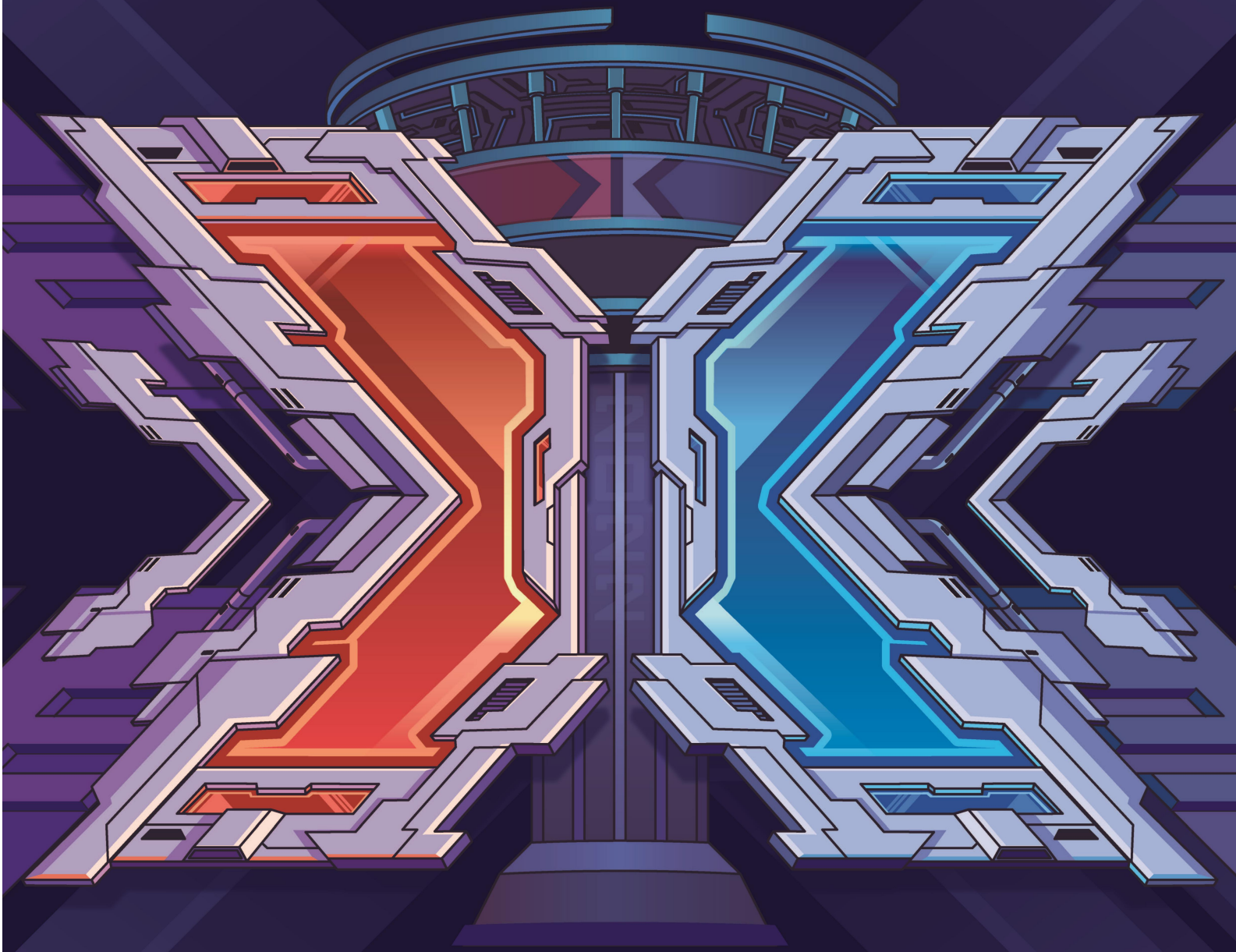
MAKEX V1.0

2022 MakeX Robotics Competition

RULES GUIDE

MAKEX CHALLENGE



Edited By MakeX Robotics Competition Committee

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Date	Version	Modifications Record
2021.09	1.0	MakeX Challenge Energy Innovator Rules Guide First Publish.

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1. Introduction

1.1 About MakeX

MakeX is an international robotics competition and education 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, Tech Event, Educational Conference etc.

As the core activity of MakeX, the namesake MakeX Robotics Competition provides exciting, challenging and high-level competitions in the spirit of creativity, teamwork, fun and sharing. It is committed to inspiring young people to learn Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) and apply such knowledge in solving real-world problems.

1.2 MakeX Spirit

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

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

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

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

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

1.3 About MakeX Challenge

MakeX Challenge is a highly confrontational competition program for students between the age of 11-18.

This program is very confrontational and enjoyable to watch, and the simple and easy-to-understand rules enhance the overall experience of participation and engagement. The design and construction of bigger robots and programming can better improve the contestants' design abilities and multi-dimensional thinking abilities of advanced robots. Also, the contestants are exercising logical thinking, strategic analysis, communication and cooperation, and improving decision-making abilities in the competition.

2.Competition Application

2.1 Participation Requirements

Participants: Contestants shall participate in a team. The number of contestants is 2-8 for each team, with 1-2 mentor(s).

Age: Team members must be teenagers or children between the age of 11-18 (born between January 2, 2003 and December 31, 2011). The mentor must be at least 18 years old.

Team Number: The mentor will receive a team number after registration on MakeX official website.

Team Roles: Everyone in the team can play their respective roles as operator, observer, mechanist, programmer and so on. In each competition, one team can only appoint 1 operator and 1 observer to participate. Each alliance includes 2 operators and 2 observers, and one of whom is designated as the captain of the alliance. The operator is responsible for operating the robot, and the observer is responsible for assisting the operator in observing the status of props and making suggestions.

Identification Symbols: Each team must have a team logo, team name, and team slogan. Teams are encouraged to use uniforms, flags, posters, badges, base decorations, etc. to show the team culture.

2.2 Registration and Application

Contestants and mentors that meet participation requirements can register on MakeX official website (https://www.makex.cc/en). After registration, mentors are able to form a team and sign up for a competition by using mentor's account.

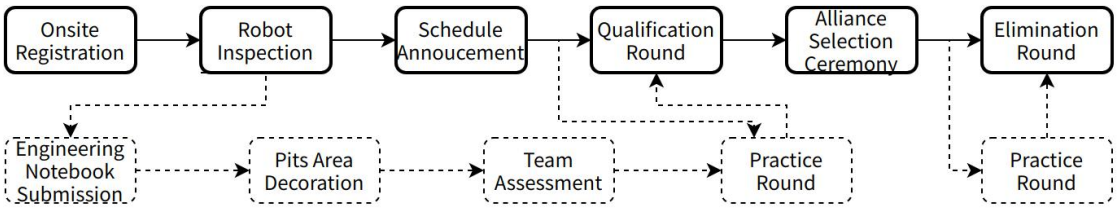
If participating team wants to change their members before competition, which leads to inconsistency with the registration information, they should inform MakeX Robotics Competition Committee in advance to finish re-registration.

For more details about the registration and application, please refer to MakeX Registration & Competition Application Guide

3. Competition Procedure

Participating teams shall pay close attention to related notices and program brochures published before each competition. If there are some updates in brochures, the latest rules will be adopted for the competition. MakeX Robotics Competition Committee reserves the rights and final interpretation to amend competition rules and system based on actual situation of different points race.

The schedule for each competition is determined by actual situation, and generally includes following procedures.



Note: The solid line frame refers to necessary procedure of each match, while the dotted line frame refers to non-essential procedure. The specifications of non-essential procedure can be understood based on **Appendix 8 Supplementary Explanation of Competition Procedure.** Please keep abreast of updates.

Onsite Registration

When a team arrives at the venue, mentors and contestants should show ID cards or other valid certificates (e. g. passport) for onsite registration and to get the competition pack. It is necessary for mentors to inform team members about the fire exit, match schedule, competition area, practice area and pits area, etc. Onsite registration and robot inspection will be conducted once the match schedule is generated.

Robot Inspection

The inspectors will strictly check the safety of robots on request. Teams can pre-check their robots and self-customized flag in advance based on "**Appendix 3 MakeX Challenge Energy Innovator Robot Self-Check List**". The robot and team flag will be inspected before the competition. If the inspection fails, the team needs to adjust their robots and check again until they pass the inspection. Those who fail to pass the inspection are not qualified for the competition.

Schedule Announcement

The committee will announce the match schedule at least 30 minutes before the competition starts through online official website and onsite announcement. The schedule includes match-up chart, match session and specific time, red alliance and blue alliance, etc.

Qualification Round

Normally, each team is requested to participate in four matches during qualification round. However, the session of qualification round may be different based on distinct points race. In qualification round, red alliance and blue alliance are randomly matched by the organizer. Points will be obtained by teams according to the winning or losing situation. It is conducted in the form of alliances confrontation and each team's alliance and the opponents will be allocated randomly by the organizer.

In each qualification round, team will receive corresponding points (including wins, ties, loss) regardless of competition type. Three points for a winner, one point for a tie, and no point for a loss. The final ranking is based on the sum of win-loss points and judging points, and the top-ranking teams will be promoted to the elimination round. If the team with the same ranking points, the ranking sequence will be determined according to following rules:

1) Team with higher win-loss points in the qualification round has a higher ranking.

2) If win-loss points are the same, team with higher total point differential in all qualification round has a higher ranking.

3) If above conditions are the same, team with highest total point in all qualification round has a higher ranking.

4) If above conditions are the same, team with highest point of a single round in all qualification round has a higher ranking.

5) If above conditions are the same, teams with the same ranking will play one-on-one extra match, and those who with the highest total point will be the winner.

Alliance Selection Ceremony

In alliance selection ceremony, promoted teams will select their alliance team in turn according to their ranking in qualification round. The alliance generated in this procedure will be the alliance team in elimination round, which will be named as Alliance One, Alliance Two, Alliance Three.... During this procedure, teams must abide by following rules (these rules only available for points race, other competitions must follow the rules unveiled before the competition).

When being chosen by other teams, promoted teams ranking top 50% can refuse for

only once, and those teams ranking bottom 50% cannot refuse. If the team is refused by another team, they can continue to choose another team until the alliance is formed.

The promoted teams who are not present before the start of alliance selection are deemed as voluntarily giving up the right to choose alliance, and those who are not present before the end of the alliance selection are considered to be as voluntarily quitting the elimination round. If the promoted teams quit amid the alliance selection ceremony, the promotion places will be given to the following teams according to the ranking in the qualification round.

The promotion proportion for 2022 season points race is as follows. However, the promotion quota in different competitions may vary according to actual situation.

Number of participating teams	Corresponding Number of promoted teams
121 or more	64
65-120	32
32-64	16
12-31	8

Elimination Round

In elimination round, the alliance generated in the alliance selection will be the opponent (red alliance and blue alliance are randomly matched by the organizer). The winner will be evaluated by BO3(Best of 3) and the alliance who achieve "two wins" or "one win and two ties" can advance to next round until the champion, runner-up and second runner-up are elected.

If the alliance achieves " one win, one loss, one tie " or " three ties " in three rounds, the winning alliance will be decided according to the following rules:

1) If win-loss points are the same, team with higher total point differential in BO3 has a higher ranking.

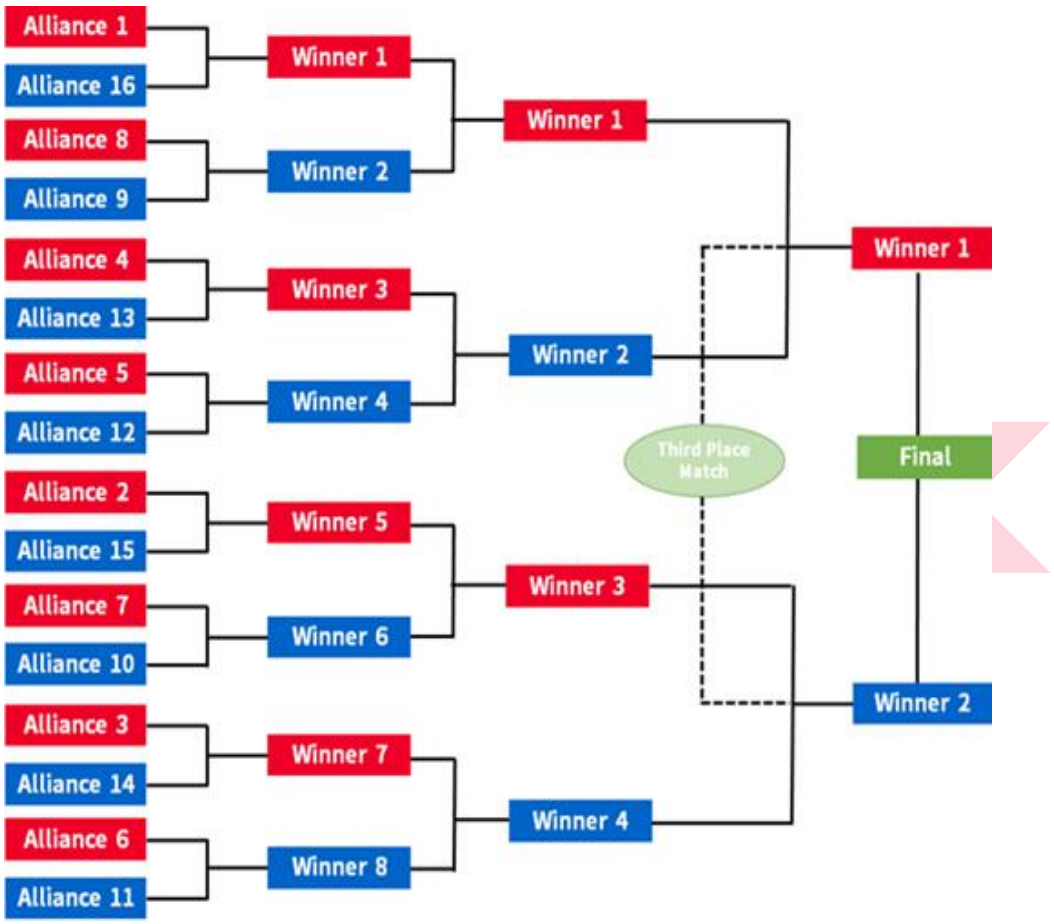
2) If above conditions are the same, team with higher average points in BO3 has a

higher ranking.

