

**MAKEX**

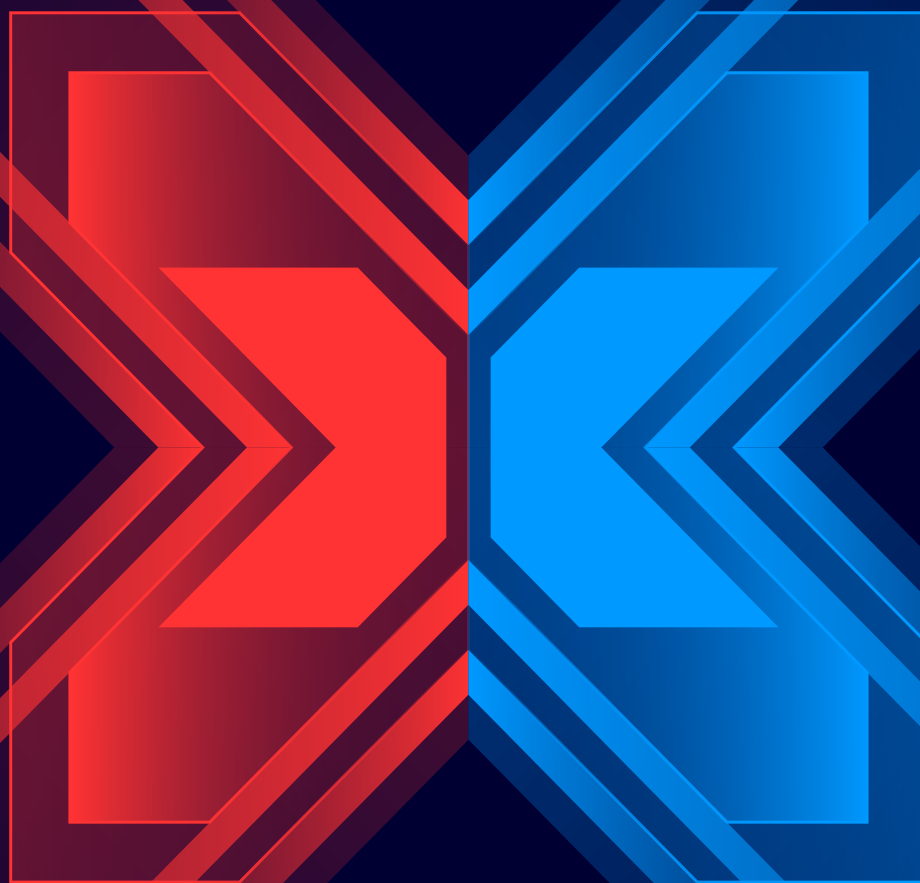
**V 1.1**

2020 MAKEX ROBOTICS COMPETITION

# TECHNICAL GUIDE

**MAKEX CHALLENGE**

**INTELLIGENT INNOVATOR**



Edited By MakeX Robotics Competition Committee



## Updates:

Date	Version	Modifications Record
2019.12.10	1.0	Intelligent Innovator Technical Guide First Published
2020.03.06	1.1	Add the definition of “Direct Contact”
		Improve the instructions of the initial placement of props on the production platform
		E07-E09: Additional instructions for suspension and stacking states of alphabet cubes
		T27: Change the usage limit of sensors

# MAKE X



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



## 1.2 MakeX Spirit

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

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

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

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

MakeX spirit is the cultural cornerstone of the MakeX Robotics Competition. We hope to provide a platform for all contestants, mentors and industry experts to exchange ideas, study and grow up, and help young people acquire new skills during creation, learn to respect others in teamwork, gain an enjoyable life experience in the competition, take delight in sharing with the society their knowledge and responsibility, and work hard to achieve their grand aspiration of changing the world and creating the future!

## 1.3 Participation Requirements

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

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:** An iron basket placed on an Arena Frame for storing the controller in the competition.
- **Arena Frame:** which is splice by flat beam and octagonal pillar.
- **Mat:** Color spraying with necessary information such as competition mission, identification and so on.
- **Ground:** It refers to the upper surface of the mat.
- **Operation Area:** The area where the operation teams are allowed to stay.
- **Side:** The area where the Alliance's robots move during the match.
- **Competition System:** Both the hardware and software are 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:** contestant who registered and participated in the MakeX 2020 Robots Competition Challenge Intelligent Innovator.
- **Mentor:** Mentor who registered and participated in the MakeX 2020 Robots Competition Challenge Intelligent Innovator.
- **Team:** Team are composed of contestants and mentors, who registered participating in the 2020 MakeX Robots Competition Challenge Intelligent Innovator.
- **Alliance:** Two Teams form an Alliance
- **Captain of Alliance:** The two teams that form the Alliance shall designate one of the Contestants on the Arena as the captain of their Alliance.



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

## 2.3 Refereeing

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

# MAKE X





## 3. The Competition

### 3.1 Background

The theme of the 2020 MakeX Challenge is "Intelligent Innovator". Industry is the lifeblood of modern economic development. However, traditional factories are gradually challenged and replaced by intelligent manipulators and modern manufacturing machinery. The background of Challenge 2020 season is set in a huge modern factory. The two Alliances will use high-precision vision sensors, mechanical control and other technologies to perform a series of operations, such as sorting out quality products and toss production materials into their opponent's smelter, so as to finish high-quality modern production.

### 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: the automatic stage, manual stage, modification stage and final stage. During the match, contestants will control robots to toss small cubes that symbolize production materials into the smelter on their opponent's Side, knock down red/blue pins on the waste platforms on their opponent's Side, or pick up alphabet cubes that symbolize quality products from the production platform and bring them to their own Side. In the manual and final stages, they can also control their robots to stack alphabet cubes in the inspection area, or fit these cubes to the suspension area to form the word "MAKEX". After the end of the match, scores of the



automatic stage and final stage will be combined to aggregated the winner.

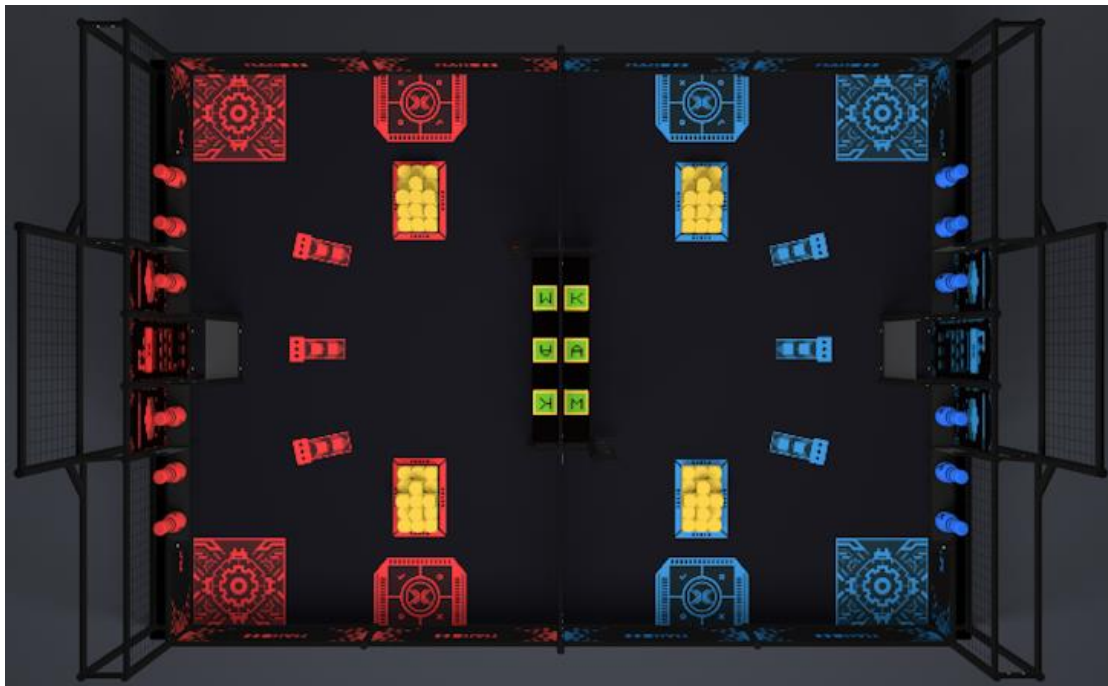


Fig 3.1 Top View of the Arena

### 3.3 Arena

The standard competition arena of 2020 MakeX Robotics Competition Challenge Intelligent Innovator is a rectangular area with a size of 3000 mm × 4400 mm. The arena mainly consists of four starting areas, two smelters (baskets), four inspection areas, four material areas, two production platforms, two waste platforms, six production lines (arrow symbols) and two suspension areas.



The central barrier evenly divides the arena into the red and blue Sides. Robots from both Sides can only compete on their own Side. Before the start of the match, the initial positions of the props are shown in Fig 3.2.

