Li-Po batteries with the same parameters (3S Li-Po Battery, Output Voltage: 11.1v, Discharge Rate: 30c).
- T21.** Except for the laser aiming devices, the robot's Power System can only use one battery. The battery shall be securely fixed inside the robot. The battery should not collide with any structure (the robot itself or the arena) during the robot's operation.
- T22.** Battery must not detach from the robot when the robot is inclined or moving. Installation of battery should not offset the center of the gravity and lead to inclined.
- T23.** Power cord should be kept intact. Cracks or leakage of cover is not allowed, and the core metal conductors should not be exposed.
- T24.** The power cord and other electrical wire should be completely electrical isolated with the robot's structure. The robot's structure should not be used for electrical power or signal transmission.
- T25.** Teams should pay attention to the safety of battery during the preparation and the competition process. Battery should not be placed in the humid or high-temperature environment. Batteries should not be overcharged or over-discharged. Details for battery usage and safety instruction, please read the Appendix 3.
- T26.** The team can prepare extra batteries for backup. To avoid unexpected accidents, appropriated battery charger can be used in the designated area to charge and discharge in the right way.
- T27.** In case expected accidents emerged due to the quality of batteries or chargers purchased by the team themselves and improper use of batteries or charge, the responsibility shall be borne by the team themselves.

## Mainboard

- T28.** Robots should use the specific mainboard (NovaPi, manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1) to prevent the teams from using the high-efficiency mainboards to affect the fairness of the competition.
- T29.** Team needs to optimize the arrangement of wiring between the mainboard and electrical devices. Labeling each wire can highly improve the efficiency of the testing, maintenance and also facilitate the inspection process.

## Electronic Sensor

- T30.** Robots should use the specific electronic sensors (electronic sensors manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: not limited) to prevent the teams from using some high-precision sensors to affect the fairness of the competition.

## Wireless-Control

- T31.** The robot should to use the specific wireless-control equipment (Bluetooth Controller, manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: 1).

# 4.3 Mechanical Requirements for Robot

## Actuator System

- T32.** The Actuator System contains all motors or servos been used by the robot structures, including but not limited to chassis, mechanical arms, etc.
- T33.** The robot should use the specific DC motors (37 DC Motor and 180 Smart Encoder Motor manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 12) to ensure the fairness of the competition.
- T34.** The teams can only use the motor from the competition kit, or the same type of motor manufactured and sold by Shenzhen Makeblock Co., Ltd.
- T35.** The robot should use the specific servo motors (MS-12A Smart Servo manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 6) to ensure the fairness of the competition.
- T36.** The teams can only use MS-12A Smart Servo from the competition kit, or the same type of Smart Servo manufactured and sold by



Shenzhen Makeblock Co., Ltd.

## Mechanical Parts

Mechanical Parts contains the parts that form the structure of a robot but without power generation.

**T37.** The team can use partially customized or purchased mechanical parts, but the purchasing channels must be open and transparent for everyone to ensure that the other team can also access.

**T38.** The team can modify the physical property of Mechanical Parts (beam, plate, self-made parts, etc.) by, drilling or painting without violating any other rules.

**T39.** The team can't perform any chemical treatment on Mechanical Parts, including but not limited to melting, casting or other chemical treatments.

**T40.** The team can use the self-made purchased parts from following materials: 3D printing pieces, metal (can be magnetic), wood, plastic, rubber, standard sheets, standard profiled extrusions, etc.

**T41.** Teams can only use a integrate commercial products with one degree of freedom, such as hinges, sprockets and roller chains, pulleys, etc.

**T42.** Teams are not allowed to use a integrate commercial products with more than one degree of freedom for competition, including but not limited to multi degree of freedom mechanical arms or manipulators.

**T43.** Teams can use lubricant to protect the parts but notice that the lubricant should not leaked and pollute the competition arena.

**T44.** The team should pay attention to the safety when using parts or tools. High-power machines or tools should be used under the correct guide from the mentor.

## 4.4 Other Technical Requirements

### Non-Electrical Energy

T45. Except for electrical energy, other source of energy which empower the operation of robots is considered as Non-Electrical Energy. The Non-Electricity Energy used by the robots must only come from the following sources:

- (1)The energy stored by changing the robot's or part's center of gravity;
- (2)The energy stored by the deformation of the robot's parts;

### Sounds and Lights

T46. Robot are not allowed to use any electronic device generating sounds, including but not limited to the buzzers or the ultrasonic sensors.

T47. The lights generate by the robot can only from the power indicator light of the mainboard, sensor and laser aiming device which comply the technical requirements. Robots should not have other light sources because it contains potential risk for the teams or audiences and interfere with the operation of the robot.

T48. In case the robot uses a laser aiming device, the power should be less than or equal to 5mW (below 3a/R level). Only one laser aiming device can be installed for one robot.

T49. In case the robot uses a laser aiming device, they need to explain to the working staff and show the specification sheet of the device when inspection.

T50. In case the robots use laser aiming device, it is strictly prohibited to aim at the human eye and cause unnecessary hurt.

T51. In case the team modifies the instruction laser pointer and use as the laser aiming device, the power source of the laser aiming device must be same with original device and this power source must not transfer energy to another robot structure.

### Use of Programming Software

T52. The robot programming software must be mBlock5.

### Team Number

T53. The Team number is the only way to identify the team and their robot during competition. The Team Number needs to be printed and attached on the side of the robot (with a frame or specially designed

structure).

- T54.** Team number's printed font should be Times New Roman, black bold, size: 140 (or height of single character must higher than 3.5 cm) and the background should be in light color.
- T55.** The visible range of the robot's Team Number should not less than 270 degrees. A flat plane has 180 degrees of visible range.
- T56.** The Team Number of the robot must be firmly fixed on the robot and able to sustain the impact during the competition.
- T57.** Robots that do not conform to this requirement will not be allowed to participate in the competition.
- T58.** The team can use the sample version of the team number provided by the MakeX Robotics Competition Committee. Detailed information can be downloaded from the official database. The example diagram is as follows:



Fig 4.1 Team Number

## 5. Competition Rules

### 5.1 Safety

#### Dangerous Structure

R06. When the robot is not started, if a certain part of the robot is loose and may cause injury to people, it must be taken the safety precautions.

