

**MAKE X**

**V 1.1**

2020 MAKE X ROBOTICS COMPETITION

# TECHNICAL GUIDE

**MAKE X STARTER**

**SMART LINKS**

Edited By MakeX Robotics Competition Committee



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# MAKE X

# 1. Introduction

## 1.1 About MakeX

MakeX is a platform of Robotic competitions for guiding the growth of young people. It aims at inspiring people's enthusiasm for creativity, sharing, collaboration and give the public a deeper understanding of the value of STEAM education through Robotics Competition, STEAM Carnival, etc.

MakeX Robotics 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 and education through high-level competition events, guiding young people to learn Science (S), Technology (T), Engineering (E), Art (A) and Mathematics (M) and applying 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 Robot Competition is dedicated to providing young people with a high-quality, high-impact and impressive viewing experience platform for Robotic competitions. Young people aged 6 to 16 (including) can register through the official website. The requirements are as follows:

1 to 2 Contestants and 1 to 2 Mentors per Team. Each Team must have a competition number as the unique identification symbol of the Team. The competition number will be automatically generated after registration.

# MAKE X





### Competition Mat Size

Competition Mat is divided into two parts.

Automatic Missions Area: the area which requires the Robot to run an automatic program to finish independent missions and Alliance missions. The size of Automatic Mission Area is  $2370 \times 1150$  mm.

Manual Missions Area: the area which requires Contestants to complete the Alliance mission by controlling the Robot through Bluetooth Controller. The size of the Manual Mission Area is  $2370 \times 1150$  mm.

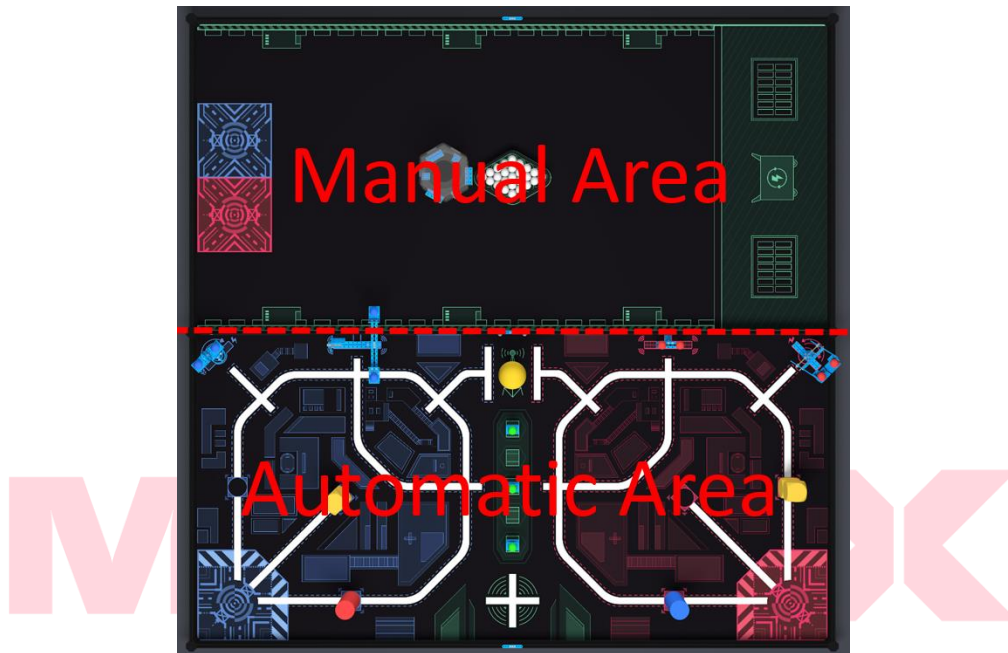


Fig 2.2 Competition Area

### Automatic Mission Area

The Automatic Mission Area consists of the Blue Independent Mission Area, the Red Independent Mission Area, and the Alliance Mission Area, as shown in Figure 2.3 below.



Fig 2.3 Red/Blue Independent and Alliance Mission Area



### Manual Mission Area

Manual Mission Area consists of Starting Areas, Loading area and placement zones for other props, as shown in Figure 2.4 below.

In the actual match, the Loading Area’s edge line which is closer to the Container is pasted with a Hoop & Loop (Loop) that is 1150mm long, 25mm wide and about 2mm thick (the following image has marked the edge as a red line).

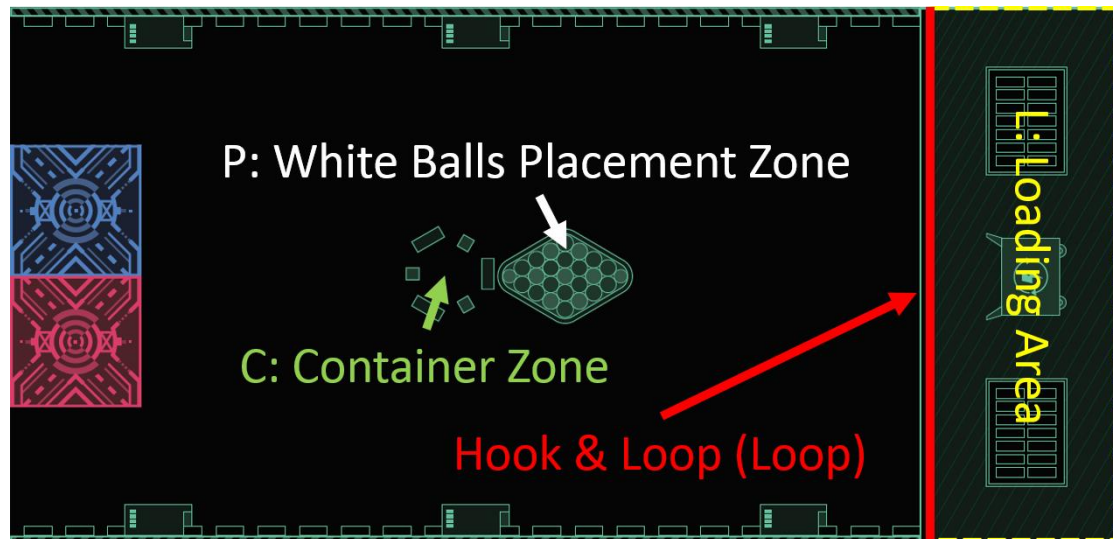


Fig 2.4 Manual Mission Area - Area Code

For the Manual Mission Area, the area’s name, code and functions are displayed in Table 2.1 below:

Area Name	Area Function
<b>L: Loading Area</b>	A place for Observers to modify Robots or load balls onto their Robots
<b>P: White Balls Placement Zone</b>	Initial Position of the White Balls with a Ball Holder
<b>C: Container Zone</b>	Position to place and fix the Container

Table 2.1 Manual Mission Area - Area Description

The division of the above areas & placement is only for function and location indications purposes only. The details of the dimension are subject to the actual Competition Mat.



### Starting Area

There are four Starting Areas in the Arena, two for the blue Team and two for the red Team.

There are two types of Starting Area. Starting Areas in the Automatic Mission Area are shown in Figure 2.5 and surrounded by black dashed lines.

Starting Areas in the Manual Mission Area are square as shown in Figure 2.7 and surrounded by black dashed lines.

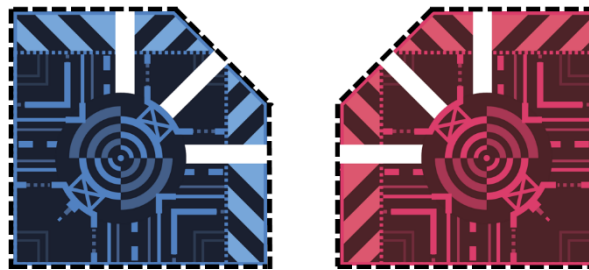


Fig 2.5 Starting Areas (Automatic Mission Area)

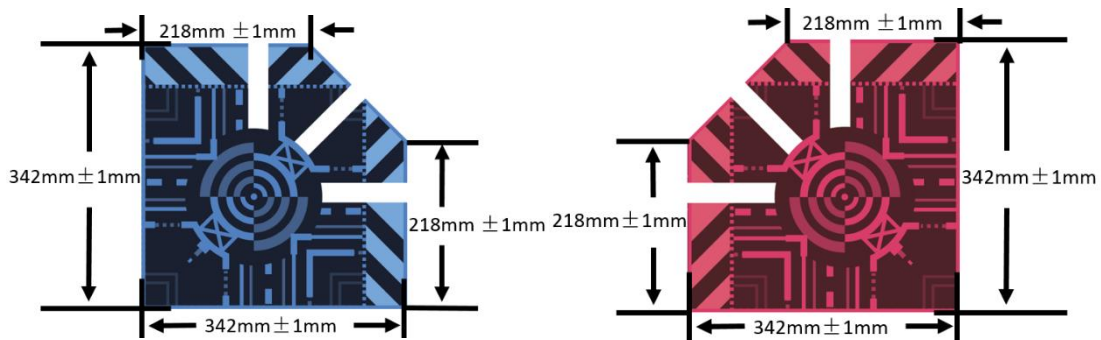


Fig 2.6 Starting Areas Size (Automatic Mission Area)



Fig 2.7 Starting Areas (Manual Mission Area)

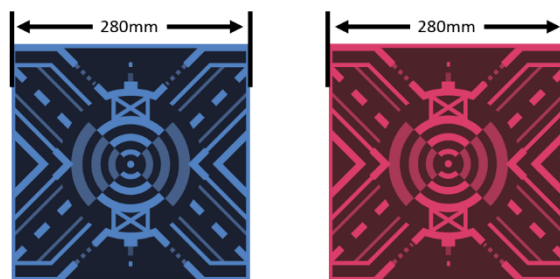


Fig 2.8 Starting Areas Size (Manual Mission Area)

## 2.3 Stages

### Description of the Duration of the Stages

Each match lasts for 240 seconds, and it consists of the Automatic Stage and the Manual Stage. The duration of the Automatic Stage is decided by both Teams of the Alliance, and the duration of the Manual Stage is the remaining section of the 240-second period.