3) If above conditions are the same, team with highest point in BO3 has a higher ranking.

4) If above conditions are the same, teams will play an extra match until the winner is elected.

Taking the promoted 32 teams as an example, the schedule of elimination round is as follows:



4.Competition Details

The theme of the 2022 MakeX Challenge is "Energy Innovator".

Renewable energy is the key of future energy, an effective solution to the consumption of energy, and a ray of hope for sustainable human development. Renewable energy integrates human thought for production and consumption as well as innovation in technology development. By adopting supercomputers and cloud computing technology, energy innovation not only connects every port in the new energy industry chain, but also unites countless people who love this planet. Let's build a sustainable new energy planet together!

4.1 Introduction

Each single match lasts for 4 minutes and 40 seconds.

MakeX Challenge Energy Innovator is a confrontational competition, among which red and blue alliance for each match, and two teams for each alliance.

Each match comprises four stages: automatic stage, manual stage, modification stage and final stage. In automatic and manual stages, contestants will control robots to finish following missions: powering and collecting new energy pins (blue and red pins), computing and storaging alphabet cube and other missions. When the match ends, judges will calculate the points based on the final state. The alliance with the highest point will be the winner.

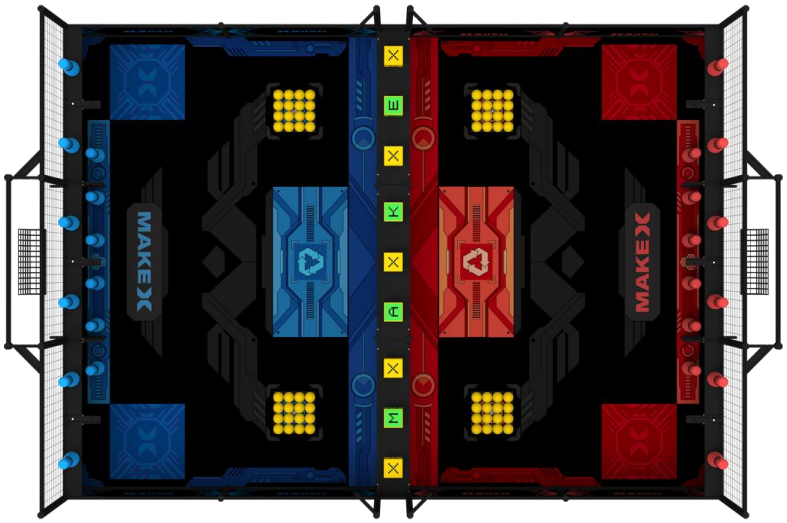


Fig 4.1 Top View of Competition Arena

4.2 Arena

The competition arena of MakeX Challenge Energy Innovator consists of map and frame. It is a rectangular area with the size of 2985 mm × 4185 mm and the outer frame's height is 400 mm. The arena mainly consists of starting area, renewable energy area, new energy data storage center (abbreviated as data storage center), energy recycling area, energy utilization station, new energy data collection center (abbreviated as data collection center), new energy data computing center (abbreviated as data computing center), flag hanging area.

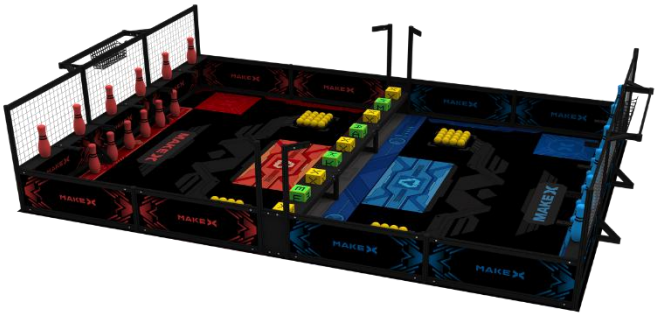


Fig 4.2-1 Axonometric View of Arena

The central barrier evenly divides the arena into the red and blue camps, with data computing center located in the central area. Robots are only required to conduct corresponding missions in their respective camp.

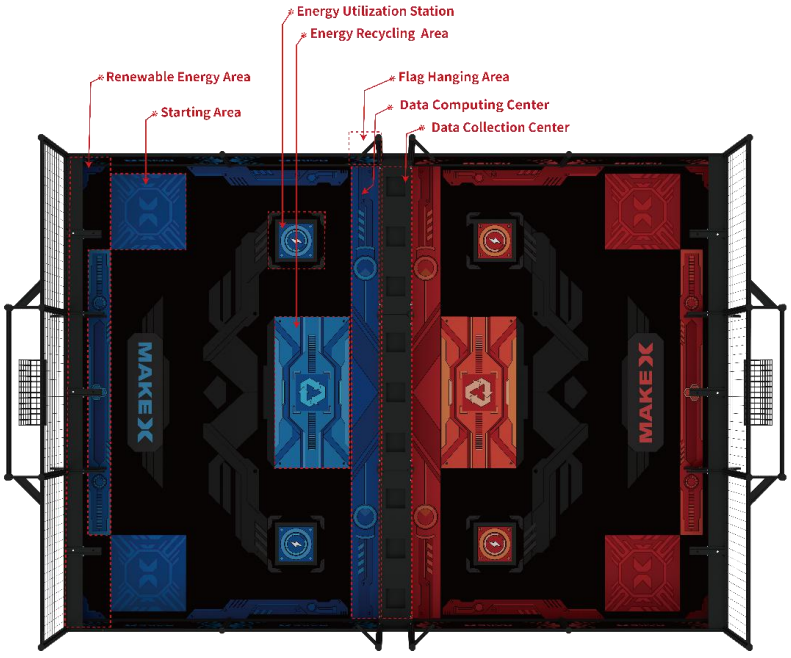


Fig 4.2-2 Top View of Arena

Data Collection Center

There is a data collection center (2985mm length x 200mm width) located at the junction of both sides (Fig 4.2-2). The height between the ground and data collection center is 254mm, while the height between the ground and the alphabet cube is 335mm (Fig 4.2-3). Nine alphabet cubes are available for both sides, which are placed in a regular sequence (Fig 4.2-4).

Fig 4.2-3 Top View of Collection Center

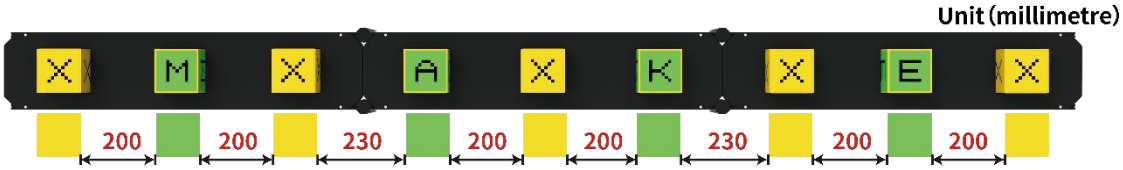


Fig 4.2-4 Distance of Alphabet Cube

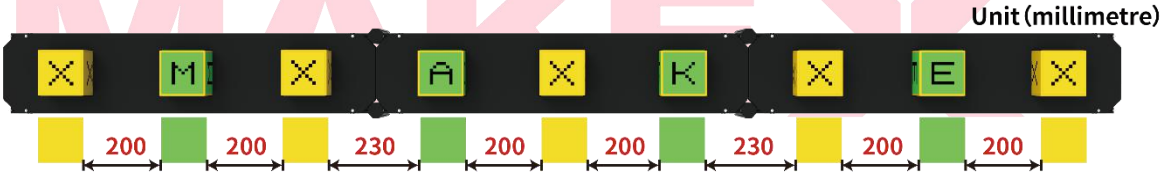


Fig 4.2-5 Front View of Data Collection Center

Starting Area: There are two starting areas in both camps, with the size of 500mm x500mm. Located in four corners of arena, this area is where robot be placed before automatic and final stage.

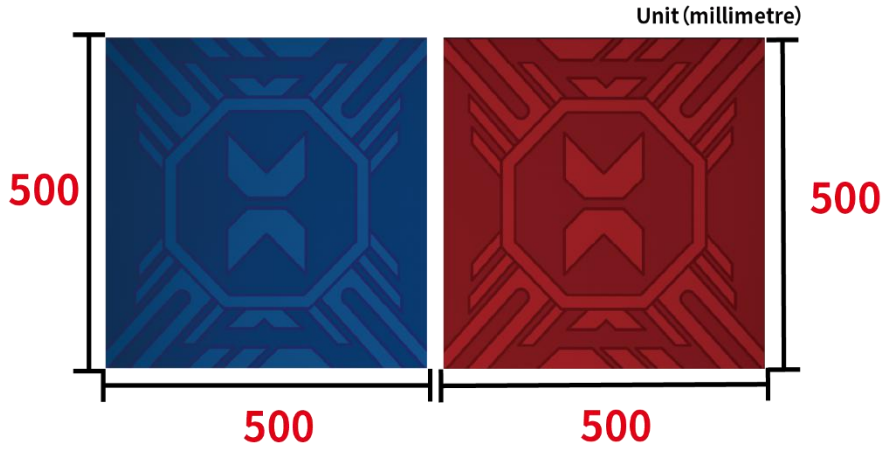


Fig 4.2-6 Starting Area

Data Computing Center

There is a data computing center in both camps, with the size of 2985mm x 200mm. In this area, contestants can control the robots to place or pile up the cube to refrain the pins in energy recycling area and renewable energy area from being knocked down.

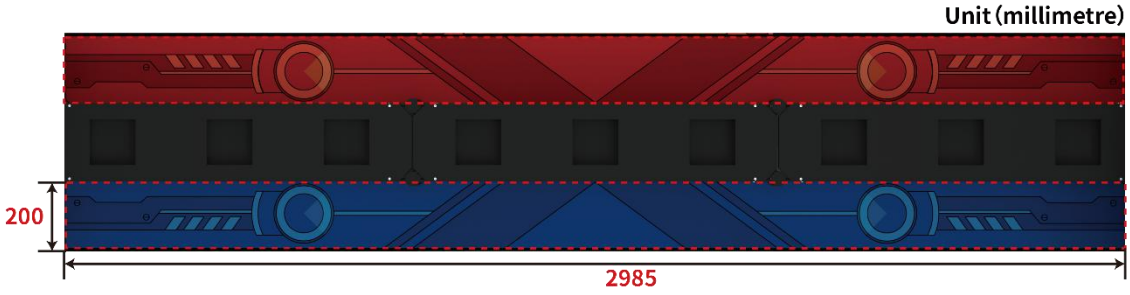


Fig 4.2-7 Data Computing Center

Energy Recycling Area

There is an energy recycling area in both camps, with the size of 500mm x 1000mm. Contestants can receive corresponding points when they control the robots to place the fallen renewable energy pins in this area.

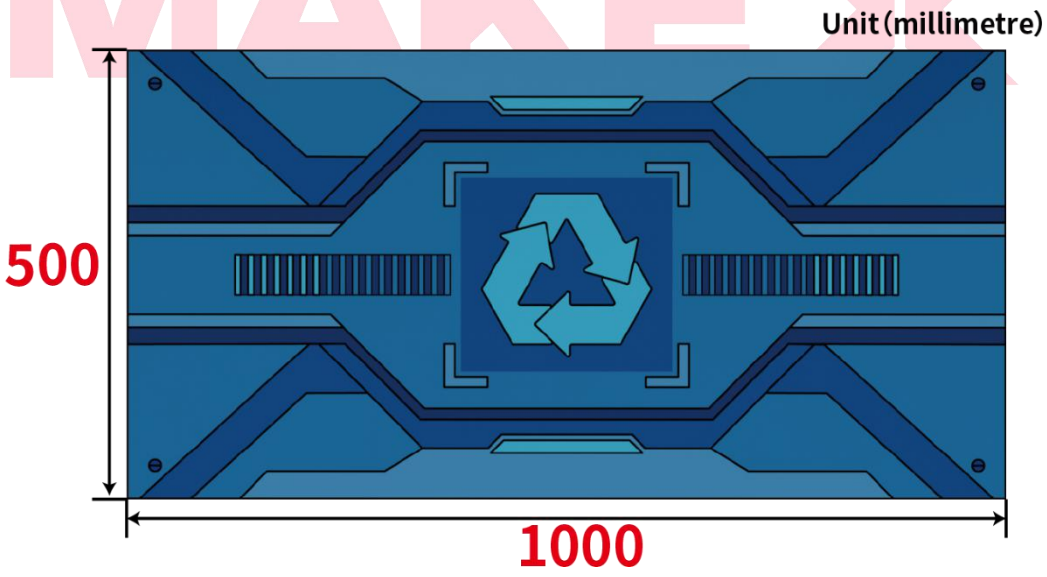


Fig 4.2-8 Top View of Energy Recycling Area

Energy Utilization Station: There are two energy utilization stations in both camps, with the size of 230mm x 230mm. The capacity of each energy utilization station is 16 energy powering ball with the diameter of 70 mm. Robots are allowed to collect energy powering ball in individual camp to knock down opponent's pins.