- ⊖ The team who is against this rule will be warned. The contestant needs to correct the robot. Otherwise, the robot will be suspended.

#### Violating Materials

R07. Robots are strictly prohibited from having the following materials or parts:

- Flammable gas, fire or smoke generating equipment, hydraulic oil or hydraulic components, switches or contactors containing liquid Mercury (Mercury);
  - Hazardous materials (such as lead);
  - Any material processed in any manner during the competition;
  - Ballasts and counterweights that do not guarantee safety, such as sand, may be scattered in the competition;
  - Materials that may cause unnecessary entanglement of the robot;
  - Material with sharp edges and angles that can easily cause injury;
  - Use materials made from animals (for health and safety reasons);
  - Materials containing liquids or gelatinous substances (except glue or lubricating oil that meets the requirements);
  - Materials that may delay the competition once being released, (e.g., coffee beans, soybeans, rice, etc.)
  - Any spare part that the electric current on the robot may be conducted to the arena.
- ⊖ The robot who is against this rule will be suspend. It needs to be modified and inspect before it continues participate in the competition. Repealed against this rule will result in disqualification.

#### Damage or Contamination of Arena

R08. Robots should not make malicious "climbing" and "bumping" movements to the boundary of the arena and the central barriers during

the competition. They should not cause the missing of any element in the arena, otherwise they will be considered unsafe for the arena. At any time, the referees judge that they are unsafe or have damaged the arena or other robots.

- ⊗ The team who is against this rule will be warned. The contestant needs to correct the robot. Otherwise, the robot will be suspended.

**R09.** Under the preconditions without contaminating the arena and other robots, glue, adhesive tape and lubricating oil can be used. In the case of contamination, the robot will be judged as unsafe. Robots should not use double-sided adhesive tape or glue to paste the arena elements throughout the whole competition.

- ⊗ The robot who is against this rule will be suspend. The robot needs to be modified and inspect before it continues participate in the competition. Repeated against this rule will result in disqualification.

### **Damage Other Robots**

**R10.** At any time, the referees can decide that the robots are unsafe such as have damaged other robots on the arena or not.

- ⊗ The robot who is against this rule will be suspend. The robot needs to be modified and inspect before it continues participate in the competition. Repeated against this rule will result in disqualification.

### **Robots Out of bound**

**R11.** During the competition, no part of the robot can be out of the boundary of the arena.

- ⊗ The robot who is against this rule will be suspend. The robot needs to be modified and inspect before it continues participate in the competition. Repeated against this rule will result in disqualification.

### **Other Unsafe Factors**

**R12.** In addition to the above issues, the referees are entitled to decide whether a specific robot is safe or not.

- ⊗ The robot who is against this rule will be suspend. The robot needs to be modified and inspect before it continues participate in the competition. Repeated against this rule will result in disqualification.

## 5.2 Operation Rules

### Operation Team

R13. Each team sends one operator and one observer for competition. Each side's operation team includes two operators and two observers, one of the operators or the observer will be the captain of the alliance.

R14. The robots are operated by their operators to complete the mission for each competition.

R15. The operator and the observer can freely switch the roles during the competition.

### Contestants' Requirements

R16. Contestants should wear goggles during the preparation of the competition, debugging robots, and on-arena competition.

R17. In the links such as preparation for the competition, debugging robots, on-arena competition, contestants who have long-haired should be tied up. Contestants should not wear toe-proof shoes to enter the arena.

### Contestants' Standing Position

R18. The activities range of the contestants during the competition shall be inside the operating area, as shown in the following figure:

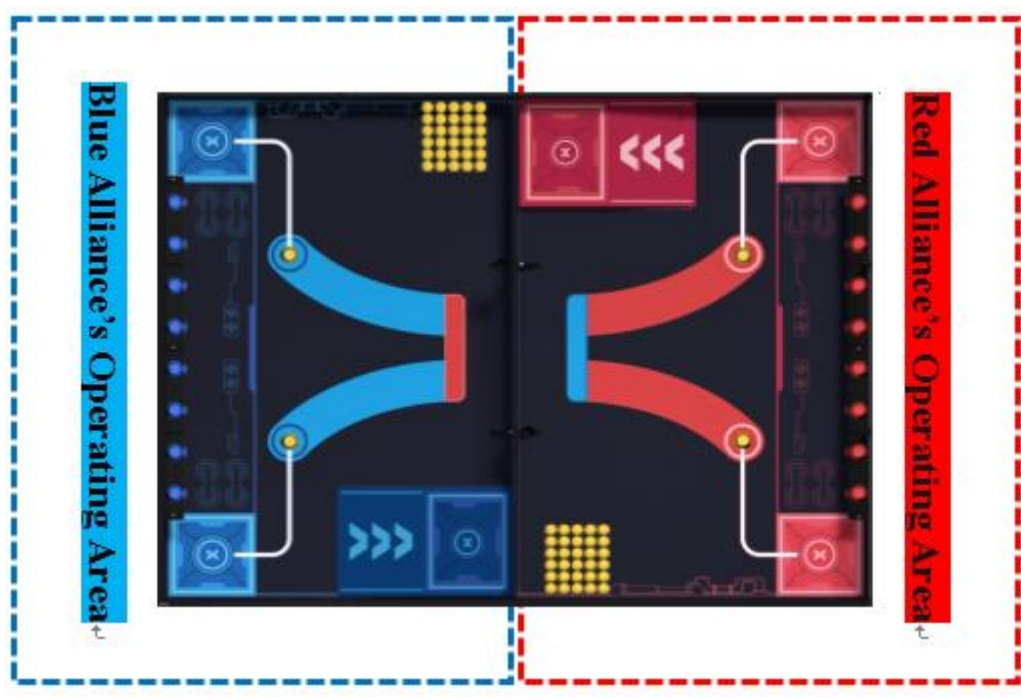


Fig 5.1 Figure of Operating Area

## **Violation of the Competition Requirements**

**R19.** Contestants violate the competition requirements at the competition arena.

- ⊗ The team will receive a Violation for the second time.

## **Elimination Tournament**

**R20.** During three sessions of the single match, it is not allowed to substitute the operator and the observer.

- ⊗ The team who is against this rule will be given a Red Card.