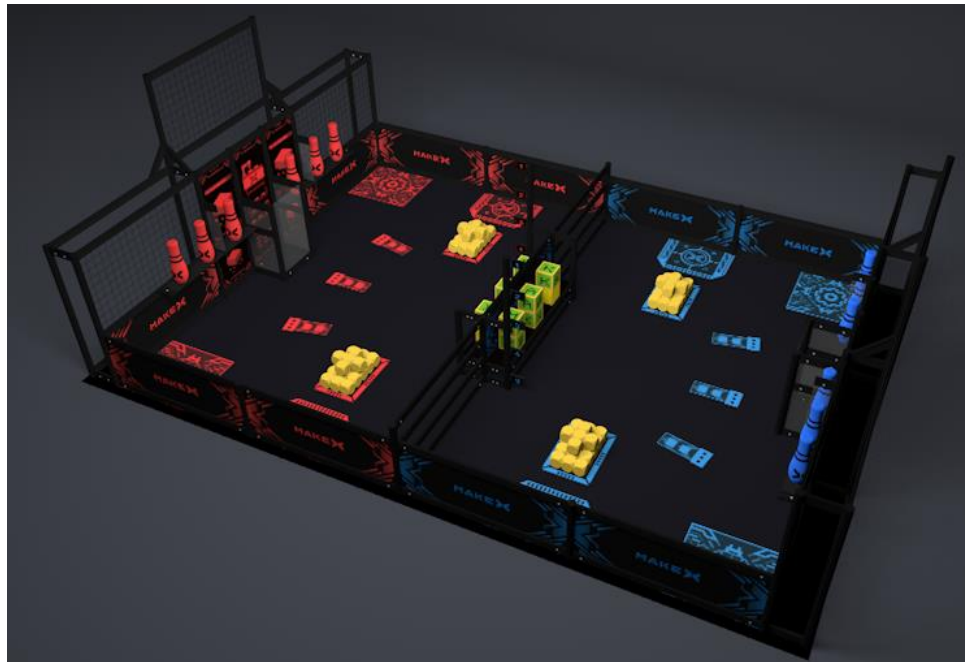


Fig 3.2 Axonometric View of the Arena

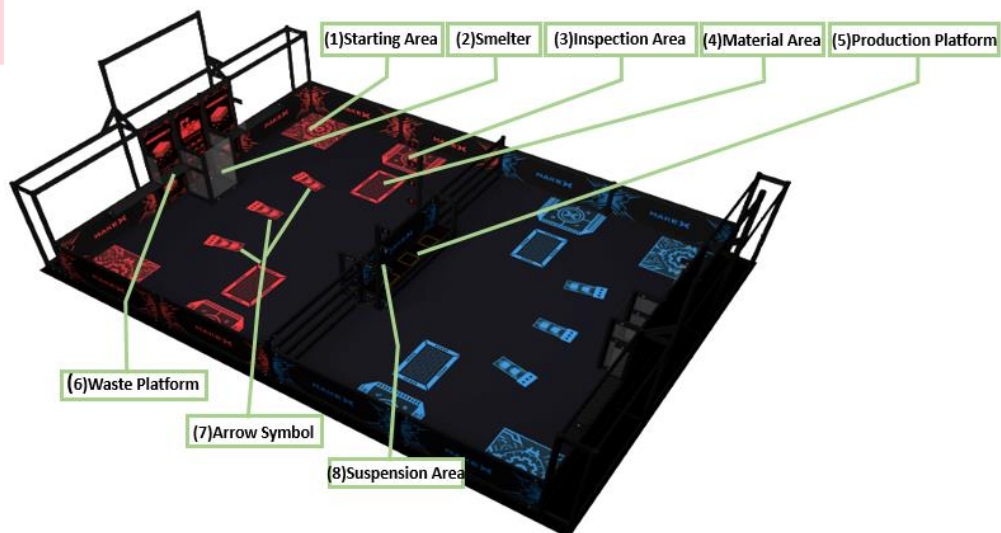


Fig 3.3 Functional Areas of the Arena

**(1) Starting Area:** Four areas in the arena are used for robots to start or stop moving in the match. The dimensions of the starting area's outer frames are 500×500 mm.

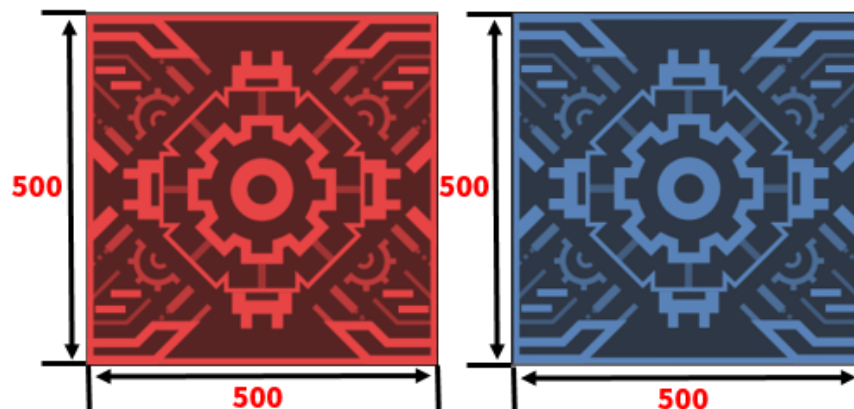


Fig 3.4 Starting Area

**(2) Basket:** Each Alliance has a basket (symbolizing a smelter in the factory) on their own Side, which is a cubic assembly made of flat beams, PVC plates, acrylic plates, and some other materials. The length, width and depth of the basket's inner frame are about 320×260×600 mm.



Fig 3.5 Basket

**(3) Inspection Area:** Each Side has two inspection areas, the dimensions of which are 500×400 mm.

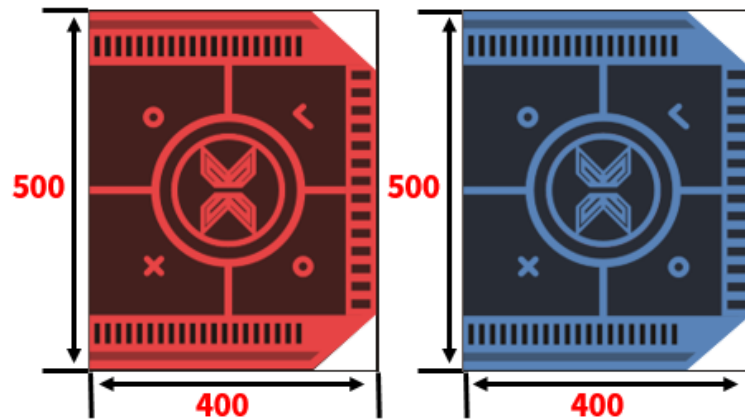


Fig 3.6 Inspection Area

**(4) Material Area:** Each Side has two material areas. 20 small cubes are initially placed in each of these material areas before the start of the match.

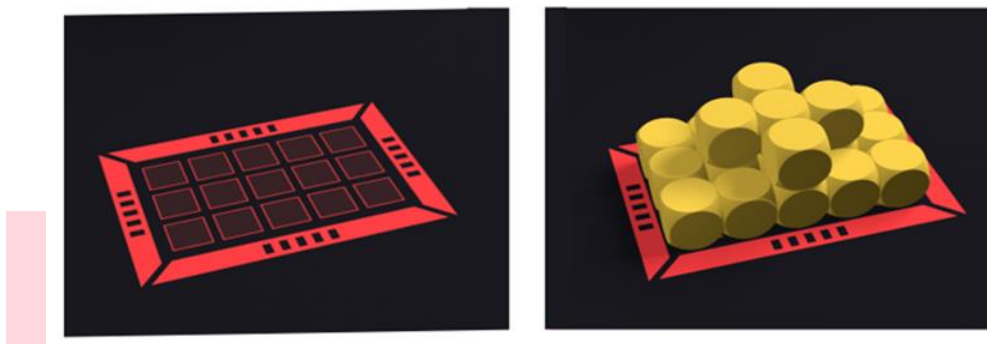


Fig 3.7 Material Area

**(5) Production Platform:** Each Side has one production platform. The Alphabet Cubes and the Blank Cubes are initially placed on these platforms before the start of the match (Before each match, the Referee shall randomly select prop card to confirm the arrangement order. All cubes shall be placed in strict accordance with the pattern shown in the prop card, and the hole of the cube shall be aligned to the central partition.) The vertical height of the platform from the Ground is 150 mm, and the cube placement position is shown in figure 3.8 and 3.9.