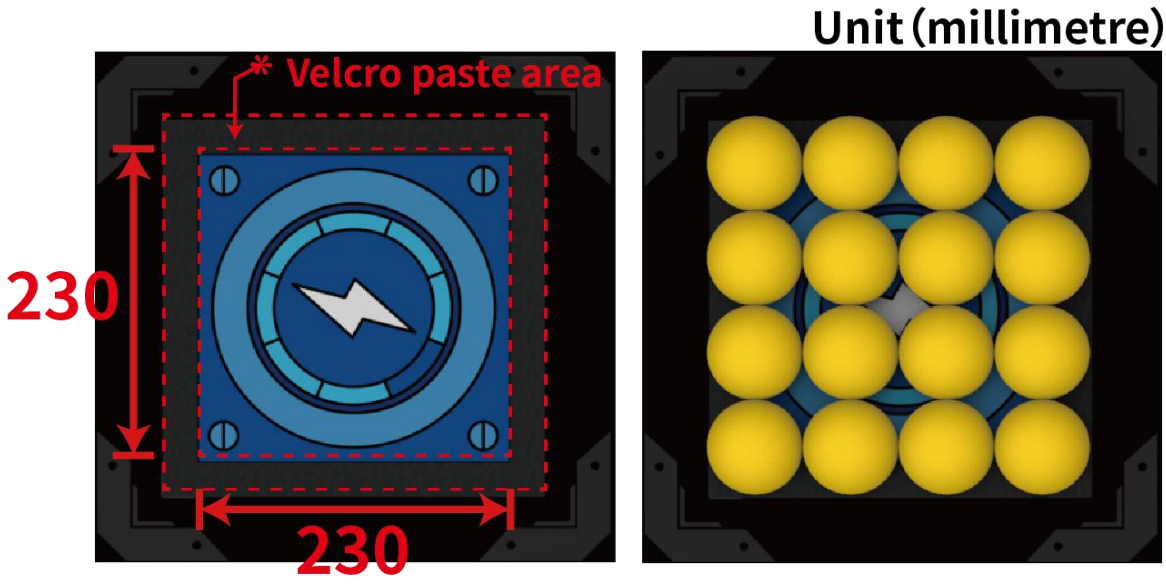


Fig 4.2-9 Energy Utilization Area

Renewable Energy Area

There is a renewable energy area in both camps, which is divided in two layers. The size of upper layer is 110mm x 2895mm, while sub-layer is 150mm x 885mm. The team can place 12 renewable energy pins in this area, and the location and number of these pins are decided by the captain of the alliance before the match.

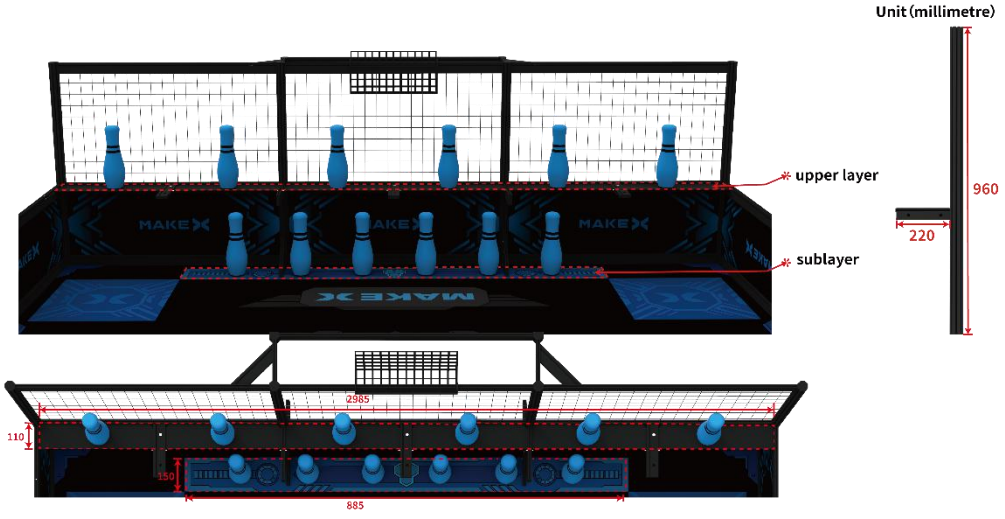


Fig 4.2-10 Renewable Energy Area

Data Storage Center

There is a data storage center in both camps, which is made of octagonal pillars (960mm) and flat beams (220mm). The robot can insert the alphabet cubes into the protrusion of flat beam. The cross-sectional size of the protrusion is 50mm x 15mm, which is arranged alternately in different directions.

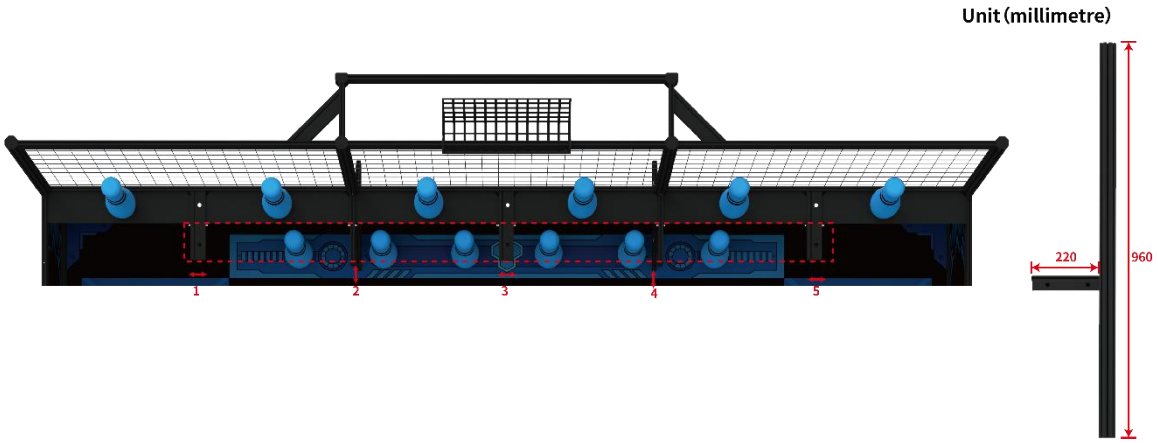


Fig 4.2-11 Data Storage Center

Flag Hanging Area

There are two symmetrical poles in both camps. The height between the pole and the ground is 960 mm, and the pole's lateral length is 160mm. The angle of the flat beam and the outer frame is 45 degrees, and the flat beam is for flag hanging.

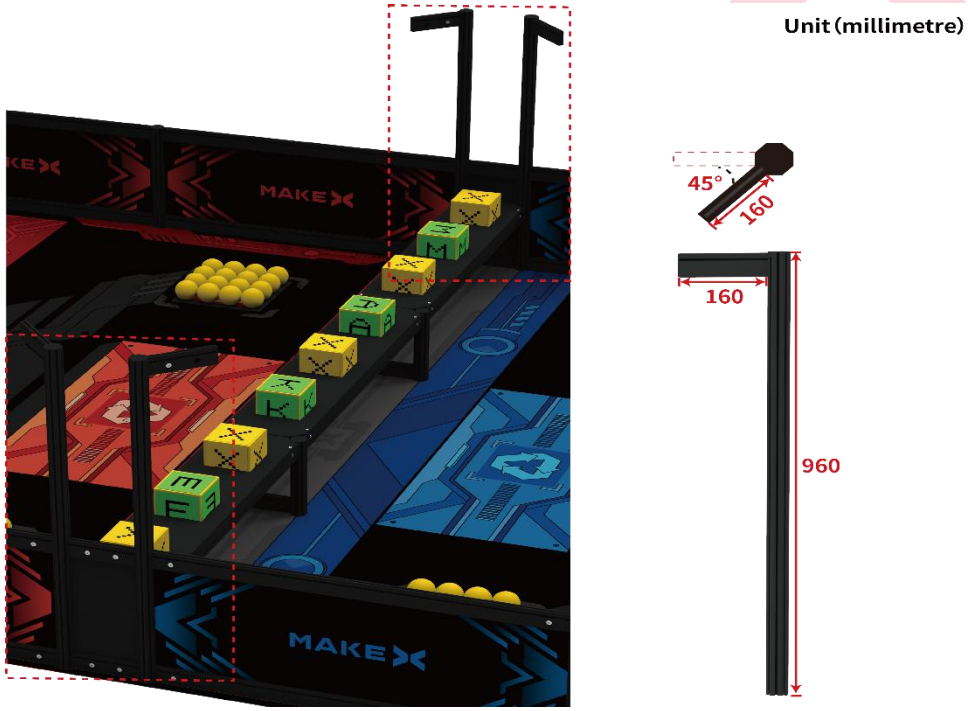


Fig 4.2-12 Flag Hanging Area

4.3 Props

The initial position of the props before the match is shown in figure 4.3-1

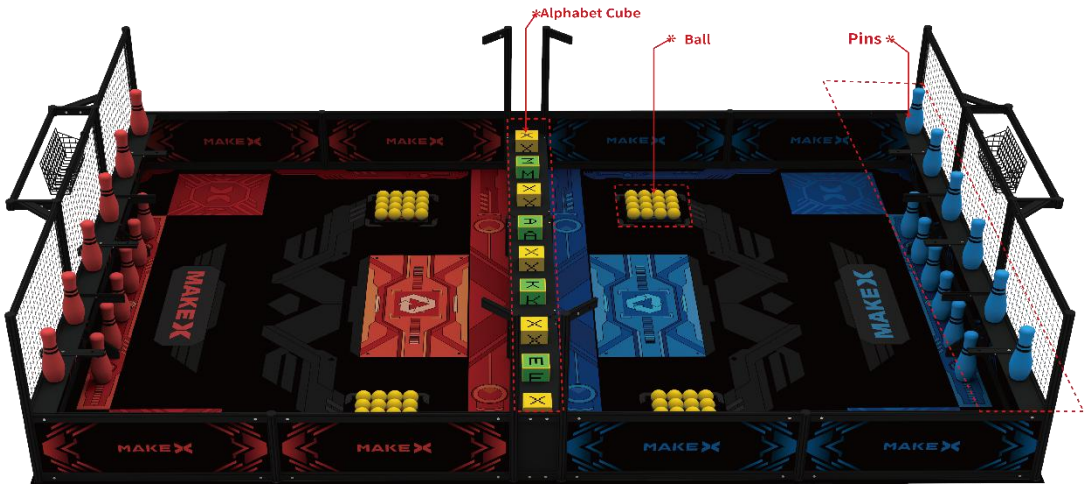


Fig 4.3-1 Initial Position of the Pros

Energy Powering Ball

Energy powering ball, a yellow one, is placed in energy utilization station, which is made of EVA and its size is 70mm. There are 16 balls being placed in each energy utilization station, with a total of 64 in the whole area. Robots are allowed to use the balls to shoot down the pins of opponent to complete the mission of Renewable Energy Pin Powering.

Unit (millimetre)

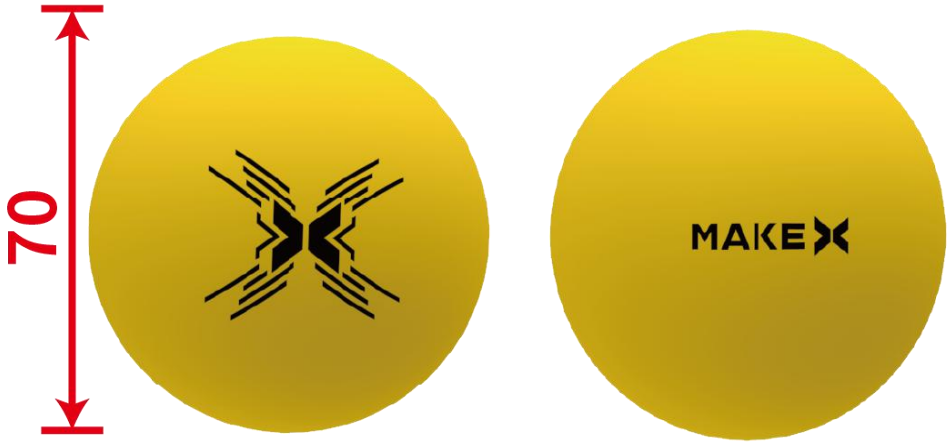


Fig 4.3-2 Energy Powering Ball

Renewable Energy Pins

Renewable energy pins refer to red and blue pins being placed in respective renewable energy area, which are made of EVA with a height of 290 mm. The

diameter of the bottom of each pin is 70mm, and the maximum diameter is 100mm (Note: A tolerance of ±10mm is permitted).12 pins for half time and 24 pins for full time. It is available for robots to toss the energy powering ball toward the pin.

