

MAKE X

V2.0

2022-2023 MakeX Robotics Competition

TECHNICAL GUIDE

MAKEX PREMIER
| POST - SECONDARY GROUP |



Edited By MakeX Robotics Competition Committee

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MAKE X

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MAKEX



1. Introduction

1.1 About MakeX

MakeX is a robotics competition platform that promotes multidisciplinary learning within the fields of science and technology. It aims at building a world where STEAM education is highly appreciated and where young engineers are passionate about innovation by engaging them in exciting Robotics Competition, STEAM Carnival, etc.

MakeX Robots Competition is hosted by the MakeX Robotics Competition Committee, organized and supported by Shenzhen Makeblock Co., Ltd. As the core activity of MakeX, it aims that through the competition, young engineers 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 engineers 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 engineers 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 Participation Requirements

MakeX Robotics Competition is dedicated to providing young engineers with a high-quality, wide influence and impressive viewing experience platform for robotics competitions. Full-time post-secondary students including doctoral, postgraduate, undergraduate and college students aged 18 (born after January 2, 2004 and above, registered before January 1st, 2023) can sign up through the official website. The requirements are as follows:

Each Team consists of 2 to 8 Contestants and 1 to 2 Mentors. 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 Mat, Arena Frame, Arena Props and so on.
- **Storage Basket:** A steel basket placed on an Arena Frame for storing the objects used in the competition.
- **Scoring Prop:** It refers to all props that can be used to score.
- **Arena Frame:** The structure which is spliced by flat beams and octagonal pillars.
- **Ground:** It also refers to the upper surface of the mat.
- **Operation Area:** The only area where the Operators and Observers are allowed to operate.
- **Side:** The arena is divided by two Sides, robots from one Alliance can only operate within their own Side during the match.
- **Competition System:** The on-arena control system, which consists of both the hardware and software, is developed to ensure fair and honest competition.

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.
- **Staff:** Personnel who are responsible for maintaining the normal operation of the competition.
- **Contestant:** Team members who have registered and participated in the MakeX Robotics Competition Premier Ultimate Warrior.
- **Mentor:** Teachers who have registered and participated in the MakeX Robotics Competition Premier Ultimate Warrior.
- **Team:** Teams are composed of Contestants and Mentors, who have registered participating in the MakeX Robotics Competition Premier Ultimate Warrior.



- **Alliance:** An Alliance is formed by two Teams.
- **Captain of Alliance:** The two Teams that form the Alliance shall appoint one of the Contestants on the Arena as the Captain of their Alliance.
- **Operator:** Contestants who operate the robots, each Alliance has 2 Operators, they are from the 2 Teams which form the Alliance respectively.
- **Observer:** Contestants who assist Operators in observing the state of props and giving advice, each Alliance has 2 Observers, they are from the 2 Teams which form the Alliance respectively.

2.3 Refereeing

- **Completely In:** The vertical projection of props or robots is completely located inside the designated area.
- **Partially In:** The vertical projection of props or robots is partially located in the designated area or has contact with the designated area.
- **Completely Out:** The vertical projection of props or robots are Completely Outside the designated area.
- **Direct Contact:** There is a physical contact at any point on the surfaces of two objects without gap.



3. The Competition

3.1 Background

The theme of MakeX Premier for the 2022-2023 season is Ultimate Warrior. Artificial Intelligence [AI] drives rapid development of modern medical technologies. When disaster strikes, it can be difficult for ambulance crews and rescuers to enter dangerous areas and accurately locate the wounded in time. In many cases, secondary injuries are unavoidable. AI has a great potential in the medical field - smart diagnostic systems and intelligent operating robots are helpful to improve traditional medical procedures and significantly increase medical efficiency. Young engineers, let us participate in the forthcoming competition and kill viruses by using future technologies. The world is counting on you to create a healthier future with your brains and hands.

3.2 Introduction



Single-match time: 4 minutes and 30 seconds.

Red and blue Alliances play against each other in each match, and each Alliance consists of two Teams.

Each match comprises four stages: Automatic Stage, Manual Stage, Modification Stage and Final Stage. In each match, Contestants of each Alliance control two robots to knock down Pins on their opponent's Side with Small and Large Attacking Cubes. Robots can also pick up Alphabet Cubes which are initially placed on the Ground in a random order, and place them onto their own Diagnostic Area in a correct order; or transfer Black Cubes into the Square Chambers on their own Side. The referee will calculate scores of each Alliance after the match, and the Alliance with a higher score becomes the winner. If the Alliance has knocked down all of the pins on their opponent's Side, it will be deemed as "KO". The match ends immediately and the Alliance who "KO" the opposite Alliance wins the match. The arena of MakeX Premier – Ultimate Warrior is shown in the following figure:

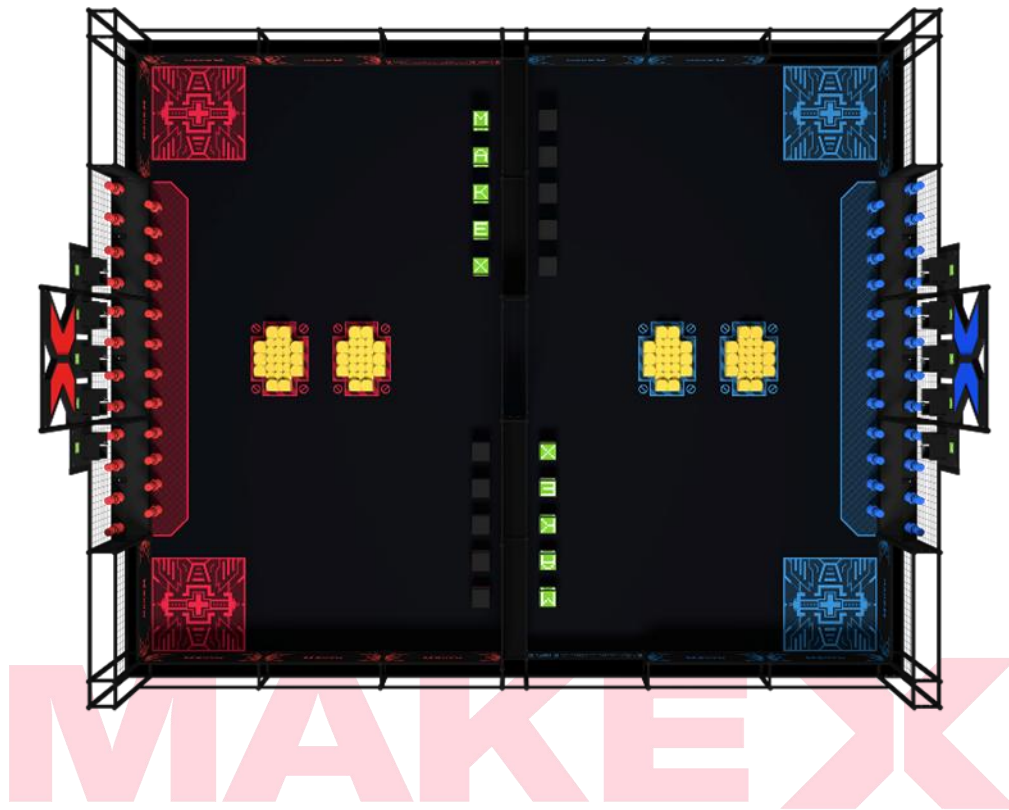


Fig 3.1 Top View of Ultimate Warrior Arena

3.3 Arena

The official arena of the 2022-2023 MakeX Premier – Ultimate Warrior is a 5400×6640 mm² rectangular area. The Central Barrier divides the arena into the red and blue Sides. Robots can only complete missions on their own Side. The layout of the arena is shown in the following figure:

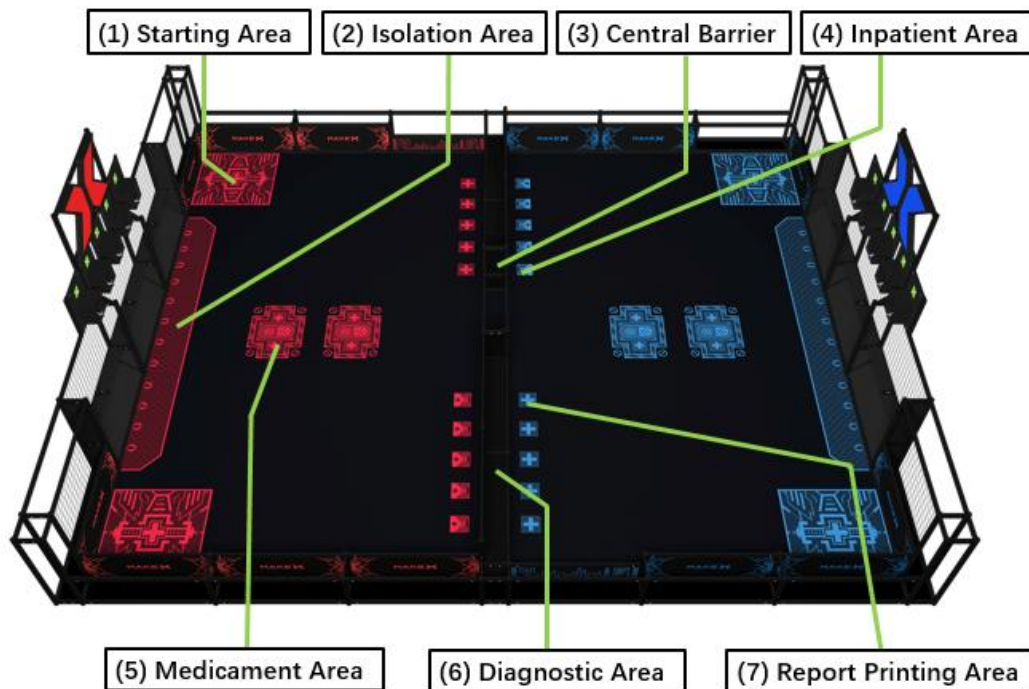
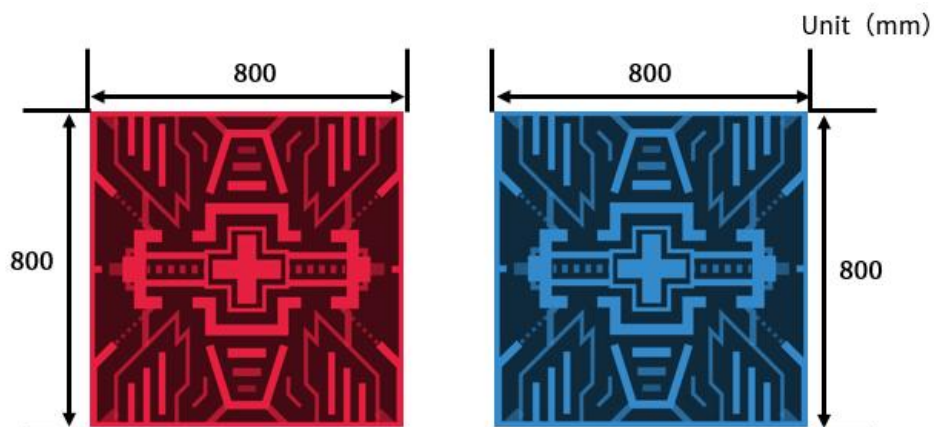


Fig 3.2 Axonometric View of the Arena Layout

- (1) **Starting Area:** An 800×800 mm² square area is arranged in each of the four corners of the arena to serve as the Starting Area for robots to start and stop their motions. Robots must start the match from the Starting Areas.

Fig 3.3 Top View of the Starting Areas



- (2) **Isolation Area:** An Isolation Area is arranged at each end of the arena. Each Isolation Area consists of a double-layer frame and five Square Chambers that represent Operating Rooms above the frame. Before the start of each match, 24 red/blue Pins are placed on the frame of each Side in upright position, with 12 on the upper floor, and 12 inside the shaded area on the Ground. The backboards

and baseboards of the Isolation Areas are made of PVC. The top (showing the shaded area) and front views of an Isolation Area are shown in the following figures.