**R21.** Each alliance has 5 minutes for adjustment after the end of per session, no timeout allowed.

- ⊗ The team will receive a Warning for the first time, Yellow Card will be given at the second time.

## **Radio Interference**

**R22.** Except for the electronic communication devices that allowed in the competition, other electronic communication devices shall not be enter the competition arena (mobile phones, transceiver wireless devices, wireless networks, etc.).

- ⊗ The team will receive a Violation for the first time, Yellow Card will be given at the second time.

## **Robot starts in advance**

**R23.** Robots shall not be started until the Referee announce the start of the competition.

- ⊗ The team will receive a Violation for the first time, Yellow Card will be given at the second time.

## **Delayed end of the competition**

**R24.** At the end of the automatic stage, manual stage and the final stage, the operator shall stop operating the robot or stopping the motion program of the robot (except for the motion caused by the inertia of the robots).

- ⊗ The team will receive a Violation for the first time, Yellow Card will be given at the second time. If the delayed end of the competition brings the offender an advantage in the competition, the referee shall judge an invalid scoring and try to reset the original state of the arena.

### **Violating contact**

R25. Except the modification stage, the contestants should not touch such arena elements as the scoring props, the arena's frame and the robots etc. during the competition, including but not limited to the cases where the operator leans on the fence and the contestants pushing the robot position. In case the contacts occur outside the arena due to the normal movement of ammunition and other props, they are not bound by this rule.

- ⊗ The team will receive a Violation at the first time. In case of the scoring due to the violation contacts or the impact on the progress of the competition, the team will receive a Yellow Card.

### **Physical Affects the Competition**

R26. During the competition, the operation team should keep its body projection out of the arena, so as to avoid possible obstruction of the opponent's robot attack route and other factors affecting the progress of the competition. Except the action of moving robots in and out of the arena during the modification stage.

- ⊗ The team will receive a Violation for the first time, Yellow Card will be given at the second time.

### **Use Remote Control in Automatic Stage**

R27. Bluetooth controller or other ways shall not be used to manually control the robots during the automatic stage.

- ⊗ The team will receive a Red Card for the first time.

### **Operate Suspend Robot**

R28. When the robot is suspended, the operation teams cannot continue to control it.

- ⊗ The team will receive a Violation at the first time. In case a serious situation will received a Yellow Card. Depending on how serious of the situation the team may receive disqualification.

### **Robot Left-Behind Parts**

R29. During the competition, the robots cannot be detached (Detachment refers to the detachment from the main body of the robot, which it is not under control) their parts or mechanical devices left behind in the competition arena. Except that the disconnections caused by collisions of opponent's robot or contact of other robots.

- ⊗ The team will receive a Violation in case it affects the progress of the



competition. Yellow Card will be given at the second time.

### **Violation Projection**

**R30.** Robots are not allowed to project the arena elements from the above of its own arena to the other arena. (This rule will be violated by projecting an alliance flag or a ball bottle, etc.)

- ⊗ The team will receive a Yellow Card. If it causes changes in the elements of the opponent's arena, it shall be paused to restore.

### **Separate Arena Elements and Robots**

**R31.** Robots should be designed to easily remove the competition elements from any mechanical structure of grabbing, containing or holding. Even if under the circumstance that the power supply is disabled or cut off, the robot should be taken out of the arena without damaging the arena.

- ⊗ The team will need to modify the robots. Disqualification will be received at second time.

### **Completely In the Opponent's Arena**

**R32.** In the process of competition, the whole subsystem 1 of the robot cannot enter the opponent's arena through the hollow part under the central barriers, nor can the whole body extend into the vertical projection plane of the opponent's arena; this rule does not penalize the robot that part of the body enters the opponent's arena.

- ⊗ The team will receive a Yellow Card at the first time.

### **Restrict the Movement of the Opponent's Robot**

**R33.** Robots should not keep back the opponent's alliance robots from moving in all directions or from touching the arena elements.

- ⊗ The team will receive a Violation at the first time. In case serious violation the team will receive Yellow Card.

**R34.** As part of the body of the robot or subsystem 1 enters the opponent's area, the opponent's alliance robot is pinned or held, the referees may suspend the competition as the case may be and warn the vehicles of two sides to separate as soon as possible. If one of the robots is found to have deliberately pinned the other's robot, the offender will commit a violation, and he will receive a yellow card.

- ⊗ The team will receive a Violation at the first time. In case serious violation the team will receive Yellow Card.

### **Mentoring in Violation**

**R35.** Throughout the whole process of the competition, no relevant person except the contestants of the team, including but not limited to the parents or mentors of the contestants, shall enter the competition area by any means and give any form of mentoring. In case of the mentoring in violation, the referees are entitled to disqualify the team on the spot.

- ⊗ The team will receive a Warned at the first time. In case serious situation the team will receive Violation. Depending on how serious of the situation the team may receive disqualification.

### **Contact out of Arena**

**R36.** During the competition, contestants are not allowed to have any direct contact with off-arena people and audiences, including but not limited to the delivery of the parts and remote-control handles.

- ⊗ The team will receive a Warning for the first time, Violation will be given at the second time.

### **Rude Action**

**R37.** It will be deemed as the Rude Action when such cases for the operation team, the contestants and the mentor show up, including but not limited to the impolite behavior, seriously affecting the arena and the safety of the audience, leading to the failure of the normal progress of the competition. Rude actions are including but not limited to: serious violations of the spirit of competition, side-line mentoring, repeated or blatant violations; uncivilized acts against operators, coaches, working staff or contestants; repeated or blatant violations of safety, etc.

- ⊗ The team will receive a Warning for the first time, Violation will be given at the second time. Depending on how serious of the situation the team may receive disqualification.

### **Uncivilized Participation**

**R38.** In participating in the activities such as the technology sharing, robotic exhibition, observation of competition, contestants and mentors should ensure respect for other teams, maintain the neatness and order of the arena, and show the action principles in good images of the MakeX competition.

- ⊗ Depending on how serious of the situation the team may receive disqualification.

## 5.3 Modification Stage Rules

### The Robot does not Enter the Starting Area Before Modification Stage

R39. At the end of the manual stage, the robot needs to be taken out from the starting area for Modification Stage. In case the robot does not Enter into the starting area, it will not be allowed to perform any operations during the Modification Stage.