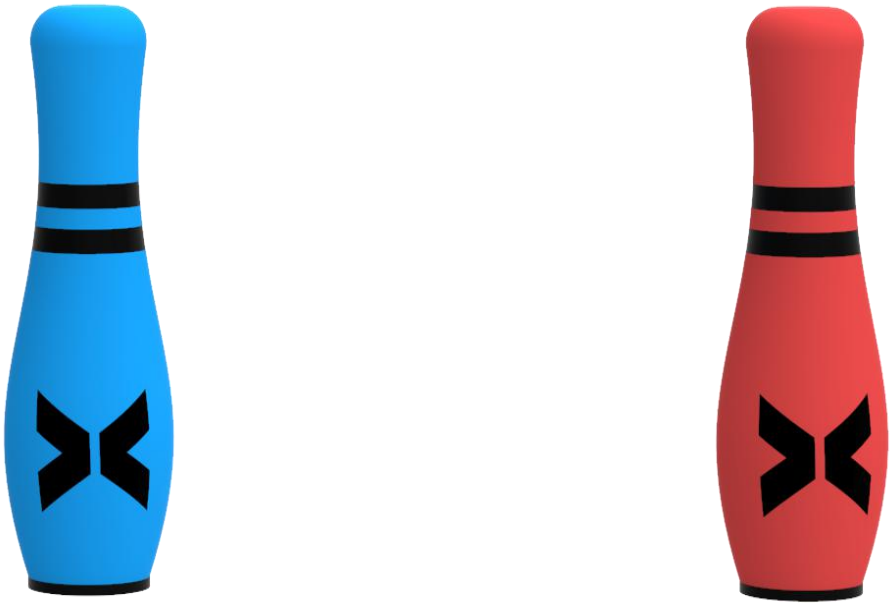


Fig 4.3-3 Renewable Energy Pins

Alphabet Cube

Located in data collection station, alphabet cube is made of EVA with an edge length of 120 mm. There are 9 alphabet cubes with the bottom side having a hollow cross hole (fig 4.3-4), among which there are 4 alphabet cubes with a letter of [M], [A], [K], [E] respectively, and 5 cubes with a letter of [X]. During the match, the shared alphabet cubes can be used to complete the missions of Crambling, Computing and Storaging. (Note: A tolerance of ±5mm is permitted).

Unit(millimetre)

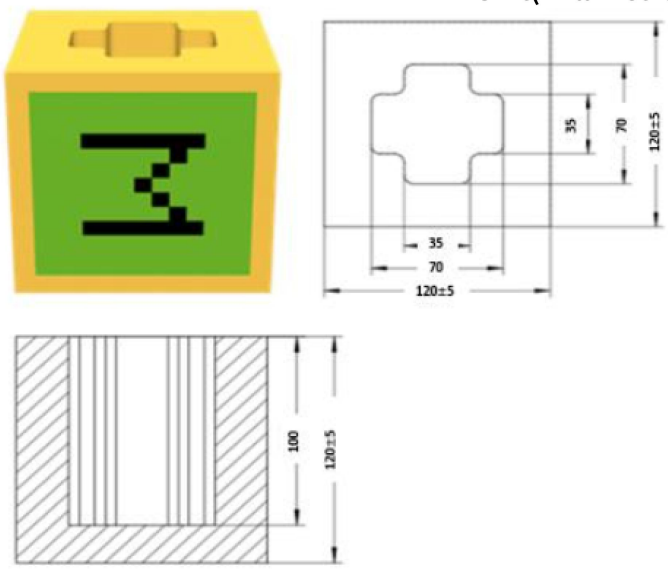


Fig 4.3-4 Alphabet Cube

* Note: All arenas and props have certain and reasonable tolerances. If there are any objection to the size of the props or other problems, the captain of alliance can apply for replacement before the match, and the final decision is on referee.

4.4 Missions

The competition includes automatic stage, manual stage, modification stage and final stage. Mission details of each stage are shown as follows:

Stage	Mission Details	Operation Area
Automatic Stage(30 seconds)	Powering new energy pin, scrambling alphabet cube, calculating data cube, storage alphabet cube.	Individual Camp
Manual Stage (100 seconds)	Adding the mission of recycling renewable energy bottles to the executable missions in the automatic stage.	Individual Camp
Modification Stage (60 seconds)	Modificating individual robots.	Off-Site
Final Stage (90 seconds)	Adding the mission of flag hanging to the executable missions in the manual stage.	Individual Camp

4.4.1 Powering Renewable Energy Pins

Operation Stage: Automatic Stage, Manual Stage, Final Stage.

Missions Details: Robots are allowed to collect yellow ball in the ground to toss opponent's pins.

Scoring State Judgement:

a. The pin of upper layer is in a vertical state and its bottom is in complete contact with the upper renewable energy area (i. e., this area refers to renewable energy area).

b. The pin of ground layer is in a vertical state and its bottom is in complete contact with the lower renewable energy area (i.e., this area refers to renewable energy area).

c. The pin has no direct contact with the robot.

Mission Points: All the above conditions are considered as valid scoring states. Twenty-five points for each pin.

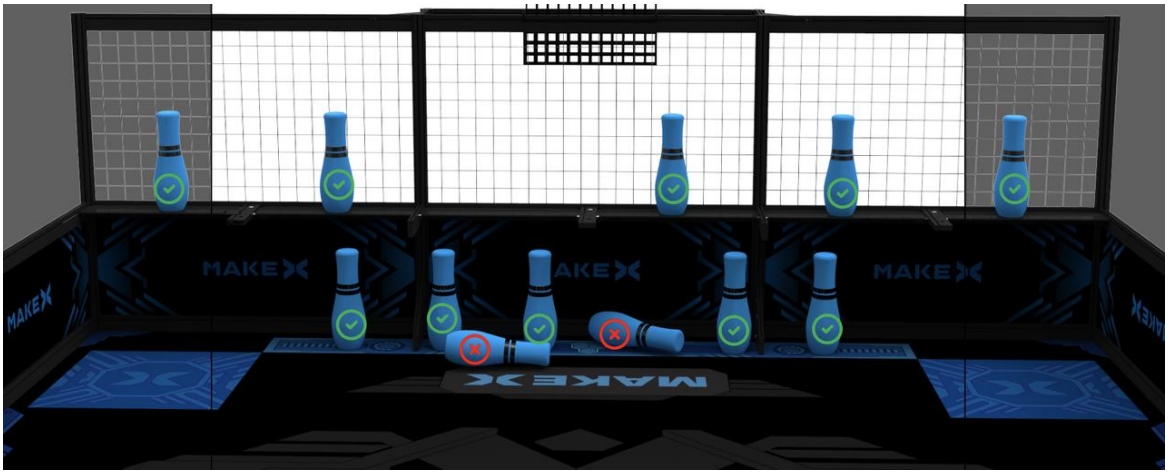


Fig 4.4-1 Valid and Invalid Scoring of Pins

4.4.2 Recycling Renewable Energy Pins

Operation Stage: Manual Stage, Final Stage.

Mission Details: Robots are allowed to place their pins in respective recycling areas.

Scoring State Judgement: It can be regarded as valid scoring state if the pin completely enters the recycling area and has no direct contact with the robot.

Mission Points: Twenty points for each pin.

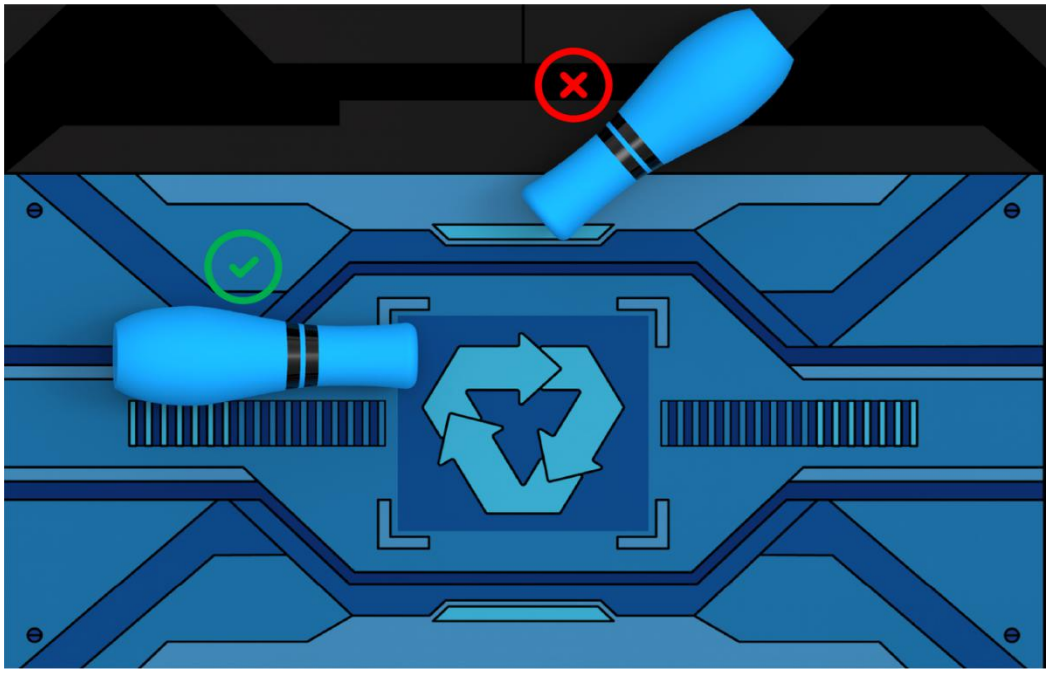


Fig 4.4-2 Valid and Invalid Scoring of Renewable Energy Pins

4.4.3 Storaging Alphabet Cube

Operation Stage: Automatic Stage, Manual Stage, Final Stage.

Missions Details: Robots are allowed to insert cubes into respective storage center.

Scoring State Judgement: The following situation is regarded as valid scoring state: the cube is suspended on the flat beam, and there is no direct contact with the robot or other arena elements (except the structural parts of the suspension area).

Mission Points: Thirty points for each cube.

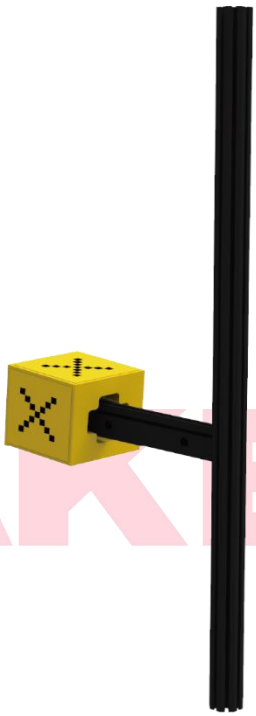


Fig 4.4-3 Valid State of Storing Alphabet Cube

4.4.4 Computing Alphabet Cube

Operation Stage: Automatic Stage, Manual Stage, Final Stage.

Missions Details: Robots are allowed to place the alphabet cube in respective computing center.

Scoring State Judgement: The following situation is regarded as valid scoring state: the vertical projection of the alphabet cube completely falls in respective computing center, and there is no direct contact with the cube and the robot.

Mission Points: Fifteen points for each alphabet cube.

Fig 4.4-4 Valid and Invalid Scoring of Alphabet Cube in Computing Center

4.4.5 Scrambling Alphabet Cube

Operation Stage: Automatic Stage, Manual Stage, Final Stage.

Missions Details: Robots are allowed to collect the alphabet cube of collection station into individual camp.

Scoring Statement Judgement: The following situation is regarded as valid scoring state: the alphabet cube is completely in individual camp (as shown in fig. 4.5-5) and there is no direct contact between the alphabet cube and the robot.

Mission Points: Five points for each cube.

Fig 4.4-5 The Remaining Cube Except Those in Data Computing Center and Data Storage Center

4.4.6 Hanging Team Flag

Operation Stage: Final Stage.

Missions Details: Robots are allowed to hang the flag in respective flagpole of suspension area. Each team is allowed to hang one flag in single match.

Scoring Statement Judgement: It can be regarded as valid hanging if the flag is hanging on the flagpole, and there is no direct contact with the ground and the robot.

Mission Points: Fifty points for one flag.

Fig 4.4-6 Valid Scoring of Team Flag

4.4.7 MakeX Bonus

Operation Stage: Automatic Stage, Manual Stage, Final Stage.

Missions Details: Robots are required to gather five alphabets of 「M」「A」「K」「E」「X」in respective camps.

Scoring Statement Judgement: It can be regarded as valid scoring if five alphabets of 「M」「A」「K」「E」「X」are gathered and located at any area of respective camp. (fig 4.4-7).

Mission Points: An extra 150 points for MakeX Bonus.