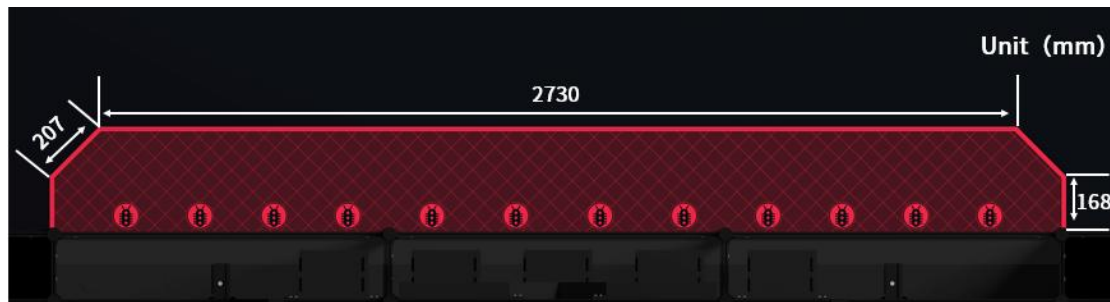


Fig 3.4 Top View of the Isolation Area

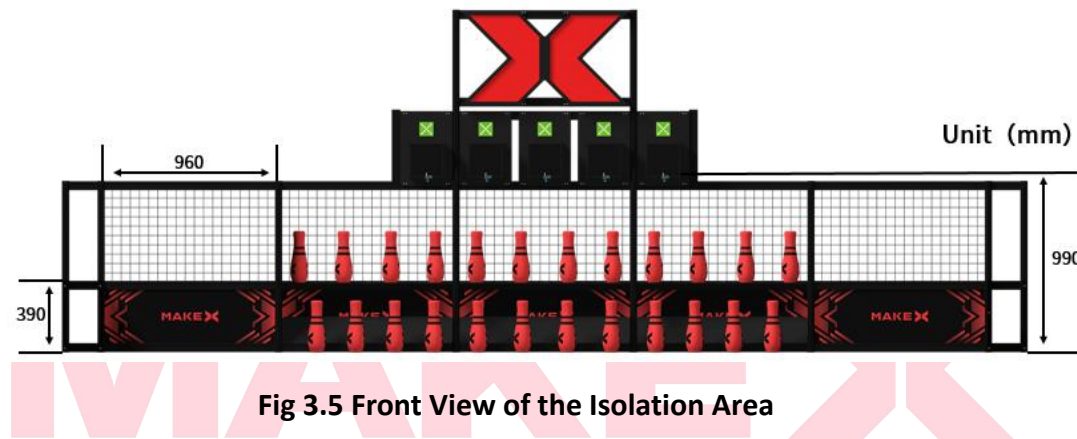


Fig 3.5 Front View of the Isolation Area

- (3) **Central Barrier:** A Central Barrier is arranged in the center of the arena to separate the red and blue Sides. The Central Barrier is made of flat beams, aluminum octagonal pillars, acrylic plates, and PVC plates. There are 2 hollow sections in the middle of the central barrier.

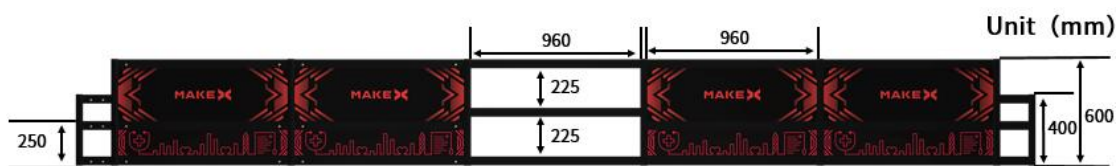


Fig 3.6 Front View of the Central Barrier

- (4) **Inpatient Area:** An Inpatient Area is arranged before the Central Barrier for each Side. It consists of five 150×150 mm² square areas. Five Black Cubes are initially placed in the Inpatient Area of each Side before the start of each match.

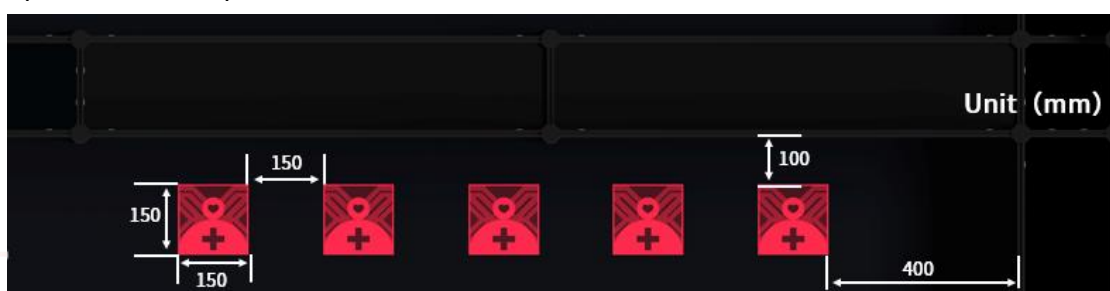


Fig 3.7 Top View of the Inpatient Area

- (5) **Medicament Area:** where Small and Large Attacking Cubes that represent Ordinary and Potent Medicaments are initially placed. 15 Small Attacking Cubes and 10 Large Attacking Cubes are placed in each Medicament Area. The following figure shows how these cubes are placed.

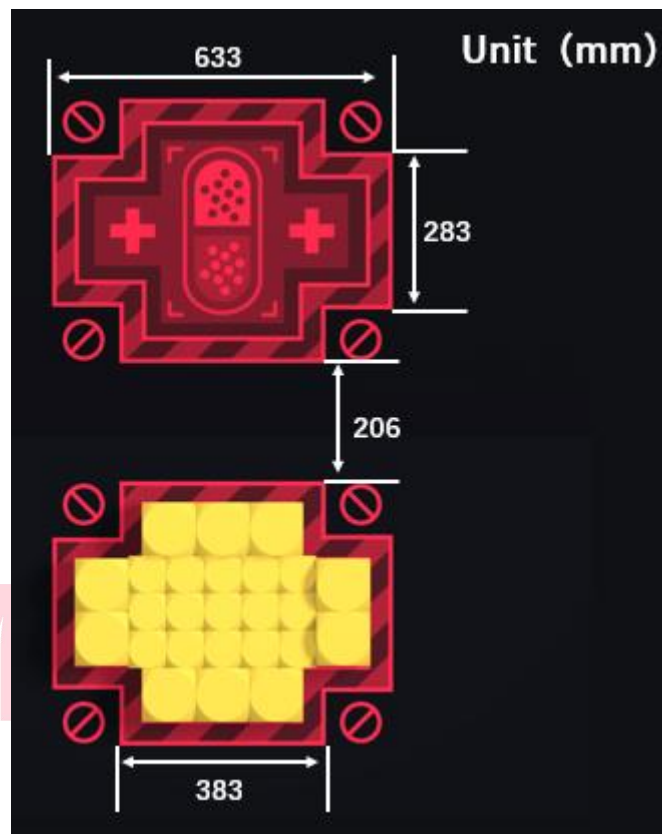


Fig 3.8 Top View of the Medicament Area

- (6) **Diagnostic Area:** The platform on the left side of the Central Barrier (viewed from the operator's angle of each side) serves as the Diagnostic Area. Contestants need to control their robots to pick up Alphabet Cubes that represent Diagnostic Reports and place them onto the Diagnostic Area on their Side in a correct order.



Fig 3.9 Axonometric View of the Diagnostic Area

(7) Report Printing Area: A Report Printing Area is arranged in front of the Central Barrier for each Side. It consists of five $150 \times 150 \text{ mm}^2$ square areas. Five Alphabet Cubes are placed on top of these five square areas (one cube for each square area) before the start of each match.



Fig 3.10 Top View of the Report Printing Area

3.4 Props

The initial positions of the props are shown in the following figure:

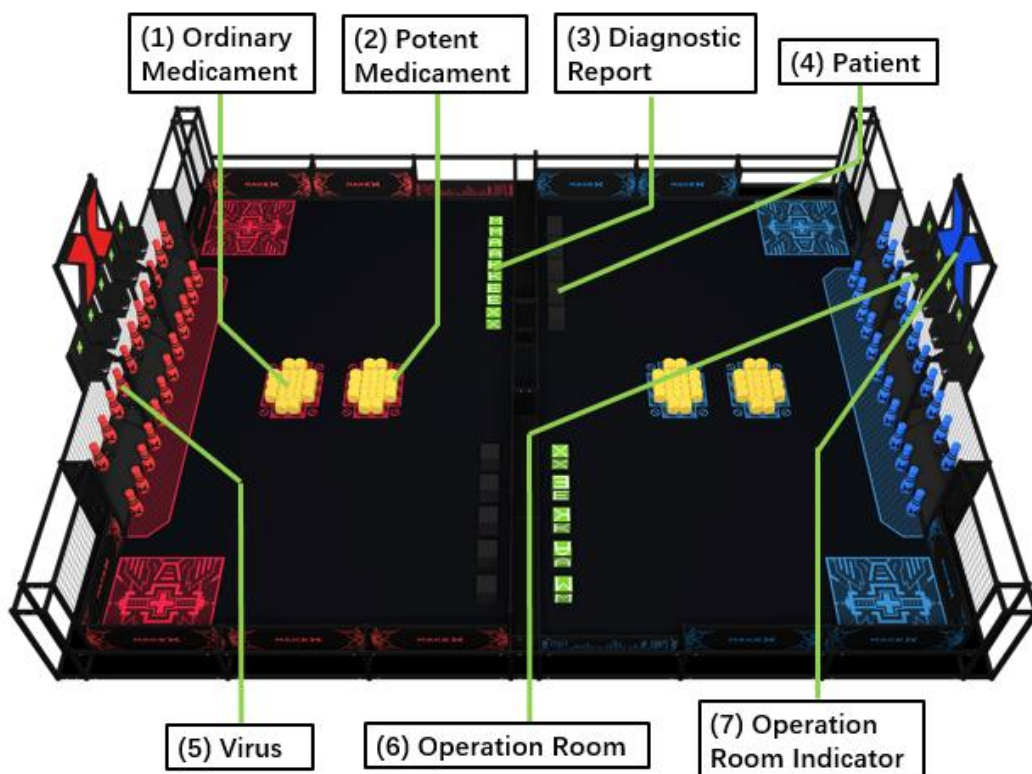


Fig 3.11 Initial Position of the Props

- (1) Ordinary Medicament/ (2) Potent Medicament:** The Small ($70 \times 70 \times 70 \text{ mm}^3$) and Large ($100 \times 100 \times 100 \text{ mm}^3$) Attacking Cubes in the arena represent the Ordinary and Potent Medicaments respectively. Both the Small and Large Attacking Cubes are made of EVA, and in the same shapes. 30 Small and 20 Large Attacking Cubes are evenly distributed in the two Medicament Areas on each Side. Robots can knock down pins on their opponent's Side with Attacking Cubes. Note: There will be a $\pm 2 \text{ mm}$ edge length tolerance for the Attacking Cubes.

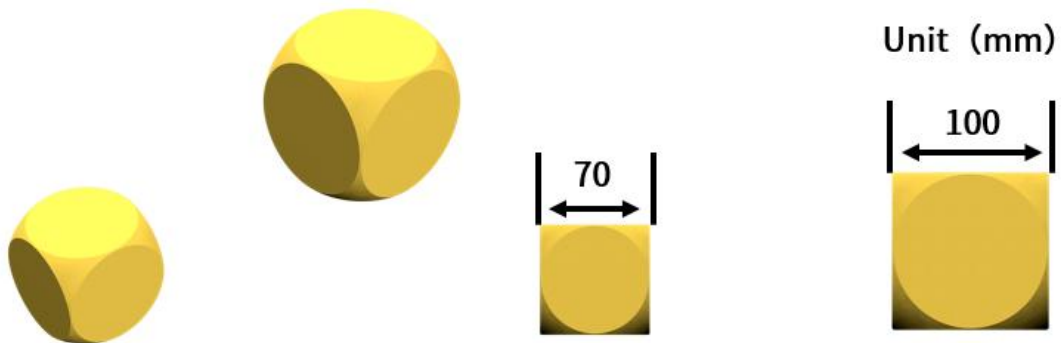


Fig 3.12 Small/ Large Attacking Cubes

- (3) Diagnostic Report:** The $150 \times 150 \times 150 \text{ mm}^3$ EVA Alphabet Cubes in the arena represent Diagnostic Reports. A total of 10 Alphabet Cubes are placed in the arena, 5 for each Side, printed with letters of "M", "A", "K", "E", and "X" respectively. The same letter is printed on all six sides of each Alphabet Cube, the side that faces the pins of its own Alliance is pointed by an arrow in the following figure. Robots are expected to recognize and pick up these Alphabet Cubes from the Report Printing Area, and place them onto the Diagnostic Area of their own Side in a correct order of "MAKEX". Note: There will be a $\pm 5 \text{ mm}$ edge length tolerance for Alphabet Cubes.