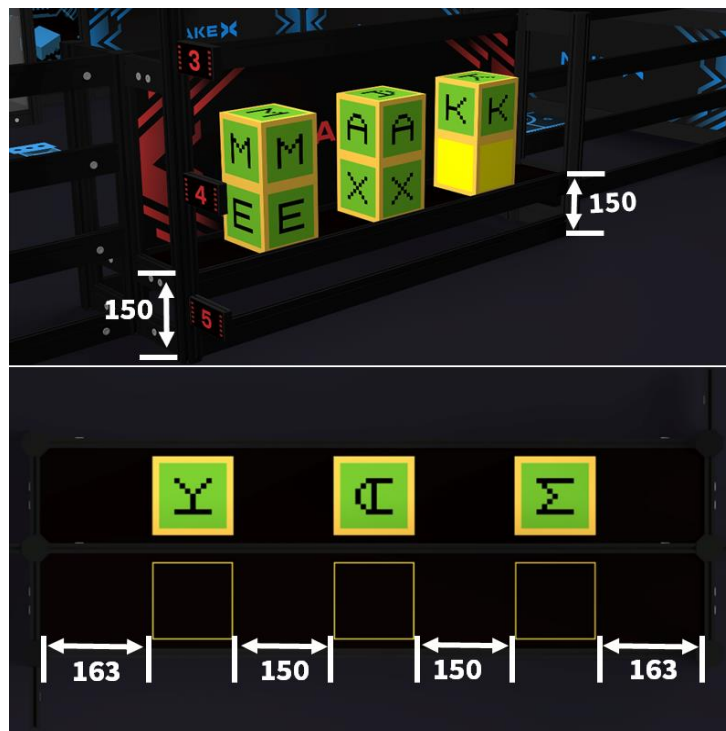


Fig 3.8 Production Platform

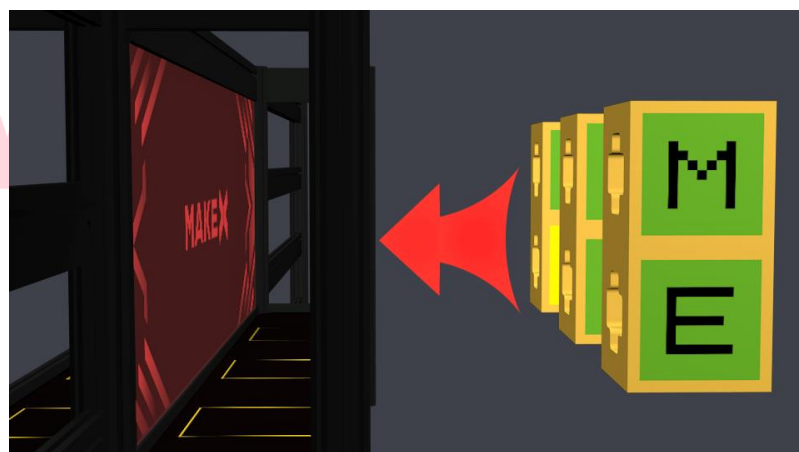
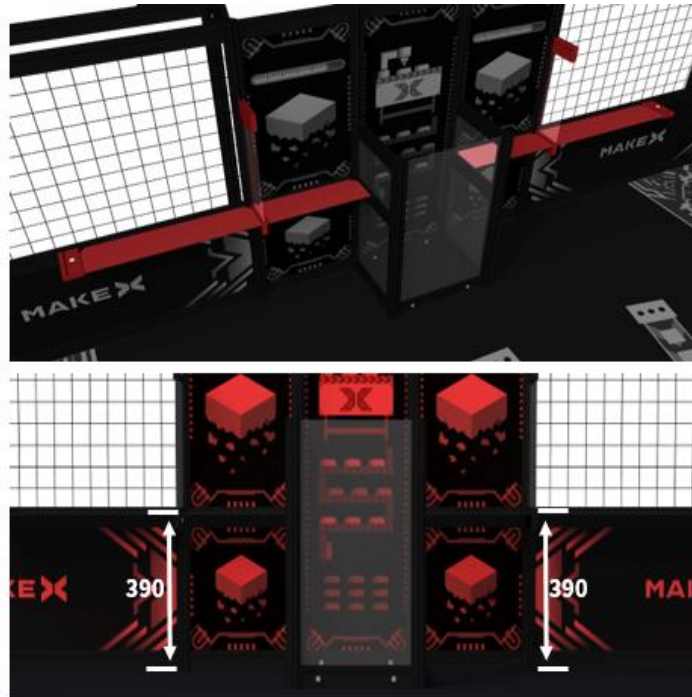


Fig 3.9 Cubes placement

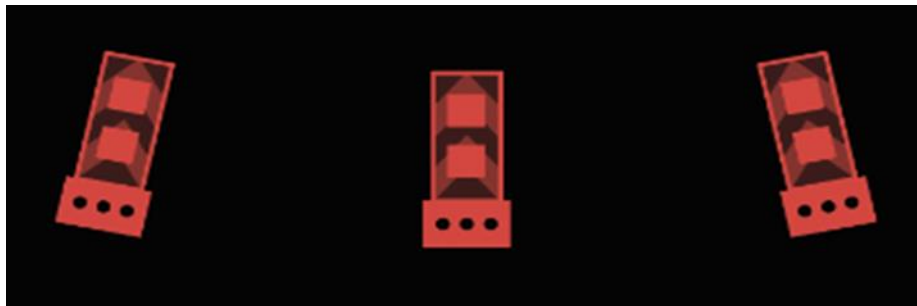


**(6) Waste Platform:** Each Side has one waste platform made of flat beams, aluminum octagonal pillars, acrylic plates, and PVC plates. Six red/blue pins are placed on this platform before the start of the match.



**Fig 3.10 Waste Platform**

**(7) Arrow Symbol:** There are three red/blue arrow symbols on each Side. These arrow symbols are used as indicators to help robots finish tasks such as toss cubes and knocking down pins.



**Fig 3.11 Arrow Symbols**

**(8) Suspension Area:** Each Side has one suspension area that is made of 960 mm octagonal pillars and 92 mm flat beams. The suspension areas are arranged in the center of the arena. Five 92 mm flat beams are mounted vertically on the 960 mm octagonal pillars to suspend alphabet cubes. These 92 mm flat beams are numbered 1, 2, 3, 4, and 5 from top down.



Fig 3.12 Suspension Area

### 3.4 Props

Before each match, the initial position of the props are shown in figure 3.13:

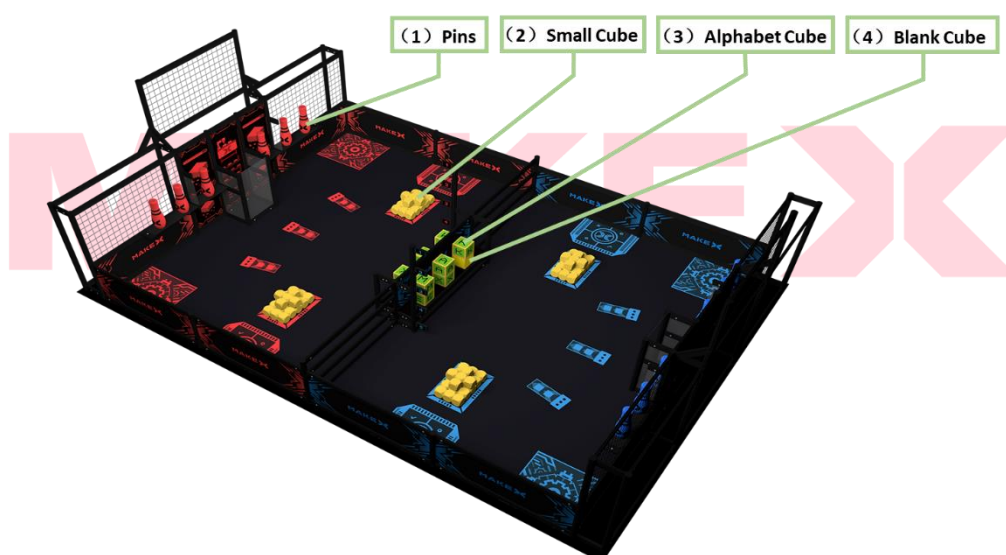


Fig 3.13 Initial Position of the Props

**(1) Pins:** There are six red/blue Pins (symbolizing production waste) on the waste platform of each Alliance Side. Pins are made of EVA with a height of 290 mm. The diameter of the bottom of each Pin is 70 mm, and the maximum diameter of the Pin is 100 mm. Robots need to toss small cubes toward Pins on the opponent's Side to



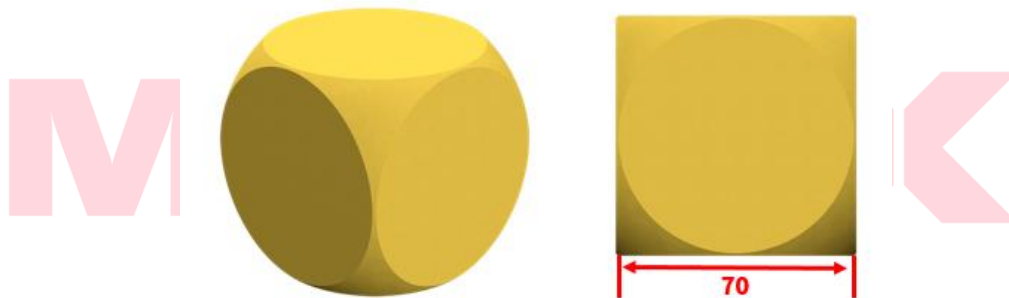


knock them down. (Note: Pins have a tolerance of  $\pm 10\text{mm}$ )



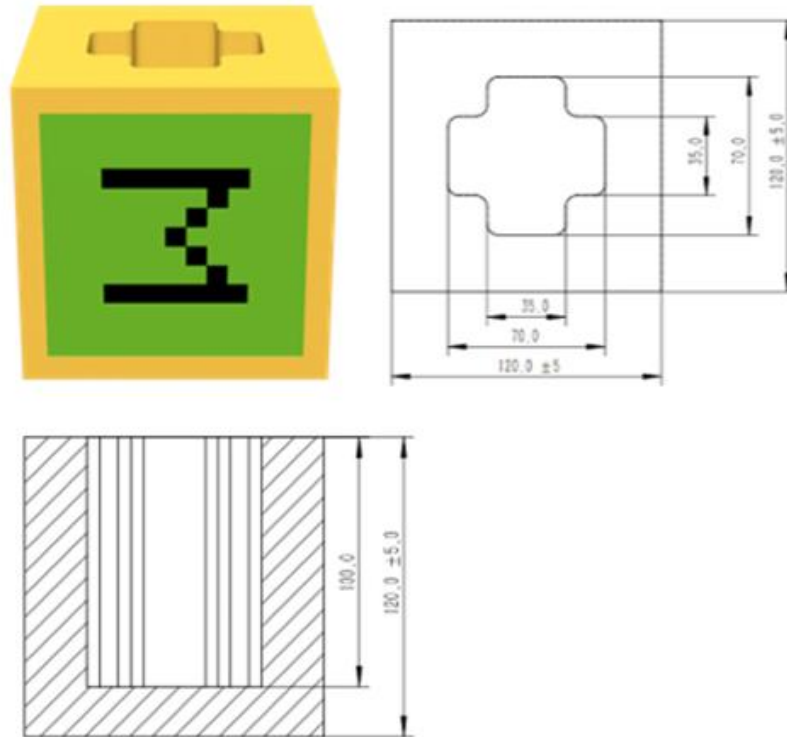
**Fig 3.14 Pins**

**(2) Small Cube:** Symbolizing production materials, the small cubes are made of EVA, with an edge length of 70 mm. 20 small cubes are placed in each of the material areas, which means we have a total of 80 small cubes in the arena. Small cubes are required in multiple tasks. For example, they can be tossed to baskets or knock down Pins. (Note: Small Cube have a tolerance of  $\pm 3\text{mm}$ )