Actual Duration (s)		Value Range
Automatic Stage	X	[0, 240]
Preparation Stage	30	[0, 30]
Manual Stage	Y	[0, 240-X]
Match Duration	X + Y	[0, 240]

**Table 2.2 Actual Durations of the Stages**

**Match Start:** After the countdown, the Referees announce “Match Starts” and start recording time. The match is entering the Automatic Stage, Teams must complete certain missions inside the Automatic Mission Area.

**Stage Shift:** After the match starts, the Alliance can shift from the Automatic Mission Area of the Automatic Stage to the Manual Mission Area of the Manual Stage at any time during the match, but there is only one chance. After Robots have entered the Manual Mission Area, they cannot return to the Automatic Mission Area. Both red and blue Teams must agree to proceed to the Manual Stage, and the Captain of the Alliance shall apply the stage shift to the Referees, as the stage shift needs the consent from the Referees.

**Preparation Stage:** The Preparation Stage is between the Automatic Stage and the Manual Stage. During this stage, Contestants can move the Robots from the Automatic Mission Area to the Manual Mission Area, modify their Robots and check the connection status of the Bluetooth Controller. At this stage, the Referee will calculate the scores for the Automatic Stage, and confirm the results with the Contestants. The Preparation Stage lasts for 30 seconds and is not counted in the 240-second match duration. After the 30-second Preparation Stage, the match starts directly and the Contestants must follow the Referee's instructions.

**Match End:** When both the red and blue Teams raise their hands and apply to terminate the match, the Referee will agree and stop recording time, the match ends in advance. Or, when the 240-second period runs out, the Referee announce "Match Ends", and the match ends directly.

## 2.4 Missions

### Overall Introduction of the Missions

The missions are divided into three parts: the Automatic Independent Mission, Automatic Alliance Mission, and Manual Alliance Mission.

The missions are divided into Independent Missions (M01-M05) and Alliance Missions (M06-M10), as well as the possible Mysterious Mission (M0X), where M01-M09 must be completed in the Automatic Area, M10 must be completed in the Manual Area, and the Mysterious Mission's position is uncertain.

Mysterious missions will only release at National Competition; Intercontinental Competition; National Events in China and World Championship. The Mysterious Mission may replace the existing mission or may be introduced as an additional mission.

Each Team will complete 3 Independent Missions, 3 Alliance Missions, and 1 mysterious mission (if any), as shown in the following table:

Single Match Mission	Missions Selection	Missions Location
<b>I1: Independent Mission 1</b>	M01 or M02	Automatic Area
<b>I2: Independent Mission 2</b>	M03 or M04	
<b>I3: Independent Mission 3</b>	M05	
<b>A1: Alliance Mission 1</b>	M06 or M07	
<b>A2: Alliance Mission 2</b>	M08 or M09	
<b>A3: Alliance Mission 3</b>	M10	Manual Area
<b>Independent or Alliance Mission</b>	M0X	Uncertain

**Table 2.3 Mission Overall Introduction**

The score for the Independent Missions will be counted as the Team's score, and the score for the Alliance Missions will be counted as the Alliance's score.

The committee will inform the red and blue Teams the 3 Independent Missions, 3 Alliance Missions and Mysterious Mission (if any) 10 days before the competition. Both red and blue Teams complete the same Independent Missions during the match.



### Mission Location Introduction

After the committee has selected the missions, the props for each match will be positioned according to the figure below. The arrangements of the Mission Props (M01-M05) in the Automatic Area is symmetric.

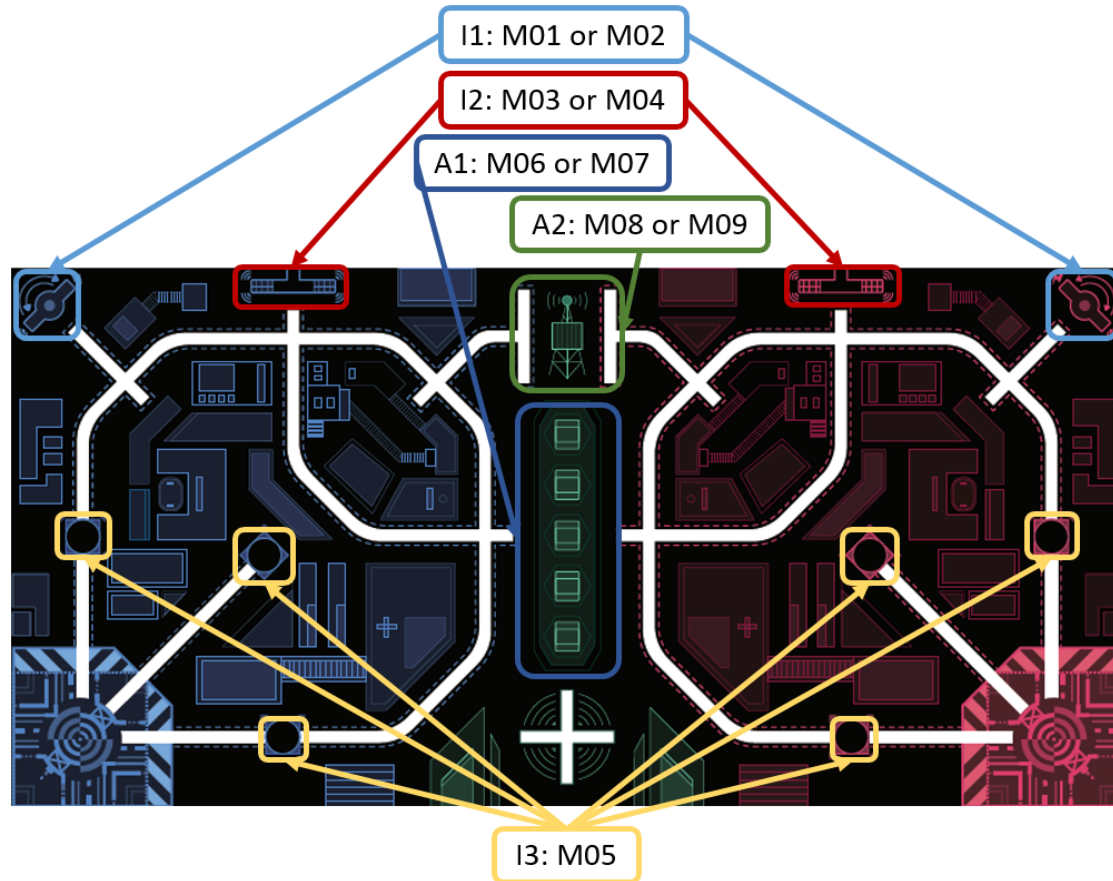


Fig 2.9 Automatic Area Mission's Location

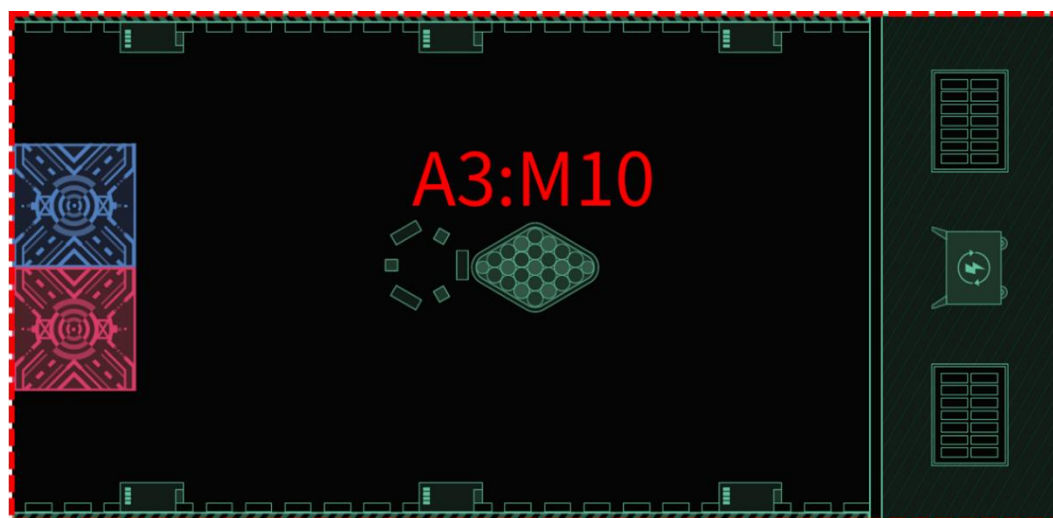
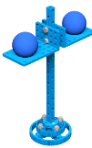

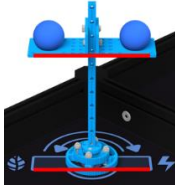
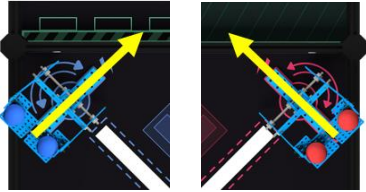


Fig 2.10 Manual Area Mission's Location

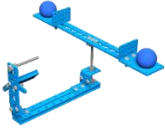

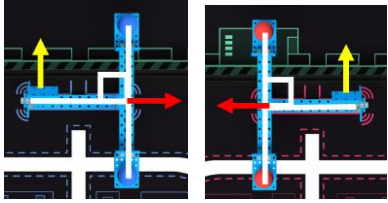
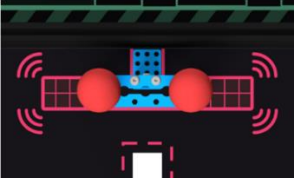


M01 and M02 are placed in the same position. Before the start of the competition, the committee will decide which missions the red and blue Teams must complete. The introduction is as follows:

<b>Independent Mission</b>	<b>M01. Enable Solar Power Station</b>	<b>M02. Send Traffic Signals</b>
<b>Mission Background</b>	On the edge of a city stands a solar power station, which is the city's energy core. Robots need to enable the solar power station and upload its operation data.	The transmitter at the edge of the city has failed. Robots need to reactivate the transmitter and send out data successfully.
<b>Scoring Props Placement</b>		
<b>Initial State Figure</b>		
<b>Initial state</b>	<ol style="list-style-type: none"> <li>1. The circular base is placed completely into the circle of the Competition Mat;</li> <li>2. The edge of the small ball bracket in the upper part is parallel to the edge of the rectangle of the Competition Mat (the two red lines in the figure above shall be parallel to each other);</li> <li>3. 2 red/blue balls are placed onto the ball's bracket;</li> <li>4. The circular base is not pasted onto the Competition Mat.</li> </ol>	<ol style="list-style-type: none"> <li>1. The bottom slide beam is completely placed and pasted into the rectangle of the Competition Mat with double-sided duct tape.</li> <li>2. The lever trigger at the upper side are oriented towards the Manual Area as the yellow arrows shown above;</li> <li>3. 2 red/blue balls are placed onto the ball's bracket.</li> </ol>
<b>Mission Target</b>	Robots aim to drop the red or blue balls onto the arena via preset automatic program.	
<b>Mission Score</b>	2 red/blue balls, 20 points each.	
<b>Scoring Judgement</b>	After the Automatic Stage ends, the red/blue ball is in contact with the Arena, including the Competition Mat (both the Automatic and Manual Area, the Competition Table, the inner or upper surface of the Competition Frame). The red/blue ball cannot still be in contact with the Robot or are dropped outside the Competition Frame.	