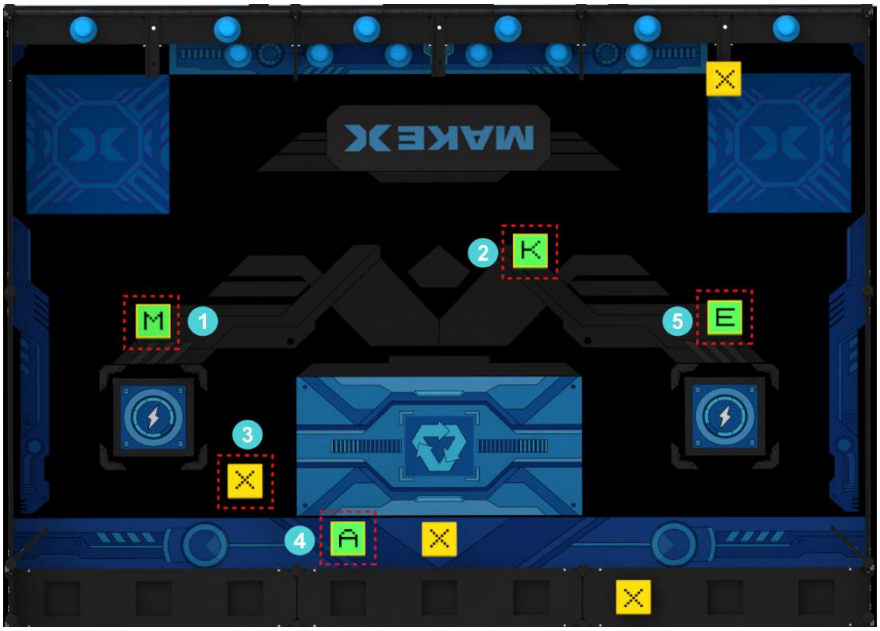


Fig 4.4-7 MakeX Bonus

4.4.8 Boundary State Judgement

During the match, if there is any uncertainty about the position of the robot (or props) and designated boundary, the following state judgement can be explained:

4.5 Scoring Explanation

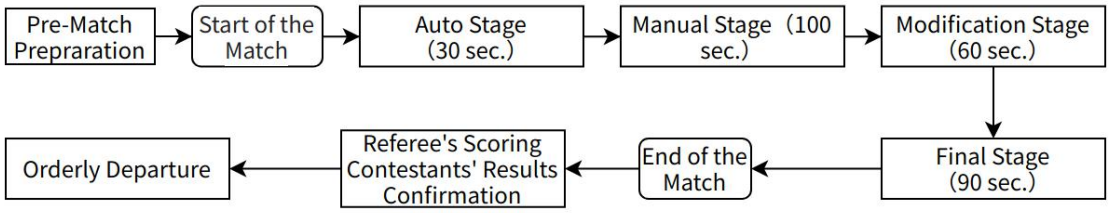
The final score of the match is determined by the final static state of the scoring prop after the match. Competition missions, scoring props and its corresponding points are as follows. After the competition, the referee calculates the sum of scores of each mission, and the alliance with the highest score will be the winner.

Single match Alliance points = Cube points + valid status pins + team flag - Penalty points

Scoring Props	Details of Scoring Props	Point of Single Prop	Maximum Point
Renewable Energy Pins	Valid Pin in Renewable Energy Area	25	300
	Valid Pin in Energy Recycling Area	20	
Alphabet Cube	Valid Alphabet Cube in Data Storage Center	30	360
	Valid Alphabe Cube in Data Computing Center	15	
	Valid Alphabe Cube in individual Camp but Except for Cube in Data Storage Center and Data Computing Area	5	
	Bonus Challenge: Gather Five	Bonus:150	

	Alphabets of 「M」「A」「K」「E」「X」 in Individual Camp		
Team Flag	Valid Flag in Flag Hanging Area	50	100

4.6 Single Match Flow



Pre-Match Preparation

Before a single match, contestants are required to check the robot and the power management module in the inspection area. After the inspection, contestants should wait and enter the competition area under the guidance of staff.

Start of the Match

Contestants are not allowed to touch the robot until referee's instruction to start the competition.

Automatic Stage

The automatic stage lasts for 30 seconds.

To ensure the competition fairness, robots in the starting area are required to power off. After the countdown of automatic stage, operator should turn on the robot and the robot can run the preset automatic program.

Manual Stage

The manual stage lasts for 100 seconds.

After the automatic stage ends, there is a preparation period before the manual stage begins. In manual stage, the operator can control the robot with bluetooth controller.

Modification Stage

The modification stage lasts for 60 seconds.

The modification stage begins after the end of automatic stage. Contestants are allowed to remove their robots (the vertical projections of the robots must partially or completely in the starting area.) out of arena and modify them. There are specifications for the length and width of the modified robot, and the height is not

limited. **(Please refer to 6.3 Modification Rules for the specifications.)**

The referees will give a signal when there is 30 seconds left. There will be ten-second countdown after the end of the modification stage. Before countdown, contestants should remove the robot to the starting area. If the robot fails to enter the starting area (partially in or completely in), the robot will be suspended in final stage.

Final Stage

The final stage lasts for 90 seconds.

After a five-second countdown, final stage begin and the operator can control the robot with bluetooth controller. At the end of the final stage, the competition will have a five-second countdown by referees.

End of the Match

After the end of the match, the operator is required to stop controlling the robot with the bluetooth controller and place the bluetooth controller in the storage basket and stay out of the arena.

Referee's Scoring and Contestants' Results Confirmation

The referee will count the scores after a single match. If there is no objection to the match, the captains of both alliances must confirm the match's result and sign on the Scoring Result Sheet. If there is any doubt about the result, the team can appeal to the referee without signing the result form.

After results confirmation, contestants shall actively assist the referee to restore the props, and leave the arena with their robots and bluetooth controller in an orderly manner.

5.Technical Specifications

5.1 Specification for Robot Construction

The specification for robot construction provides a fair and safe competition standard for all teams and the committee encourages teams to make innovative designs of their robots on the prerequisites of meeting these specifications. The committee encourages teams to conduct hardware construction and software programming on the premise of observing the specifications. During the competition, it is a must for robots to abide by the specifications. Any robot that violates the specifications will be required to be modified. Those who commit serious offense will be punished for canceling the results or disqualification.

Robot Mechanical Specification

T01. The size specification of the robot is: 500mm (length) x 500mm (width) x 700mm (height) before enhanced modification; 500mm (length) x 500mm (width), and with unlimited height after enhanced modification. The length and width of robot are defined before the competition, without redefinition after the competition. When measuring the robot size, the flexible material on it should not be affected by external forces. (The flexible material includes but not limited to rolled strip, tape, foam block, etc.).

	Requirements	Details
Maximum Initial Size	500 mm(Length) 500 mm(Width) 700 mm(Height)	1.The height should not exceed 700 mm and the vertical projection of the robot on the arena should not exceed the square area of 500 x 500 mm. 2.Before the modification stage, the robot's size must comply with the requirement of maximum initial size. 3.The team should show the maximum size of the robot during the inspection.
Maximum Modified Size	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 the rectangular area of 500 x 500 mm. 2. After the modification stage, the robot's size

		must comply with the requirement of the maximum modified size. 3. The team should show the maximum size of the robot during the inspection.

T02. The maximum net weight of the robot shall not exceed 10 kg, including the weight of battery, parts and flag.

T03. Robots must be equipped with connected structure rather than detached structure.

T04. The equipment with high performance that infringes the competition fairness is prohibited, which must be operated with following performance indicators:

Equipment	Component	Specification	Note
Motor& Servo	DC Motor	25 DC Motor Rated Voltage：6V Rated Rotation Speed：50&200RPM 37 DC Motor Rated Voltage：12V Rated Rotation Speed：50&200RPM	The maximum total number of the motor is 13. The maximum total number of the smart servo is 6. It is forbidden to change the mechanical structure and electrical layout of any motor or servo
	Brushless Motor	2823/2824 Brushless Motor Rated Voltage：10000 mA MAX Rated Rotation Speed：7300 rpm	
	Encoder Motor	180 Smart Encoder Motor Rated Voltage：12V No-load Speed：580±10%RPM Reduction Ratio：39:43	
	Smart Servo	MS-12A Smart Servo Working Voltage：DC6V~12.6V Torque：12kgf.cm	

T05. The parts can be lubricated with lubricant, but contestants should protect the

arena from lubricant leaking.

T06. The following robot's parts that may cause danger are forbidden:

- Sharp angle;
- Oil pressure parts or hydraulic parts;
- Switches or contacts containing mercury;
- Parts that will conduct electrical current from robots to arena;
- Parts that tend to develop connections with other robots, such as hook-shaped parts and other parts;
- Other dangerous parts as determined by the judges.

T7. The following hazardous materials are forbidden:

- Flammable and explosive gases;
- Materials containing liquids or gelatinous substances (except for glues and lubricants used in prescribed and small quantities);
- Materials that may cause arena contamination, such as sand, ink, etc.;
- Materials made from animal tissue;
- Materials that may cause danger as determined by other judges.

T8. Each robot can only be equipped with one battery, and the battery must be fixed inside the robot except for laser sighting device. The battery is prohibited from colliding with and separating from the robot.

T9. The power of the laser sighting device should be less than or equal to 5mW (below Grade 3 a/R), and at most one laser sight

- Each robot is only allowed to install at most one laser sight.

T10. The battery cables shall be intact without cracks, breakages and metal wires. There must be an electrical isolation between power supply lines and robot structures.

T11. The electronic equipment with high-performance that infringes competition fairness is prohibited, which must be operated with following performance indicators:

System	Module	Specification	Note
Power System	Li-Po Battery	3S Li-Po Battery, Output Voltage 11.1-11.2V, Discharge Rate 25-30c	

Mainboard System	Mainboard	Processor： High Performance M7 Processor ATSAMS70N20A-AN，STM32F030CC T6 Coprocessor Working Voltage： 6V ~ 13V(The minimum input voltage of motor is required to meet the requirement of motor's working voltage） Communication Ports and Protocols： Serial Port /mBuild Protocol	Raspberry Pi 3 Model B+ is also available
Sensor System	Vision Sensor	Viewing Angle： 65.0 degrees Effective Focal Length： 4.65±5% mm Identification Speed： 60 frames/seconds Identification Distance： 0.25-1.2m is the best range Method of Power Supply： 3.7V Lithium Battery or 5V mBuild Power Module Power Consumption Range ： 0.9-1.3W	Type and quantity are not limited It is forbidden for robots to use any sensors that will interfere with the perception ability of other robots
Wireless Control System	Bluetooth Controller	Bluetooth Version: Support 4.0+ Distance of Remission： 20m Working Current： ≤25mA Transmit Power： 4dBm Transmit Data： Data packets within 100ms can be acquired by bluetooth devices (low latency) Battery： Two No.5 AA Dry Batteries Supported Platform： macOS / Windows	During the competition, one bluetooth controller is available for one team; The bluetooth module should connect with Nova Pi mainboard

	Bluetooth Module	Bluetooth Version： BT4.0 Band Range： 2402~2480MHz Antenna Gain： 1.5dBi Energy Consumption Grade： ≤4dBm Working Current： 15mA	It is forbidden to use any form of wireless control device to communicate with robots other than the official bluetooth controller, including but not limited to any artificially triggered sensors

T12. Except for the buzzer embedded in motor and main board, robots are not allowed to equip with any other electrical sound equipment. In the meantime, robots shall not be equipped with other lighting devices except for the mainboard, the sensor indicator light, the light used with the sensor and the laser sighting device that meet the technical specifications.

T13. Teams are allowed to self-construct or procure mechanical parts. It is suggested to use complete commercial product components with low integration, such as hinges, sprockets, roller chains and pulleys, etc. It is not allowed to use highly integrated complete commercial products, including but not limited to multi-DOF manipulators or mechanical hand.

5.2 Specification for Team Flag

T14. The flag consists of flag surface and flagpole, which are made of flexible materials. The flag must be unfolded during the competition and its size is no less than 400 mm (length) x 300mm (width).

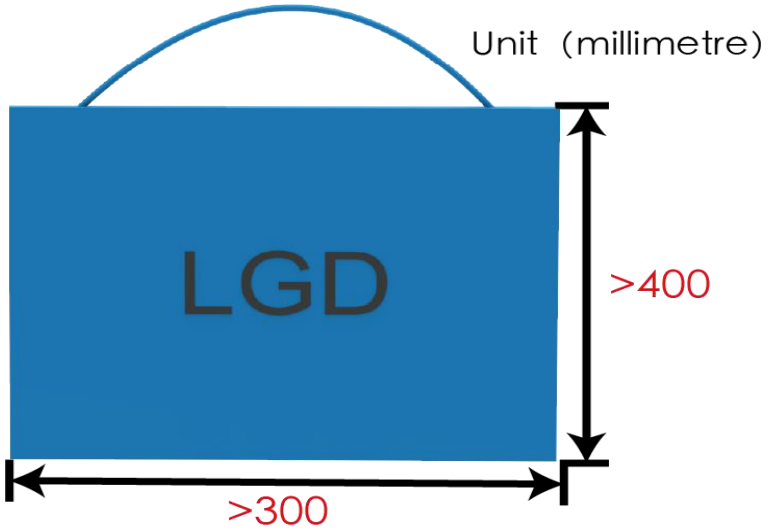


Fig. The Size of Flag

- The flag surface and flagpole should not in contact with the ground, and do not lean on anything except for Cylinder and Max.
- Flag can be carried to the competition arena after robot inspection and pre-match inspection.
- At most one flag for per team.
- The committee encourages teams to draw personalized patterns or words on the flag, which calls for positive content reflecting competition theme and spirit, without showing words or pictures related to MakeX Robotics Competition Committee.

6.Competition Rules

6.1 Penalty

Verbal Warning

E01. The referee gives the team a verbal warning of the first violation and asked them to stop any violation and obey the referee's instructions. In the meantime, no points will be deducted and the competition will not pause.

Violation

E02. The referee issues a violation to the team, and immediately deducted 20 points. In the meantime, the competition will not pause.

Suspension

E03. The referee issues a suspension to ask the robot to stop its action. The Referee is entitled to suspend robots according to the actual situation in the Arena.

- The contestants shall ask the referee to suspend the robot while encountering robot malfunction or uncontrollability.

Yellow card

E04. If alliance members' behavior seriously affects the competition fairness or violates the safety rules, the alliance will receive a yellow card with 60 points deductions.

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 escalate to a Red Card, will be cleared after qualification round.

- If a team receives a yellow card, 60 points deductions from its alliance.

Red Card

E05. If alliance members' behavior seriously affects the competition fairness or violates the safety rules, the alliance will receive 120 points deductions, and its robot will be suspended. If a team receives a red card in automatic stage, its robot must be taken out from arena after the end of automatic stage.