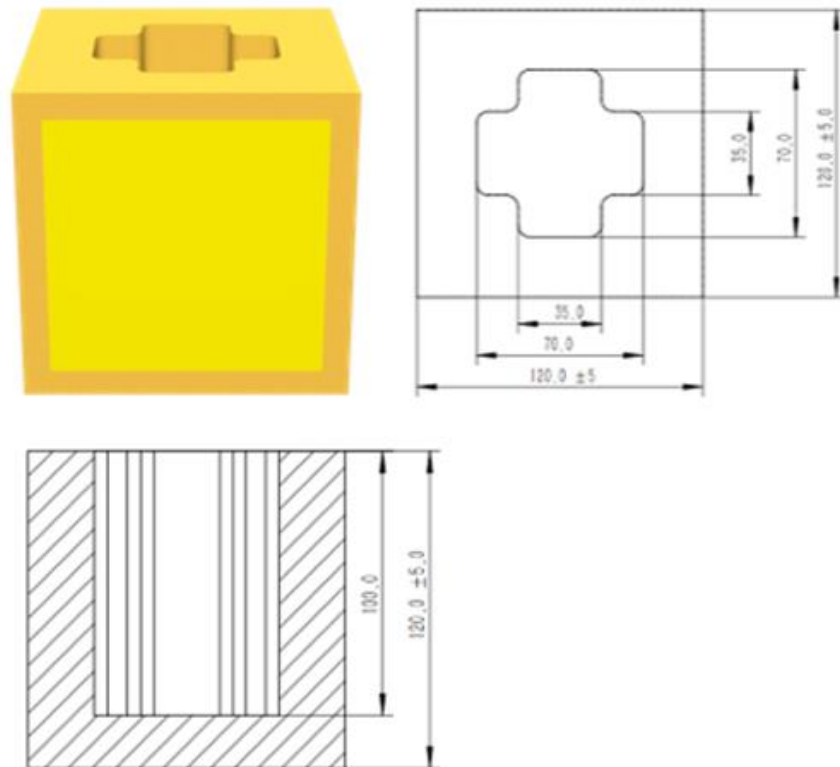
**Fig 3.15 Small Cube**

**(3) Alphabet Cube:** There are 10 EVA alphabet cubes (symbolizing quality products) with an edge length of 120 mm in the arena, hollow and drilled with a cross hole ( $70 \times 35 \times 100\text{ mm}$ ) each. They are evenly distributed on the production platform of each Alliance. These five alphabet cubes are stuck with a letter of [M], [A], [K], [E], or [X] respectively. (Notice: Alphabet Cubes have a tolerance of  $\pm 5\text{mm}$ )



**Fig 3.16 Alphabet Cube**

- (4) **Blank Cube:** There are two EVA blank cubes (symbolizing defective products) with an edge length of 120 mm in the arena, hollow and drilled with a cross hole (70×35×100 mm) each. They are evenly distributed on the production platform of each Alliance. The alphabet cubes and the blank cube are stacked in two layers on each platform, with three cubes on each layer. There is no alphabet sticker on a blank cube. (Notice: Blank Cubes have a tolerance of  $\pm 5$ mm)

**Fig 3.17 Blank Cube**

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

### 3.5 Missions

#### Automatic Stage

The automatic stage lasts for 30 seconds.

To ensure competition fairness, during the 5-second countdown before the start of a match, robots in the starting areas will be simultaneously powered off. After the countdown, the competition system will power on the robots, which will run their automatic programs.

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

- (1) Inside their own Alliance Side, sort the Alphabet Cube on the Production Platform to the Ground to score;
- (2) Inside their own Alliance Side, automatically collect the Small Cube on Material Area and toss it into opponent's smelter to score;
- (3) Inside their own Alliance Side, automatically collect the Small Cubes to knock down the red/blue Pins on opponent's Waste Platform to score.



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

The lighting of the arena, each Team's competition period might be different, the Team should install and debug the sensor properly before the match. The Committee does not guarantee that the environment of the arena will never change. Actually, with the progress of the match, the environment of the arena may change from time to time, and the robots must be able to adapt to the changes.

### Manual Stage

The manual stage lasts for 90 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 90-second manual stage starts. In this stage, the operators can use the controller to operate the robots manually. In the manual stage, the teams can score through the following ways:

- (1) Continuing to pick up the Small Cubes and toss them into the opponent's Basket to score;
- (2) Continuing to pick up the Small Cubes to knock down the red/blue Pins on the Waste Platform of opponent's Side to score;
- (3) Successfully suspend the Alphabet Cubes to the Suspension Area to score;
- (4) Successfully stack the Blank and Alphabet Cubes in the Inspection area to score.

Before the end of the manual stage, the competition system counts down 5 seconds, after which it will automatically power off the robots.

### Modification Stage

The modification stage lasts for 60 seconds.

After the manual stage is over, the match moves to the modification stage. Contestants can move their robots that have partially or completely in the starting areas out of the arena for modification. They can also move the alphabet cubes or the blank cube that are completely placed in the inspection areas away from the arena, and manually load the cubes on their robots to complete the corresponding tasks. 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

in 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.

In the Final Stage, the robot can score by the following ways:

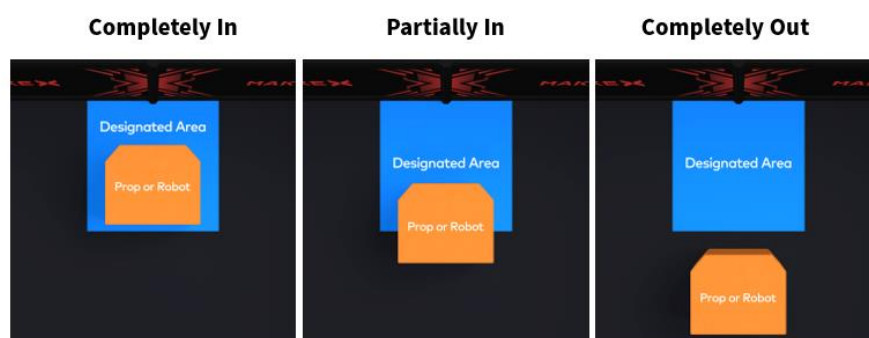
- (1) Continuing to pick up the Small Cubes and toss them into the opponent's Basket to score;
- (2) Continuing to pick up the Small Cubes to knock down the red/blue Pins on the Waste Platform of opponent's Side to score;
- (3) Successfully suspend the Alphabet Cubes to the Suspension Area to get the corresponding scores;
- (4) Successfully stack the Blank and Alphabet Cubes in the Inspection area to get the corresponding scores.

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 the 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:



### Sorting State Judgment

**E02.** In the automatic stage, if an alphabet cube is completely out of the vertical projection of the production platform and is not in Direct Contact with robots

of the same Alliance, this alphabet cube is regarded as successfully sorted.

**E03.** In the automatic stage, if the blank cube is completely out of the vertical projection of the production platform or comes into Direct Contact with any robots of same Alliance, all their alphabet cubes will be regarded as invalidly sorted, and the sorting task score of the Alliance will be cleared to 0 points immediately.

### Toss State Judgment

**E04.** When a small cube (with an edge length of 70 mm) completely falls in the opponent's basket, it is regarded as a valid toss.

**E05.** If the conditions specified in E04 are not met, the toss is invalid.

### Pins State Judgment




**E06.** If there is no Direct Contact between the Pin and the waste platform, or the same Alliance's robots Direct Contact the Pin, that Pin will be regarded as knocked-down state.

### Suspension State Judgment

**E07.** When the Referee counts the scores (at the end of final stage), if the alphabet cube is suspended on one of the 92mm flat beam of suspension area, and there is no Direct Contact with the robot or any other Arena Elements (except the suspension area components), that alphabet cube will be regarded as successful suspension state.

### Stack State Judgment

**E08.** When the Referee counts the scores (at the end of final stage), the blank cube and the alphabet cube are completely in the same inspection area, If the blank cube is placed on the bottom and the alphabet cube stacked on the top, and there is no Direct Contact with the robot, it will be regarded in successful stack state.

Status	1	2	3
Image			
Judgment	✓	✓	✗

**E09.** When the Referee counts the scores (at the end of final stage), If an alphabet cube does not completely in the inspection area or has Direct Contact with the



robot, the stack will be regarded as invalid, i.e. no score, and other alphabet cubes will be scored normally.

### State of Robot's Entry into the Starting Area Judgment

- E10.** The vertical projections of the robots must fall completely in the starting areas before the start of the match.
- E11.** At the end of the manual stage (or the start of the modification stage), if a robot partially enters a starting area, it is deemed to have entered the starting area.
- E12.** The vertical projections of the robots must partially or completely in the starting areas at the start of the final stage.