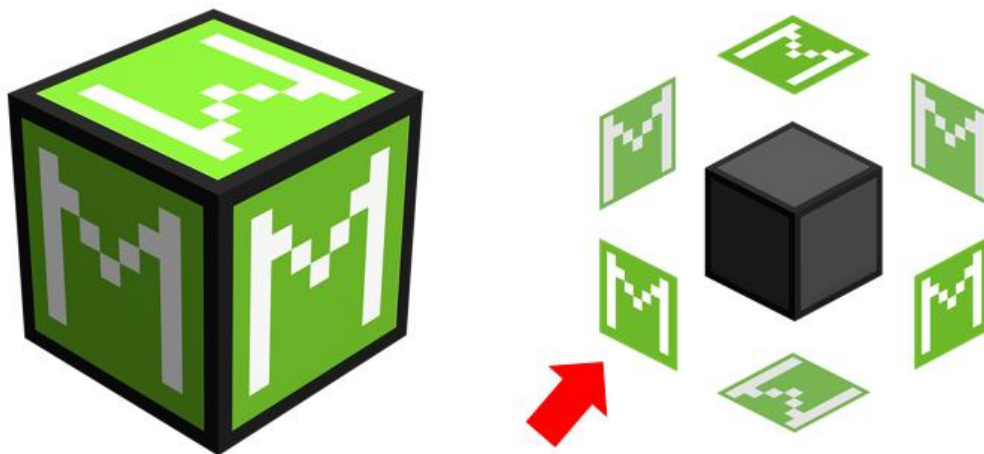


Fig 3.13 Alphabet Cube



- (4) **Patient:** Black Cubes in the arena represent Patients. Both the size and material of these black cubes are the same as those of the Alphabet Cubes. A total of 10 Black Cubes are placed in the arena, 5 for each Side. Robots are expected to transfer these Black Cubes to the Square Chambers that represent Operating Rooms on their own Side. Note: There will be a ± 5 mm edge length tolerance for Black Cubes.

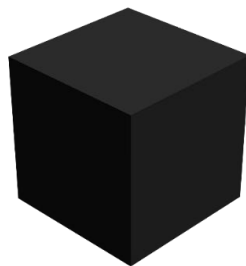


Fig 3.14 Black Cube

- (5) **Virus:** Pins in the Isolation Area of each Side represent Viruses. 24 red or blue Pins are placed on each Side of the arena. These Pins are made of EVA, with a height of 290 mm, a bottom diameter of 70 mm, and a maximum diameter of 100mm. Robots are expected to knock down these Pins with Attacking Cubes. Note: There will be a ± 10 mm tolerance for these Pins.



Fig 3.15 Pins

- (6) **Operating Room:** Square Chambers above the Pins represent Operating Rooms. 10 Square Chambers are arranged in the arena, 5 for each Side. The Square Chambers are made of acrylic plates, and the internal dimensions of the Square Chambers are $180 \times 180 \times 140$ mm³. The backboard of each Square Chamber is pasted with an 80×80 mm² sticker for visual recognition. Every sticker is printed with a letter "X". Each Square Chamber has a limit switch on the bottom board, Contestants must consider the small resistance caused by the limit switch. The

upper side of the bottom board of each Square Chamber is 990 mm above the Ground (see Figure 3.5). Note: There will be a ± 0.5 mm edge length tolerance for these Square Chambers, Contestants must also consider possible errors caused by installation.

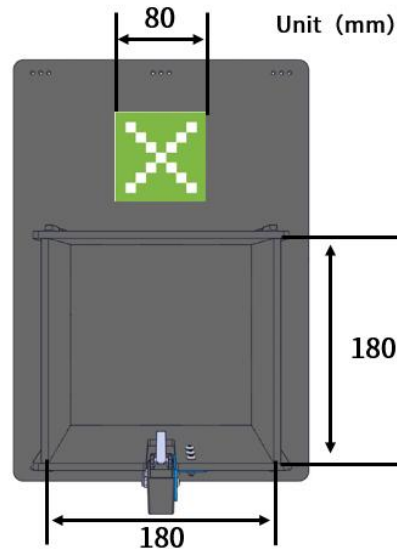


Fig 3.16 Square Chamber

- (7) Operating Room Indicator:** A Light Box is arranged on each Side of the arena to serve as the Operating Room Indicator. The Light Box is mounted on top of the Square Chambers to form an automation mechanism with them. The Light Box is turned on when all the Black Cubes are inserted into the Square Chambers. Note: Light Boxes will be used only in competitions organized by the MakeX Robotics Competition Committee. They might not be available in some regional points races, but their absence does not affect the scores.

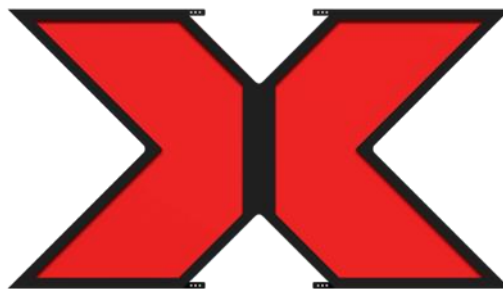


Fig 3.17 Light Box

Note: There will be some reasonable errors in the arena and props. If there are any problems with the props, Contestants can apply for replacement before the



start of the match.

3.5 Missions

Automatic Stage

The Automatic Stage lasts for 45 seconds.

After Contestants place their robots into the Starting Areas, the Referee will decide the initial placement order of Alphabet Cubes in the Report Printing Area through drawing. After the order is determined, the Contestants are not allowed to touch their robots again.

To ensure the fairness of the match, all robots in the Starting Areas will be powered off by the Competition System during the five-second countdown period. After the countdown, the system will power on the robots, and then the robots will run the preset automatic programs.

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

- (1) Recognizing and picking up the Alphabet Cubes disorderly placed on the ground, and then placing them onto the Diagnostic Area of their own Side in the correct order ("M", "A", "K", "E", and "X");
- (2) Picking up the Small/ Large Attacking Cubes on their own Side to shoot and knock down Pins of their opponent's Side.

The Competition System will count down five seconds before the completion of the Automatic Stage. It will power off all robots upon the completion of the Automatic Stage, and the Referee will calculate the scores.

After the Automatic Stage, Contestants must check their scores for this stage with the Referee. Afterward, they will pick up the Bluetooth controllers and prepare for the Manual Stage upon receiving the signal from the Referee and the Competition System.

The lighting conditions and match starting time of Teams may vary. Therefore, all Teams must test their sensors before the start of their matches. The competition committee does not guarantee that lighting conditions in the arena will not change. The lighting conditions in the arena may change with the progress of the matches.

Manual Stage

The Manual Stage lasts for 75 seconds.

After the scores and states of the Automatic Stage are confirmed, the match moves to the Manual Stage. After the 5-second countdown of the Competition System, the



robots will be powered on and the 75-second Manual Stage starts. In this stage, the Operators can control the robots through the Bluetooth controller.

During the Manual Stage, Contestants can control their robots to score by shooting and knocking down Pins on their opponent's Side with Small/ Large Attacking Cubes in the arena; or keep placing the unfinished Alphabet Cubes onto their Diagnostic Areas in the correct order.

Before the end of the Manual Stage, the Competition System counts down 5 seconds, after which it will automatically power off the robots to directly enter the Modification Stage.

Modification Stage

The Modification Stage lasts for 60 seconds.

After the Manual Stage is over, the match moves to the Modification Stage. Contestants can remove their robots that have Partially or Completely in the Starting Areas out of the arena for modification. The length and width of a 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 notify the Contestants. Before the end of the modification, there will be a 10-second countdown. Before the countdown finishes, the Contestants must put the robots back into the Starting Areas.

Final Stage

The Final Stage lasts for 90 seconds.

When the Contestants are ready and the states are confirmed, the match moves to the Final Stage. After the 5-second countdown, the 90-second Final Stage starts. The Competition System will power on the robots and the robots will run the manual programs.

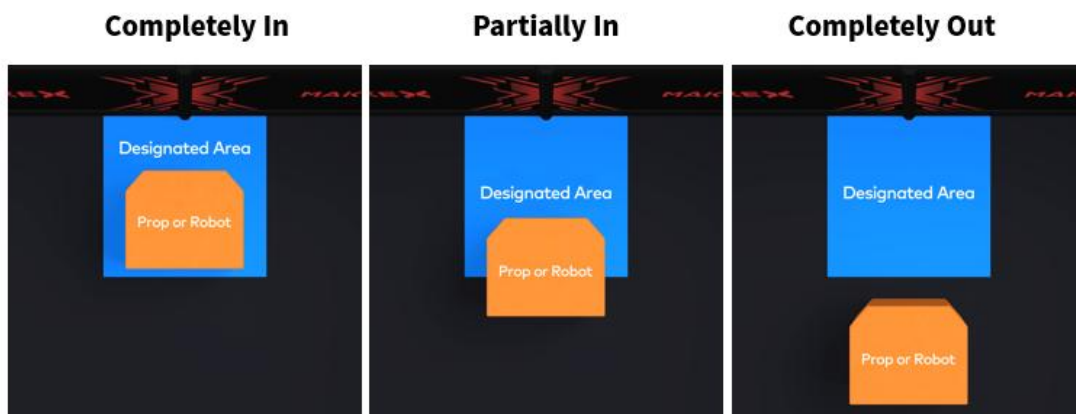
During the Final Stage, Contestants can control their robots to continue shooting and knocking down Pins on their opponent's Side, and keep placing the unfinished Alphabet Cubes onto their own Diagnostic Area. They can also control their robots to pick up Black Cubes and insert them into the Square Chambers manually or semi-automatically, by recognizing the "X" stickers pasted on the backboards of the Square Chambers with the help of visual recognition sensors to accurately locate the Square Chamber.

At the end of the Final Stage, the Competition System will power off the robots and the Referee will calculate the scores. All Contestants should put their controllers into the Storage Baskets and stay away from the arena.

3.6 State Judgment

Boundary State Judgment

- E01.** During the entire match, when the positions of the robots or props are not very clear, the following statements can be used to tell their positions:



Upright State of Pins Judgment

- E02.** A Pin is in upright state if its bottom is in full contact with either the upper surface of the upper floor of the frame inside Isolation Area, or the shaded area on the Ground.

State Judgement of Pins inside Isolation Area

- E03.** A Pin that was initially placed on the upper floor of the frame inside the Isolation Area is considered to be knocked down only if its bottom is Completely Out of contact with the upper surface of the upper floor, and it is not in upright position on the shaded area on the Ground. It is considered not to be knocked down if it is found in other states on the upper floor, such as standing upright, leaning against each other, or leaning against the upper frame.
- E04.** A Pin that was initially placed on the upper floor of the frame inside the Isolation Area is considered not being knocked down if it is out of contact with the upper surface of the upper floor of the frame, but stands upright on the shaded area on the Ground.
- E05.** A Pin that was initially placed on the lower floor (shaded area) of the frame inside the Isolation area is considered to be knocked down if it does not stand upright (for example, it falls down, leans against each other, leans against other objects, or it is Completely Out of the shaded area on the Ground) at the end of the match.