- ⊗ The team who modifies the robot that does not enter into the Starting Area will receive a red card.

### Modify Outside the Designated Area

R40. The team can only modify the robot after the vertical projection of the robot is completely outside the Arena. Any modification cannot start when the robot is lifted just above the Arena.

- ⊗ Team who is against this rule will receive a Violation.

### Change State of the Arena Elements

R41. Contestants should not change the state of the Arena Elements on purpose or touch the props when they are taking out the robot. The Arena Elements taken out by robots is not included, but they need to be put back into the Arena according to instruction.

- ⊗ The team who is against this rule will receive a Violation. If the state changing brings scoring advantage in the competition, the referee can withdraw the scoring and reset the arena state before the violation.

### Indirect Contact

R42. When contestant taking out the robot, if the robot has contact with the props on the Arena in any form, it will be deemed as the Indirect Contact with the props, and the contacted props will be deemed as the invalid scoring state.

- ⊗ The team who is against this rule will receive a Violation. If the indirect contact brings scoring advantage in the competition, the referee can withdraw the scoring.

### The Robot does not Enter the Starting Area After Modification Stage

R43. The robot should be placed in their own Starting Area before the end of the Modification Stage. The robot should not contain any Arena Elements.

- ⊗ The robot who against this rule will be suspended.

## **Robot's Requirements after Modification**

R44. The robot after the Modification Stage should conform with the modification state at the time of inspection, including but not limited to the Maximum Modification Size. (The height of Robot is not limited.)

- ⊖ The team who against the rule will receive a Red Card.

## **5.4 Abnormal Situation**

When something unexpected happens, the referee has the right to pause the competition and take action. Including but not limited to following situation:

### **Potential safety Risk**

E17. The competition venue emerges problems that might affect the safety of teams or robot.

### **Uncontrollable Technical Issues**

E18. The competition cannot continue because the robots or competition systems in the Arena is interfered by radio wave or other uncontrollable technical issues.

### **Damage of Arena or Prop**

E19. The props or arena are damaged accidentally, and the competition cannot continue.

### **Re-competition**

E20. Referees have the right to discuss and determine if a Re-competition is necessary according to the actual situation. The reason for Re-competition may because of the error of competition process or unexpected situation.

E21. During the Automatic Stage, if the competition is paused, Re-competition will be arranged to keep fairness.

E22. The abnormal situation is caused by the team themselves such as low battery life, failure of robot's parts, communication errors or the defect of Power Management Module will not lead to Re-competition. (Power Management Module check point is set near the Arena for team to verify the function of Power Management Module) Other defects of the robot itself will not lead to re-competition.

### **Abnormal Change of Arena Elements**

E23. During the competition, the state of the Arena Elements is changed because of an abnormal action such as the effects from

outside of the arena.

### **Resume from Pause**

- E24. After the Abnormal Situation is solved, the paused competition can be resumed from the time of pause.
- E25. Contestants should keep positive attitude after the competition pause. If they cannot continue the competition due to unexpected reason, they should sign and confirm in the Arena or inform the MakeX Robotics Competition Committee by other means. The other teams need to continue that competition normally.

## **5.5 Punishment**

### **Warning**

- E26. The referee gives the team an oral notice, Warning, and requires the team to stop violating the rules and obey the referee's instructions. During the Warning, the competition will be timed normally.

### **Violation**

- E27. The referee gives the team a noted punishment, Violation with 20 points deducted for the team. When referee discovers that the team has corresponding violated performance, the Violation will be given immediately. During the Violation, the competition will be timed normally

### **Yellow Card**

- E28. When the contestant's or related person's action that seriously affect the fairness of the competition or violate the safety principle, the alliance will receive a Yellow Card with 60 points deduction for both alliance teams.
- E29. Accumulation of Yellow Card: In Qualification Round, the accumulation of Yellow Card for each Single Match is counted for one team. If one team receives two Yellow Card, it will upgrade to Red Card. In the Elimination Tournament, the accumulation of Yellow Card for each Session is counted for one Alliance (two teams). If one Alliance receives two Yellow Card, it will upgrade to Red Card for the Alliance.

### **Red Card**

- E30. When the contestant's or related person's action that extremely affect the fairness of the competition or violate the safety principle, the alliance will receive a Red Card with 120 points deduction for both

alliance teams. The robot will be suspended. During the Automatic Stage, if a team receives a Red Card, the team's robot must be taken out from the Arena after the Automatic Stage.

- E31. Object of Punishment: In the Qualification Round, the Red Card will be given to team only. When a team received a Red Card, the team will be deducted for 120 points and their robot will be suspended but the competition will continue normally. In case both teams from one alliance receive red card, the alliance will directly be Loss and record the final points at that time. (After deduction, if the point of the losing alliance is higher than that of the winner alliance, the final points will change to winner alliance has 10 points advantage than losing alliance)

In the Elimination Tournament, the Red Card will be given to Alliance only. When a team received a Red Card, their alliance will directly be Loss and record the final points at that time. (After deduction, if the point of the losing alliance is higher than that of the winner alliance, the final points will change to winner alliance has 10 points advantage than losing alliance)

### Suspend

- E32. If the robot is defect (such as parts falling) or violating of safety principles, the robot will be suspended by stop movement and remain still on Arena until the end of the competition. During the Automatic Stage, if a robot is suspended, it must be taken out from the Arena after the Automatic Stage.

During the Modification Stage, if a robot is suspended outside the Arena, it must not be put back in the Arena.

When the defected robot may against the rules such as "Damaging the Arena", the contestants can apply to the referee for Suspend their robot. The referee has the right to use Suspend according to the actual situation on the Arena.

### Disqualify

- E33. Team's action which serious violates the safety rules, the spirit of the competition or etc. will result in disqualify for competition awarding but points will be kept. In the Qualification Round, if two teams from same Alliance are disqualified, the competition will proceed as usual. In the Elimination Tournament, if two teams from same Alliance are disqualified, the other alliance will win the

## 5.6 Explanations

**R45.** To ensure fair and high-quality competition experience, MakeX Robotics Competition Committee has the right to update this Guide regularly, and to publish and implement necessary changes before the competition.