Penalty of Red Card:

Qualification Round: When the contestant's or related person's action that extremely affect the fairness of the competition or violates the safety principle, the

Alliance will receive a Red Card with 120 points deductions for both Alliance teams. The robot will be suspended， but the match will continue as usual. If two teams of the alliance receive a red card, the alliance will be the loser. (if the score of the winner is lower than the loser, the winner will receive extra 10 points higher than the final score of the loser.)

Elimination Round: If the alliance receives a red card, the alliance will be the loser. (If the score of the winner is lower than the loser, the winner will receive extra 10 points higher than the final score of the loser)

Disqualification

E06. If the team receives disqualification by the referee, its robot will be immediately suspended, and the team will lose the chance to participate in this match and next match. If two teams from the same alliance are disqualified, the alliance will be the loser with zero point, while another alliance will be the winner with current score as their final score.

6.2 Operation Rules

Dangerous Structure

R01. The measure of safety protection should be taken if robot's structure may cause damage to humans, such as sharp angles.

- The contestants must modify the robot after receiving verbal warning, otherwise the robot will be suspended.

Destructing or Contaminating Arena

R02. Robots are not allowed to maliciously "climb" or "collide" the boundary of the arena and the central partition.

- The robot that violates the rules will be suspended from the match. A second violation will lead to disqualification.

R03. If arena contamination caused by the robot, the robot will be regarded as in an unsafe state. Robots are not allowed to use double-sided tape or glue to fix arena elements during competition.

- The robot that violates the rules will be suspended from the match. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

Destructing Other Robots

R04. Robots are not allowed to collide with other robots during competition in

purpose .

- The robot that violates the rules will be suspended from the match. A second violation will lead to disqualification.

Robots Out of Boundary

R05. Any parts of robot are not allowed to go beyond the arena boundary.

If robot is in contact with the ground and the object, the robot will be suspended and those who commit a second offense will be disqualified.

Violating Materials.

R06. The following hazardous materials or dangerous structures embedded in robot are forbidden, such as:

- Flammable gases, fire or smoke generating equipment, hydraulic oil or hydraulic parts, switches or contacts containing liquid mercury (mercury);
- Hazardous Substances (e.g., Lead);
- Materials that may cause arena contamination, such as sand and other objects that may be scattered during competition;
- Materials that develop connections with other robots;
- Materials with sharp edges that may cause injury.
- Materials made from animal tissue (for health and legal consideration).
- Materials containing liquids or gelatinous substances (except for glues and lubricants).
- Parts that can conduct electrical current from robots to any other parts in arena.
- The robot that violates the rules will be suspended. If the robot continues to be a participant, contestant should modify it to accept re-inspection. A second violation will be disqualified.

Other Unsafe Factors

R07. In addition to R06, referees are entitled to decide whether the robot is safe or not.

- The robot that violates the rules 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.

Team Role

R08. One operator and one observer for each team. Each alliance includes two operators and two observers, one of them is selected to be the captain of the

alliance.

- Operators are responsible for controlling the robot in each match.
- The operator and the observer can freely switch their roles during the match.

Contestants' Requirements

R09. Contestants should wear goggles during competition preparation,

robot debugging and on-field match.

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

R10. Contestants should tie up their long hair during competition preparation, robot debugging and on-field match. Toe-baring shoes are forbidden.

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

Contestants' Standing Position

R11. Contestants shall stand in certain range as shown in the following figure(the size of the operating area is subject to actual conditions):

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

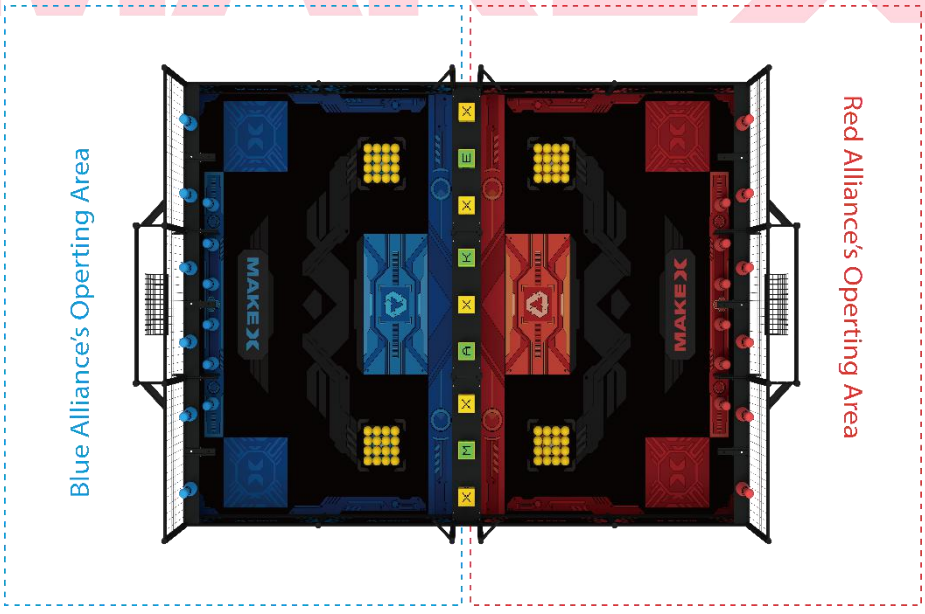


Fig. Standing Position of Operating Area

Substitution of On-Arena Players

R12. It is not allowed for a third person as a substitution of operator and observer.

The team will receive a red card.

Rules of Elimination Round

R13. After the end of each elimination round, each alliance has 5 minutes for debugging.

- The team will receive a verbal warning, and those who commit a second offense will receive a violation.

Radio Interference

R14. It is not allowed for contestants to bring electronic communication devices (mobile phone, transceiver, computer, wireless network devices and etc) into the competition area except for prescribed devices.

- The team will receive a violation, and those who commit a second offense will receive a yellow card.

Operating the Robot in Advance

R15. Robots are not allowed to operate until referee's announcement to start the competition.

- The team will receive a violation, and those who commit a second offense will receive a yellow card.

Delayed end of the Competition

R16. After the end of automatic stage, manual stage and final stage, operator should stop controlling the robot or stop robot's operation program (except for the motion caused by inertia).

- The team will receive a violation. An invalid point will be given to those offenders who enjoy the advantage as a result of delayed end of competition. Besides, the offender is required to reset the original state of the arena.

Violating Contact

R17. 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~~ yellow balls or other props, they are not bound by this rule.

- The team will receive a violation, and those who commit a second offense will receive a yellow card.

Physical Interference

R18. In order to ensure an unblocked attacking router for opponent, team members should keep their body projection out of the arena during the competition. This rule is exception to the action of moving robots in and out of the arena during the modification stage.

- The team will receive a violation, and those who commit a second offense will receive a yellow card.

Using Bluetooth Controller in Automatic Stage

R19. Bluetooth controller should be connected with robot before the match, and the former one needs to be switched on. It is not allowed to use bluetooth controller in automatic stage, otherwise the referee has the right to give the team a disqualification.

The team will receive a red card.

Operating Suspended Robot

R20. When the robot is suspended, the operation teams cannot continue to control it.

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

Robot's Left-Behind Components

R21. During the competition, the following situation is forbidden, such as detachment of robot and its component and left-behind mechanical devices (detachment refers to detachment of robot ontology and its components). This rule is exception to the shedding caused by collision of opponent's robot or direct contact with other robots.

- The team will receive a violation in case it affects the progress of the competition. A second offense will be given a yellow card.

Robot Inconformity

R22. Robots must comply with the size, weight and other parameters specifications during the match. Except that the robot size exceeds the requirements caused by opponent's toss of arena elements.

- The team will receive a red card.

Toss in Violation

R23. Robots are not allowed to toss arena elements to opponent's camp. (such as the toss of pins, robot parts, alphabet cubes or blank cube)

- The team will receive a yellow card. The arena elements need to be restored if it causes any changes of arena elements in the opponent's side.

Completely in Opponent's Camp

R24. During the competition, the robot shall not enter the opponent's area completely through the hollow part of the partition at the bottom of the midfield or the upward side of the Data collection area

- The team will receive a yellow card.

Restricting the Movement of Opponent's Robot

R25. Robots are not allowed to prevent the robot of other alliance from moving in all directions or touching arena elements.

- The team will receive a violation, and those who commit serious offense will receive a yellow card.

R26. As part of robot's ontology enters opponent's camp, which leads to the other side's alliance robot being stopped or restricted, the competition will be suspended based on actual situation, and robots of both alliances must be detached as soon as possible.

- The team will receive a violation, and those who commit serious offense will receive a yellow card.

Mentoring in Violation

R27. During the competition, contestants other than family members and mentors are allowed to enter the competition area. In case of mentoring in violation, the referee is entitled to give the team a disqualification.

- The team will receive a verbal warning, and those who will receive a violation if they refuse to correct their mistake. Those who will be disqualified based on actual situation.

Off-Arena Contact

R28. During the competition, contestants are not allowed to have any direct contact with off-arena person and audiences, including but not limited to the delivery of the parts and bluetooth controller.

- A second violation will receive a violation.

6.3 Modification Rules

In terms of those behavior that seriously violate the medication rules, the

committee is entitled to give the team a disqualification.

The Robot Not in the Starting Area Before Modification Stage

R29. 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

R30. 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.

Changing the State of Arena Elements

R31. Contestants are not allowed to change the state of arena elements on purpose or touch the scoring props (such as robots but except for small yellow cubes) when they are taking out the robot.

- The team will receive a violation. An invalid point will be given to those offenders who enjoy the advantage as a result of changing the state of arena elements. Besides, the offender is required to reset the original state of the arena.

The Robot Not Inside the Starting Area After Modification Stage

R32. 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

R33. 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.

7. Appeal and Arbitration

7.1 Results Confirmation

Results Confirmation

When a single match ends, captains of both teams need to confirm the results with the referees and then sign the result form. Both teams shall not have any objection to the results of this single match after their signatures.

Dispute Settlement

If the team has any objections to the results and referee's explanation, they can refuse to sign the score sheet. Instead, they need to write clearly about the situation on the remarks part of the result form.

7.2 Appeal Procedure and Valid Appeal Period

Appeal Procedure

Appeals should be lodged within the "valid appeal period" by the prescribed procedure and follow the civil participation spirit. The captain of the team needs to fill in the Appeal Form, then cooperates with the Arbitration Commission to investigate actual situation. Both sides will be required to arrive at the designated place if the Arbitration Commission requires. During the investigation, the captain of the appeal team must be present, and only captains or contestants of both teams can be present. The Arbitration Commission has the right to communicate with the the team alone, avoiding the mentor, the parents of the contestants, their relatives, or friends. The appellant should express facts clearly and objectively, not being over-emotionally.

Valid Appeal Period

Normally, the appeal should be lodged within 30 minutes after the end of the competition. Please check the Program Brochure for a specific effective appeal period before the competition. The appellant and the respondent must be present at the designated place on time.

Appeal Response

Normally, the Arbitration Commission responds to the appeal after the end of the competition on the same day or before the start of the competition on the next day.

7.3 Invalid Appeal

Overdue Appeal

Appeals that are not lodged within the "valid appeal period" will be considered invalid and inadmissible. If the appellant fails to be present on time or leaves without any reason during the investigation, the appeal will be considered invalid. If the respondent fails to be present on time, the Arbitration Commission will directly determine the arbitration result and render it as a final result.

Appellants out of Stipulation

The appellants must be the participating contestant and the appeal of another person is inadmissible. The Arbitration Committee will caution the offending team if parents, mentors, or other persons out of the stipulation participate in the arbitration process without the permission of the Arbitration Committee.

A disqualification will be given for multiple invalid warnings.

Vague Appeal's Requests

If the Arbitration Commission is unable to understand the appeal or conduct the normal investigation due to emotion factor of the appealing party, the offending party will receive a verbal warning.

A disqualification will be given for multiple invalid warnings.

Uncivil Appeal

Neither side shall make uncivil behavior nor offensive action and remarks.

A disqualification will be given for multiple invalid warnings.

7.4 Arbitration Procedure

Arbitration Procedure

The Arbitration Commission consists of the chief referee, the arbitration consultant, and the competition technical director. The Arbitration Commission is responsible for accepting the appeals and conducting arbitration investigations, to ensure the smooth progress of the competition and the fairness and justice of the competition results. The playback videos and photographs of any competition may be inaccurate due to the shooting angle, which is only used as reference but not arbitration evidence.

Arbitration Results

The arbitration results can be divided into “maintaining the original result of the

match” or “re-match”, and the two teams shall not appeal again. If the arbitration result is a "re-match", the two teams shall have a re-match according to the time and arena stipulated in the Appeal Form. If either team fails to reach the arena within 5 minutes after the beginning of the match, the team shall be deemed to quit the match.

Additional Remarks

The Arbitration Commission determines the final arbitration result, and neither side shall dispute the result of the appeal anymore.

8.Statement

MakeX Robotics Competition Committee reserves the final interpretation of *2022 MakeX Challenge Energy Innovator Rules Guide.*

8.1 Rules Explanation

In order to ensure a fair competition and high-quality competition experience, MakeX Robotics Competition Committee has the right to update and complement this Rules Guide regularly, issue and implement the latest version before the competition.

During the competition, all matters not stated in the Rules Guide shall be decided by the referee team.

This Rules Guide is the basis for refereeing, and the referee team has the right of adjudication during the competition.