## 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

- (1) An Alliance scores 20 points for each successfully sorted alphabet cube, and these points stack. However, if the blank cube is completely out of the vertical projection of the production platform or Direct Contacts any robots of the same Alliance, the sorting score will be cleared to 0 points immediately;
- (2) An Alliance scores 10 points for each successful cube toss in the opponent's basket;
- (3) If an Alliance scores more than zero points for cub toss as specified in item (2), it scores an additional 10 points for each Pin knocked down on the opponent's Side. It scores 50 extra points if all Pins are knocked down.

### Manual Points

- (1) An Alliance scores 20 points for each successful cube toss;
- (2) If an Alliance scores more than zero points for cube toss as specified in item (1), it scores an additional 20 points for each Pin knocked down on the opponent's Side. It scores 50 extra points if all Pins are knocked down;
- (3) An Alliance scores 30 points for each alphabet cube successfully suspended on flat beams numbered 1 to 5 in the suspension area. It scores 50 extra points for successful suspension of all alphabet cubes in the order of [M], [A], [K], [E], [X] (from top down);
- (4) Regarding cube stacking in the inspection area, the blank cube must be



placed on the bottom layer. An Alliance scores 20 points for each layer on top of the bottom layer, and the full score is 100 points. If an Alliance stacks 5 layers on top of the bottom layer, and the letters of the cubes read [M][A][K][E][X] (from top down), it scores 50 extra points.

Automatic score = Cube sorting score + Cube toss score + Pin score – Violation points.  
The automatic score is calculated at the end of the automatic stage.

Manual score = Cube toss score + Pin score + Cube suspension score + Cube stacking score – Violation points. The manual score is calculated at the end of the final stage.

Single-match score = Automatic score + Manual score.

# MAKE X



### 3.8 Single-Match Flow Chart

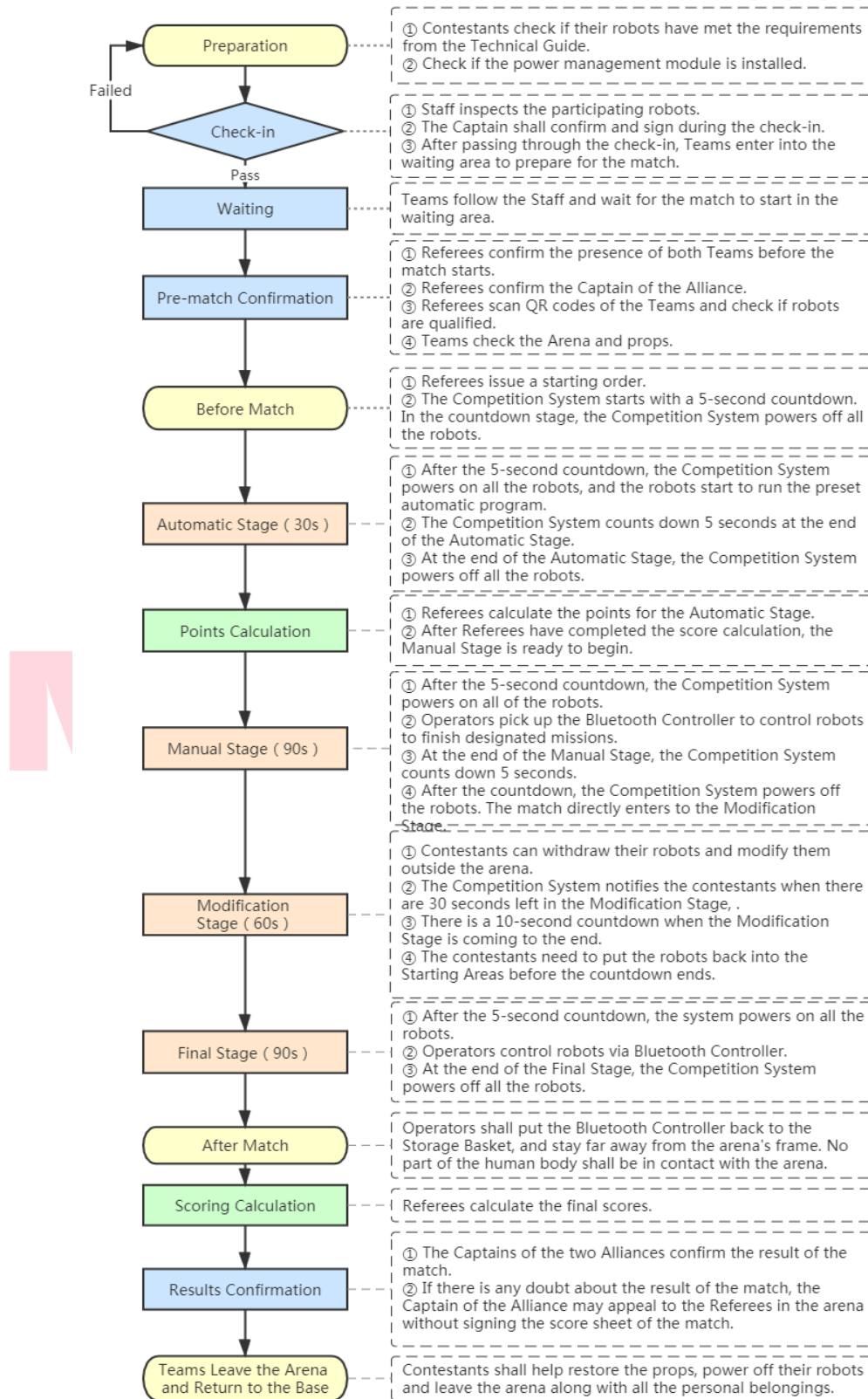


Fig 3.18 Single-match Flow Chart



## 4. Robot Technical Requirements

When the teams are designing their robots to participate in the 2020 MakeX Challenge Intelligent Innovator, 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 technical requirements.

### 4.1 Robot General Technical Requirements

The general technical requirement explains and defines 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 robot 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 horizontal plane 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 Mat (in Direct Contact with robots) to the furthest point of the robot with respect to the Mat.
- 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.
- T14.** The following table presents the Robot Size Requirements:

	Requirements	Remarks
Maximum Initial Size	500 mm (Length) 500 mm (Width) 500 mm (Height)	1. The height should not exceed 500 mm and the vertical projection of the robot on the arena should not exceed 500 mm by 500 mm square area. 2. Before the Modification Stage starts, the robot's size must comply with the Maximum Initial Size requirement.
Maximum Size after Modification	500 mm (Length) 500 mm (Width) Unlimited (Height)	1. There is no limitation on height and the vertical projection of the robot on the arena should not exceed 500mm by 500mm square area. 2. After the Modification Stage, the robot's size must comply with the maximum size requirement after modification.

### Weight of the Robot

**T15.** Weight of the robot refers to the net weight of the robot at any time during the competition (the combined weight of Subsystem excluding the props from the arena).

**T16.** Weight of the robot must be less than 8 KG.

## 4.2 Electrical Requirements for Robot

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

### Power System

**T17.** 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).

**T18.** 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.



- T19.** Battery must not detach from the robot when the robot is inclined or moving. Installation of battery should not offset the robot's center of the gravity and lead to declination.
- T20.** Power cord should be kept intact. Cracks or leakage of cover is not allowed, and the core metal conductors should not be exposed.
- T21.** 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.
- T22.** 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.
- T23.** 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.
- T24.** 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

- T25.** Robots should use the specific mainboard (NovaPi, manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1) to prevent the teams from using the high-efficiency mainboards to affect the fairness of the competition.
- T26.** Teams need to optimize the arrangement of wiring between the mainboard and electrical devices. Labelling each wire can highly improve the efficiency of the testing, maintenance and also facilitate the inspection process.

### Electronic Sensor

- T27.** Robots should use the specific electronic sensors (electronic sensors manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: not limited) to prevent the teams from using some high-precision sensors to affect the fairness of the competition. In addition, teams can also use mBuild system sensors manufactured and sold by Shenzhen Makeblock Co., Ltd.

### Wireless-Control



- T28.** The robot should use the specific Bluetooth Controller (Bluetooth Controller manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: 1) to ensure the fairness of the competition.
- T29.** 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 applies to other non-electronic components used by the robot.

#### Actuator System

- T30.** The actuator system contains all motors or servos used by the robot, including but not limited to chassis, mechanical arms, etc.
- T31.** The robot must use the specific motors (37 DC Motor and 180 Smart Encoder Motor, manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 12) to ensure the fairness of the competition.
- T32.** The robot must use the specific brushless motors (2823/2824 Brushless Motor manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 2) to ensure the fairness of the competition.
- T33.** The robot must use the specific servo motors (MS-12A Servo Motor manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 6) to ensure the fairness of the competition.
- T34.** 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.

- T35.** 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.
- T36.** 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.
- T37.** The team cannot perform any chemical treatment on mechanical parts, including but not limited to melting, casting or other chemical treatments.



- T38.** 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.
- T39.** Teams can only use an integrate commercial products with one degree of freedom, such as hinges, sprockets and roller chains, pulleys, etc.
- T40.** Teams are not allowed to use an integrate 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.
- T41.** Teams can use lubricant to protect the parts but notice that the lubricant should not leak and pollute the competition arena.
- T42.** 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.

## 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.

- T43.** The non-electricity energy used by the robots must only come from the following sources:
- (1) The energy stored by the height difference of robot's or part's center of gravity;
  - (2) The energy stored by the deformation of the robot's parts;

### Sounds and Lights

- T44.** . Robot are not allowed to use any electronic device that generates sounds, except for the build-in buzzers from motors and mainboards.
- T45.** 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.
- T46.** 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.