**R46.** During the competition, all matters not specified in the Technical Guide can be decided by the referee team.

**R47.** This Technical Guide is the reference for the referee. During the competition, the referee has the right to give final decision.

## 6. Technical Guide Statement

The official language for MakeX is Chinese. English translation is prepared to facilitate the team's preparation process. All documents translated to English are for reference only.

The MakeX Robotics Competition Committee reserves the final interpretation of MakeX Robotics Competition - Technical Guide for Courageous Traveler.

## 7. Disclaimer

All contestants in 2019 MakeX Robotics Competition shall fully understand that safety is the most important issue for the sustainable development of MakeX Robotics Competition. To protect the rights and interests of all contestants and organizers, according to relevant laws and regulations, all contestants registered for the 2019 MakeX Challenge - Courageous Traveler, shall acknowledge and abide by the following safety provisions:

Contestants shall take adequate safety precautions when constructing the robotics, and all parts used for constructing the robotics shall be purchased from legal manufacturers.

Contestants shall ensure that the structural design of the robotics takes into account the convenience of the inspection and actively cooperate with the host of

the competition.

When modifying and using the parts with potential safety hazards for the robotics, it must conform to the national laws, regulations and quality & safety standards. Those operations shall be manufactured and operated by persons with relevant professional qualifications.

During the competition, the teams shall ensure that all the actions such as construction, testing and preparation will not do harm to their own team and other team, referees, staff, audiences, equipment and arenas.

In the process of construction and competition, if any action that may violate the national laws, regulations or standards occur, all consequences will be borne by the contestants themselves.

The competition kits and parts sold and provided by the supporter, Shenzhen Makeblock Co., Ltd., shall be used in accordance with the instructions. Shenzhen Makeblock Co., Ltd., Shenzhen Hulu Maker Co., Ltd. and MakeX Robotics Competition Committee will not be responsible for any injury or loss of property caused by improper use.

## **8. Copyright Declaration**

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## **Appendix 1: Competition Resources**

MakeX Official Website: <http://www.makex.cc>

Any Feedback & Question Please Sent to:

[info@makex.cc](mailto:info@makex.cc)

Additional Information:

<http://www.makex.cc/information/download/>



## Appendix 2: MakeX Challenge

### Robot Self-check List (Courageous Traveler)

MakeX Challenge Robot Self-Check List (Courageous Traveler)			
Size and Weight of Robots			
SN	Items	Specific Requirements	State
1	Size	<p>The initial size is the size that the robots are in a stationary state before the start of the competition.</p> <p>Maximum size refers to the size of the robot moving to the limit state during operation.</p> <p>The initial size requirement of the robot at the start of the competition is 500 mm (long) x 500 mm (wide) x 500 mm (high).</p> <p>After intensified modification, the initial size of the robot before restarting is required to be 500 mm (long) x 500 mm (wide) x unlimited (high).</p>	

2	<b>weight</b>	The weight of the robot is less than 8 KG. (Including the weight after the modification; the weight after the installation of batteries).	
<b>Safety</b>			
3	<b>Risks structure</b>	Safety protection is required for the structures that may cause injury to people in the process of clamping, handling and using the machines.	
4	<b>Damaged arena</b>	In the process of loading, unloading, handling and using the machine, there shall be no act of the obvious damage to the arena.	
5	<b>High power tools</b>	No high-power equipment during loading, unloading and operation.	
6	<b>Unsafty energy storage equipment</b>	In the process of using the unsafty energy storage equipment (springs, etc.), safty shall be ensured.	
8	<b>People's safty</b>	In the competition, contestants shall wear goggles; long hairs shall be tied up; contestants are prohibited from wearing toe-baring shoes into the competition arena.	
9	<b>Banned substance</b>	Robots are not allowed to use the flammable gases, fire or smoke generating equipment, hydraulic components, Mercury-containing switches,	

		exposed hazardous materials, unsafe counterweights, designs that may cause entanglement and competition delays, sharp edges and angles, materials containing liquids or gelatinous substances, and any part that the electric current on the robot may be conducted to the arena.	
<b>Robot's Modules</b>			
<b>10</b>	<b>Flag</b>	The flagpole is limited 260-400 mm, and the diameter is 6-21 mm (both solid and hollow are acceptable). The flag surface must be regular rectangular; the length should within 180~240 mm and the width should within 120mm~160mm.	
<b>11</b>	<b>Controller</b>	The competition shall specify the controller to be used, and it is only be used by the operator.	
<b>12</b>	<b>Mainboard</b>	The required mainboard shall be used by the competition, and there is only one receiving module matched to use by the mainboard and the remote control.	
<b>13</b>	<b>Power supply</b>	Batteries with specified parameters are used as power supply and shall be securely fixed inside the robots. Each robot can only use one	

		<p>battery (In addition to the required laser sight devices). Detailed parameters are: 3S Li-Po batteries, output voltage: 11.1v, discharge rate: 30c.</p>	
14	<b>Battery Management Module</b>	<p>Battery management module can run in a supporting way according to the requirements of the competition system: supporting to complete three actions: support completing the power on, power cut and starting the automatic program.</p>	
15	<b>Self-customized parts and accessories</b>	<p>Self-customized parts can be used: plates, profiled materials, 3D printing pieces, metals, wood, plastics, rubber, magnets; Auxiliary materials' use requirements: It is allowed to use the ropes, cables, wires, springs, rubber bands, leather hoses, surgical tubing, punched sheets, injection molded products; It can use a single-freedom complete commercial products package and system wheels; It is not allowed to use the multi-freedom commercial products package.</p>	