M03 and M04 are placed in the same position. Before the start of the competition, the committee will decide which missions the red and blue Teams must complete. The introduction is as follows:

<b>Independent Mission</b>	<b>M03. Rotate Radar</b>	<b>M04. Activate Door Switch</b>
<b>Mission Background</b>	The radar of the city requires routine maintenance. Robots need to maintain the radar and upload the data collected by the radar.	An urban data transmission node has accumulated a large amount of redundant data. Robots need to restart the transmission node and upload the latest operational data.
<b>Scoring Props placement</b>		
<b>Initial state Figure</b>		
<b>Initial state</b>	<ol style="list-style-type: none"> <li>1. The bottom slide beam is completely placed and pasted inside the rectangle of the Competition Mat with double-sided duct tape.</li> <li>2. The rotatable beams are oriented towards M08 (Alliance Mission Area) as the red arrows shown above.</li> <li>3. The bottom slide beam of the prop is perpendicular to the rotatable beam above.</li> <li>4. The slope beams are oriented towards the Manual Mission Area as yellow arrows shown above.</li> <li>5. Place 2 red/blue balls at the rotatable part of the ball's bracket.</li> </ol>	<ol style="list-style-type: none"> <li>1. The rectangular base of the prop is completely placed in the rectangle of the Competition Mat;</li> <li>2. The rectangular base is not pasted onto the Competition Mat;</li> <li>3. Place 2 red/blue balls at the upper part of the ball's bracket.</li> </ol>
<b>Mission Target</b>	Robots aim to drop the red or blue balls onto the arena via preset automatic program.	
<b>Mission Score</b>	2 red/blue balls, 20 points each.	
<b>Scoring Judgement</b>	After the Automatic Stage ends, the red/blue ball is in contact with the Arena, including the Competition Mat (both the Automatic and Manual Mission Area, the Competition Table, the inner or upper surface of the Competition Frame). The red/blue ball cannot still be in contact with the Robot or are dropped outside the Competition Frame.	



<p><b>Independent Mission</b></p>	<p><b>M05. Identify Obstacles</b></p>	
<p><b>Mission Background:</b></p>	<p>As an important part of Smart Links, Robots must have the basic function to identify, bypass, or remove obstacles.</p>	
<p><b>Scoring Props placement</b></p>		
<p><b>Initial state Figure</b></p>		
<p><b>Initial state</b></p>	<ol style="list-style-type: none"> <li>Two cubes are stacked into two layers and are completely placed into the squares of the Competition Mat.</li> <li>The base of the cylinder is placed completely into the circle of the Competition Mat.</li> <li>The blue Team uses the red cylinder, and the red Team uses the blue cylinder.</li> <li>Before each single match, among the three positions on each side (blue: A, B, C, red: D, E, F), two positions will be drawn out via Prop Card to place props.</li> <li>Dual cubes or cylinders can be placed in any position.</li> <li>The red and blue Team's cubes and cylinders are not necessarily placed in the same order.</li> <li>It is possible to have either two cylinders or two dual cubes for red and blue Teams. Since the individual value and quantity for cylinders and dual cubes are same, this scenario does not change the highest obtainable score.</li> </ol>	
<p><b>Mission Target</b></p>	<ol style="list-style-type: none"> <li>Robots aim to drop the upper cube into the Arena via preset automatic program.</li> <li>Robot keep the cylinder upright inside the initial circle before the Automatic Stage ends.</li> </ol>	
<p><b>Mission Score</b></p>	<p>20 points each for upper cube and cylinder, 2 props per side (red/blue).</p>	
<p><b>Scoring Judgement</b></p>	<p>After the Automatic Stage ends:</p> <ul style="list-style-type: none"> <li>The upper cube is in scoring state if it falls into the Arena, including the Competition Mat (both the Automatic and Manual Mission Area, the Competition Table, the inner or upper surface of the Competition Frame). The upper cube cannot still be in contact with the Robot or are dropped outside the Competition Frame.</li> <li>The cylinder is in scoring state if it remains upright in the initial circle of the Competition Mat.</li> </ul>	





**Dual Cube Scoring Judgement:**

2 cubes form a pair. If one of the cubes falls outside of the Arena (not in contact with either the Arena or the arena frame), this pair will not be considered as in the scoring state.

Status	Completely Separated	Partially Separated
Figure	 	 
Score Or Not	✓	✓

**Table 2.4 Scoring detail of the Dual Cube (side view)**

Status	Not Dropped	Completely Out of the Arena
Figure		
Score or Not	✗	✗

**Table 2.5 Scoring detail of the Dual Cube (side view)**

**Cylinder Scoring Judgement:**

The cylinder must be in upright position, which means its bottom must be fully in contact with the Arena. And it is not tilted, fallen or leaned.

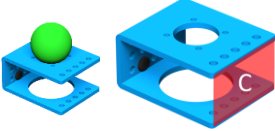
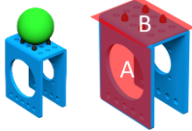
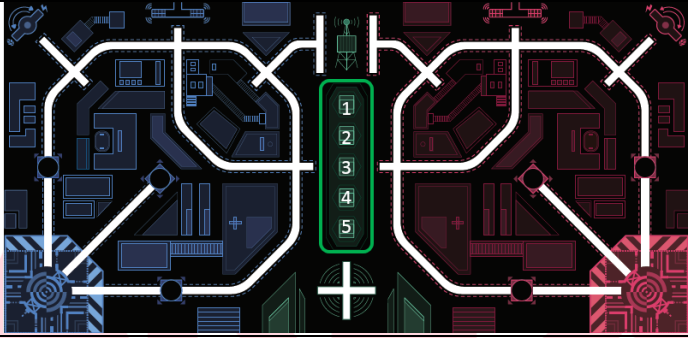
The cylinder must be Completely In or Partially In the initial circle to be considered as in the scoring state at the end of Automatic Stage. When the bottom of the cylinder is tangent to the initial circle, it is considered as in the “Partially In” state.

Status	Completely In	Partially In	Partially In
Figure			
Score or Not	✓	✓	✓

**Table 2.6 Scoring detail of the Cylinder (top view)**


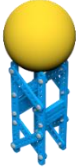
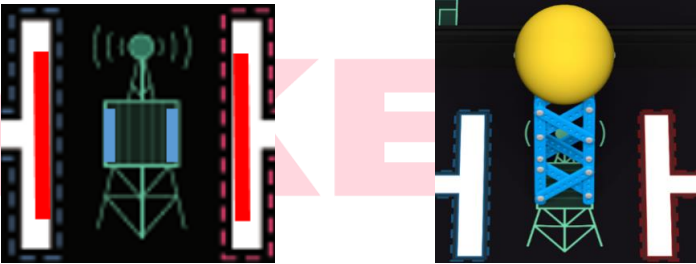


M06 and M07 are placed in the same position. Before the start of the competition, the committee will decide which missions the red and blue Teams must complete. The introduction is as follows:

Alliance Mission	M06. Community Data Inspection	M07. Traffic Data Inspection
Mission Background	The community data exchange centers are built for low-rise complexes. Robots need to regularly inspect and upload operational data of each community data exchange center.	The traffic data exchange centers are built for the transportation system. Robots need to regularly detect and upload operational data of each traffic data exchange center.
Scoring Props placement		
Initial state Figure		
Initial state	<ol style="list-style-type: none"> <li>1. M06 placement:                             <ul style="list-style-type: none"> <li>● Side A of the U-type bracket is pasted with double-sided duct tape;</li> <li>● Side A is Completely into the bigger rectangle on the Competition Mat;</li> <li>● Side B is oriented towards the Manual Mission Area.</li> </ul> </li> <li>2. M07 placement:                             <ul style="list-style-type: none"> <li>● Side C of the U-type bracket faces down;</li> <li>● Side C is Completely into the smaller rectangle on the Competition Mat;</li> <li>● The A side is oriented towards the Manual Mission Area.</li> </ul> </li> <li>3. A green ball is placed on top of each prop with a total of 3 props.</li> <li>4. Before each single match, 3 positions will be drawn out of the 1-5 positions in the form of Prop Card.</li> </ol>	
Mission Target	Robots aim to drop the green balls into the Arena via preset automatic program.	
Mission Score	3 green balls, 20 points each.	
Scoring Judgement	After the Automatic Stage ends, the green ball is in contact with the Arena, including the Competition Mat (both the Automatic and Manual Mission Area, the Competition Table, the inner or upper surface of the Competition Frame). The green ball cannot still be in contact with the Robot or are dropped outside the Competition Frame.	