- E06.** If a Pin that is Completely Out of contact with the lower floor (shaded area) of the frame inside the Isolation Area, or it is Completely Out of contact with the upper surface of the upper floor of the frame, it is considered to be knocked down.
- E07.** When the Referee calculates the scores, a Pin is considered to be knocked down if it is still in contact with the robot (for example, the pin leans against the robot).

KO State Judgment

- E08.** If either Alliance knocks down all Pins on their opponent's Side to KO the opponent Alliance during the match, the match ends immediately and the Alliance who KO the opponent Alliance wins the match.
- E09.** A KO state exists only in the Manual and Final Stages. If all Pins of either Side are knocked down during the Automatic or Modification stage, the KO state will be announced at the start of the next stage.

State Judgment of Robot inside Starting Area

- E10.** Before the start of the Automatic Stage, the vertical projection of the robot must be Completely Inside the Starting Area.
- E11.** Before the Manual Stage ends, the Subsystem 1 of the robot only needs to be Partially Inside the Starting Area if the Team wants to modify its robot.
- E12.** After the Team finishes modifying its robot, the Subsystem 1 of the robot only needs to be Partially Inside the Starting Area.

Alphabet Cube State Judgment

When the Referee calculates the scores, the Team scores for correctly placing Alphabet Cubes only when conforming to the following four statements:

- E13.** The vertical projection of an Alphabet Cube is Completely Inside the platform (Diagnostic Area) of its own Side, and an Alphabet Cube must be in direct contact with the upper surface of the platform. The area of the platform is represented by the large yellow rectangle shown in the

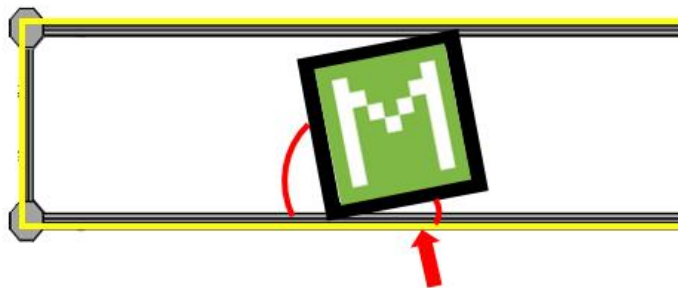


following figure:

- E14.** The side of an Alphabet Cube that contacts the surface of the platform can be any side, but the letter that faces Pins of its own Alliance must be placed in the correct form, as shown in the following figures:



The side of an Alphabet Cube that forms a smaller angle with the edge of the platform is the one that faces Pins of its own Alliance, as pointed by the red arrow in the following figure:



- E15.** Two or more Alphabet Cubes are placed on the platform in the correct order, namely "M", "A", "K", "E", and "X", from left (towards the side edge of the Central Barrier) to right (towards the center line of the Central Barrier), if these Alphabet Cubes that are Completely Inside the platform of their own Side, they only need to be presented in a correct sequential order to satisfy E15.

If only one Alphabet Cube is Completely Inside the platform and presented in a correct manner, or some Alphabet Cubes are placed in a wrong order, the scores for all Alphabet Cubes are considered invalid.

- E16.** When the Referee calculates the scores, the Alphabet Cubes are not in contact with the robot.

If the robot is still in contact with an Alphabet Cube, the score for that Alphabet Cube is considered to be invalid.

Black Cube State Judgment

When the Referee calculates the scores, the Team scores for placing Black Cubes into the Square Chambers only when conforming to the following two statements:

- E17.** Black Cubes stay inside Square Chambers without external support.
E18. When the Referee calculates the scores, the Black Cubes must not in contact with the robot.

If the robot is still in contact with a Black Cube, the score for that Black Cube is considered to be invalid.

3.7 Scoring Details

The Referee counts the automatic points after the end of the Automatic Stage and counts the manual points after the end of the Final Stage. The scoring details are as follows:

Automatic Points

- E19.** Points for red/ blue Pins: An Alliance scores 20 points for each Pin on the opponent's Side that conforms to any of the following statements at the end of the Automatic Stage.

Only 1 Alphabet Cube
Invalid Score



2 Alphabet Cubes
Satisfy E15



4 Alphabet Cubes
Satisfy E15



Wrong Order
Invalid Scores for
All Alphabet Cubes





- (1) The Pin that was initially placed on the lower floor of the frame inside the Isolation Area is knocked down or its bottom is Completely Out of the shaded area on the Ground.
- (2) The Pin that was initially placed on the upper floor of the frame is out of contact with the upper surface of the upper floor of the frame, and does not stand upright in the shaded area on the Ground.
- (3) The Pin is in contact with the robot.

E20. Points for Alphabet Cubes: At the end of the Automatic Stage, an Alliance scores 30 points for each Alphabet Cube which satisfies E13, E14, E15 and E16 in the same time. An Alliance can score 50 bonus points if all five Alphabet Cubes satisfy E13, E14, E15 and E16 in the same time.

Manual Points

E21. Points for red/ blue Pins: An Alliance scores 20 points for each Pin on the opponent's Side that conforms to any of the following statements at the end of the Final Stage.

- (1) The Pin that was initially placed on the lower floor of the frame inside the Isolation Area is knocked down or its bottom is Completely Out of the shaded area on the Ground.
- (2) The Pin that was initially placed on the upper floor of the frame is out of contact with the upper surface of the upper floor of the frame, and does not stand upright in the shaded area on the Ground.
- (3) The Pin is in contact with the robot.

E22. Points for Alphabet Cubes: At the end of the Final Stage, an Alliance can score 50 points if all five Alphabet Cubes satisfy E13, E14, E15 and E16 in the same time.

E23. Points for Black Cubes: At the end of the Final Stage, an Alliance scores 40 points for each Black Cube which satisfies E17 and E18 in the same time. An Alliance can score 50 bonus points if all five Black Cubes satisfy E17 and E18 in the same time.

E24. Automatic Points = Points for knock-down Pins + Points for finished Alphabet Cubes – Points for Alliance Violation. The Automatic Points are calculated at the end of the Automatic Stage.



- E25.** Manual Points = Points for knock-down Pins + Points for finished Alphabet Cubes + Points for finished Black Cubes – Points for Alliance Violation. The Manual Points are calculated at the end of the Final Stage.
- E26.** Single-match Points = Automatic Points + Manual Points.

KO Points

- E27.** If KO state occurs, the match ends immediately and live score will be recorded. If the live score of the Alliance who knocks out the opposite Alliance (winning Alliance) is less than the counterpart of the opposite Alliance (losing Alliance), the final score will be modified to the winning Alliance has 10 points advantage than the losing Alliance.

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3.8 Single-Match Flow Chart

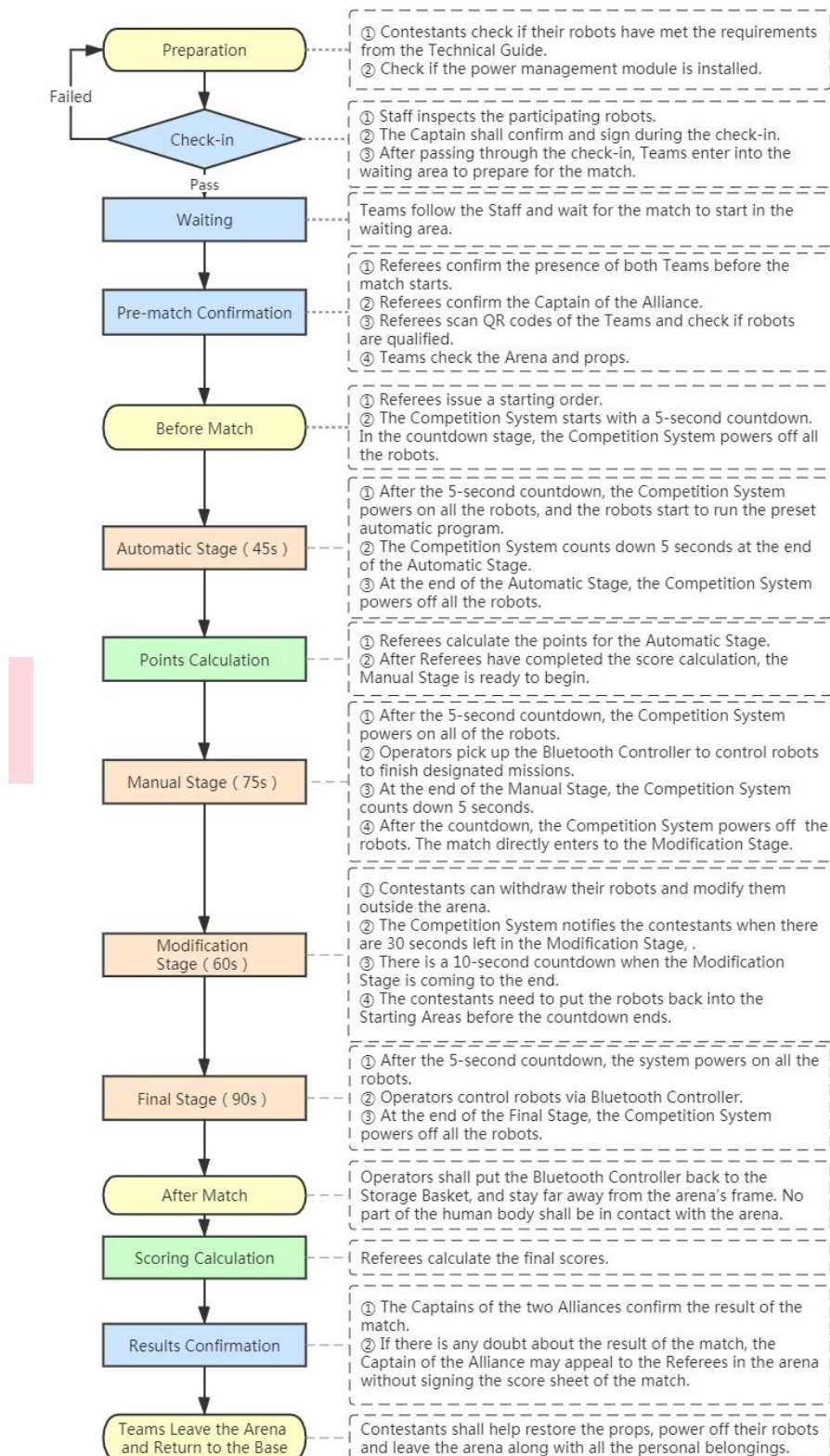


Fig 3.18 Single-match Flow Chart

4. Robot Technical Requirements

When the Teams are designing their robots to participate in the 2022-2023 MakeX Premier Ultimate Warrior, they shall comply with the following technical requirements. The technical requirements provide a fair and safe competition standard for all Teams and encourage Teams to make innovative designs of their robots on the prerequisites of meeting these technical requirements.

4.1 Robot General Technical Requirements

The general technical requirements explain and define the requirements of quantity, size and weight for the Subsystems of robots.

Subsystem of the Robot

- T01.** Subsystem 1: The mainboard and mobile robot chassis (including wheels, tracks or other mechanisms) that enables the robots to move on the Mat. For a stationary robot or a robot without any moving mechanism, the structure which has direct contact with the Mat is deemed as Subsystem1.
- T02.** Subsystem 2: The power system includes the motors or servos which empowers the Subsystem 1 and the battery that supplies energy to the power system.
- T03.** Subsystem 3: The function system includes the functional structure of the robots, including but not limited to the structures for identifying the external environment, operating the competition props, and crossing the obstacles etc. Subsystem 3 includes mechanical parts and electronic parts.
- T04.** In case a Subsystem has the functions of multiple Subsystems, it will be deemed as the Subsystem with higher level. The hierarchy of the Subsystem levels from high to low is Subsystem 1, Subsystem 2 and Subsystem 3.

Quantity 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 robots during the competition and the Subsystem 1 cannot be modified. In case a Team modifies the Subsystem 1, it will be considered that the Team has used a second robot, and the Team will be disqualified.



- T06.** If the component malfunctions (such as wheels defect, motors defect, etc.), replacement of the same component will not be deemed as replacing the Subsystem.
- T07.** One Team can only use one robot in the competition, and it is not allowed to use multiple robots alternatively in different matches of one Regional Competition or World Final. Other than the On-site Assessment, it is not allowed to use one robot inside the arena while another is being assembled or modified outside the arena.
- T08.** Robots are not allowed to have a structure which can be separated on purpose. During the competition, all Subsystems of robots need to be connected firmly.

