MAKEX

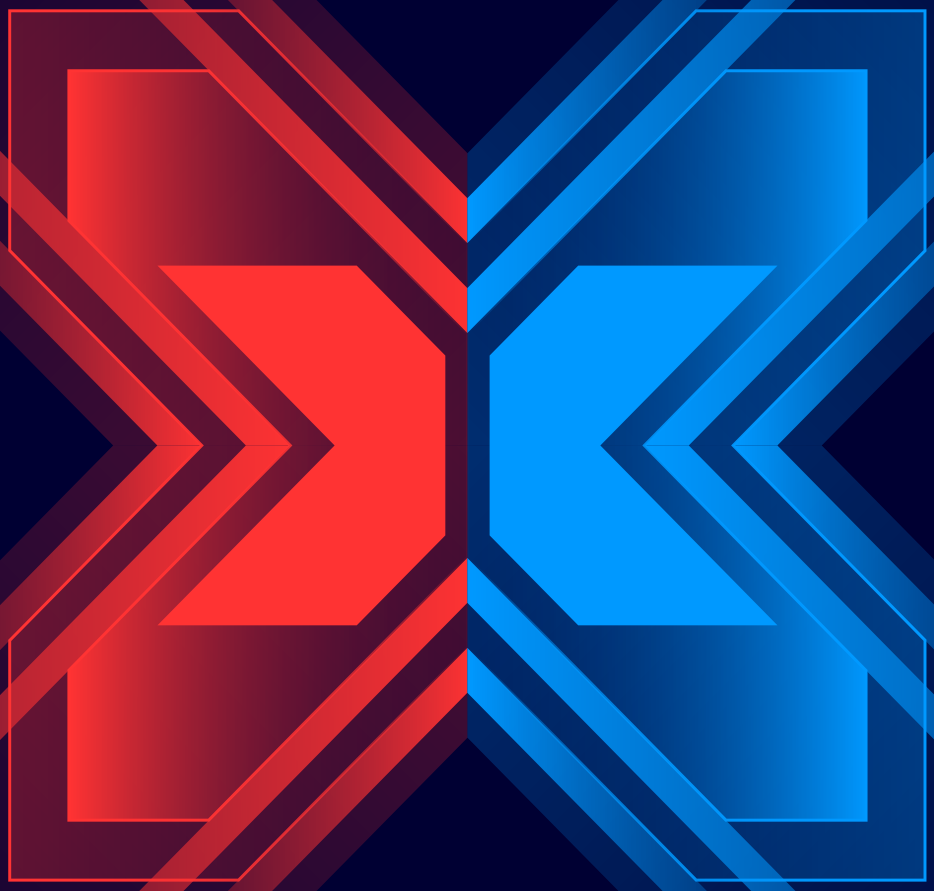
V 1.0

2020 MAKEX ROBOTICS COMPETITION

TECHNICAL GUIDE

MAKEX STARTER

SMART LINKS



Edited By MakeX Robotics Competition Committee

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CONTENTS

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.

2. Competition

2.1 Background

In the 2020 Season, the theme of MakeX Starter is “Smart Links”, which mainly tests contestants’ logical thinking, strategic teamwork, and problem-solving abilities.

In daily life, there will always be annoying moments, for example traffic congestion during off-duty hours and the parking difficulties. Urban garbage contributes to traffic inconvenience. In the AI era, we expect smart transportation to make full use of technologies such as the Internet of Things, cloud computing, the Internet, automatic control, and mobile Internet to create a mobile transportation scene where everything is interconnected through signals and energy. Let us enter the AI era together in 2020 to facilitate people's lives!

2.2 Arena

The Arena of MakeX Robotics Competition Starter Smart Links is divided into three parts Competition Mat, Competition Table and Competition Frame. The total size of the Arena is 2440 × 2440mm.

Fig 2.1 Competition Arena

Competition Mat Size

Competition Mat is divided into two parts: 2370 × 1150 mm Automatic Missions Area and 2370 × 1150 mm Manual Missions Area.