M08 and M09 are placed in the same position. Before the start of the competition, the committee will decide which missions the red and blue Teams must complete. The introduction is as follows:

Alliance Mission	M08. Unblock Base Stations	M09. Unlock Elevated Base Stations
<p><b>Mission Background:</b></p>	<p>There are base stations in the city responsible for collecting data in a specified area. Robots need to unlock the full functions of these base stations.</p>	<p>There are elevated base stations in the city, responsible for communication with satellites to collect space data. Robots need to unlock the full functions of these elevated base stations.</p>
<p><b>Scoring Props placement</b></p>		
<p><b>Initial state Figure</b></p>		
<p><b>Initial state</b></p>	<ol style="list-style-type: none"> <li>M08 uses low bracket, M09 uses high bracket.</li> <li>The bottom of the prop is placed Completely In the rectangle of the Competition Mat.</li> <li>The slide beams on both sides of the prop must be parallel to the white guidelines on the Competition Mat (marked as red line in the figure above).</li> </ol>	
<p><b>Mission Target</b></p>	<p>Robots aim to drop the yellow ball into the Arena via preset automatic program.</p>	
<p><b>Mission Score</b></p>	<p>The yellow ball is worth 30 points.</p>	
<p><b>Scoring Judgement</b></p>	<p>After the Automatic Stage ends, the yellow ball is in contact with the Arena, including the Competition Mat (both the Automatic and Manual Mission Area, the Competition Table, the inner or upper surface of the Competition Frame). The yellow ball cannot still be in contact with the Robot or are dropped outside the Competition Frame.</p>	



<p><b>Alliance Mission</b></p>	<p><b>M10. City Data Collection</b></p>
<p><b>Mission Background</b></p>	<p>Each function area of the city gathers different data. Robots need to dump the data balls into the data processing center, which is deemed as a successful data collection process.</p>
<p><b>Scoring Props placement</b></p>	
<p><b>Initial state</b></p>	<ol style="list-style-type: none"> <li>1. The slide beams and brackets 3*3 are pasted Completely In the rectangles of the container placement zone;</li> <li>2. The container is constrained by slide beams and brackets 3*3, so it cannot be easily dislocated;</li> <li>3. 25 white balls are constrained by the ball holder in the white balls placement zone;</li> <li>4. The edge of the Loading Area which is closer to the container is pasted with a Hook &amp; Loop (Loop) as a boundary;</li> <li>5. After the match starts, the neatly arranged white balls will not be restored even if they are dislocated.</li> </ol>
<p><b>Mission Target</b></p>	<ol style="list-style-type: none"> <li>1. Place all the small balls into the container;</li> <li>2. Place the yellow ball on top of the container;</li> </ol>
<p><b>Mission Score</b></p>	<ol style="list-style-type: none"> <li>1. A total of 25 white balls in the Manual Mission Area, 10 points each, a total of 250 points;</li> <li>2. The balls moved from the Automatic Mission Area to the Manual Mission Area:             <ul style="list-style-type: none"> <li>● A total of 4 red balls, 20 points each, a total of 80 points;</li> <li>● A total of 4 blue balls, 20 points each, a total of 80 points;</li> <li>● A total of 3 green balls, 20 points each, a total of 60 points;</li> <li>● Only one yellow ball, 30 points, a total of 30 points.</li> </ul> </li> </ol>
<p><b>Scoring Judgement</b></p>	<p>After the match:</p> <ul style="list-style-type: none"> <li>● The small ball is in scoring state when it is fully the inside of the container, partially entering the container (e.g. located above the container) is not counted;</li> <li>● The yellow ball is in scoring state when it is on top of the container;</li> <li>● Balls are inside the Loading Area are not counted as valid scores.</li> </ul>

### Judgement of Balls inside the Container

All the small balls must be Completely In the Container to be considered as in the scoring state, as shown in Table 2.7.

If a small ball falls on top of the Container and does not enter the Container, it is not in the scoring state.

The states of all the small balls inside the Container are determined by this judgement, as shown in the figure below:

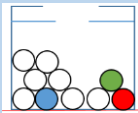
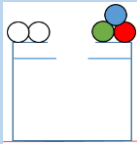
Status	Completely In	Partially In
Figure		
Score or Not	✓	✗

Table 2.7 Scoring detail of the Balls (side view)

The yellow ball is considered as in the scoring state when it is on top of the container (either Completely In or Partially In), as shown in Table 2.8.

Completely in means: the yellow ball falls into the hole of the Container.

Partially in means: the yellow ball is stationary above the Container and does not contact with the Robot.

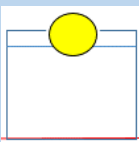
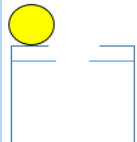
Status	Completely In	Partially In
Figure		
Score or Not	✓	✓

Table 2.8 Scoring detail of the Balls (side view)

### Judgement of Manual Loading

Only when the small ball is Completely In the Loading Area, the Observer can manually pick it up and load it onto the Robot (Already Completely In the Loading Area).

It is not allowed to manually touch the yellow ball at any time during the match.

Completely In refers to the small ball or Robot's vertical projection is fully into the Loading Area identified by the shadow part (the inner edge of the Hook & Loop).

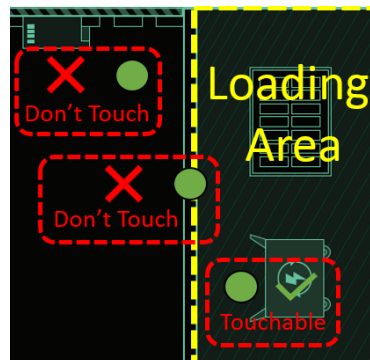
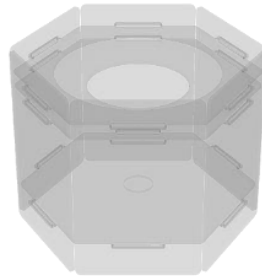


Fig 2.11 Whether Small balls can be touch

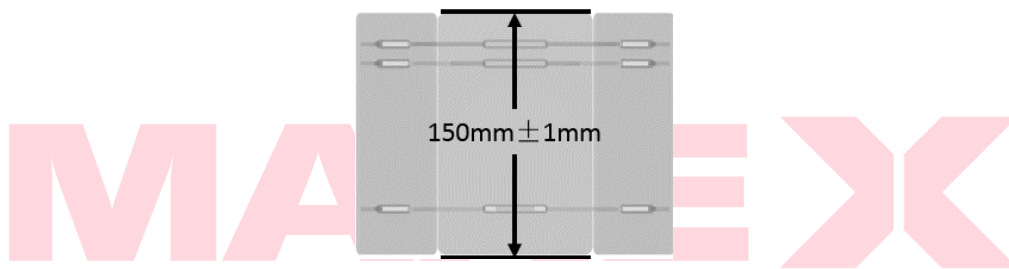


**Container**

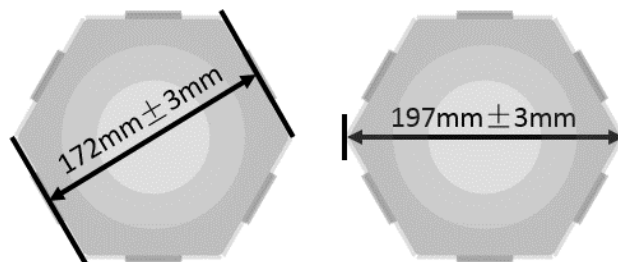
The main material of the Container is 3mm-thick Acrylic plates. The height of the container is  $150\pm 1$  mm. Its edge width is  $172\pm 3$  mm and the diagonal width is  $197\pm 3$  mm. The diameter of the circle in the center of the top Acrylic plate is  $130\pm 1$  mm, and the diameter of the circle in the center of the second Acrylic plate is  $80\pm 1$  mm.



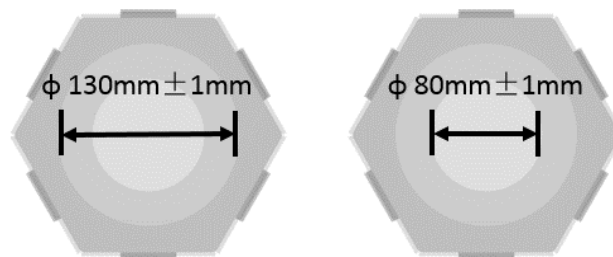
**Fig 2.12 Container**



**Fig 2.13 Container Height**



**Fig 2.14 Top view of the Container width**



**Fig 2.15 Container circle diameter**



## Mysterious Mission

Mysterious missions refer to the missions that may exist in National Competition; Intercontinental Competition; National Events in China and World Championship. If there is a Mysterious Mission, it will be announced in advance, and it will not be an existing mission (M01-M10). When it is published, the description of the Mysterious Mission is the same as the other missions, which is as follows:

<b>Mysterious Mission</b>	<b>MOX. Resolving Emergency Event</b>
<b>Mission Background</b>	In the daily life of the city, there are all kinds of emergencies; The Robot must go to the place where the incident occurs and handle it properly.
<b>Scoring Props placement</b>	The Mysterious Mission can be placed onto any part of the Competition Mat (Automatic Mission Area, Manual Mission Area). It is also possible to replace existing mission, for example: If MOX is placed on I1 (M01 or M02), and mission M01 or M02 will not occur in this entire competition.
<b>Props Description</b>	A figure that describes the shape, size, how it was triggered, and how it was installed.
<b>Initial state</b>	A figure and text description of how the prop is placed onto the Arena.
<b>Mission Target</b>	Describe what Robots should do, and what Robots want to achieve. It includes but not limited to movement, handling, sound and light indications, visual recognition, etc. This mission may be performed during the Automatic Mission Stage or during the Manual Mission Stage.
<b>Mission Score</b>	The Mission Score for the Mystery Mission MOX may be an independent mission score or an Alliance mission score. This mission score may affect the total score of the match.
<b>Scoring Judgement</b>	The score of the Mysterious Mission may be calculated after the Automatic Stage ends or after the entire match ends. The scoring state of the mission may be based on the Final State of the scoring prop, the Final State of the Robot, or the state of the prop itself (similar to Mission M05).

## 2.5 Scoring Explanation

Throughout the entire match, the Referee calculates scores twice: after the Automatic Stage ends and after the Manual Stage ends. During the match, the Referees monitor the progress of the match in real time and records any violations.