Size of the Robot

- T09.** The size of the robot is defined by its length, width and height. The vertical projection of the robots on the Ground must not exceed the specified dimension of the square area, and the height of the robots must not exceed the specified dimension. Robot's height is measured from the vertical distance of the Ground (in contact with robots) to the furthest point of the robot with respect to the Ground.
- T10.** Robot's length and width are defined in the inspection and are not allowed to be redefined after the inspection.
- T11.** During the competition, the maximum initial size means that the maximum extended size of the robot before the Modification Stage, the size of the robot must not exceed the maximum extended size before the Modification Stage.
- T12.** During the competition, the maximum modification size means that the maximum extended size of the robot after the Modification Stage, the size of the robot must not exceed the maximum extended size after the Modification Stage.
- T13.** If the robot uses flexible materials (including but not limited to cable ties, stickers, foams or Team number plates), 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.

	Requirements	Explanations
Maximum Initial Size	800 mm (Length) 800 mm (Width) 800 mm (Height)	<ol style="list-style-type: none"> 1. The height should not exceed 800 mm and the vertical projection of the robot on the Ground should not exceed 800 mm by 800 mm square area. 2. Before the Modification Stage starts, the robot's size must comply with the Maximum Initial Size requirement. 3. In the inspection stage, Teams should demonstrate the maximum extended size of the robot, and it will be recorded during inspection.
Maximum Size after Modification	800 mm (Length) 800 mm (Width) Unlimited (Height)	<ol style="list-style-type: none"> 1. There is no limitation on height and the vertical projection of the robot on the Ground should not exceed 800 mm by 800 mm square area. 2. After the Modification Stage, the robot's size must comply with the maximum size requirement after modification. 3. In the inspection stage, Teams should demonstrate the maximum extended size of the robot, and it will be recorded during inspection.

Weight of the Robot

- T14.** Weight of the robot refers to the net weight of the robot at any time during the match (the combined weight of Subsystems excluding the props from the arena).
- T15.** Weight of the robot must be less than 20 KG.

4.2 Electrical Requirements for Robot

The electrical requirements for robots apply to the mainboard, sensors, batteries, or other part which has electronic signals transmission with the mainboard. (Not including Solenoid Valves, motors, servos or other kinds of actuator)

Power System

- T16.** 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: 11.1-11.2v, Discharge Rate: 25-30c).
- T17.** 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.

- T18.** Battery must not detach from the robot when the robot is inclined or moving. Installation of battery should not offset the robot's centre of the gravity and lead to declination.
- T19.** Power cord should be kept intact. Cracks or leakage of cover is not allowed, and the core metal conductors should not be exposed.
- T20.** The power cord and other electrical cables should be electrically isolated with the robot's structure. The robot's structure should not be used for electrical power or signal transmission.
- T21.** Teams should pay attention to the safety instruction when using the 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 4.
- T22.** Teams should prepare extra batteries for backup. To avoid unexpected accidents, qualified battery charger can be used in the designated area to charge and discharge in the right way.
- T23.** In case unexpected accidents emerged due to the quality of batteries or chargers purchased by the Team themselves, or improper use of batteries or charger, the responsibility shall be borne by the Team themselves.

Mainboard

- T24.** Robots should use the specific mainboards (NovaPi, manufactured and sold by Shenzhen Makeblock Co., Ltd. and Raspberry Pi 3 Model B+ developed by The Raspberry Pi Foundation) to prevent the Teams from using the high-efficiency mainboards to affect the fairness of the competition. Each robot is only allowed to use 1 NovaPi mainboard and 1 Raspberry Pi 3 Model B+ mainboard.

Electronic Sensor

- T25.** Teams are recommended to use the specific electronic sensors (electronic sensors manufactured and sold by Shenzhen Makeblock Co., Ltd.) on their robots. But it is also allowed to use other sensors. The type and quantity of sensors are not restricted.
- T26.** It is not allowed to use sensors which is capable to interfere with the sensory ability of other robots.



Wireless-Control

- T27.** The robot should use the specific Bluetooth Controller and Bluetooth Module (Bluetooth Controller manufactured and sold by Shenzhen Makeblock Co., Ltd.) to ensure the fairness of the competition. During the match, each team can only use 1 Bluetooth Controller. The Bluetooth Module must be connected to Raspberry Pi 3 Model B+.
- T28.** It is not allowed to communicate to the robot with other forms of wireless-control, including but not limited to any sensor triggered by human.

4.3 Mechanical Requirements for Robot

The mechanical requirements for robots apply to other non-electronic components used by the robot.

Actuator System

- T29.** The robot must use the specified motors (37 DC Motor with 50rpm or 200rpm, 36 Encoder Motor Brushless, 2823/2824 DC Brushless Motor and 180 Smart Encoder Motor manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 18) to ensure the fairness of the competition.
- T30.** The robot must use the specified servo motors (MS-12A Smart Servo Motor manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 6) to ensure the fairness of the competition.
- T31.** It is not allowed to modify any internal mechanical structure or electrical arrangement of the motors or servos.

Mechanical Parts

Mechanical parts contain the unpowered parts that form the structure of a robot.

- T32.** The Team can use partially customized or purchased mechanical parts, but the purchasing channels must be open and transparent for everyone, to ensure that other Teams can also access.
- T33.** The Team can modify the physical property of mechanical parts (beam, plate, self-made parts, etc.) by cutting, drilling or painting without violating any other rules.
- T34.** The Team cannot perform any chemical treatment on mechanical parts, including but not limited to melting, casting or other chemical

treatments.

- T35.** The Team can use the self-made or purchased parts from the following materials: 3D printing pieces, metal (can be magnetic), wood, plastic, rubber, standard sheets, standard profiled extrusions etc.
- T36.** Teams can only use integrated commercial products with one degree of freedom, such as hinges, sprockets and roller chains, pulleys, etc.
- T37.** Teams are not allowed to use integrated commercial products with more than one degree of freedom for competition, including but not limited to mechanical arms or manipulators with multi degree of freedom.
- T38.** Teams can use lubricant to protect the parts but notice that the lubricant should not leak and pollute the competition arena.
- T39.** The Team should pay attention to the safety requirements when using parts or tools. High-power machines or tools should be used under the guidance from the Mentor.

Pneumatic System

- T40.** Pneumatic systems refer to devices and related modules that use the difference in air pressure to transfer energy and provide kinetic energy to robots, including but not limited to Cylinders, Solenoid Valves, Air Pipes etc.
- T41.** The robot must use the specified pneumatic kits (Pneumatic Kits manufactured and sold by Shenzhen Makeblock Co., Ltd.) to ensure the fairness of the competition.
- T42.** The robot's pneumatic system must include the following parts (except for the Cylinder, all of the parts must be from the specified Pneumatic Kit):
- Cylinder: The Teams can only use the Cylinder provided in the official equipment kits or the same type of Cylinder (MI10X60CA, inner diameter 10mm, stroke 60mm, pressure range: 0.1 ~ 1.0Mpa) or Cylinder (MI10X150CA, inner diameter 10mm, stroke 150mm, working pressure range: 0.1 ~ 1.0Mpa) manufactured and sold by Shenzhen Makeblock Co., Ltd. The quantity of Cylinders must not exceed 6;
 - Air Bottles: The Teams can only use 2L coke bottles made by PepsiCo. as Air Bottles (Pepsi Bottles are thicker and safer), and a maximum of

4 can be used. The explosion-proof tape must be used to wrap the Bottles. The MakeX Robotics Committee has the right to doubt the safety of the Air Bottles;

- Bottle Caps: The Teams can only use the two-way Bottle Caps provided in the official equipment kits or the same type;
- Solenoid Valve: The Teams can only use Airtac brand Solenoid Valves provided in the official equipment kits. Operating pressure range: 0.15 ~ 0.8Mpa;
- Hand Valve: A Hand Valve that is easy to operate manually must be used to relieve the pressure from the pneumatic device;
- Regulator: Its pressure range is 0.05 ~ 0.9Mpa, and it needs to be able to display the pressure value inside Cylinder;
- Safety Valve: The set pressure is 0.8Mpa;

T43. The parts listed below are optional to use in the pneumatic system of robots:

- Speed control valve of exhaust throttle;
- Straight connector;
- T type 3-way connector;
- Cross 4-way connector;
- General copper silencer;
- Gauge: it must be installed onto the outlet of the Air Bottle;
- Female rod ends;
- Sealing tape;
- Speed control valve of intake throttle;

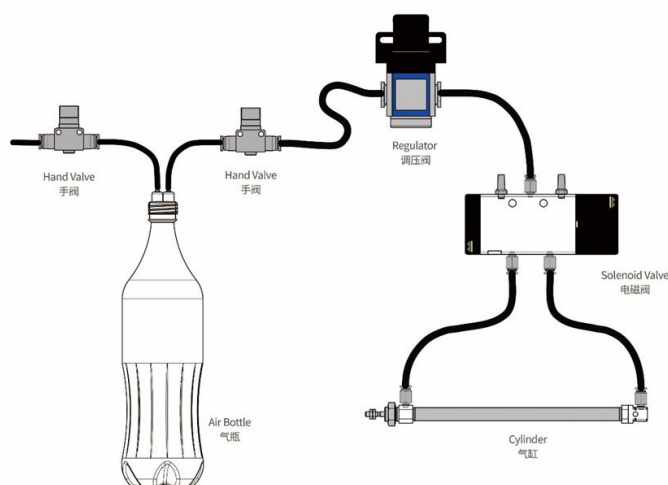


Fig 4.1 Standard diagram of single-cylinder pneumatic device



T44. The following devices are not pneumatic devices and are outside the scope of the pneumatic system requirements (but they must meet safety rules):

- Pneumatic shock absorber;
- Inflated (pneumatic) tires;

T45. All pneumatic components must be used in their original, unmodified state, but not limited to:

- Cut off the pipes/tubes;
- Use threads, mounting brackets, connectors, etc. to assemble and connect pneumatic components;
- The Cylinder itself is unmodified, only the mounting method of the Cylinder is changed;
- Marks can be used to indicate the purpose, connectivity and functionality of each equipment.

T46. No compressor (including air motor) can be installed on the robot. Robots can only use the official compressor to inflate the Air Bottles after the pre-match inspection. After the match, they must deflate the Air Bottles before leaving the arena or testing area.

T47. Air Bottles must not be inflated in any way, and not be replaced outside the designated area of testing pneumatic devices.

T48. The maximum air pressure of the robot's air source (Air Bottle) must not exceed 0.7MPa.

T49. For safety and fairness reasons, the use of pneumatic devices outside the scope of safety and fairness requirements (such as special-typed Cylinders) is prohibited, and the use of pneumatic actuators other than Cylinders, such as pneumatic mechanical claws, pneumatic turntables, etc. are also prohibited. In case of illegal use, MakeX Robotics Competition Committee has the right to disqualify the Team.

T50. Air Bottles may be subject to aging problems after repeated use. Teams need to check the Air Bottles regularly and replace them if necessary (It is encouraged to use brand new Air Bottles each time). MakeX Robotics Competition Committee is not responsible for any problems affecting the game caused by the aging of the Air Bottles.

- T51.** Teams shall ensure that the Air Bottles do not fall off, contact with the Arena Frame or the Ground when the robot is moving or tipping, and the Air Bottles shall not cause the tipping of the robot. If the Air Bottles fall off during the match, the robot will be suspended and removed from the arena.
- T52.** The sharp corners in the robot's structure which may touch robot's own Air Bottles or the Air Bottles of other robots are not allowed to be exposed. The soft buffer material must be used to protect the sharp corners of the non-executive structure (A sponge bar is recommended). Diagrams are shown below:



Fig 4.2 Examples of sharp corners protection



Fig 4.3 Example of recommended sponge bar

4.4 Other Technical Requirements

Non-Electrical Energy

Except for electrical energy, other source of energy which empowers the operation of robots is considered as non-electrical energy.