- T47.** 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.
- T48.** In case the robots use laser aiming device, it is strictly prohibited to aim at the human eye and cause unnecessary injury.
- T49.** 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

- T50.** 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).
- T51.** Team number's printed font should be Times New Roman, black, bold, size: 130.
- T52.** 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.
- T53.** The Team Number of the robot must be firmly fixed on the robot and able to sustain the impact during the competition.
- T54.** Robots that do not conform to this requirement will not be allowed to participate in the competition.
- T55.** 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 4.1 Team Number





## 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 should not cause the missing of any element in the arena, otherwise they will be considered unsafe to the arena. At any time, the Referees are entitled to judge the robot as unsafe or have damaged the arena or other robots.

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

**R03.** In the case of contamination, the robot will be judged as unsafe. Robots should not use double-sided adhesive tape or glue to paste the arena elements throughout the whole match.

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

#### Damage Other Robots

**R04.** At any time, the Referees are entitled to decide that the robots are unsafe such as have damaged other robots on the arena or not.

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

#### Robots Out of bound

**R05.** During the competition, no part of the robot can be out of the boundary of the arena.

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

to be modified and inspected before it can be back to the competition.  
Repeated against 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;
- Use materials made from animals (for health and safety reasons);
- Materials containing liquids or gelatinous substances (except glue or lubricating oil that meets the requirements);
- Materials that may delay the competition once being released, (e.g., coffee beans, soybeans, rice, etc.)
- Any spare part that the electric current on the robot may be conducted to the arena.

- ⊙ The robot who is against this rule will be suspended. The robot needs to be modified and inspected before it can be back to the competition.  
Repeated against 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.

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

## 5.2 Operation Rules

### Operation Team

**R08.** Each team sends one operator and one observer for the competition. Each Alliance includes two operators and two 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 the roles during the match.

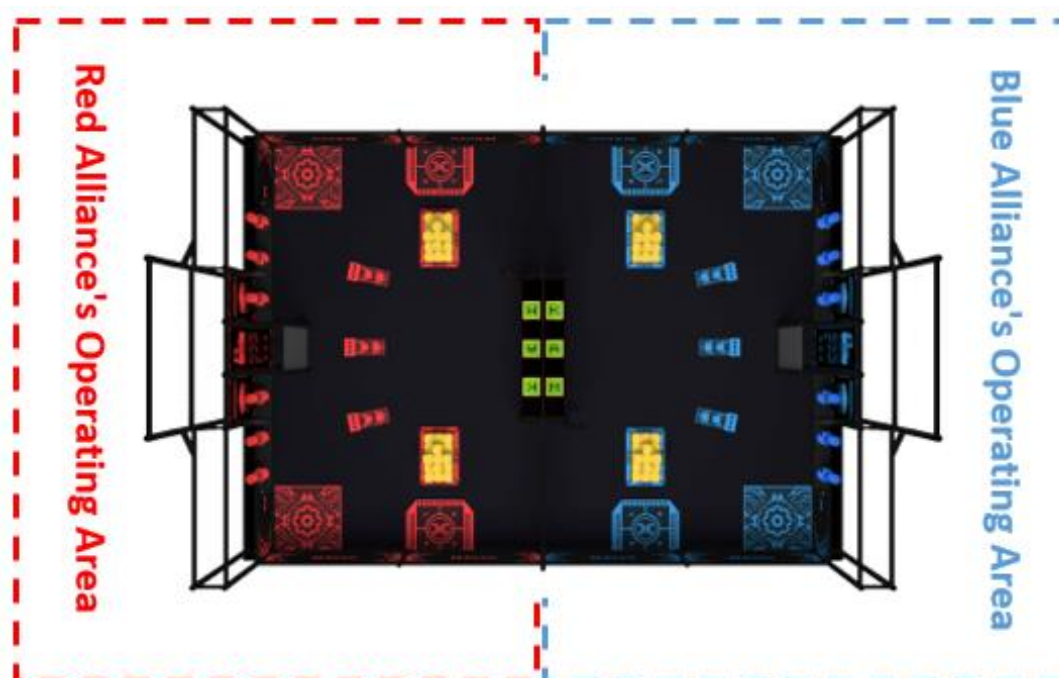
### Contestants' Requirements

**R11.** Contestants should wear goggles during the preparation of the competition, debugging robots, and on-field match.

**R12.** In the processes such as the preparation of the competition, debugging robots, on-arena match, contestants should tie up their long hair. Contestants should wear closed shoes to enter the arena.

### Contestants' Standing Position

**R13.** The activities range of the contestants during the match shall be inside the operating area, as shown in the following figure: (the size of the operating area is subject to the actual site conditions):



**Fig 5.1 Figure of Operating Area**

### Violation of the Competition Requirements

**R14.** Contestants violate the competition requirements at the competition arena.

- ⊙ The team will receive a violation for the second time.

### Substitution of On-arena Players

**R15.** During the match, it is not allowed the third person outside of the arena to substitute the operator or the observer.

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

### Elimination Round Rule



**R16.** Each Alliance has 5 minutes for adjustment after the end of each match, no timeout is allowed.

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

#### Radio Interference

**R17.** Except for the electronic communication devices that allowed in the competition, no other electronic communication devices can be carried by the contestants to enter the competition arena (mobile phones, transceiver wireless devices, wireless networks, etc.).

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

#### Robot starts in advance

**R18.** Robots shall not be started until the Referee announce the start of the competition.

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

#### Delayed end of the competition

**R19.** At the end of the Automatic Stage, Manual Stage and the Final Stage, the operator shall stop operating the robot or stopping the motion program of the robot (except for the motion caused by the inertia of the robots).

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

#### Violating contact

**R20.** 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 Direct Contacts occur outside the arena due to the normal movement of small 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 competition, the team will receive a Yellow Card.

#### Physical Affects the Competition

**R21.** During the competition, the operation team should keep its body

projection out of the arena, so as to avoid possible obstruction of the opponent's robot attack route and other factors affecting the progress of the competition. Except 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 Remote Control in Automatic Stage

**R22.** Robots should be connected with the Bluetooth controller before the match starts, and Bluetooth controller needs to be switched on during the match. 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 Suspend Robot

**R23.** When the robot is suspended, the operation teams cannot continue to control it.

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

#### Robot Left-Behind Parts

**R24.** During the competition, the robots cannot be detached (Detachment refers to the detachment from the main body of the robot, which it is not under control) their parts or mechanical devices left behind in the competition arena. Except that the disconnections caused by collisions of opponent's robot or Direct Contact of other robots.

- ⊗ The team will receive a Violation in case it affects the progress of the competition. Yellow Card will be given at the second time.

#### Robot Not Conform to the Requirements During the Match

**R25.** 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.

#### Violating Toss

**R26.** Robots cannot toss the Arena Elements to the opponent's Side. (Such as toss Alphabet Cubes or Blank Cube)

- ⊗ The team will receive a Yellow Card. If it causes any changes of Arena Elements in the opponent's side, the Arena Elements need to be

restored.

### Maliciously Damage Finished Alphabet Cubes

**R27.** The subsystems of the robots are not allowed to Direct Contact with the Alphabet Cubes which are already inserted in the Suspension Area in the opponent's side.

- ⊙ The team will receive a Red Card.

### Separate Arena Elements and Robots

**R28.** Robots should be designed to easily remove the Arena Elements from any mechanical structure of grabbing, containing or holding. Even if under the circumstance that the power supply is disabled or cut off, the robot should be taken out of the arena without damaging the arena.

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

### Completely in the Opponent's Side

**R29.** In the process of match, the whole Subsystem 1 of the robot cannot enter the opponent's arena through the hollow part under the Central Barriers, nor can the whole body extend into the vertical projection plane of the opponent's arena; this rule does not penalize the robot that part of the body enters the opponent's arena.

- ⊙ The team will receive a Yellow Card.

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

**R30.** 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.

**R31.** 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 held, the Referees may stop the match as the case may be and warn the vehicles 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

**R32.** Throughout the whole process of the competition, no relevant person except the contestants of the team, including but not limited to the parents or mentors of the contestants, shall enter the competition area by any means and give any form of mentoring. In case of the mentoring in



violation, the Referees are entitled to disqualify the team on the spot.

- ⊙ The team will receive a 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 receive disqualification.

#### Contact out of Arena

**R33.** During the competition, contestants are not allowed to have any Direct Contact with off-arena people and audiences, including but not limited to the delivery of the parts and remote-control handles.

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

#### Serious Action

**R34.** 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 behavior, 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, coaches, staff or contestants; repeated or blatant violations of safety, etc.

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

#### Uncivilized Participation

**R35.** In participating in the activities such as the technology sharing, robotic exhibition, observation of competition, contestants and mentors should ensure respect for other teams, maintain the neatness and order of the arena, and show the action principles in good images of the MakeX Robotics Competition.

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

## 5.3 Modification Stage Rules

#### The Robot Not in the Starting Area Before Modification Stage

**R36.** At the end of the Manual Stage, the robot needs to be taken out from the Starting Area for modifications. In case the robot is not inside the Starting Area (Partially or Completely In), it will not be allowed to conduct any

operations 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

**R37.** 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

**R38.** Contestants cannot change the state of the Arena Elements on purpose or touch the scoring props when they are taking out the robot. The Small Cubes carried by the robot and the Blank and Alphabet Cubes which are completely in the Inspection Area will not be restricted by this rule.

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

#### The Robot Not Inside the Starting Area After Modification Stage

**R39.** 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

**R40.** 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

**R41.** 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

- E13.** The competition venue emerges problems that might affect the safety of teams or robot.