During the Preparation Stage that follows the Automatic Stage, the Referees calculate the corresponding independent mission (M01-M05) and the Alliance mission (M06-M09) score based on the state of the scoring prop. After the calculation of the scores, no subsequent actions of the Contestants or the Robots will affect the scores. The same Scoring Prop will not be counted repeatedly during the same scoring period.

After the Manual Stage, the Referee calculates the scores based on the quantity and color of the scoring balls in the Container.

### Red/Blue Team's Independent Mission Score

Red/blue Team's independent mission score is based on the total independent mission scores (M01-M05) in the Automatic Stage.

Scoring Prop	Quantity	Scoring States	Score Per Prop	Total Score
Red/Blue Balls	4	Contact Arena	20 Points	80 Points
Upper Cube	1	Contact Arena	20 Points	20 Points
Red/Blue Cylinder	1	Locate at Initial Position	20 Points	20 Points
Total Score	*	*	*	120 Points

Since the quantity of upper cubes and cylinders on the red/blue Team is added up to 2, there may be cases in the actual match where both positions are placed with just cubes or just cylinders, the quantity of upper cube and cylinder in the table above is as an example of the quantity of props.

The quantity of upper cubes and cylinders do not affect the calculation of the highest obtainable score as their total quantity and individual value are the same.

### Alliance Mission Score

The Alliance mission score consists of the score of the Alliance mission (M06-M09) in the Automatic Stage and the score of the Alliance mission (M10) in the Manual Stage.

#### Automatic Alliance Mission Score:

Scoring Prop	Quantity	Scoring States	Score Per Prop	Total Score
Green Balls	3	Contact Arena	20 Points	60 Points
Yellow Ball	1	Contact Arena	30 Points	30 Points
Total Score	*	*	*	90 Points





### Manual Alliance Mission Score:

Scoring Prop	Quantity	Scoring States	Score Per Prop	Total Score
Red Balls	4	Container	20 Points	80 Points
Blue Balls	4	Container	20 Points	80 Points
Green Balls	3	Container	20 Points	60 Points
Yellow Ball	1	Container	30 Points	30 Points
White Balls	25	Container	10 Points	250 Points
Total Score	*	*	*	500 Points

### Single-Match Points

After the end of each Single Match, the Referee will confirm the Team's Single Match Points. Each Team's Single Match Points consist of 3 parts: Alliance Mission Points, Independent Mission Points for the Red/Blue Team and the Violation Points. The method for calculating the Single Match Points are as follows:

**Single Match Points of Qualification Round** = Independent Mission Points for Red/Blue Team + Alliance Mission Points (Automatic + Manual) - Violation Points for Red/Blue Team.

**Single Match Points of Championship Round** = Independent Mission Points for Red Team + Independent Mission Points for Blue Team + Alliance Mission Points (Automatic + Manual) - Violation Points for Red Team - Violation Points for Blue Team.

**Single Match Total Points of Qualification Round** = 120 Points (Independent for Red/Blue Team) + 90 Points (Automatic Alliance) + 500 Points (Manual Alliance) - 0 Points (Violation Red/Blue) = 710 Points

**Single Match Total Points of Championship Round** = 120 Points (Red Independent) + 120 Points (Blue Independent) + 90 Points (Automatic Alliance) + 500 Points (Manual Alliance) - 0 Points (Violation Red) - 0 Points (Violation Blue) = 830 Points



## 2.6 Single-Match Flow Chart

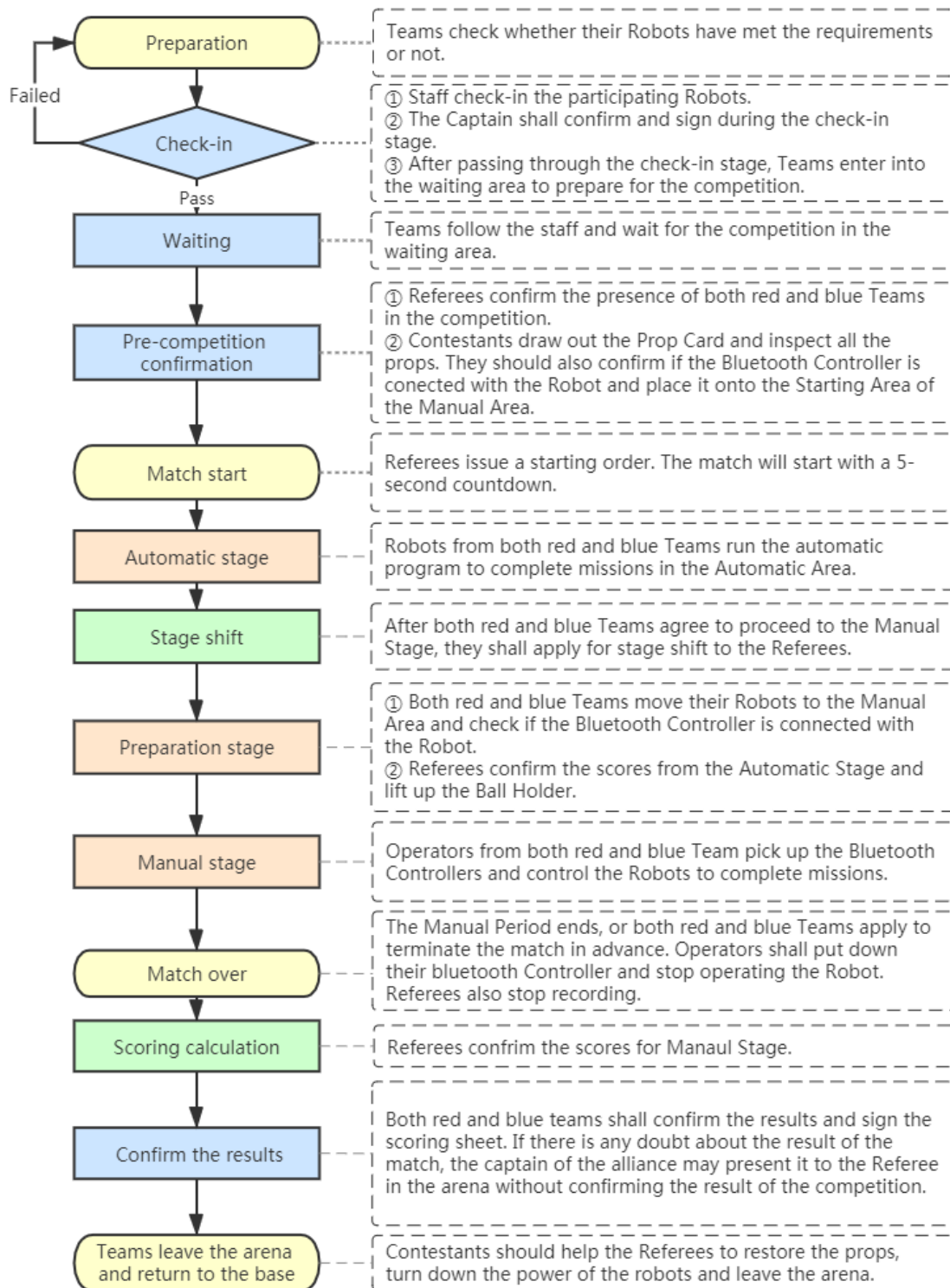


Figure 2.16 Single-Match Flow Chart



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## 3. Robot Technical Requirements

When the Teams are designing their Robots to participate in the 2020 MakeX Robotics Competition Starter Smart Links should comply with the following technical requirements. It is suggested that the Teams should read and get familiar with all the Technical Requirements before designing and constructing Robots. The Technical requirements provide a fair and safe competition platform for all Teams, and encourage Teams to make innovative designs of their Robots on the prerequisites of meeting technical requirements.

### 3.1 General Technical Requirements

The General Technical Requirement explains and defines the requirements of quantity, size and weight for the Subsystems of the Robot.

#### Subsystems of the Robot

- T01.** Subsystem 1: The mainboard and mobile Robot chassis (including wheels, tracks or other mechanisms) that enable 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.

#### Safety of the Robot

- T05.** Dangerous high-power equipment is not allowed to be used by the Teams during the competition and the preparation of the competition.
- T06.** If the Robot uses energy storage equipment (springs, etc.), Contestants should ensure the safety in the process of using it.
- T07.** The structures and parts of the Robots that may cause potential injury to personnel in the process of clamping, handling, etc. should be provided with safety precaution.
- T08.** Robots should not pursue the destruction of the site in the process of clamping and handling.



- T09.** Robots are not allowed to use flammable gases, parts with potential fire risk, hydraulic components, Mercury-containing components, exposed hazardous materials, unsafe counterweights, designs that may cause entanglement and competition delays, sharp edges, materials containing liquids or gelatinous substances, and any parts that may conduct electrical current from the Robot to the arena.
- T10.** The Robot's safety will be thoroughly checked during the Inspection. Teams can pre-check through the Robot Self-Checklist provided in the Appendix.

#### Number of the Robot

- T11.** Only one Robot per Team is allowed to compete in each regional competition, points race or 2020 MakeX World Championship. Any kind of replacement of the Robot is not allowed after Inspection.
- T12.** It is allowed to replace the defect parts of the Robot (such as wheels, motors or sensors) but except the mBot chassis.
- T13.** Replacement of the mBot chassis will be considered as using a second Robot, and the Team will be disqualified for all Single Match.

#### Size of the Robot

- T14.** The Size of Robot is only defined at inspection by its length, width and height. The vertical projection of the Robots on the horizontal plane must not exceed the specified dimension of the square area, and the height of the Robots must not exceed the specified dimension. This is considered that the Robot's size conforms to the Robot Size Requirements. Robot's height is measured from the horizontal plane of the arena (contact with Robots) to the furthest structure of the Robot respect to the arena plane.
- T15.** The maximum size means that the maximum extended size of the Robot must not exceed the limit at any time in any stage of the match, whether it is before or after modification.
- T16.** If the Robot uses flexible materials (including but not limited to cable ties and decorative stickers), the flexible materials must comply with the size requirements of the Robot without being affected by external forces when measuring the size of the Robot.