8.2 Disclaimer

All contestants in 2022 MakeX Robotics Competition shall fully understand that safety is the most important issue for the sustainable development of the 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 2022 MakeX Challenge Energy Innovator, shall acknowledge and abide by the following safety provisions:

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

Contestants shall ensure that the structural design of the robots 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 robots, 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 team and other teams, referees, staff, audiences, equipment, and arenas.

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

The competition kits and parts sold and provided by the supporter, MakeX Robotics Competition Committee, shall be used by the instructions. MakeX Robotics Competition Committee will not be responsible for any injury or loss of property caused by improper use.

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

8.3 Copyright Declaration

Appendix 1. Awards and Annual Points

In 2022 season, MakeX Explorer competition shares the same rules of annual points as MakeX Challenge competition. According to competition scale and team number, the competition will be classified into Points Race/Regional Competition, National Competition, Intercontinental Competition, and World Championship. In MakeX Challenge Energy Innovator competition, teams can obtain the points based on the number of wins, ties and losses in the match. Each team can voluntarily sign up for all kinds of Points Race all year round to accumulate the annual points. The accumulation of annual points is based on the Team Number.

In single points race, teams can obtain annual points based on the winning points in qualification round and elimination round.

Competition Type	Rounds	Win	Tie	Loss
Points Race Regional Competition	Qualification	5	2	1
	Elimination (Best of 3)	10	/	2
National Competition	Qualification	10	4	2
	Elimination (Best of 3)	20	/	4
Intercontinental Competition	Qualification	15	6	3
	Elimination (Best of 3)	30	/	6

Teams that have won the champion, runner-up, second runner-up and other awards can obtain additional annual points. For the details of award list, please refer to **2022 MakeX Awards Guide.**

Category	Awards	Regional /Points Race	National	Intercontinental
Explorer, Challenge &Premier	Champion	15	30	45
	Runner-up	10	20	30
	Second runner-up	5	10	15
	Innovative Design	-	5	10

	Award			
	Engineering Notebook Award	-	5	10
Excellence Award	Outstanding Mentor Award	-	-	-
	Promotion Ambassador Award	-	5	10
	Technology Sharing Award	-	5	10
	MakeX Spirit Award	-	-	10

For example, team X20000 obtains the champion in one Points Race, and all the results show as below.

Qualification Round 1	Qualification Round 2	Qualification Round 3	Qualification Round 4	Annual Points from Qualification Round=13
Win (5)	Loss (1)	Tie (2)	Win (5)	
Top Eight Battle	Semi-final	Final		Annual Points from Elimination Round=30
Win (10)	Win (10)	Win (10)		

The total annual points that team X20000 obtains = 13+30+15 = 58.

Appendix 2. Engineering Notebook Guideline

2022 MakeX Robotics Competition

Engineering Notebook Guideline

***Instruction:**

1. The value of engineering notebook: It helps the team establish files and record the whole learning process. Therefore, it is necessary to record engineering notebook during the entire preparation for the competition.

2.Engineering notebook submission: Teams can use online documents or handwriting. No matter which way to use, each team must submit a paper version onsite.

Paper engineering notebook: As the Challenge & Premier programs require the assessment process, 1 copy of the paper version shall be submitted by each team to the judges onsite. If there is no assessment process (Starter & Explorer), each team will need to submit 1 copy of the paper version to the staff at the inspection area. Teams that cannot submit the original engineering notebook should prepare their own copies.

3. An engineering notebook will be required for the evaluation of all technical awards. Please refer to the Competition Guide for the evaluation criteria.

Basic Requirements for Cover

The team's name, team number, and competition program must appear on the cover of the engineering notebook.

Basic Requirements for Contents

1. **Clear content**

Creating content brings convenience for the judges to review and quickly find the corresponding section.

2. **Process records (Required)**

Every improvement of the robots should be recorded from prototype design, construction, to the debugging. **Keep pictures of all manuscripts, design drawings,**

calculation processes, circuit diagrams, etc., and insert them into the engineering notebook in the form of pictures.

1）Schedule of robot building progress

2）Design inspiration/sketch

3）Technical principle (it can be disassembled into different parts)

4）Production step by step (with clear pictures)

5）Problems encountered and solutions

Examples of problems:

What technical failures did you encounter? Why did you fail? How did you solve the problems finally?

What efforts have you made for the robots? What improvements have been achieved?

Does your project progress schedule go as planned? What accidents or delays have occurred? How to fix it?

Have there been any disputes among the team members and how to settle them in the end?

3. **Projects summary**

1）The structure and function of the project (with pictures and text enclosed)

2）The technical innovations of the project

3）Competition strategies for scoring and defenses

4. **Team introduction**

1）A brief biography of each team member and their role on the team

2）Culture displaying (logo, team flag, slogan, posters, T-shirt, etc.)

3）Excellent achievements sharing (Stories)

5. **Feelings and other things you want to share (optional)**

1) Achievement in the competition (Technical)

2) Growth in the competition (Spiritual)

3) Suggestions for competition

Appendix 3 MakeX Challenge Robot Self-Check List

MakeX Challenge Robot Self-Check List (Energy Innovator)			
Size and Weight of Robots			
SN	**Items**	**Specific Requirements**	**Status**
1	**Size**	The initial size refers to the size of the robot remaining stationary before the start of the competition. Maximum size refers to the maximum extended size of the robot moving to the limit state. The initial size of robot ahead of the competition is required to be 500 mm (length) x 500 mm (width) x 500 mm (height). After intensified modification, the initial size of the robot before restarting is required to be 500 mm (length) x 500 mm (width) x unlimited (height).	
2	**Weight**	The weight of the robot must not exceed 4 kg. (It refers to the maximum net weight including the weight of batteries during the competition).	
3	**Team Flag**	The flag surface is made of flexible material, and the size shall no less than 400mm (length) *300mm (width). The flag lanyard is made of flexible material.	
Safety			
4	**Dangerous Structure**	The robot's structure that may do harm to people is required to ensure safety protection during robot handling and transporting.	
5	**Competition Area Destruction**	Competition area destruction is prohibited in the process of robot loading, unloading and	

		transporting.	
6	**High-power Equipment**	High-power equipment is not available during assembling and operating the robot.	
7	**Unsafe Energy Storage Equipment**	Please keep safe while using energy storage devices (spring).	
8	**Personal Safety**	Contestants shall wear goggles; long hairs shall be tied up; contestants are prohibited from wearing toe-baring shoes to enter the competition area.	
9	**Banned Material**	Robots are not allowed to use the flammable gases, pyrotechnic equipment, hydraulic components, mercury-containing components, 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 competition area.	
Robot's Modules			
10	**Bluetooth Controller**	Teams have to use designated controller, and it is only be used by the operator.	
11	**Mainboard**	Teams have to use designated mainboard, and there is only one receiving module paired with controller.	
12	**Power**	Teams have to use batteries with specified parameters as power supply to be securely fixed inside the robots. Each robot can only use one battery (excluding required laser aiming device); Detailed parameters are: 3S Li-Po batteries, output voltage: 11.1v, discharge rate: 25c -30c, battery capacity 4200mAh	
13	**Battery Management**	The battery management module should be	

	Module	operated based on the requirement of competition system, which must complete three actions of power-on, power-off, and starting the automatic program.	
14	**Self-Customized Parts and Accessories**	Self-customized parts can be used: plates, profiled materials, 3D printing pieces, metals, wood, plastics, rubber, magnets; Usage requirements for auxiliary materials: It is allowed to use the ropes, cables, wires, springs, rubber bands, leather hoses, surgical tubing, punched sheets, injection molded products; It can use commercial product components with low integration instead of higher integration.	
	Luminous/ Acoustic Sensor	There is no light source except the laser sighting device and the indicator light self-contained of the mainboard or the sensor with its power less than 5 mW (Limited to only one); No other sound generating device is allowed except the buzzer on the mainboard.	
15		If the laser sighting device modified by the laser pen requires independent power supply, it can only use the configured batteries (such as dry batteries) of the device. If it is not a common laser sighting device, please provide the corresponding model and parameters for query and verification.	
16	**Servo**	Teams have to use designated model of smart servo (MS-12A), and the maximum number of servo available on a robot is 6 pieces.	
	Motor	The robot has to use the required DC Motor, Encoder Motor (37 DC Motor,180 smart motor and the maximum number of them is 13) to ensure the fairness of the competition.	

17		The robot shall use the required Brushless Motor (2823/2824 Brushless Motor and the maximum number of them is 2) to ensure the fairness of the competition.	
18	**Wrap the Sharp Structure**	The exposed sharp edges of the robots have to be wrapped with sponge strips.	
19	**Detachment/Shedding**	Detachment of the robot and its component is forbidden during the competition.	
20	**Interference**	It is prohibited to interfere with the electronics and sensors of other robots.	
21	**Team Number**	Team number's printing font should be Microsoft YaHei, black bold, 130 font sizes, and the background should be in light color.	
22	**Engineering Notebook Submission**	Submitting project notebook containing robot control source code before the competition.	
23	**Contaminating Competition Area**	The lubricant and other materials used by robots shall not contaminate the arena or other robots.	

Appendix 4. MakeX Challenge Penalties List

Scope	Item	Generation	Violation	Yellow Card	Red Card	Suspend	Disqualification
Operation Rules	**Dangerous Structure**	If it is found that robot's structure may cause damage to human, contestant must modify it after receiving verbal warning.				✔	
	Destruct Arena or Other Robots	It will be disqualified if have a second violation.				✔	✔
	Use suspended Materials	If it is found that contestant use banned materials, these materials will be suspended. A second violation will be disqualified.				✔	✔
	Contaminate Competition Area	Under the preconditions without contaminating the competition area, the robots can use the glue, adhesive				✔	✔

		tape and lubricant; These materials will be suspended if be found, and a second violation will be disqualified.					
	Robots Out of Bounds	Any parts of robot are not allowed to go beyond the arena boundary.				✔	✔
	Other Unsafe Factors	The referee has the right to suspend contestants' robot and ask them to operate modification if other unsafe factors to be found. A second violation will be disqualified.				✔	✔
Operation Rules	**Bring Electronic Communication Devices**	A second violation will be given a yellow card.	✔	✔			
	Delay the end of the competition	The corresponding score will be deducted.	✔				
	Touching in Violation	A yellow card will be given if	✔	✔			

		affects the points or the progress of the competition.					
	The body is not allowed to extend into the arena to affect opponents' score	A second violation will be given a yellow card.	✔	✔			
	Manually controlling in automatic stage	The bluetooth controller should be placed in the storage basket in automatic stage.			✔		
	Robots' spare parts left in the arena	A violation will be given based on the situation; A yellow card will be given if commits a second offense.	✔	✔			
	Remove other arena elements from the arena	The scoring behavior is not included.	✔				
	Toss in Violation	If resulting a change in opponent's arena elements, it should be suspended for restoration.		✔			
	Malicious destruction of	The violators will be given a			✔		

	the opponent's letter cube	red card.					
	Arena elements are difficult to remove from robots	Repeated offenses affecting the progress of the competition will be disqualified.					✔
	Completely in opponent's camp			✔	✔		
	Hinder opponent's robots	A penalty will be given for deliberately hindering the opponent's robot.	✔	✔	✔	✔	✔
	Operating prohibited robots	Please don't operate the robots that have been prohibited. The violators will receive a violation for the first time. Those who commit serious offense will receive a yellow card or be disqualified.	✔	✔	✔	✔	✔
	Misconduct	Misconduct is including but not limited to: repeated or	✔	✔	✔	✔	✔

		blatant offense; Impolite behaviors to the operators, referees, staff, or contestants; Repeated or blatant offense of safety rules; A second violation will be disqualified.					
	Mentoring in violation	A verbal warning will be given for the first time. Repeated or blatant offense will be given a violation. Those who commit serious offense will be disqualified.	✔	✔	✔	✔	✔
	Contact and exchange parts outside the arena	This behavior is prohibited during the competition.	✔	✔	✔	✔	✔
Modification Rules	**Unauthorized modification without entering the starting area**	Entering the starting area is subject to the direct contact with the line of starting area.			✔		
	Modification in the arena	Contestants have to modify the robot	✔				

		outside the arena.					
	Initiatively change the arena elements in modification stage	The competition elements removed from the robots should be placed in the arena, which will not change the state of other elements.	✔	✔			
	Failure to enter the arena before the end of the modification stage	Robots can't enter the arena anymore.				✔	
	Bring competition elements into the arena after modification	Robots carrying competition elements are not allowed to enter the arena.				✔	
	Incompatible the state of inspection after modification	If there are any major changes, the contestants should declare to the referees for inspection after robots are put into the arena.			✔	✔	
Identical Robot	**The appearance of identical robot**	It is not allowed for two or more than two robots					✔

		with high degree of similarity to participate in the competition. If such situation occurs during the inspection, it will be determined by judge group leader.					