T53. The non-electricity energy used by the robots must only come from the following sources:

- The energy stored by the height difference of robot's or component's center of gravity;
- The energy stored by the deformation of the robot's parts;
- Energy stored in compressed air;

Sounds and Lights

T54. Robot are not allowed to use any electronic device that generates sounds, except for the build-in buzzers from motors and mainboards.

T55. The lights generated by the robot can only be 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 interferes with the operation of the robot.

T56. 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 per robot.

T57. In case the robot uses a laser aiming device, they need to explain to the Staff and show the specification sheet of the device during inspection.

T58. In case the robots use laser aiming device, it is strictly prohibited to aim at the human eye and cause unnecessary injury.

T59. In case the Team modifies the laser pointer and uses it as the laser aiming device, the power source of the laser aiming device must be the battery from the original package, and this battery must not transfer energy to another robot structure.

Team Number

T60. 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 (on a frame or a specially designed structure).

T61. Team number's printed font should be Times New Roman, black, bold, size: 130.

T62. The visible range of the robot's Team Number should not be less than 270 degrees. A flat plane has 180 degrees of visible range.

T63. The Team Number of the robot must be firmly fixed on the robot

and able to sustain the impact during the competition.

T64. Robots that do not conform to this requirement will not be allowed to participate in the competition.

T65. 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 BBS. The example diagram is as follows:



Fig 4.4 Example of team number plate





5. Competition Rules

5.1 Safety

Dangerous Structure

R01. 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.

Damage or Contamination of Arena

R02. Robots should not make malicious "climbing" and "bumping" movements to the boundary of the arena and the Central Barriers during the match. They must not cause the missing of any element in the arena, otherwise they will be considered as unsafe to the arena. At any time, the Referees are entitled to judge if the robot is unsafe or have damaged the arena.

- ⊗ The robot who is against this rule will be suspended. The robot needs to be modified and inspected before it can be taken back to the match. Violating this rule twice will result in disqualification.

R03. If the robot has contaminated the arena, the robot will be judged as unsafe. Robots must not use double-sided adhesive tape or glue to paste the Arena Elements throughout the whole match.

- ⊗ The robot who is against this rule will be suspended. The robot needs to be modified and inspected before it can be taken back to the match. Violating this rule twice will result in disqualification.

Damage Other Robots

R04. At any time, the Referees are entitled to decide if the robots are unsafe or have damaged other robots on the arena.

- ⊗ The robot who is against this rule will be suspended. The robot needs to be modified and inspected before it can be taken back to the match. Violating this rule twice will result in disqualification.

Robots Out of bound

R05. During the match, no part of the robot can exceed the boundary of the arena.



- ⊗ If the robot has contacted the Ground or objects outside the boundary of the arena, the robot will be suspended. Violating this rule twice will result in disqualification.

Violating Materials

R06. 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 Mercury;
 - Hazardous materials (such as lead);
 - Ballasts and counterweights in which their safety is not guaranteed, such as sand, may be scattered in the match;
 - Materials that may cause unnecessary entanglement of the robot;
 - Material with sharp edges and angles that can easily cause injury;
 - 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 match once being released.
 - Any spare part on the robot that may conduct the electric current to the arena.
- ⊗ The robot who is against this rule will be suspended. The robot needs to be modified and inspected before it can be taken back to the match. Violating this rule twice will result in disqualification.

Other Unsafe Factors

R07. In addition to the above issues, the Referees are entitled to decide whether a specific robot is safe or not.

- ⊗ If the referee has judged the robot as unsafe, the robot will be suspended. The robot needs to be modified and inspected before it can be taken back to the match. Violating this rule twice will result in disqualification.

5.2 Operation Rules

Operation Team

R08. Each Team sends one Operator and two Observers for the match. Each Alliance has two Operators and four Observers, one of them is selected to be the Captain of the Alliance.

R09. The robots are operated by their Operators to complete the mission for each match.

R10. The Operator and the Observer can freely switch their roles during the match.

Contestant's Requirements

R11. Contestants should wear goggles when preparing and testing robots before the match, as well as during the on-arena match.

R12. Contestants should tie up their long hair when preparing and testing robots before the match, as well as during the on-arena match.

R13. Contestants should also wear closed shoes to enter the arena.

Contestant's Standing Position

R14. The activities range of the Contestants during the match must be inside the Operation Area, as shown in the following figure: (the size of the Operation Area is subject to the actual site conditions):

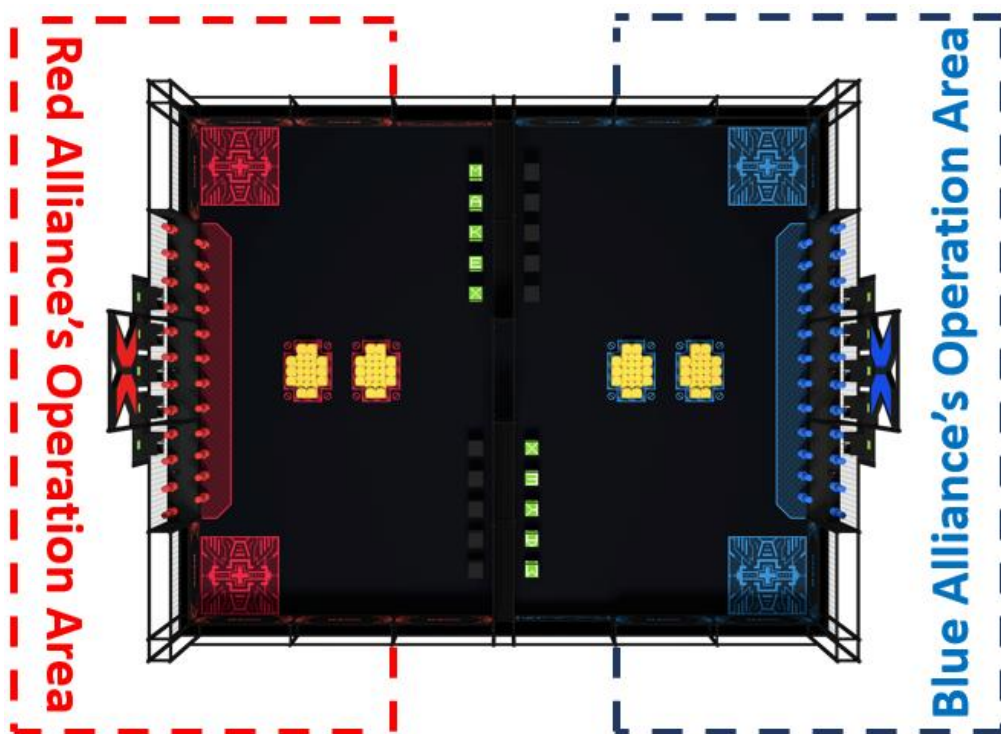


Fig 5.1 Figure of Operation Area

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

Violation of the Competition Requirements

R15. Contestants violate the competition requirements at the arena.

- ⊙ The Team will receive a Violation for the second time.



Substitution of On-arena Players

R16. During the match, off-arena contestants outside of the arena are not allowed to substitute the on-arena Operators or the Observers.

- ⊖ The Team who is against this rule will be given a Red Card.

Elimination Round Rule

R17. Each Alliance has 5 minutes for adjustment after the end of each match, no extra time is allowed.

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

Radio Interference

R18. Except for the electronic communication devices that allowed in the match, no other electronic communication devices can be carried by the Contestants to enter the competition arena (including mobile phones, walkie talkie, other devices with 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

R19. Robots shall not be initiated until the Referee announce the start of the match.

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

Delayed end of the Match

R20. 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. If the delayed end of the match brings the offender an advantage in the match, the Referee shall verify the invalid scores and try to restore the arena.

Violating contact

R21. Except for the Modification Stage, the Contestants should not touch Arena Elements such as the Scoring Props, the Arena's Frame and the robots etc. during the match, including but not limited to the cases where the Operator leans on the fence and the Contestants push the robot. In case the contacts occur outside the arena due to the normal movement of Attacking Cubes or 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 violating contacts or the impact on the progress of the match, the Team will receive a Yellow Card.

Physical Affects the Match

R22. During the match, 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 match. Except for 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 Controller in Automatic Stage

R23. Robots should be connected with the Bluetooth controller before the match starts, and Bluetooth controller needs to be switched on during the match. However, it is not allowed to use Bluetooth controller to manually control the robots during the Automatic Stage.

- ⊙ The Team will receive a Red Card for the first time.

Operate Suspended Robot

R24. 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 be disqualified.

Robot Left-Behind Parts

R25. During the match, 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 match. Yellow Card will be given at the second time.

Robot Not Conform to the Requirements During the Match

R26. Robots must comply with the size, weight and other parameters requirements during the match. Except for the case that the robot is hit by Arena Elements which causes the robot's size exceeds the requirements.



- ⊗ The Team will receive a Red Card.

Toss Arena Elements Out of the Arena

R27. Robots cannot toss the Arena Elements (Except for Attacking Cubes) or robot components out of the arena. (Such as Alphabet Cubes, Black Cubes and Pins etc.) The Arena Elements which have been tossed out cannot be put back to the arena.

- ⊗ The Team will receive a Violation.

Toss Arena Elements to the Opponent's Side

R28. Robots cannot toss the Arena Elements (Except for Attacking Cubes) or robot components to the Opponent's Side. (Such as Alphabet Cubes, Black Cubes and Pins etc.)

- ⊗ The Team will receive a Yellow Card.

Maliciously Damage Finished Alphabet Cubes

R29. The Subsystems of the robots are not allowed to contact with the Alphabet Cubes which have been placed onto the Consulting Area at the opponent's Side (Not including the case that robots use Attacking Cubes to knock down the Alphabet Cubes).

- ⊗ The Team will receive a Red Card.

Separate Arena Elements and Robots

R30. Robots should be designed in a way that the Arena Elements from any mechanical structures of grabbing, containing or holding can be easily removed. Even if when 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. The team will be disqualified at the second time.

Completely In the Opponent's Side

R31. During the match, the whole Subsystem 1 of the robot cannot enter the opponent's arena through the hollow part under the Central Barrier, 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 its body enters the opponent's arena.

- ⊗ The Team will receive a Yellow Card.

Restrict the Movement of the Opponent's Robot

R32. 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.

R33. If part of the body of the robot or Subsystem 1 enters the opponent's area which causes the opponent's Alliance robot is blocked or constrained, the Referees may stop the match as the case may be and warn the robots of two Sides to separate as soon as possible.

- ⊙ The Team will receive a Warning. In case serious Violation the Team will receive Yellow Card.

Mentoring in Violation

R34. Throughout the whole process of the match, 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.

- ⊙ The Team will receive a Warning at the first time. In case serious situation the Team will receive a Violation. Depending on how serious of the situation the Team may be disqualified.

Off-Arena Contact

R35. During the match, Contestants are not allowed to have any direct contact with off-arena personnel such as audiences, including but not limited to the delivery of the parts and Bluetooth controller.

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

Serious Action

R36. It will be deemed as Serious Action if the operation Team, the Contestants and the Mentor have conducted the following actions, including but not limited to the impolite behaviour, seriously affecting the arena and the safety of the audience, leading to the failure of the normal progress of the match. Serious 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, Mentors, 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 be disqualified.

Uncivilized Participation

R37. In participating in the activities such as the technology sharing, robot demonstration, match watching etc., Contestants and Mentors should respect other Teams, maintain the order of the arena, and show the actions in good images of the MakeX Robotics Competition.

- ⊙ Depending on how serious of the situation the Team may be disqualified.

5.3 Modification Stage Rules

The Robot Not in the Starting Area Before Modification Stage

R38. At the end of the Manual Stage, robots need to be inside the Starting Area before it can be taken out for modifications. In case the robot is not inside the Starting Area (Partially or Completely In), it will not be allowed to be modified during the Modification Stage.

- ⊙ The Team who modifies the robot that is not inside the Starting Area will receive a Red Card.