T17. The following table presents the Robot Size Requirements:

	Requirements	Remarks
<b>Maximum Extension Size</b>	280mm (Length) 280mm (Width) 300mm (Height)	<ol style="list-style-type: none"> <li>1. During the whole match, the vertical projection of the Robot on the Arena should not exceed 280 mm by 280 mm square area and the height should not exceed 300 mm.</li> <li>2. During Inspection, the Teams should demonstrate the maximum extended size of the Robot.</li> <li>3. The single-axis fixed structure must be tightened and ensure that the angle cannot be easily changed. Otherwise the maximum extended size of the active part will be recorded.</li> </ol>

Table 3.1 Robot Size Requirements

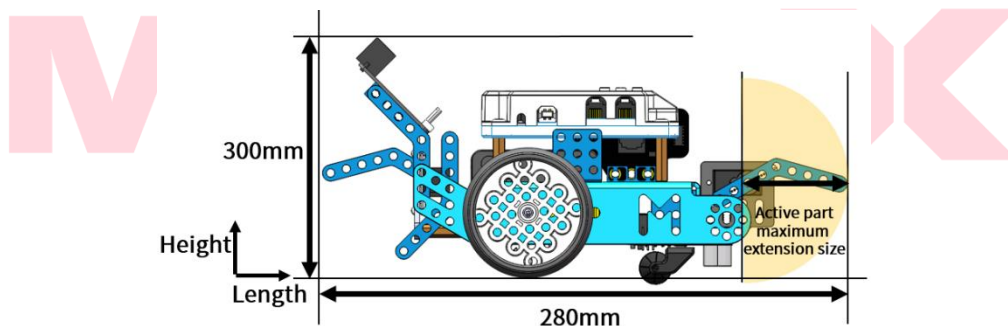


Figure 3.1 Maximum Size Top View

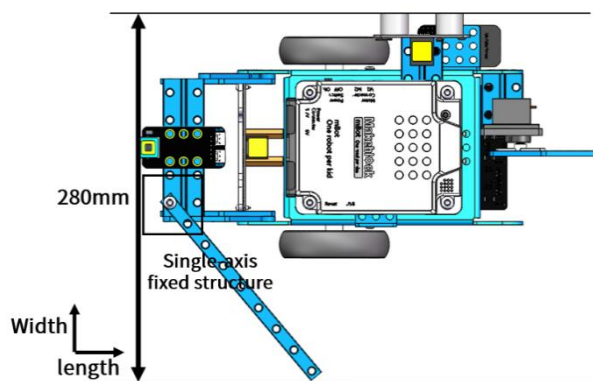


Figure 3.2 Maximum Size Side View



### Weight of the Robot

- T18.** Weight of the Robot refers to the net weight of the Robot at any time during the match (total weight of subsystem 1, 2 and 3, excluding the props from the Arena).
- T19.** Weight of Robot must be less than 2 KG.

## 3.2 Technical Requirements for Equipment

### Main Control Board

- T20.** Robots should use the specific mainboard (mCore, manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1) to prevent the Teams from using some of the high-efficiency mainboards to affect the fairness of the competition.

### Sensor

- T21.** 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.

### Motor and Servo

- T22.** The Robot should use the specific DC motors (130 DC geared motor 6V/312RPM or 130 DC geared motors 6V/200RPM manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 2) to ensure the fairness of the competition.
- T23.** The Robot should use the specific servo (9g micro servo manufactured and sold by Shenzhen Makeblock Co., Ltd., Installation Quantity: Maximum 1) to ensure the fairness of the competition.

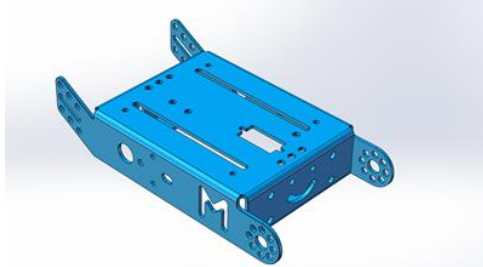
### Wireless-Control

- T24.** The Robot should use the specific wireless-control equipment (Bluetooth Controller and mBot Bluetooth modules manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1 of each).
- T25.** The Robots are only allowed to use mBot Bluetooth modules and Bluetooth Controller for wireless controls. The 2.4G Wi-Fi Controller is not allowed to use.



## Mechanical Parts

- T26.** There is no restriction on Robot chassis. Contestants can choose to use the mBot chassis manufactured and sold by Shenzhen Makeblock Co., Ltd. There is also no restriction on the quantity of the chassis.



**Fig 3.3 Robot Chassis**

- T27.** The following materials can be used to make self-made parts: 3D printing, corrugated paper, wood, Acrylic plate and rubber bands. No manufacturer LOGO is allowed to be attached onto homemade parts.
- T28.** Teams are not allowed to build Robots using similar commercial products (Not manufactured and sold by Shenzhen Makeblock Co., Ltd), including but not limited to multi-degree of freedom Robotic arms, Robots, metal/plastic structural parts, etc.

## Battery

- T29.** The Robots should use the specific model of 3.7V mBot battery (mBot battery manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1), as shown in Table 3.2 below. The battery must be securely fixed on the Robot.
- T30.** To ensure the fairness of the competition, it is prohibited to use 6V Power Connector (for AA battery holder).
- T31.** To ensure the fairness and safety of the competition, Teams should read the Instructions of Batteries (see Appendix 2).
- T32.** The Smart Camera should use the specific model of mBuild battery (mBuild battery manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1) or the specific model of 3.7V mBot battery (mBot battery manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1), and the battery must be securely fixed on the Robot.
- T33.** Smart Camera cannot use two or more than two battery at the same time.



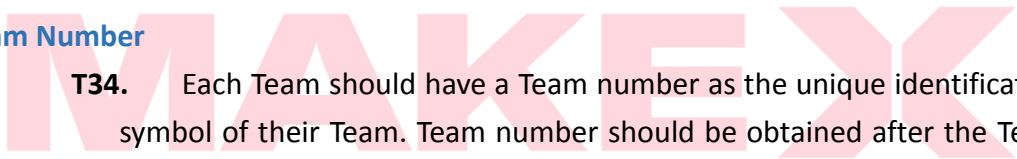


<p style="text-align: center;">✓</p> <p style="text-align: center;">Mainboard Smart Camera Allowed</p>	<p style="text-align: center;">✓</p> <p style="text-align: center;">Only Smart Camera Allowed</p>	<p style="text-align: center;">✗</p> <p style="text-align: center;">Prohibited</p>

**Table 3.2 Allowed and Prohibited Model of Vision Sensor Battery**

### 3.3 Other Technical Requirements

#### Team Number



**T34.** Each Team should have a Team number as the unique identification symbol of their Team. Team number should be obtained after the Team has registered on MakeX official website.



## 4. Competition Rules

### 4.1 Penalty

#### Warning

**R01.** The Referee gives the Team an oral notice of the first violation and asked the Team to stop the violation and obey the Referee's instructions. During the Warning, the competition will be timed normally. Every Team in qualification round has and has only one chance to be warned. Alliance in a single match of championship round has and only has one chance to be warned. If a Team or Alliance are violate some rules and also being warned once before in this single match, the Referee will be directly convicted of the violation.

#### Violation

**R02.** The Referee immediately announced the violation to the Team and deducted 20 points from the Team as soon as it found a violation (the Team had been warned once before in this single match). During the Violation, the competition will be timed normally.

**R03.** During the competition, if any scoring advantages are obtained because of the violation, the scoring advantages are invalid and the Scoring Props will become Invalid Prop.

#### Invalid Prop

**R04.** From the moment the conditions for Invalid Prop are reached, it will trigger the Invalid Prop and the Referee will announce the specific prop is invalid.

**R05.** The Invalid Props will be removed from the Arena by the Referee and cannot continue to get points, if the prop which was already invalidated lead to a new penalty, then the penalty will continue as usual.

**R06.** The Referee has the right to determine whether the Final State of the prop before invalid can be scored or not according to the contents of this Guide.

#### Disqualify Single Match

**R07.** During the match, the Team violated the rules, resulting in invalidate of the score of the match, but did not affect other match.

#### Disqualify Entire Competition

**R08.** During the competition, serious violations of safety rules or serious violations of the spirit of the competition, resulting in invalidate of all competition results, the Team will lose the opportunity to continue to participate in the competition and the right to award.

## 4.2 Safety

### Robot's Safety

- R09.** The design and construction of the Robots by the Teams should meet the Technical Requirements.
- R10.** Each part of the Robot should be used safely under the guide of the Mentor.
- R11.** The Robot should not eject or launch any parts from itself on purpose.
- R12.** Robots should not use double-sided adhesive tape or glue to paste the Arena Props throughout the whole match.
- R13.** The Referee has the right to reject dangerous Robots to enter the arena for competition. The Referee has the right to judge whether to disqualify the Team for all Single Match according to the danger level of the Robot.

### Team's Safety

- R14.** Under the guide of the Mentor and after reading this Technical Guide, Contestants can proceed to prepare for the competition and to design and construct their Robot.
- R15.** In the preparation process, the Team must follow the instructions of the Mentor and should not perform any dangerous action without Mentor's authorization.
- R16.** The Team should pay attention to safety when using dangerous tools (screwdrivers, sharp knives) and must use under the guide of their Mentors.
- R17.** During the competition, Teams should wear goggles; long hair should be tied up; Teams are prohibited from wearing slippers into the competition arena.
- R18.** During the competition, Teams should not press the table heavily or perform other dangerous actions (e.g. damage the arena or props).
- R19.** The Referee has the right to reject the Teams that do not conform the safety rules to enter the competition arena. The Referee has the right to disqualify a Team for all Single Match according to the level of danger.