### Uncontrollable Technical Issues

- E14.** The competition cannot continue because the robots or competition systems in the Arena is interfered by radio wave or other uncontrollable technical issues.

### Damage of Arena or Prop

- E15.** The props or arena are damaged which cause the competition cannot continue.

### Rematch

- E16.** Referees is entitled to discuss and 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.
- E17.** During the Automatic Stage, if the competition is paused, rematch will be arranged to ensure the fairness.
- E18.** 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.

### Abnormal Change of Arena Elements

- E19.** During the competition, the state of the Arena Elements is changed because of an abnormal action such as the effects from outside of the arena.

### Resume from Pause

- E20.** After the abnormal event is solved, the paused competition can be resumed from the time of pause.

### Forfeit Match

- E21.** 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. The other teams need to continue that competition normally.

## 5.6 Punishment

### Warning

**E22.** 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 go on normally.

### Violation

**E23.** 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 be timed normally.

### Yellow Card

**E24.** 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.

**E25.** Accumulation of Yellow Card: In Qualification Round, the accumulation of Yellow Card for each match is counted for one team. If one team receives two Yellow Cards, it will be escalated to a Red Card. In the Elimination Tournament, the accumulation of Yellow Card for each match is counted for one Alliance. If one Alliance receives two Yellow Cards, it will be escalated to a Red Card.

### Red Card

**E26.** 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.

**E27.** 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 competition will continue normally. 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 winner Alliance, the final score will be modified to the winner 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 winner Alliance, the final score will be modified to the winner

Alliance has 10 points advantage than the losing Alliance).

### Suspension

**E28.** 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 competition. 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

**E29.** 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

**E30.** 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.

**E31.** During the competition, all matters not specified in the Technical Guide can be decided by the referee team.

**E32.** 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 Intelligent Innovator.

### 6.1 Disclaimer

All contestants in 2020 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 2020 MakeX Challenge - Intelligent Innovator, 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., Shenzhen Hulu Maker Co., Ltd. and MakeX Robotics Competition Committee will not be responsible for any injury or loss of property caused by improper use.



## 6.2 Copyright Declaration

Shenzhen Hulu Maker Co., Ltd. reserves the copyright of this Technical Guide. Without the written consent or authorization from Shenzhen Hulu Maker Co., Ltd, any entity or individual may not reproduce, including but not limited to any network media, electronic media or written media.

MAKE X

## Appendix 1: Competition Resources

MakeX Official Website: [makex\\_overseas@makeblock.com](mailto:makex_overseas@makeblock.com)

Any Feedback & Question Please Sent to:

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

Additional Information:

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

# MAKE X



## Appendix 2: MakeX Challenge Robot Self-check List (Intelligent Innovator)

MakeX Challenge Robot Self-Check List (Courageous Traveler)			
Size and Weight of Robots			
SN	Items	Specific Requirements	State
1	Size	<p>The initial size is the size that the robots are in a stationary state before the start of the competition.</p> <p>Maximum size refers to the size of the robot moving to the limit state during operation.</p> <p>The initial size requirement of the robot at the start of the competition is 500 mm (long) x 500 mm (wide) x 500 mm (high).</p> <p>After intensified modification, the initial size of the robot before restarting is required to be 500 mm (long) x 500 mm (wide) x unlimited (high).</p>	
2	weight	<p>The weight of the robot t has to within 8 KG. (Including the weight after the modification; the weight after the installation of batteries).</p>	
Safety			
3	Dangerous structure	Safety protection is required for the structures that may cause injury to people in the process of clamping, handling and using the machines.	
4	Damage Arena	In the process of loading, unloading, handling and using the machine, there shall be no act of the obvious damage to the arena.	
5	High power tools	No high power equipment during loading, unloading and operation.	
6	Unsafty energy storage equipment	In the process of using the unsafety energy storage equipment (springs, etc.), safety shall be ensured.	
7	Personal safety	In the competition, contestants shall wear goggles; long hairs shall be tied up; contestants are prohibited from wearing toe-baring shoes into the competition arena.	



8	Banned substance	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 competition delays, sharp edges and angles, materials containing liquids or gelatinous substances, and any part that the electric current on the robot may be conducted to the Arena.	
Robot's Modules			
9	Controller	Teams have to use the specify controller , and it is only be used by the Operator.	
10	Mainboard	The required mainboard shall be used by the competition, and there is only one receiving module matched to use by the mainboard and the remote control.	
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 (In addition to the required laser sight devices). Detailed parameters are: 3S Li-Po batteries, output voltage: 11.1v / 11.2v, discharge rate: 25c / 30c.	
12	Power Management Module	Power management module can run in a supporting way according to the requirements of the competition system: supporting to finish three actions: support completing the power on, power cut and starting the automatic program.	
13	Self-customized parts and accessories	Self-customized parts can be used: plates, profiled materials, 3D printing pieces, metals, wood, plastics, rubber, magnets; Auxiliary materials' use requirements: It is allowed to use the ropes, cables, wires, springs, rubber bands, leather hoses, surgical tubing, punched sheets, injection molded products; It can use a single-freedom complete commercial products package and system wheels; It is not allowed to use the multi-freedom commercial products package.	





14	Sounds and Lights	<p>There is no light source except the laser sight device and the indicator light self-contained of the mainboard or the sensor with its power less than 5 mW (Limited to only one);</p> <p>No other sound generating device is allowed except the buzzer on the mainboard.</p>	
		<p>In case it requires the independent power supply when the teaching laser pen is used to be modified into the laser sight device, it can only use the configured batteries (such as dry batteries) of the device, and the batteries cannot transmit energy for the power system of the robot. If it is not a common laser sight device, please provide the corresponding model and parameters for query and verification.</p>	
15	Smart Servo	<p>Teams have to use the smart servo equipped with the official equipment package or the same type of smart servo (MS-12A), the maximum number of servo available on a robot is 6 pieces.</p>	
16	Motor	<p>The robot have to use the required DC Motor, Encoder Motor (37 DC Motor, 180 smart motor manufactured and sold by Shenzhen Makeblock Co., Ltd.) ;and the maximum number of them is 12) to ensure the fairness of the competition.</p>	
		<p>The robot shall use the required Brushless Motor (2823/2824 Brushless Motor manufactured and sold by Shenzhen Makeblock Co., Ltd.) ;and the maximum number of it is 2) to ensure the fairness of the competition.</p>	
17	Wrap the sharp structure	<p>The exposed sharp edges of the robots have to be wrapped with sponge strips.</p>	
18	Separation/Abscission	<p>It is not allowed that there are parts detached from the main body of the robots in the completion. The arena parts may be detached from the robots.</p>	



19	Interference	Cannot interfere with the electronics and sensors of other robots.	
20	Team Number	Team number's printed font should be Times New Roman, black bold, size: 130, and the background should be in light color.	
21	Engineering note submission	Submit project notes containing the source code of the robot control before the competition.	
22	Arena contamination	Lubricating oil etc. used by robots shall not contaminate the venue or other robots.	

# MAKE X



## Appendix 3: List of Violations and Penalties

Scope	Items	Generalization	Violation	Yellow card	Red card	Suspended.	Disqualification
Safety rules	Risks structure	In case it is found that the structure of the robots may injure human, they should be modified immediately after warning.				✓	
	Damaging Arena or other robots	Two or more violations will be disqualified				✓	✓
	Use banned substances	In case it is found that the use of the banned substances by contestants, it will be prohibited, and two or more violations will be disqualified.				✓	✓
	Contaminating of Arena	Under the preconditions without contaminating the arena, the glue, adhesive tape and lubricating oil can be used by the robots; In case it is found violated with this rule, they will be prohibited to use, and second violation will be disqualified.				✓	✓
	Robots Out of bounds	No part of the robot can be out of the boundary of the Arena.				✓	✓
	Other unsafe factors	In case the referees find the other unsafe factors of the robots, they are entitled to request the contestants not to use such robots and make modifications. Second				✓	✓

		violations will be disqualified.					
Operation rules	Bring electronic communication devices	Two violation may be penalized by showing a yellow card.	✓	✓			
	Delayed end of the competition	The corresponding score will be deducted.	✓				
	Violating contact	The team will receive a Yellow Card. If it causes any changes of Arena Elements in the opponent's side, the Arena Elements need to be restored.		✓			
	Maliciously Damage Finished Alphabet Cubes	The team will receive a Red Card.			✓		
	The human body is not allowed to extend into the arena to affect the opponent to score.	A yellow card will be given for two violations	✓	✓			
	Manually control at the Automatic Stage.	In the Automatic Stage, the controller should be placed in the storage basket.				✓	
	Robots leave behind the spare parts in the Arena	Giving violations according to the seriousness of the circumstances, a yellow card will be given for two violations.	✓	✓			
	Remove other Arena elements from the Arena.	The scoring behavior is not included.	✓				
	Violating Toss	In case of resulting in the change of elements in the opponent's camp, it		✓			

		should be suspended for restoration.					
	Arena elements are difficult to remove from robots.	Repeated violations affecting the progress of the competition will be disqualified.					✓
	Completely in opponent's camp	If it fails to return to its own camp after a penalty, it will be penalized by a red card.		✓	✓		
	Pinning or holding opponent's robots	A penalty will be given for deliberately holding the opponent's robot.	✓	✓	✓	✓	✓
	Operating prohibited robots	Please don't operate the robots that have been prohibited. For the first time, offenders will be penalized for violations. For serious violation, a yellow card will be given until the disqualifications of the competition.	✓	✓	✓	✓	✓
	Overdone act	Overdone acts are including but not limited to: repeated or blatant violation, Impolite behaviors to the operators, referees, staff, or contestants; Repeated or blatant violations of safety; Two violations will be penalized and disqualified.	✓	✓	✓	✓	✓
	Mentor in Violation	The team will receive a Warned at the first time. In case serious situation the team will receive a violation. Depending on how serious of the situation the team may receive disqualification.	✓	✓	✓	✓	✓