Appendix 5 MakeX Challenge Score Sheet

MAKEX ROBOTICS COMPETITION

2022 MakeX Challenge Energy Innovator - Score Sheet

Competition Info: Qualification Round ☐ / Elimination Round☐ ___ (Arena) No.___ (Session)

Registration	Match Points			Winner
Red Alliance	**Red Alliance**		**Blue Alliance**	
Team 1 (No.) :	*(25 points each)*	Pin	*(25 points each)*	Red Alliance
Team 2 (No.) :	*(20 points each)*	Recovering New Energy Pin	*(20 points each)*	
Blue Alliance	*(15 points each)*	Computing Data Cube	*(15 points each)*	
Team 1 (No.) :	*(30 points each)*	Storaging Data Cube	*(30 points each)*	
Team 2 (No.) :	(5 points each)	Scrambling Data Cube	(5 points each)	Blue Alliance
	(50 points each)	Flag	*(50 points each)*	
	150 points	MakeX Bonus	150 points	
		Penalty		
		Total Points		

Captain of Red Alliance:	Captain of Blue Alliance:	Remark
(Please confirm the scoring results and sign here)	*(Please confirm the scoring results and sign here)*	*(If there's any disagreement about the results, please write down the situation clearly and sign here.)*
Referee of Red Alliance:	Referee of Blue Alliance:	
(Please confirm the scoring results and sign here)	*(Please confirm the scoring results and sign here)*	

Appendix 6 Instructions for Li-Po Battery

To ensure the safety of Li-Po battery, each team should designate a person to supervise the usage of battery, and to inform the teammates about the safety instructions for Li-Po battery. The following issues should be noted while using Li-Po battery:

- Please use the Li-Po battery while ensuring that you carefully read and understand the safety instructions.
- Safely charging and discharging.
- It is required to use the specified charger for Li-Po battery provided by the manufacturer, as well as read the instructions for charger carefully. In case of emergencies to be dealt with, please ensure that someone is nearby during charging. Please do not overcharge or over-discharge. It will be deemed overcharge if the voltage of a single battery cell is over 4.2v, and less than 3.0v is over-discharge. Overcharge may cause the explosion of the Li-Po battery, while over-discharge can easily damage the battery and shorten the service life of it.
- Please check the battery's voltage and electricity quantity carefully before charging or using.
- Please charge the battery at 0-45 ℃.
- Safe storage
- The battery cell cannot be overheated any time. When the temperature of the battery cell is as high as 60℃, there will be potential safety hazards, even burning.
- In the process of charging, the battery is not required to 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.
- Please do not put batteries near liquids, open fire or heaters. Place batteries out of reach by kids.
- Please do not detach and restructure the batteries arbitrarily or change its wiring, do not assemble the batteries privately. The following behaviors are deemed as

dangerous: detach and restructure the old battery cells, or restructure one of the detached battery cells with another restructured one (It can easily cause short-circuit combustion without the particular assembly instrument).

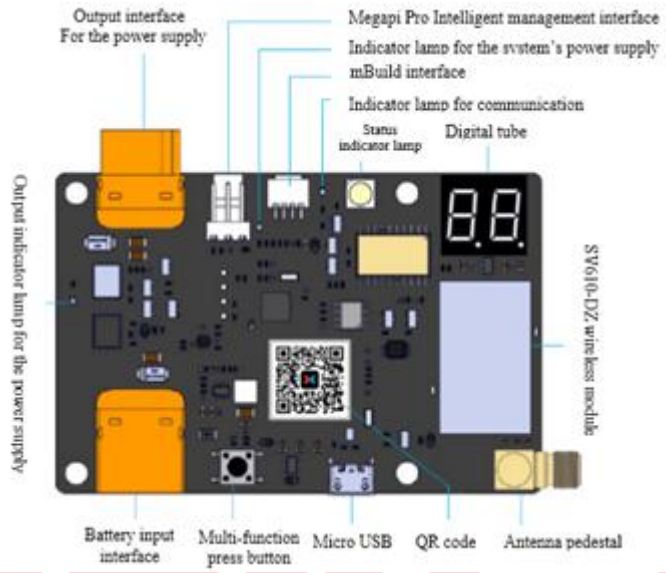
- If occurs collision during the competition, please take out the battery. Please carefully check the state of battery and connector. (Note: Batteries may be overheated with high temperature.)
- Do not spill electrolyte on eyes or skin. In case it spills inadvertently, please wash it with clean water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

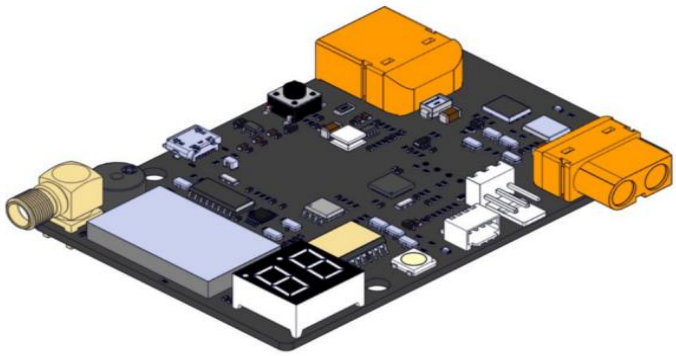
Appendix 7 Power Management Module

Introduction of Power Management Module

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 2022 Season energy innovator and ultimate warrior.

Module Size: 85mm(length) x 56mm(width) x 11.5mm(height);





Working Voltage: 6V - 12V;

On-board LED Lamp

LED Lamp includes an indicator lamp for power output, an indicator lamp for system power and an indicator lamp for communication

- **Indicator Lamp for Power Output:** The red indicator lamp is always on when having power output, and goes off when the power is disconnected.

- **Indicator Lamp for System Power:** The red indicator lamp for system power is always on when the module is working.
- **Indicator Lamp for Communication:** The blue indicator for lamp communication flashes when the module updates its firmware.

Indicator Lamp for Status (RGB Lamp)

- Indicator lamp for status mainly includes four statuses: power off, red, green and blue.
- **Power Off:** The bluetooth module is detected after the power management module is powered on. The RGB lamp is powered off when the bluetooth module cannot be detected.
- **Red:** After a normal power-on, click the button and the RGB lamp flashes red once;
- **Green:** In manual stage;
- **Blue:** In automatic stage.

Digital Tube

The two-digit digital tube is mainly used to display the current channel 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 will detect the wireless communication module when it is powered on. If the wireless communication module cannot be detected, the 2-digit digital tube will display the letter "Er" , meaning error.
- When the battery is low powered, the two-digit digital tube displays the symbol "-" and the current channel number alternately.

Buzzer

The buzzer will send the sounds of reminding and warning.

- The buzzer will shortly buzz when the module is normally powered on and be

detected, together with 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 of Power Management Module

- **Multi-function Button**

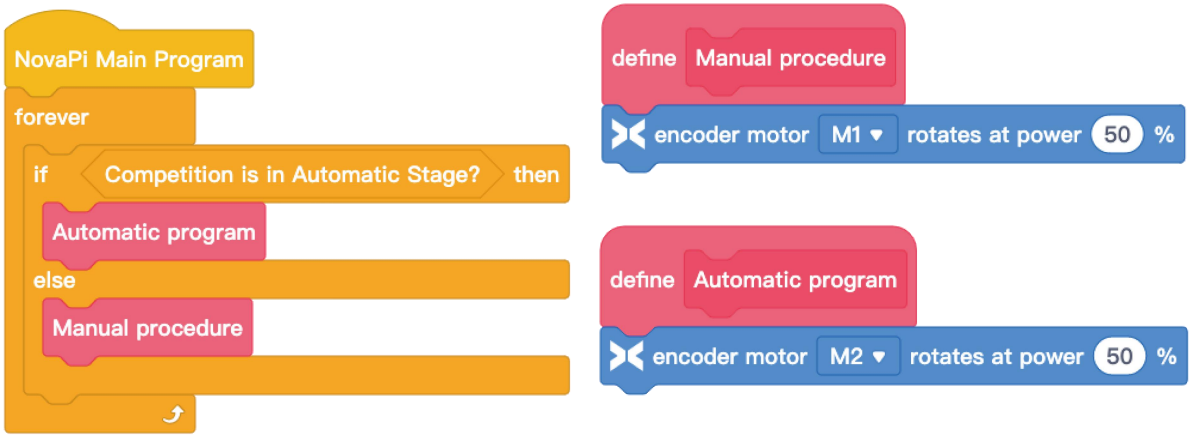
Multifunctional button has four modes: reset, click, double-click and long-press.

- **Reset：** Firstly, press the multi-function button and meanwhile insert the Li-Po battery into the power management module. The power management module restores the default configuration parameters. The buzzer sounds for 2 seconds and the digital tube displays the number "20";
- **Click:** Click the multi-function button once, the power management module reports the bluetooth module UID once, and the RGB lamp flashes red once.
- **Double Click:** Double click the multi-function button 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 automatic stage, the RGB green lamp is always on during manual stage, and the RGB lamp flashes during the delayed switching). Double click is only valid when the bluetooth module is the defaulted to "20" channel (It is only valid when the digital tube displays the number "20");
- **Long Press:** Long press the multi-function button (2-3 sec.) to switch the output state of the power supply. That is if the current power is disconnected, the power will connect after long pressing and its indicator lamp becomes red. If the power connects, the power will disconnect after long pressing and its indicator lamp powers off.
-

Starting Signal Identification Code of Automatic Program

- In automatic stage, the competition system sends relevant instructions to the power management module of the robot, so as to shield the controller signal and

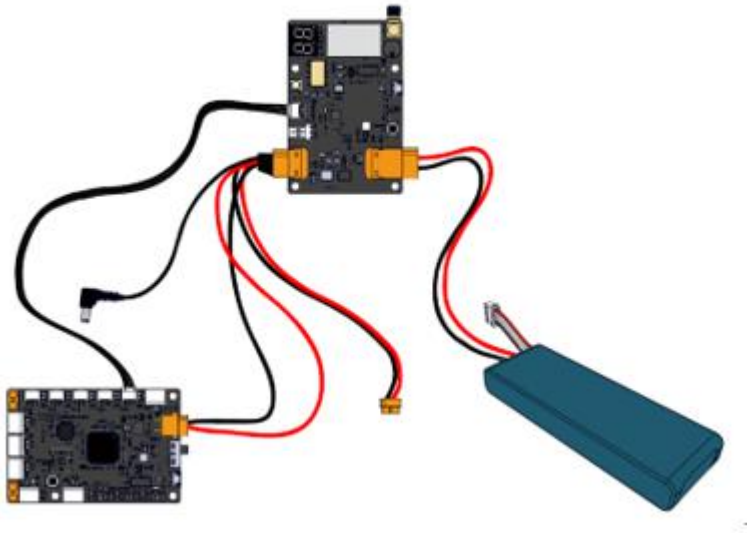
start the automatic program of the robot. In order to start the automatic program on the mainboard normally, it is necessary to insert a fixed code into the program to identify the instructions to start the automatic program sent by the competition system.



(Please put the program in manual stage and automatic stage into the corresponding positions.)

Installation Manual

- 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 of power management module;
- The data cables leading to the mainboard must be connected firmly as follows:



• Adjust the position of the antenna to prevent it from interfering with the movement of other motion devices, and try to avoid the antenna exposed to 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 the unauthorized replacement of the power module shall be borne by the team.

Appendix 8 Supplementary Explanation of Competition Procedure

Explanation of Recommended Procedure

Engineering Notebook Submission

MakeX Robotics Competition Committee encourages teams to record engineering notes, and excellent notes will be an important basis for team's award evaluation. The submission of paper engineering notebook and award setting based on pre-match notice and program brochure. Generally speaking, the submission of paper engineering notes is a necessary in medium and large-scale events, which will serve as an important basis for the award evaluation. Please refer to **Appendix 2 Engineering Notebook Guideline**.

Pits Area Decoration

Each team has its own space in the pits area, where teams can decorate their space to make their teams known to people, and participate in the award evaluation. Teams can rest and debug robots in the pits area, and please keep the area clean and tidy. The suggestions are as follows:

1. Display Content (provided by teams)

   Team Flag

   HD Images(3-4 copies)

   Team Introduction (no more than 200 words)

   Peripheral Display (if any)

2. Display Form

Team Poster/Roll Up Banner + Team Flag + Team Peripheral (if any) + Team Members/Teachers' Onsite Suggestion

Practice Round

Teams who have finished their robot inspection can participate in practice round. The schedule will be announced at the entrance in form of notices, and teams are required to queue in line before entrance. Not all competitions have a practice round, which can be informed based on actual situation.

Team Assessment

MakeX encourages contestants to master theoretical knowledge of robots as well as develop their creativity and skills of making robots by participating in the competition. By the method of Q&A and onsite problem-solving, the assessment with 10 minutes will be conducted to examine students' knowledge of robots. In this procedure, all team members must participate together except their mentors. Each team should attend the assessment on time, with 1 copy of the engineering notebook and the robot.

The assessment, with its aim to examine students' knowledge of robot, will be conducted in three aspects, including basic robotics theory, machinery and programming as well as innovation. The judges will ask questions or require an onsite operation demonstration. In a regular points race, teams can obtain different score (5, 3, 2, 0) based on their onsite performance grade (S, A, B, C). The assessment result will be announced on the MakeX official website after the qualification round. Teams obtaining zero point in the assessment procedure will not be able to enter the elimination round. The assessment score will be adjusted accordingly for different grade of point races.

Appendix 9 Competition Resources

Competition resources include but are not limited to official resources provided by the committee, such as Competition Guide, Equipment Instructions, Rules Videos, etc. The contestants are obliged to keep abreast of the update of competition resources before the competition, and any problems caused by the players' failure to keep abreast of the updates shall be borne by the players themselves. All official competition resources will be updated on MakeX Website https://www.makex.cc/en.

MakeX Robotics Competition Committee will revise and improve the Rules Guide with the progress of the competition and the new version will be announced in MakeX Official Website https://www.makex.cc/en. The contestants and mentors can download the latest version in MakeX

Website Download https://www.makex.cc/en/information/download.

MakeX Official Website: https://www.makex.cc/en.

Any Feedback & Question Please Sent to: makex_overseas@makeblock.com

MAKEX

Edited By MakeX Robotics Competition Committee

MAKEX CHALLENGE RULES GUIDE

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