## 4.3 Operation

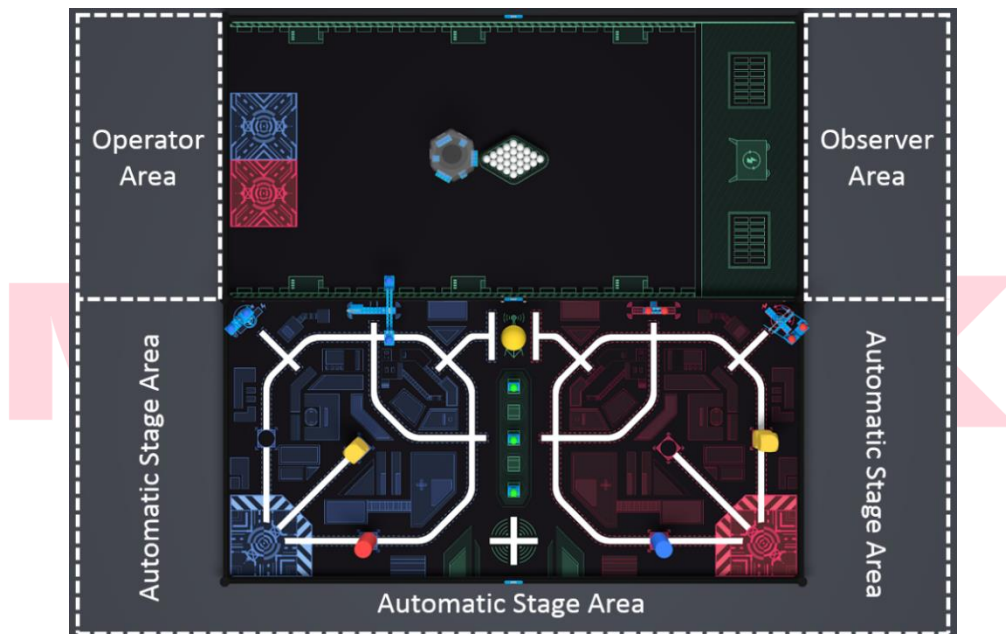
### Late Arrival

- R20.** Teams should arrive on time, and the Referee has the right to disqualify Teams for one Single Match who are not present on time.

## Role and Position during Competition

**R21.** During the automatic stage, the Contestants can compete in the following area (shown by figure 5.1). The dimension of area may vary according to the actual size of the competition venue.

**R22.** In the manual stage, an Operator and an Observer for each Team are required to compete in the following area (shown by figure 5.1). The Contestants are not allowed to compete outside the specific operating area. If there is only one Contestant in the Team, one specific competition role should be selected to participate in the competition, do not act as both Operator and Observer (example: Operator cannot operate the Robot with a Bluetooth Controller in the Observer Area). The dimension of area may vary according to the actual size of the competition venue.



**Fig 5.1 Operation Area**

**R23.** In the manual stage, if the Operator and the Observer need to exchange their roles, they should apply to the Referee and announce, “Red/Blue Team exchange role”. After the Referee responds, “Agree Red/Blue Team Exchange”, the current operation should be stopped, and the Contestants go to the correspondent operation area to continue the competition. During the change of roles, the competition will be timed normally. A violation of this rule will be deemed to be a violation.

## Using Programming Tools

**R24.** During the competition, the Teams should not bring computers, tablets, etc. into the arena for programming. In case of Using Programming Tools inside the arena, the Referee has the right to disqualify the Teams for one Single Match.



### Robot Start

- R25.** The Contestants must start the Robot in their Starting Area after the Referee announces the start of the competition. Only when the Robot is placed inside the Starting Area (the vertical projection of the entire Robot is within the Starting Area), the Team can switch on the Robot's power.
- R26.** If the Robot is started outside the Starting Area, the Team will get a Violation. In some serious cases, the Referee have the right to disqualify the Team on this single match.
- R27.** If the Robot is not started Completed In Starting Area, it will consider as Robot started outside the Starting Area.

### Robot Start in Advance

- R28.** Contestants must start the Robot after the Referee announces the start of the competition. If the Robot is started in advance, the Team will get Violation.

### Robot enters the wrong area

- R29.** The Robot cannot Completed In the Manual Mission Area for any reason during Automatic Stage. Same as Manual Stage, the Robot cannot Completed In the Automatic Mission Area for any reason. Once the Robot is completed enter the area different from its stage, Contestants must immediately apply to restart and remove their Robot. It will get a Violation. In some serious cases, the Referee has the right to disqualify the Team for this single match. If the Contestant refuses to apply for restart Robot, the Referee has the right to disqualify the Team for the single match. Restart and Modification of the Robot

### Wireless Remote-Control Operation

- R30.** Except for the manual stage, the Teams should not use Bluetooth communication, 2.4 G WI-FI communication or infrared communication, etc. to control the Robots in the competition area. Otherwise, they will be deemed as manual control of the Robots. Except during the manual stage, the Team who manually controls a Robot in the competition will be disqualified for one Single Match.
- R31.** The connection between the Robots and the wireless controller must be completed before the competition start and the wireless controller must be always powered on during the whole competition. After the Automatic Stage, the Team can test the connection between Robot and controller. Robots are not allowed to be wirelessly controlled during the Automatic Stage. Otherwise, the Referee has the right to disqualify the Teams for one Single Match.



### Robot Restart & Modification

- R32.** During the competition, the Contestants can restart and modify the Robot at any time.
- R33.** If the Contestants choose to restart or modified their Robot, the Contestant of the Red/Blue Team should raise his hand to the Referee and announce, "Red/Blue Team requests Restart". After the Referee responds, "Agree Red/Blue Team Restart", the Robot can be taken out by Contestants for restart or modification.
- R34.** The Robot can be modified after been taking out from the arena. The modified Robot must conform to the technical requirements. Referees have the right to spot check the Robots after the end of each Single Match. If the Robot has non-conformity with technical requirements or violations, the Referee has the right to disqualify the Team for one Single Match.
- R35.** If Contestants restart the Robot when it touches the props, the Contestant's action will be regarded as Indirect Contact. The correspondent prop becomes invalid (no scoring for following operations), but it does not affect the points that the props have scored before. If other props are also touching with the prop which in contact with the Robot, the other props become invalid as well. It will be violation each time Indirect Contact. In some serious cases, the Referee has the right to disqualify the Team for this single match. The restart and/or modification of the Robots will not suspend the competition, and the competition will be timed normally.

### Violation Due to Contact with the Robot

- R36.** During the competition, with the exception of obtaining restart permission from the Referee, Contestants are strictly prohibited from directly contacting Robots which are not located inside one of the Starting Area. Each violated contact with Robot will be considered as a Violation. If the violated contact with Robot completes the mission, the scoring prop(s) in that mission will become invalid, and the prop(s) cannot be scored. In some serious cases, the Referee has the right to disqualify Teams for one Single Match.

### Violation Due to Contact with the Props

- R37.** During the competition, except for the designated area in the manual stage, the Contestants are strictly prohibited from directly contacting the props. Each violated contact with props will be considered as a Violation. If the violated contact with props completes the mission, the scoring prop(s) in that mission will become invalid, and the prop(s) cannot be scored.



### Referee Picks Robot

**R38.** If the Robot cannot be reached by the Contestants, they can ask the Referee for help. The Contestant can raise his hand to the Referee and announce, “Blue Team requests take out” or “Red Team requests take out”. The responsibility for any kind of impact due to the Referee's touch should be undertaken by the Team itself.

### Props Enter Starting Area

**R39.** If the Robot moves any prop Completely In or Partially In the Starting Area and affecting the start or restart of Robot, the prop will not be taken out by any person during the competition. Any penalty relative to this corresponding prop will count as usual regardless whether it's located at Starting Area.

### Handling Out-of-Arena Props

**R40.** If the Robot moves any props Completely Out the Arena, the corresponding props will become an Invalid Props and cannot put back on Arena.

### Robot Keep in Contact with Props

**R41.** When a scoring prop is in contact with a Robot, the scoring prop does not score regardless of whether it is in the scoring state.

### Violation Due to Mentoring

**R42.** During the whole process of the competition, including but not limited to the parents or Mentors of the Contestants must not go into the competition area or give any form of Mentoring to the Contestants by any means. In case of violated Mentoring happens, the Referee has the right to disqualify the Team for one Single Match.

### Deliberately pressing or hitting the Arena

**R43.** During the whole course of the competition, the Contestants shall not deliberately press or hit the playing field. If Contestants gain a scoring advantage after pressing or hitting the Arena, the scoring advantage is invalid and the Scoring Props associated with it will be invalidated.

### Egregious Behaviors

**R44.** It will be regarded as Egregious Behaviors if a Team or a person related with the Team incurs into, but not limited to, any of the following circumstances. In case of Egregious Behaviours happens, the Referee has the right to disqualify a Team for one or all Single Match.

- Impolite behaviors (abuse, bad words, unnecessary physical contact).
- Seriously affecting the competition and the safety of the audiences.



Interfering the process of competition.

- Seriously violating the spirit of competition (e.g. cheating).
- Repeated violations or ignoring the Referee's warning.

#### Malicious destruction Alliance's Props

**R45.** During the match, if any Team intentionally invalidates its Alliance Scoring Props, the Referee has the right to disqualify the Team on that single match, and the match is completed independently by the remaining Teams.

#### Uncertainty of Props and Arena

**R46.** Due to the uncertainty of production and processing, there will be unavoidable minor difference (Dimensions, weight, color or flatness) for all props and Arena. The design of the Robot should consider and adapt those factors. If there are other free props and arena, Contestants are allowed to request for exchange. Robots should be able to adapt to the uncontrollable factors such as folds of mat, changes in lighting, etc. The Teams should perform their own targeted testing for those uncontrollable factors' impact on Robot.

#### Unexpected Quit

**R47.** After onsite registration, if the Team cannot continue the competition due to unexpected reasons, the Team should report the reason to the MakeX Robotics Competition Committee and the sessions involved by the Team must be held as usual.

### 4.4 Similar Robot

**R48.** It is not allowed that two or more than two Robots with a 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.

### 4.5 Abnormal Situation

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

#### Potential Safety Risk

**R49.** The competition venue emerges problems that might affect the safety of Teams or Robot.

#### Damage of Arena or Prop

**R50.** The props or arena are damaged accidentally, and the competition cannot continue.





## Re-competition

- R51.** Referees have the right to discuss and determine if a Re-competition is necessary according to the actual situation.
- R52.** The abnormal situation caused by the Team themselves such as low battery life, failure of Robot's parts etc. will not lead to Re-competition.