	Contact and exchange parts outside the Arena	It is strictly prohibited to take place during the competition.	✓	✓	✓	✓	✓
Modification Rules	Forced modification without entering the Starting Area	Entering the Starting Area is subject to the Direct Contact of the bottom of the robot with the Starting Area.			✓		
	Modification in the arena	Contestants have to modify outside the arena.	✓				
	Initiatively change the Arena elements in the Modification Stage	The Arena elements removed from the robots will not affect the state changes of the other of elements as they are placed in the Arena.	✓	✓			
	Failure to enter the Arena before the end of the Modification Stage	The robot can't enter the arena anymore.				✓	
	Bring Arena elements into the Arena after modification	Robots carrying Arena elements are not allowed to enter the Arena.				✓	
	Incompatible the state of inspection after modification	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.					✓



## 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

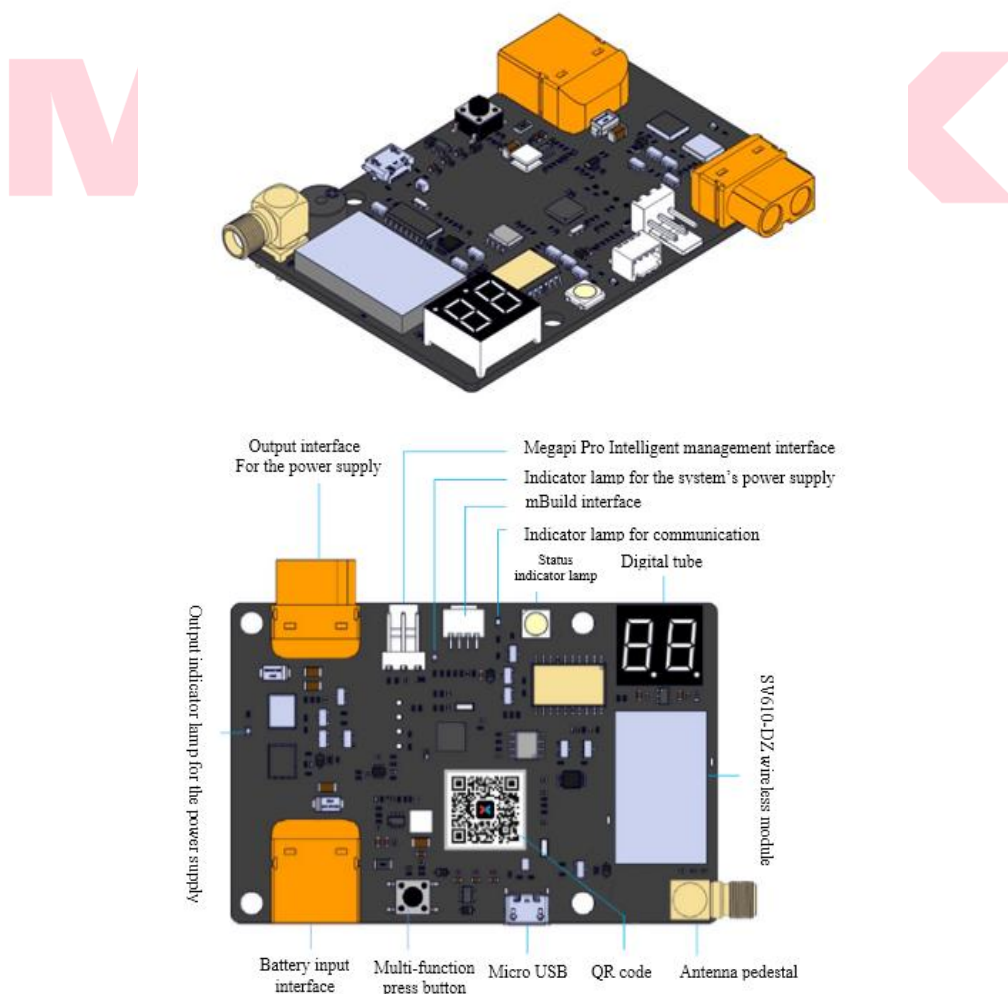
### Instructions

The power management module is used in coordination with the mainboard (NovaPi), which is a necessary electronic device to participate in the competitions of intelligent innovator and ultimate warrior, 2020 Season.

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

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

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





## On-board LED Lamp

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

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

## Status indicator lamp (RGB lamp)

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

- **Off:** The Bluetooth module is tested after the power management module is powered on. When the Bluetooth module cannot be detected, the RGB lamp is off;
- **Red:** After normal power-on, click the button and the RGB lamp flashes red one time;
- **Green:** In the Manual Stage of the competition;
- **Blue:** In the Automatic stage of the competition.

## Digital tube

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

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

## Buzzer

The buzzer output reminding and warning sounds.

- The module will shortly buzz when the module is normally powered



on and be detected, and the wireless communication module is online.

- When the power management module is reset, the buzzer will sound for 2 seconds;
- When the wireless communication module cannot be detected after power-on, the buzzer rings three times continuously.

## Operation

### Multifunctional button

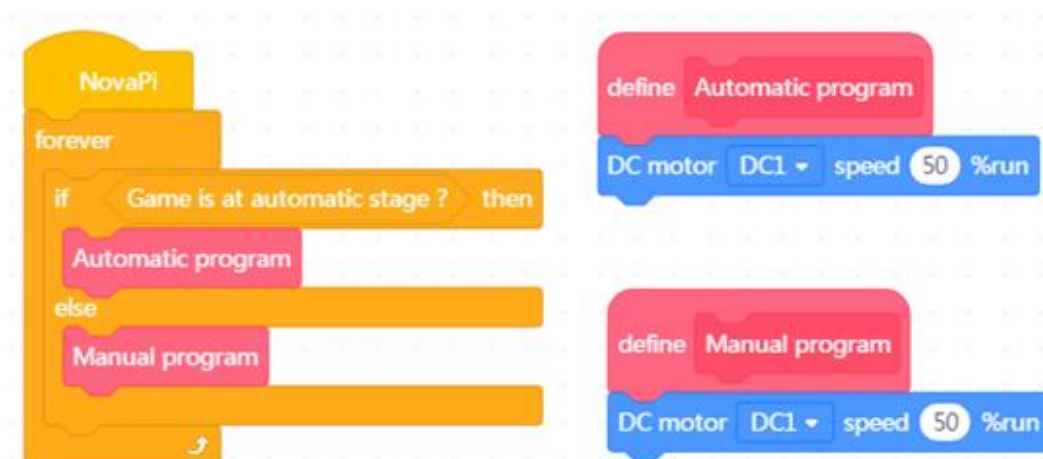
Multifunctional button has four modes: Reset, Click, double-click and Long-press.

- **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 Automatic Program starting

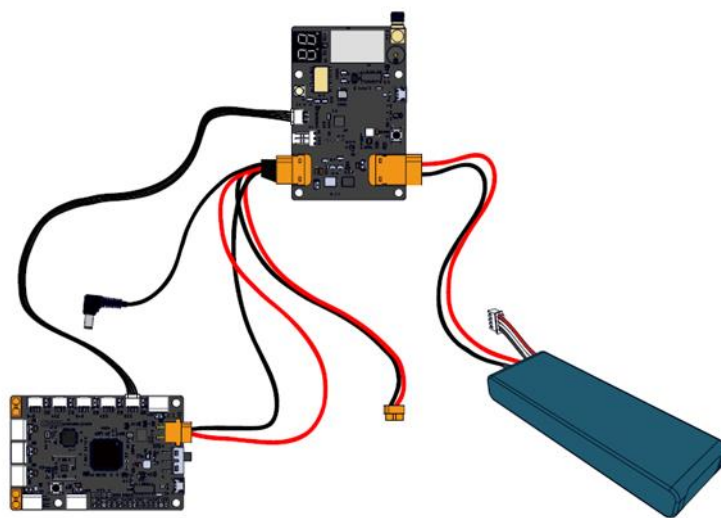
In the Automatic Stage, the competition system sends relevant instructions to the power management module of the robot, to shield the controller signal and start the automatic program of the robot. To start the automatic program on the mainboard normally, it is necessary to insert a fixed code into the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

positions).



### Suggestions for Installation and Use

- The power management module is a necessary electronic component for the competition. Please make sure that it is securely fixed, and cables are tightly connected. For protection, it is suggested to use an acrylic box for the power management module;
- The data cables leading to the mainboard must be connected firmly as the following picture:



- Adjust the position of the antenna to prevent it from interfering with the movement of other moving devices, and try to avoid the antenna too close to the large area of metal materials;
- The power management module must be fixed on the surface of the robot and be accessible to scan (power management module ID);
- The following operations are not allowed at any stage after the start of the competition, especially during the Modification Stage:

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 Teams' information in the Competition System one by one. Please do not replace that module without authorization. If it needs to be replaced, please contact the Staff. Any problems caused by an unauthorized replacement of the power supply module shall be borne by the Team.

# MAKE X



MakeX Robotics Competition Committee

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(CN): [www.makex.cc](http://www.makex.cc)

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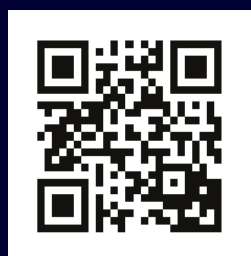
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