Modify Outside the Designated Area

R39. The Team can only modify the robot after the vertical projection of the robot is Completely Outside the Arena. Modification cannot be conducted 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

R40. Contestants cannot change the state of the Arena Elements on purpose or contact with the Scoring Props when they are taking out the robot. The Attacking Cubes carried by the robot are not restricted by this rule, contestants do not need to remove the Attacking Cubes inside the robot, but they cannot put the Attacking Cubes which have been tossed out of the arena back to the robot; If the robot carries other Arena Elements, the Arena Elements cannot be put back to the arena; If the robot carries Scoring Props, the Scoring Props become invalid, and the opponent Alliance will score correspondingly.

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

The Robot Not Inside the Starting Area After Modification Stage

R41. The robot should be placed in their own Starting Area before the end of the Modification Stage.

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

Robot's Requirements after Modification

R42. 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 Similar Robot

R43. It is not allowed that two or more than two robots with high degree of similarity to participate in the competition. The judgement of similarity will be determined by the Head Referee during the inspection.

- ⊗ If the robots are determined to be identical, they must be modified until they pass the inspection, otherwise they will be disqualified.

5.5 Abnormal Events

In the case when unexpected events occur, the Referee is entitled to pause the match and take action. Including but not limited to following situation:

Potential Safety Risk

E28. The competition venue emerges safety problems that might affect the arenas, Teams and robots.

Uncontrollable Technical Issues

E29. The match cannot continue because the robots or Competition Systems in the Arena is interfered by radio wave or other uncontrollable technical issues.

Damage of Arena Elements

E30. The Arena Elements (including Scoring Props or Arena Frame etc.) are damaged which cause the match cannot continue.

Abnormal Change of Arena Elements

E31. During the match, the state of the Arena Elements is changed because of an abnormal action such as the effects from outside of the arena.

Rematch

E32. Head Referee is entitled determine if a rematch is necessary according to the actual situation. The reason of rematch may come from



errors of Staff, Competition System, on-arena control or arena itself.

- E33.** During the Automatic Stage, if the match is paused, rematch will be arranged to ensure the fairness.
- E34.** The abnormal event 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 rematch. (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 rematch.

Resume from Pause

- E35.** After the abnormal event is solved, the paused match can be resumed from the time of pause.

Forfeit Match

- E36.** Contestants should keep a positive attitude. If they cannot continue the match due to self or irresistible reasons, they should sign and confirm in the Arena or inform the MakeX Robotics Competition Committee by other means. Their Alliance teammate shall continue that match.

5.6 Punishment

Warning

- E37.** 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 match will not pause.

Violation

- E38.** When Referee discovers that the Team has violated the rules, the Violation notice will be given immediately and 20 points will be deducted to the Alliance. During the Violation, the match will not pause.

Yellow Card

- E39.** When the Contestant's or related person's action that seriously affect the fairness of the competition or violate the safety principle, the Team will receive a Yellow Card with 60 points deduction for the Alliance.
- E40.** Accumulation of Yellow Card: In Qualification Round, the accumulation of Yellow Card for each match is counted for each Team. If one Team receives two Yellow Cards, it will be escalated to a Red Card.



In the Elimination Stage, the accumulation of Yellow Card for each match is counted for each Alliance. If one Alliance receives two Yellow Cards, it will be escalated to a Red Card.

Red Card

E41. 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.

E42. Object of Punishment: In the Qualification Round, the Red Card will be given to Team only. When a Team received a Red Card, the Alliance will be deducted for 120 points and their robot will be suspended but the match will continue as usual. In case both Teams from one Alliance receive Red Cards, the Alliance will directly lose the match and the live score will be recorded. (After deduction, if the score of the losing Alliance is higher than that of the winning Alliance, the final score will be modified to the winning Alliance has 10 points advantage than the losing Alliance)

In the Elimination Stage, the Red Card will be given to Alliance only. When a Team receive a Red Card, their Alliance will directly lose the match and live score will be recorded. (After deduction, if the score of the losing Alliance is higher than that of the winning Alliance, the final score will be modified to the winning Alliance has 10 points advantage than the losing Alliance).

Suspension

E43. If the robot is failed (such as parts falling) or has violated any safety principles, the robot will be suspended. The robot must stop its movement and remain still on Arena until the end of the match. During the Automatic Stage, if a robot is suspended, it must be removed 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 to the Arena. When the defected robot may be against the rules such as "Damaging the Arena", the Contestants can notify the Referee to suspend their robot. The Referee is entitled to suspend robots according to the actual situation on the Arena.

Disqualify

- E44.** If Team's action has seriously violated the safety rules, the spirit of the competition etc., it will be disqualified and lose the chance be awarded, but the points will be remained. In the Qualification Round, if two Teams from same Alliance are disqualified, the competition will proceed as usual. In the Elimination Stage, if two Teams from same Alliance are disqualified, the other Alliance will win the match.

5.7 Explanations

- E45.** 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.
- E46.** During the competition, all matters not specified in the Technical Guide can decided by the Referee Team.
- E47.** 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 MakeX Robotics Competition Committee reserves the final interpretation of MakeX Robotics Competition - Technical Guide for Ultimate Warrior.

6.1 Disclaimer

All Contestants in 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 MakeX Premier – Ultimate Warrior, 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 Teams, Referees, Staff, audiences, equipment and Arena.

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. and MakeX Robotics Competition Committee will not be responsible for any injury or loss of property caused by improper use.



6.2 Copyright Declaration

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MAKE X

Appendix 1: Competition Resources

MakeX Official Website: <http://www.makex.io/en>

Any Feedback & Question Please Sent to:

makex_overseas@makeblock.com

Additional Information:

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

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Appendix 2: Robot Self-checking List (Ultimate Warrior)

MakeX Premier Robot Self-Check List (Ultimate Warrior)			
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 match.</p> <p>Maximum size refers to the maximum extended 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 match is 800 mm (long) x 800 mm (wide) x 800 mm (high).</p> <p>After intensified modification, the maximum size of the robot before restarting is required to be 800 mm (long) x 800 mm (wide) x unlimited (high).</p>	
2	Weight	The weight of the robot must not exceed 20 kg. (Including the weight of batteries and extra components installed after the Modification Stage).	
Safety			
3	Dangerous Structure	Safety protection is required for the structures that may cause injury to people in the process of operating.	
4	Damage Arena	In the process of loading, unloading and operating, there shall be no act of damaging the arena.	
5	High-power Tools	No high-power equipment allowed during loading, unloading and operation.	
6	Unsafe Energy Storage Equipment	In the process of using the unsafe energy storage equipment (springs, etc.), safety shall be ensured.	

7	Personal Safety	During the match, Contestants shall wear goggles; long hairs shall be tied up; Contestants are prohibited from wearing toe-baring shoes into the competition arena.	
8	Banned Material	Robots are not allowed to use the flammable gases, pyrotechnic equipment, hydraulic components, Mercury-containing switches, exposed hazardous materials, unsafe counterweights, designs that may cause entanglement and delay the competition, sharp edges and angles, materials containing liquids or gelatinous substances, and any part that may conduct the electric current on the robot to the arena.	
Robot's Modules			
9	Controller	Teams have to use the specified Bluetooth controller, and it is only allowed to be used by the Operator.	
10	Mainboard	Teams have to use the specified NovaPi and Raspberry Pi 3 Model B+ as the mainboards. There is only one Bluetooth receiving module paired with the Bluetooth Controller.	
11	Power Supply	Batteries with specified parameters are used as power supply and shall be securely fixed inside the robots. Each robot can only use one battery (Except for the battery required for the laser aiming devices). Detailed parameters are: 3S Li-Po batteries, output voltage: 11.1v - 11.2v, discharge rate: 25c - 30c.	
12	Power Management Module	Teams have to use the specified power management module which can be connected to the Competition System to finish the following actions: power on robots, power off robots and initiate the automatic program.	
13	Customized Parts and Accessories	The following customized parts can be used: plates, profiled materials, 3D printing pieces, metals, wood, plastics, rubber, magnets; Auxiliary materials requirements: It is allowed to use the ropes, cables, wires, springs, rubber bands, leather hoses, surgical tubing, punched sheets, injection molded products; It is allowed	

		to use a single-degree-of-freedom complete commercial products package and system wheels; It is not allowed to use the multi-degree-of-freedom commercial products package.	
14	Sounds and Lights	There is no light source except the laser aiming device with its power less than 5 mW (Limited to only one) and the self-contained indicator light of the mainboard or the sensor; No other sound generating device is allowed except for the buzzer on the mainboard.	
		In case it requires the independent power supply when using the laser pen for educational use. It is only allowed to use the configured batteries (such as dry batteries) of the device, and the batteries cannot transmit energy to the power system of the robot. If it is not a common laser aiming device, please provide the model serial number and parameters for inspection.	
15	Sensors	It is not allowed to install any sensor that may interfere with the sensory ability of other robots.	
16	Smart Servo	Teams are only allowed to use the smart servo inside the official equipment package or the same type of smart servo (MS-12A), the maximum number of servos available on a robot is 6.	
17	Motor	Teams are only allowed to use the required 37 DC Motor, 180 Encoder Motor, 36 Encoder Motor Brushless and 2823/2824 Brushless Motor, the maximum number of motors available on a robot is 18.	
18	Bottle Cap	Teams are only allowed to use the Bottle Cap inside the official equipment package or the same type of Bottle Cap.	
19	Air Bottle	Teams are only allowed to use the 2L coke bottle manufactured by Pepsi Co. Each robot's pneumatic system can only use up to 4 Air Bottles. Air Bottles are not allowed to be exposed; they	

		need to be wrapped with explosion-proof tape.	
20	Air Pipe	Air Pipes are not allowed to be exposed, to prevent the damage caused by sharp objects	
21	Solenoid Valve	Teams are only allowed to use the Solenoid Valve inside the official equipment package or the Solenoid Valves manufactured by Airtac.	
22	Cylinder	Teams are only allowed to use the Cylinder or the same type of cylinder (MI10X60CA or MI10X150CA) manufactured by Shenzhen Makeblock Co., Ltd.	
23	Wrap the Sharp Structure	The exposed sharp edges of the robots have to be wrapped with sponge strips.	
24	Separation/Abscission	It is not allowed for the main body of the robots to detach any parts during the match; The arena parts may be detached from the robots.	
25	Interference	Cannot interfere with the electronic modules and sensors of other robots.	
26	Team Number	Team number's printed font should be Times New Roman, black bold, size: 130.	
27	Engineering Notebook Submission	Submit the Engineering Notebook containing the code of the robot control before the competition.	
28	Arena Contamination	Lubricating oil etc. used by robots shall not contaminate the arena or other robots.	