## 4.6 Explanations

- R53.** 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.
- R54.** During the competition, all matters not specified in the Technical Guide are decided by the Referee Team.
- R55.** This Technical Guide is the reference for the Referee. During the competition, the Referee has the right to give final decision.

# MAKE X



## 5. Technical Guide Statement

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.

The MakeX Robots Competition Committee reserves the final interpretation of MakeX Robots Competition - Technical Guide for Smart Links.

### 5.1 Disclaimer

All Contestants in 2020 MakeX Robotics Competition should fully understand that safety is the most important issue for the sustainable development of MakeX Robotics Competition. To protect the rights and interests of all Contestants and organizers, according to relevant laws and regulations, all Contestants registered for the MakeX 2020 Robots Competition Starter Smart Links, should acknowledge and abide by the following safety provisions:

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

Contestants should 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 should be manufactured and operated by persons with relevant professional qualifications.

During the competition, the Teams should 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 arenas.

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

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

### 5.2 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.



## Appendix 1: Terms

### Roles

**Contestant:** Participant who registered and participated in the 2020 MakeX Robotics Competition Starter Smart Links.

**Mentor:** Coach who registered and participated in the 2020 MakeX Robotics Competition Starter Smart Links.

**Alliance:** The resulting combination of two Teams competing simultaneously in one arena.

**Team:** Team is composed of Contestants and Mentors, who are registered and will participating in the 2020 MakeX Robotics Competition Starter Smart Links.

**Captain of Alliance:** The two Teams that form the Alliance should designate one of the Contestants on the arena as the captain of the Alliance.

**Robot:** Robot that the Team designed, constructed and participated in the Starter Smart Links for the MakeX 2020 Robots Competition.

**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.

**Operator:** During the manual stage, the driver who controls the Robot by the Bluetooth Controller.

**Observer:** During the manual stage, the Contestants who observe and provide feedback of the competition, and also responsible for stacking in the garbage station.

### Robot

**Moving:** The Robot transports the competition props by changing the position of the props.

**Parts:** In addition to the mechanical parts and electronic parts, other elements used for the Robot construction.

**Flexible Material:** During the competition, the material that can have an obvious deformation due to the action of the Robots.

### Competition

**Competition Mat:** The field where all the competition elements are placed, including missions, guideline, props, etc.

**Competition Table:** Refers specifically to the rectangular area of the Competition Frame.

**Competition Frame:** Used to block Scoring Props from dropping off-field borders.

**Arena Props:** Scoring Props and Mission Props are collectively referred as Arena Props.

**Scoring Props:** The Scoring Props are divided into three categories by scoring methods: Ball, Cube, and Cylinder. Includes Cubes, red/blue cylinders, red balls, blue balls, green



balls, white balls, and yellow balls.

**Mission Props:** An object that carries a Scoring Props.

**Starting Area:** The area where the Robot can start. When the vertical projection of the chassis of the Robot is Completely In this area, the Robot can be started.

**Mission Area:** The area where the missions and corresponding props are located. It is divided into automatic mission area and manual mission area.

**Operator Area:** During the manual stage, the area where the Operator is allowed to stay.

**Observer Area:** During the manual stage, the area where the Observer is allowed to stay.

**Guideline:** The white line, width of 25 mm, on the Competition Mat that can guide the movement of Robot.

**Single Match Points:** Used for ranking in the Qualification Round and the Championship Round.

### Refereeing

**Initial State:** Description of the initial placement of the Mission Props and Scoring Props.

**Stationary State:** Props or Robots are not moving respect to the Competition Mat.

**Final State:** The eventual condition of the props or the Robots after the end of the competition or stage.

**Direct Contact:** There is physical contact at any point on the surface of the two objects. Or during the competition, the Contestant touches the props or Robots, where contact ways include but are not limited to: skin, hair, clothing, accessories.

**Indirect Contact:** During the competition, when the Contestants have Direct Contact with the Robots and at the same time the Robots also have contact with props.

**Completely In:** The vertical projection of the props or the Robots are completely located in the designated area.

**Partially In:** The vertical projection of the props or the Robots are partially located in the designated area or have contact with the designated area.

**Completely Out:** The vertical projection of the props or the Robots are completely outside the designated area.

## Appendix 2: Competition Resources

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

Any Feedback & Question Please Sent to: [makex\\_overseas@makeblock.com](mailto:makex_overseas@makeblock.com)

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

### Instruction of mBot batteries:

1. The output voltage of battery will decrease because of lower power or aging.
2. If the output voltage lower than a certain level, it may have an impact on the stability of the system.

### Recommendation:

1. Use a newer battery when participating in the competition.
2. Fully charge the battery before each game.

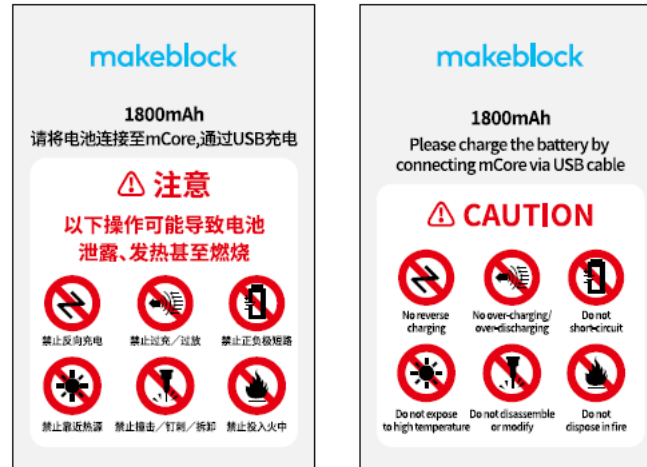


Fig. A Battery Safety Instruction



## Appendix 3: MakeX Starter Robot Self-Check List (Smart Links)

MakeX Starter Robot Self-Check List (Smart Links)			
Safety of Robot			
No.	Items	Specific Requirements	Status
1	High-power Equipment	Dangerous high-power equipment is not allowed to be used by the Teams during the competition and the preparation of the competition.	
2	Energy storage equipment	If the Robot uses energy storage equipment (springs, etc.), it should ensure the safety in the process of using.	
3	Safety protection	The structures and parts of Robots that may cause potential injury to person in the process of clamping and handling etc. should be provided with safety protection.	
4	Damaged arena	Robots should not take the initiative to destroy the site in the process of clamping and handling.	
5	Banned substance	Robots are not allowed to use the flammable gases, parts with potential fire risk, hydraulic components, Mercury-containing components, exposed hazardous materials, unsafe counterweights, designs that may cause entanglement and competition delays, sharp edges, materials containing liquids or gelatinous substances, and any parts that may conduct electrical current from the Robot to the arena.	



<b>Number, Size and Weight of Robots</b>			
<b>No.</b>	<b>Items</b>	<b>Specific requirements</b>	<b>Status</b>
6	Number of Robots	Only one Robot is allowed to compete in each point race or 2020 MakeX World Championship. Any kinds of replacement of the Robot is not allowed after Inspection.	
7	Robot's size	Robots should conform to the requirements by T14, T15, T16, T17.	
8	Robot's weight	Weight of Robot should be less than 2 KG during the competition.	
<b>Parts of Robot</b>			
<b>No.</b>	<b>Items</b>	<b>Specific Requirements</b>	<b>Status</b>
9	Mainboard	Robots should use the specific mainboard (mCore, manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1).	
10	Sensor	Robots should use the specific electronic sensors (electronic sensors manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: not limited)	
11	Motor	The Robot should use the specific DC motors (130 DC geared motor 6V/312RPM or 130 DC geared motors 6V/200RPM manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Maximum 2)	
12	Servo	The Robot should use the specific servo (9g micro servo manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1).	
13	Wireless control	The Robot should use the specific wireless-control equipment (Bluetooth Controller and mBot	



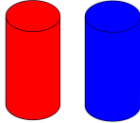

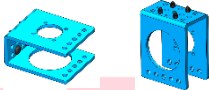
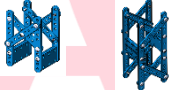








		Bluetooth modules manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1 of each).	
14	Chassis	The Robot chassis can use the mBot chassis manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: No limit.	
15	Self-make parts	The following materials can be used to make self-made parts: 3D printing, corrugated paper, wood, Acrylic plate and rubber bands. No manufacturer LOGO is allowed to be attached onto homemade parts.	
16	Mechanical parts	Teams are not allowed to build Robots using similar commercial products (Not manufactured and sold by Shenzhen Makeblock Co., Ltd), including but not limited to multi-degree of freedom Robotic arms, Robots, metal/plastic structural parts, etc.	
17	Battery	The Robot's main board should use the specific model of 3.7V mBot battery (mBot battery manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1). The Smart Camera should use the specific model of mBuild battery. (mBuild battery manufactured and sold by Shenzhen Makeblock Co., Ltd., Quantity: Maximum 1). The battery must securely fixed on the Robot. Robot is prohibited to use 6V Power Connector (for AA battery holder).	





## Appendix 4: List of Props

Name	Figure for Reference	Key size <sup>1</sup>	Mission Used
Yellow block		Maximum Length 70mm	M05
Color Balls		Diameter 32mm ±2mm	M01-M04, M06-M07,M10
Red/Blue Cylinders		Height 140mm Diameter 70mm	M06
Yellow Ball		Diameter 90mm ±3mm	M08,M09
Motor rack		*	M06,M07
Ball rack		*	M08,M09
Solar Power Station		*	M01
Transmitter		*	M02
Radar		*	M03
Door type switch		*	M04
Ball Holder		*	M10
Container		*	M10

<sup>1</sup> Prop's size has unavoidable error, please read Competition Rules R45 & R46 for details.

\* Please refer to the real prop for the size.



MakeX Robotics Competition Committee

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**Official Website:**

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

(EN): [www.makex.io](http://www.makex.io)

**Instagram:**

[makexofficial](https://www.instagram.com/makexofficial)

**Facebook:**

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