16	Sounds and Lights	<p>There is no light source except the laser sight device and the indicator light self-contained of the mainboard or the sensor with its power less than 5 mW (Limited to only one);</p> <p>No other sound generating device is allowed except the buzzer on the mainboard.</p>	
		<p>In case it requires the independent power supply when the teaching laser pen is used to be modified into the laser sight device, it can only use the configured batteries (such as dry batteries) of the device, and the batteries cannot transmit energy for the power system of the robot. If it is not a common laser sight device, please provide the corresponding model and parameters for query and verification.</p>	
17	Smart Servo	<p>The teams can only use the smart servo equipped with the official equipment package or the same type of smart servo (MS-12A), the maximum number of servo available on a robot is 6 pieces.</p>	
18	Motor	<p>The robot shall use the required DC Motors ,Optical Encoder Motors(37 DC Motor, 180 smart Motors</p>	

		manufactured and sold by Shenzhen Makeblock Co., Ltd.) ;and the maximum number of them is 12) to ensure the fairness of the competition.	
19	<b>Robot angle-wrapping</b>	The exposed sharp edges of the robots have to be wrapped with sponge strips.	
20	<b>Separation/abscission</b>	It is not allowed that there are parts detached from the main body of the robots in the completion. The arena parts may be detached from the robots.	
21	<b>Interference</b>	Cannot interfere with the electronics and sensors of other robots.	
22	<b>Team Number</b>	Team number's printed font should be Times New Roman, black bold, size: 140 (or height of single character must higher than 3.5 cm) and the background should be in light color.	
23	<b>Project note submission</b>	Submit project notes containing the source code of the robot control before the competition.	
24	<b>Arena contamination</b>	Lubricating oil etc. used by robots shall not contaminate the venue or other robots.	

## Appendix 3: List of Violations and Penalties

scope	Items	Generalization	Violation	Yellow card	Red card	Suspended.	Disqualification
Check-in rules	Use the robots that unqualified of the check-in status.	The contestants have to modify the robots that unqualified until pass the check-in.					✓
	Risks structure	In case it is found that the structure of the robots may injure human, they should be modified immediately after warning.				✓	
Safety rules	Damaging arenas or other robots	Two or more violations will be disqualified				✓	✓
	Use banned substances	In case it is found that the use of the banned substances by contestants, it will be prohibited, and two or more violations will be disqualified.				✓	✓
	Contaminating of arena	Under the preconditions without contaminating the arena, the glue, adhesive tape and				✓	✓



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		lubricating oil can be used by the robots; In case it is found violated with this rule, they will be prohibited to use, and second violation will be disqualified.					
	Robots Out of bounds	No part of the robot can be out of the boundary of the arena.				✓	
	Other unsafe factors	In case the referees find the other unsafe factors of the robots, they are entitled to request the contestants not to use such robots and make modifications. Second violations will be disqualified.				✓	✓
Operati on rules	Bring electronic communication devices	Two violation may be penalized by showing a yellow card.	✓	✓			
	Delayed end of the competition	The corresponding score will be deducted.	✓				
	Violating contact	A yellow card will be received if it affects the score or the progress of the competition.	✓	✓			
	The human body is not allowed to extend into the arena to affect the	A yellow card will be given for two violations	✓	✓			

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	opponent to score.						
	Manual control at the automatic stage.	In the automatic stage, the controller should be placed in the storage basket.			✓		
	Robots leave behind the spare parts in the arena	Giving violations according to the seriousness of the circumstances, a yellow card will be given for two violations.	✓	✓			
	Remove the arena elements from the arena.	The scoring behavior is not included.	✓				
	Projecting the arena elements that are not allowed to be projected to the opponent's camp	In case of resulting in the change of elements in the opponent's camp, it should be suspended for restoration.		✓			
	Arena elements are difficult to remove from robots.	Repeated violations affecting the progress of the competition will be disqualified.					✓
	Completely in the opponent's camp	If it fails to return to its own camp after a penalty, it will be penalized by a red card.		✓	✓		
	Pinning or	A penalty will be given	✓	✓	✓	✓	✓

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	holding opponent's robots	for deliberately holding the opponent' s robot.					
	Operating prohibited robots	Please don't operate the robots that have been prohibited. For the first time, offenders will be penalized for violations. For serious violation, a yellow card will be given until the disqualifications of the competition.	✓	✓	✓	✓	✓
	Overdone act	Overdone acts are including but not limited to: repeated or blatant violation, Impolite behaviors to the operators, referees, working staff, or contestants; Repeated or blatant violations of safety; Two violations will be penalized and disqualified.	✓	✓	✓	✓	✓
	Mentoring in Violation	The team will receive a Warned at the first time. In case serious situation the team will receive Violation. Depending on how serious of the situation the team may receive disqualification.	✓	✓	✓	✓	✓
	Contact and exchange	It is strictly prohibited to take place during the	✓	✓	✓	✓	✓

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	parts outside the arena	competition.					
Modification Rules	Forced modification without entering the starting area	Entering the starting area is subject to the contact of the bottom of the robot with the starting area.			✓		
	Modification in the arena	Contestants have to modify outside the arena.	✓				
	Initiatively change the competition arena elements in the modification stage	The arena elements removed from the robots will not affect the state changes of the other of elements as they are placed in the arena.	✓	✓			
	Failure to enter the arena before the end of the modification stage	The robot can't enter the arena anymore.				✓	
	After modification, bring arena elements into the arena	Robots carrying arena elements are not allowed to enter the arena.				✓	
	Incompatible the check-in status after modification	If there are any major changes, they should declare to the referees for inspection after being put into the arena.			✓		

## Appendix 4: Instructions for Li-Po Battery

To ensure the safety of Li-Po battery, each team should designate a person to supervise the safe use of Li-Po battery and to popularize the knowledge of the safe use of Li-Po battery to teammates. In the process of use, the following issues should be noted:

- Please use the Li-Po battery while ensuring that you carefully read and understand the guidelines for safe use of it.
- Safely charging and discharging
- Only to use the special charger for Li-Po battery matched by the manufacturer and scrutinize the Guide for the use of the charger. Please make sure that someone is nearby during charging. In order to deal with emergencies immediately, please do not overcharge or over-discharge. A single battery cell with 4.2V is overcharge, and cell with less than 3.0V is over-discharge. Overcharge may cause the explosion of the Li-Po battery. Over-discharge can easily damage the battery and shorten the service life of it.
- Please check the battery's voltage and quantity of electricity carefully before charging or using.
- Please charge the battery at 0-45 °C.
- Safe storage
- The battery cannot be overheated any time. When the temperature of the battery cell is as high as 60°C, there will be potential safety hazards, even burning.
- When charging, the battery should not be closely or placed directly on flammable materials (paper, plastic, etc.). If conditions permit, it is best to charge it in a fire-proof safe box.
- Do not put batteries near liquids, open fire or heaters. Place batteries out of reach by kids.
- Do not open and restructure the batteries arbitrarily or change its wiring, do not self-assemble the batteries privately, open and restructure the old batteries cells, or restructure one of the opened battery cells with another battery pack. This act is risky (without the particular assembly instrument, it can easily cause short-circuit

combustion).