Appendix 3: List of Violations and Penalties

Scope	Items	Generalization	Violation	Yellow Card	Red Card	Suspended.	Disqualification
Safety rules	Hazardous structure	In case it is found that the structure of the robots may injure human, they should be modified immediately after Warning.				✓	
	Damage arena	Robot which has damaged the arena will be suspended. Violating this rule twice will escalate to Disqualification				✓	✓
	Contaminate arena	Under the preconditions without contaminating the arena, the glue, adhesive tape and 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.				✓	✓
	Damage other robots	Robot which has damaged another robot will be suspended. Violating this rule twice will escalate to Disqualification.				✓	✓
	Use banned materials	In case it is found that the use of the banned materials by Contestants, the robot will be suspended. Violating this rule twice will escalate to Disqualification.				✓	✓
	Robots Out of bounds	No part of the robot can exceed the boundary of the arena.				✓	✓

	Other unsafe factors	In case the Referees have found the other unsafe factors of the robots, they are entitled to suspend such robots and require Contestants to make modifications. Violating this rule twice will escalate to Disqualification.				✓	✓
Operation rules	Operators or Observers leave designated Operation Area	Operators or Observers must stay inside the designated Operation Area during match.	✓				
	Contestants do not comply with match requirements	On-arena Contestants must comply with the match requirements.	✓				
	Replace on-arena Contestants during the match	Contestant outside the arena is not allowed to replace the on-arena Operator and Observer during the match.			✓		
	Contestants spend more than 5 minutes between the three matches of the elimination round	During the elimination round, each Alliance has 5 minutes of adjustment after each match, no extra time will be given.	✓				
	Bring electronic communication devices into arena	Violating this rule twice will escalate to Yellow Card.	✓	✓			
	Robots start the match in advance	Violating this rule twice will escalate to Yellow Card.	✓	✓			
	Delayed end of the match	The corresponding score will be deducted.	✓				

Violating contact during the match	A Yellow Card will be given if it affects the score or the progress of the match.	✓	✓			
The human body is not allowed to extend into the arena to affect the opponent to score.	A Yellow Card will be given if violating this rule twice.	✓	✓			
Control robots via Bluetooth	In the Automatic Stage, the Controller at the Automatic Stage.				✓	
Operating suspended robots	After the robot is suspended, the operation team is not allowed to control the robot.	✓	✓	✓	✓	✓
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 violating this rule twice.	✓	✓			
Robots do not meet specifications during the match	Parameters such as the size and weight of the robot during the match must comply with the specifications. Except for being hit by an opponent's Attacking Cube, causing the robot size to exceed the size limit			✓		
Remove Arena Elements from the arena	Except when trying to score.	✓				
Toss the Arena Elements that are not allowed to be tossed to the opponent's	In case of change of Arena Elements in the opponent's Side, it should be suspended for restoration.		✓			

	Side						
	Maliciously interfere or destroy the Alphabet Cubes on the opponent's Side	Robots are not allowed to interfere with or destroy the Alphabet Cubes which are already onto the Diagnostic Area (Not including using Attacking Cubes to knock them down)			✓		
	Arena Elements are difficult to remove from robots	Repeated Violations which affect the progress of the competition will be disqualified.					✓
	Completely In opponent's Side	If it fails to return to its own camp after a penalty, it will be penalized by a Red Card.		✓	✓		
	Restricting opponent's robots to move	A penalty will be given for deliberately restricting the opponent's robot.	✓	✓	✓	✓	✓
	Serious action	Serious actions include but not limited to: repeated or blatant Violations, Impolite behaviors to the Operators, Referees, Staff, or Contestants; Violating this rule twice will be disqualified.	✓	✓	✓	✓	✓
	Mentor Violation	The Team will receive a Warning at the first time. In case serious situation in the Team will receive a Violation. Depending on how serious of the situation the Team may be disqualified.	✓	✓	✓	✓	✓

	Contact and exchange parts between outside and the arena	It is strictly prohibited to take place during the competition.	✓	✓	✓	✓	✓
	Uncivilized participation	In participating in the activities such as the technology sharing, robot demonstration, match watching etc., Contestants and Mentors should respect other Teams, maintain the order of the arena, and show the actions in good images of the MakeX Robotics Competition.	✓	✓	✓	✓	✓
Modification Rules	Modification outside the Starting Area	Entering the Starting Area is subject to the contact of the bottom of the robot with the outside line of the Starting Area.			✓		
	Modification in the arena	Contestants must modify outside the arena.	✓				
	Change the state of Arena Elements in the Modification Stage	The Arena Elements removed from the robots cannot be put back to the arena (Except for the Attacking Cubes).	✓	✓			
	Failure to enter the Arena before the end of the Modification Stage	The robot cannot be put back into the arena.				✓	
	Different to the inspection state after the Modification stage	If there are any major changes, they should declare to the Referees for inspection after being put into the Arena.			✓	✓	

Similar Robot	It is not allowed that two or more than two robots with high degree of similarity to participate in the competition. The judgement of similarity will be determined by the Head Referee during the inspection.	If the robots are determined to be identical, they must be modified until they pass the inspection, otherwise they will be disqualified.					✓
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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. It will be deemed overcharge if the voltage of Li-Po battery is over 12.6v, and less than 9.0v 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.

MAKE X

Appendix 5: Instructions for Power Management Module

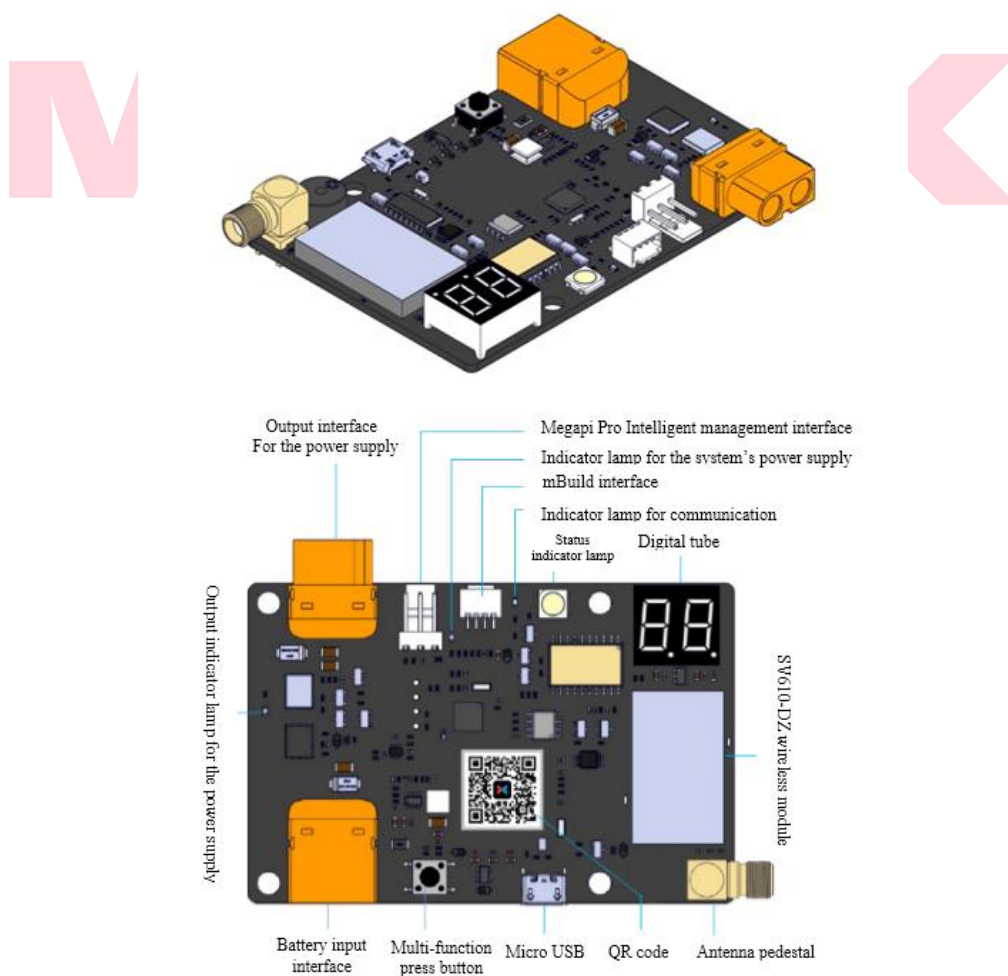
Instructions

The power management module is used in coordination with the main board (NovaPi), which is a necessary electronic device to participate in the competitions of Intelligent Innovator and Ultimate Warrior in the 2022-2023 Season.

During the match, 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 Team's robots, as well as switch between the 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.

Operation

Multifunctional button

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

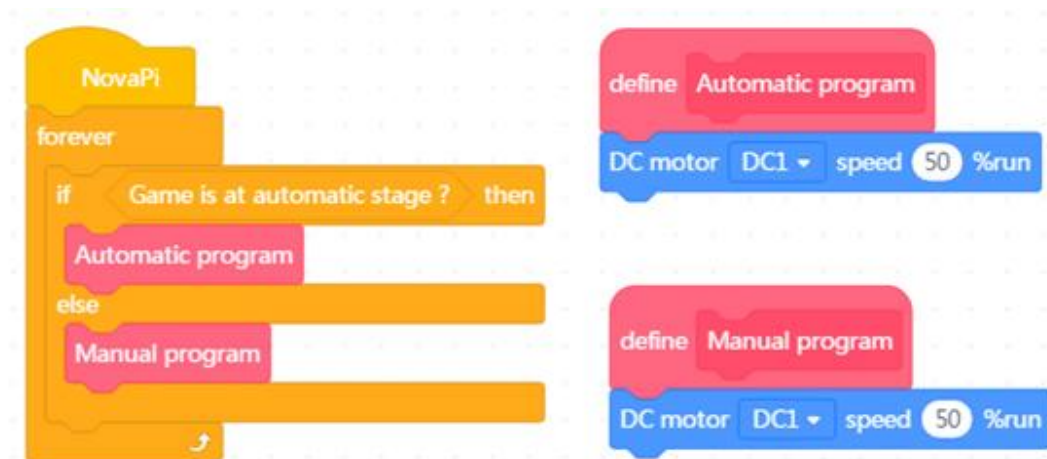
- **Reset:** Firstly, press the multi-function button and insert the Li-Po battery into the power management module at the same time. The power management module restores the default configuration parameters. The buzzer sound for 2 seconds and the nixie tube display the number "20";
- **Click:** Click 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 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 Starting Automatic Program

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, a fixed code must be inserted 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).

When using mBlock:



```

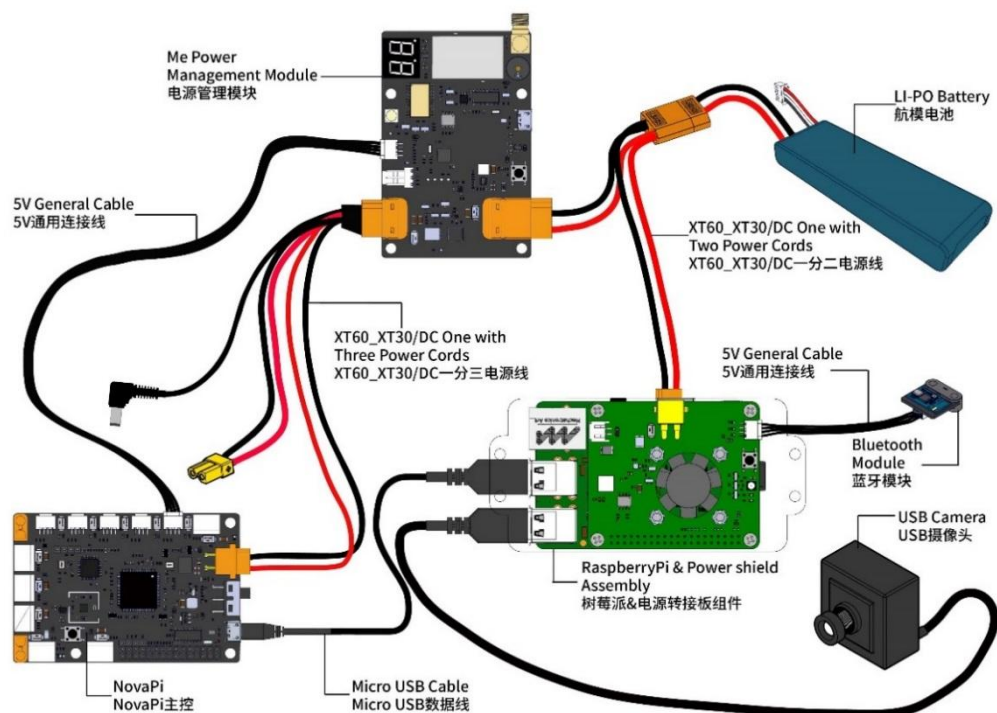
1  from hardware.mbuild import power_manage_module
2
3  from hardware.mbuild import power_expand_board
4  import sys, time, math
5
6  # new class
7
8  def Automatic_Program ():
9      power_expand_board.set_power("DC1",50)
10     time.sleep(30)
11     power_expand_board.stop("DC1")
12
13  def Manual_Program ():
14      power_expand_board.set_power("DC1",50)
15
16  while True:
17      time.sleep(0.001)
18      if power_manage_module.is_auto_mode():
19          Automatic_Program()
20
21      else:
22          Manual_Program()

```

When using Python:

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:
 - 1.The replacement of Li-Po battery or re-unplugging and re-plugging of the Li-Po battery.
 - 2.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 Team's 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 Staff. Any problems caused by an unauthorized replacement of the power supply module shall be borne by the Team.

MAKEX

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RULES GUIDE MAKEX PREMIER