- In case the collision occurs during use, please remove the battery. Please carefully check whether the battery and connector are normal, just in case. (Note: Batteries may be overheated with high temperature.)
- Do not spill electrolyte on eyes or skin. In case it spills inadvertently, please wash it with clean water immediately. In case it is serious, please seek medical attention immediately.
- No short circuit is allowed (positive and negative poles are connected).
- Do not directly contact the leaked battery.
- About the long-term unused battery, please ensure a charge-discharge activation within 3 months to maintain the stability of it.
- During the storage and transportation of Li-Po battery, please place them in the special fire-proof safety bags or safety boxes.



## Appendix 5: Instructions for Power Management Module

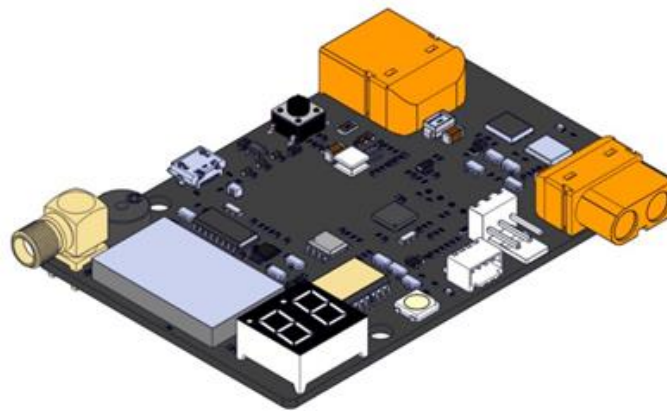
### Instructions

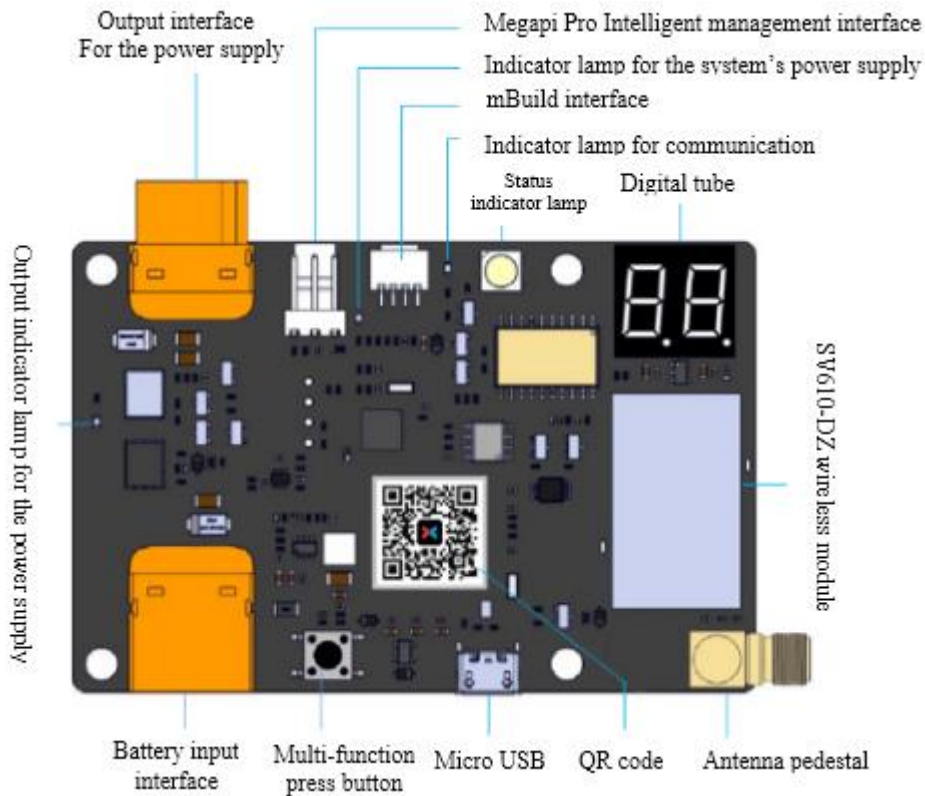
The power management module is used in coordination with the mainboard (NovaPi), which is a necessary electronic device to participate in the competitions of Courageous Traveler and Strong Alliance, 2019 Season.

During the competition, the power management module is wirelessly connected with the MakeX competition system, so that the MakeX competition system can control the power supply of the teams' robots, as well as switch between automatic and manual programs.

**Module's size:** 85mm x 56mm x 11.5mm;

**Working voltage:** 6V - 12V;





### On-board LED Lamp

The LED light includes a power supply output indicator lamp, system power supply indicator lamp and communication indicator lamp.

- **Power supply output indicator lamp:** When the power supply has output, the red indicator lamp is always on, and when the power supply is disconnected, the red indicator lamp is off.
- **System power supply indicator lamp:** The red indicator lamp of the system power is always on when the module is working.
- **Communication indicator lamp:** The blue communication indicator lamp flash when the module updates his firmware;

### Status indicator lamp (RGB lamp)

The status indicator lamp is mainly divided into four statuses: off, red, green and blue.

- **Off:** The Bluetooth module is tested after the power management module is powered on. When the Bluetooth module cannot be detected, the RGB lamp is off;



- **Red:** After normal power-on, click the button and the RGB lamp flashes red one time;
- **Green:** In the manual stage of the competition;
- **Blue:** In the automatic stage of the competition.

## Digital tube

The two-digit digital tube is mainly used to display the current channel number and an abnormal state of the wireless communication module.

- In the normal state, the channel number of the current wireless communication module is displayed by the two-digit digital tube. The channel number of the wireless communication module is 1~40, so that the number displayed by the digital tube is 1~40. If the current channel is 16 channels, the two-digit digital tube displays the number "16".
- The power management module detects the wireless communication module when it is powered on. When the wireless communication module cannot be detected, the two-digit digital tube displays the letter "Er", meaning "error".
- When the battery is low power, the two-digit digital tube displays the symbol "-" and the current channel number alternately.

## Buzzer

The buzzer output reminding and warning sounds.

- The module will shortly buzz when the module is normally powered on and be detected, and the wireless communication module is online.
- When the power management module is reset, the buzzer will sound for 2 seconds;
- When the wireless communication module cannot be detected after power-on, the buzzer rings three times continuously.

## How to use

### Multifunctional button

Multifunctional button has four modes: Reset, Click, double-click and Long-press.

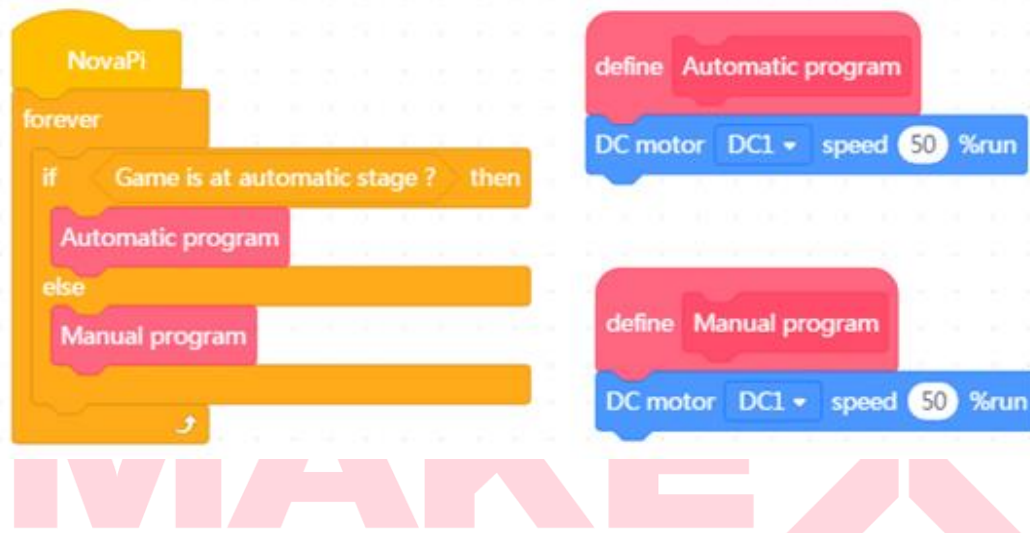
- **Reset:** Firstly, press the multi-function button and insert the Li-Po battery into the power management module at the same time. The power management module restores the default configuration

parameters. The buzzer sound for 2 seconds and the nixie tube display the number "20";

- **Click:** Click the multi-function button one time, the power management module reports the Bluetooth module UID one time, and the RGB lamp flash red one time.
- **Double-click:** Double click the multi-function key once, the power management module will delay 3 seconds and switch between the automatic program and manual program (It can be observed whether the state switch is successful through the RGB indicator, the RGB blue lamp is always on during the automatic competition, the RGB green lamp is always on during the manual competition, and the RGB lamp flashes during the delayed switching). Double-click function is only valid when the Bluetooth module is the defaulted to "20" channel (that is, only when the nixie tube displays the number "20";
- **Long-press:** Long press the multi-function key (2-3 sec.) to switch the output state of the power supply. That is if the current power supply is disconnected, the power supply connects after long pressing, the power supply output indicator lamp becomes red. If the power supply is connected, after long pressing, the power supply is disconnected, the power supply output indicator lamp turns off.

## Signal Identification Code of Automatic Program starting

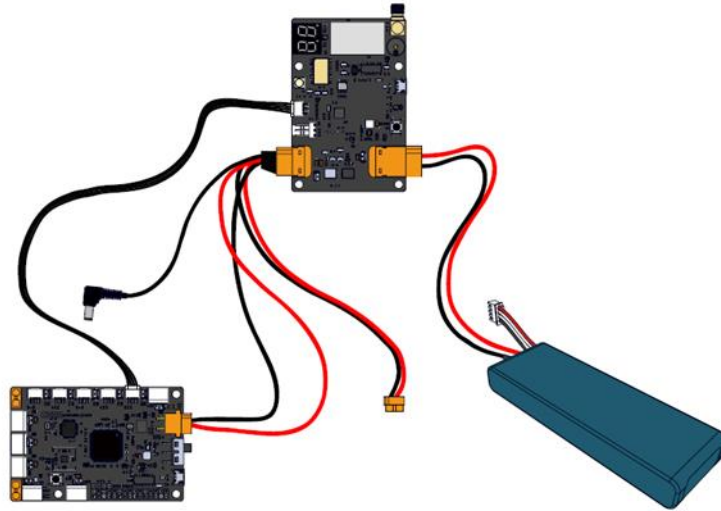
In the automatic stage, the competition system sends relevant instructions to the power management module of the robot, to shield the controller signal and start the automatic program of the robot. To start the automatic program on the mainboard normally, it is necessary to insert a fixed code into the program to identify the instruction to start the automatic program sent by the competition system (please put the program in the manual stage and the automatic stage into the corresponding positions).



## Suggestions for Installation and Use

- The power management module is a necessary electronic component for the competition. Please make sure that it is securely fixed, and cables are tightly connected. For protection, it is suggested to use an acrylic box for the power management module;

- The data cables leading to the mainboard must be connected firmly as the following picture:



- Adjust the position of the antenna to prevent it from interfering with the movement of other moving devices, and try to avoid the antenna too close to the large area of metal materials;
- The power management module must be fixed on the surface of the robot and be accessible to scan (power management module ID);
- The following operations are not allowed at any stage after the start of the competition, especially during the modification stage:
  - ⊗ The replacement of Li-Po battery or re-unplugging and re-plugging of the Li-Po battery.
  - ⊗ Press the reset button of the power management module (any operation of the power management module is prohibited).
- When the competition is finished, the robot needs to be re-powered by itself, and the power supply can be restored by unplugging and plugging the Li-Po battery;
- The power management module corresponds to the teams' information in the competition system one by one. Please do not replace that module without authorization. If it needs to be replaced, please contact the working staff. Any problems caused by an unauthorized replacement of the power supply module shall be borne by the team.

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**MAKE X**

MakeX Robotics Competition Committee