Automatic Mission Area

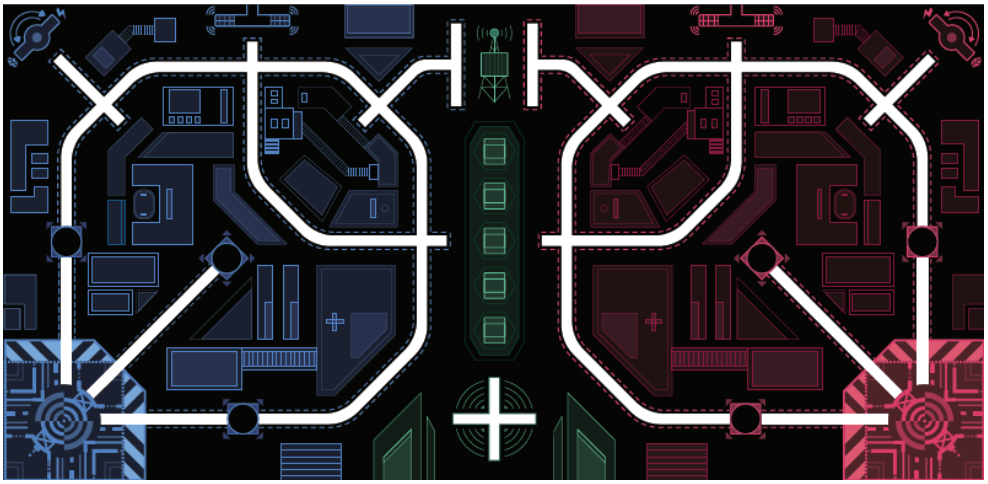


Fig 2.2 Automatic Mission Area

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

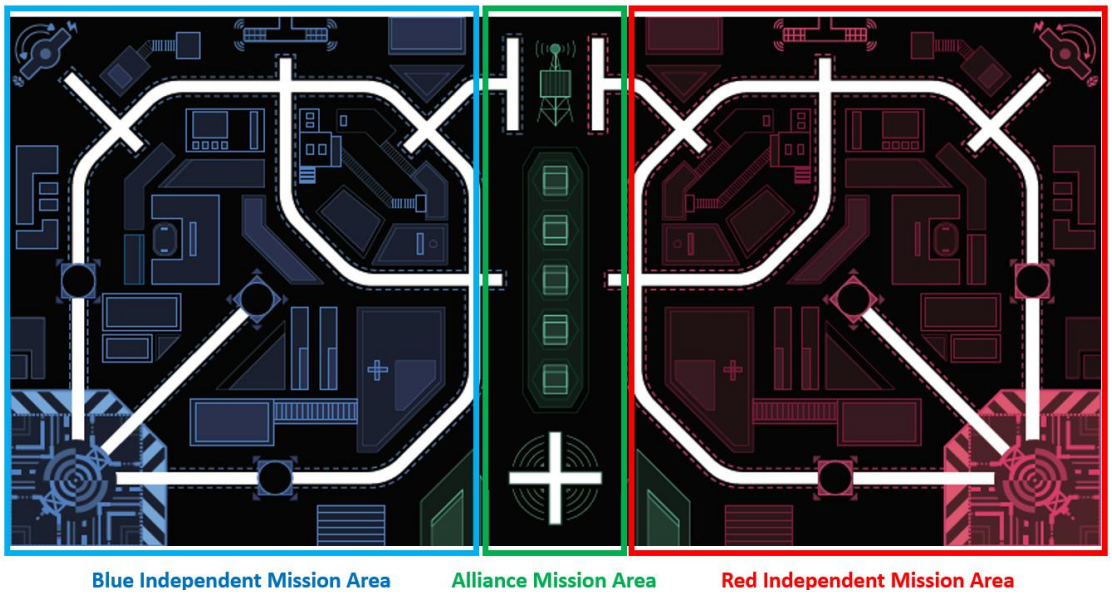


Fig 2.3 Red/Blue Independent and Alliance Mission Area

There are six types of areas in the Automatic Mission Area: I1, I2, I3, A1, A2 and S.

The red and blue sides each have one I1 area, one I2 area, three I3 areas, and one S area, symmetrically distributed along the centerline of the Automatic Mission Area, representing their own Automatic Independent Mission Areas.

There is only one A1 area and A2 area in the middle of the Automatic Mission Area, as shown in Figure 2.4 below.

The division of the above areas is only for naming and location indication purposes, not dimensional positioning. The location of the details is based on the actual Competition Mat.

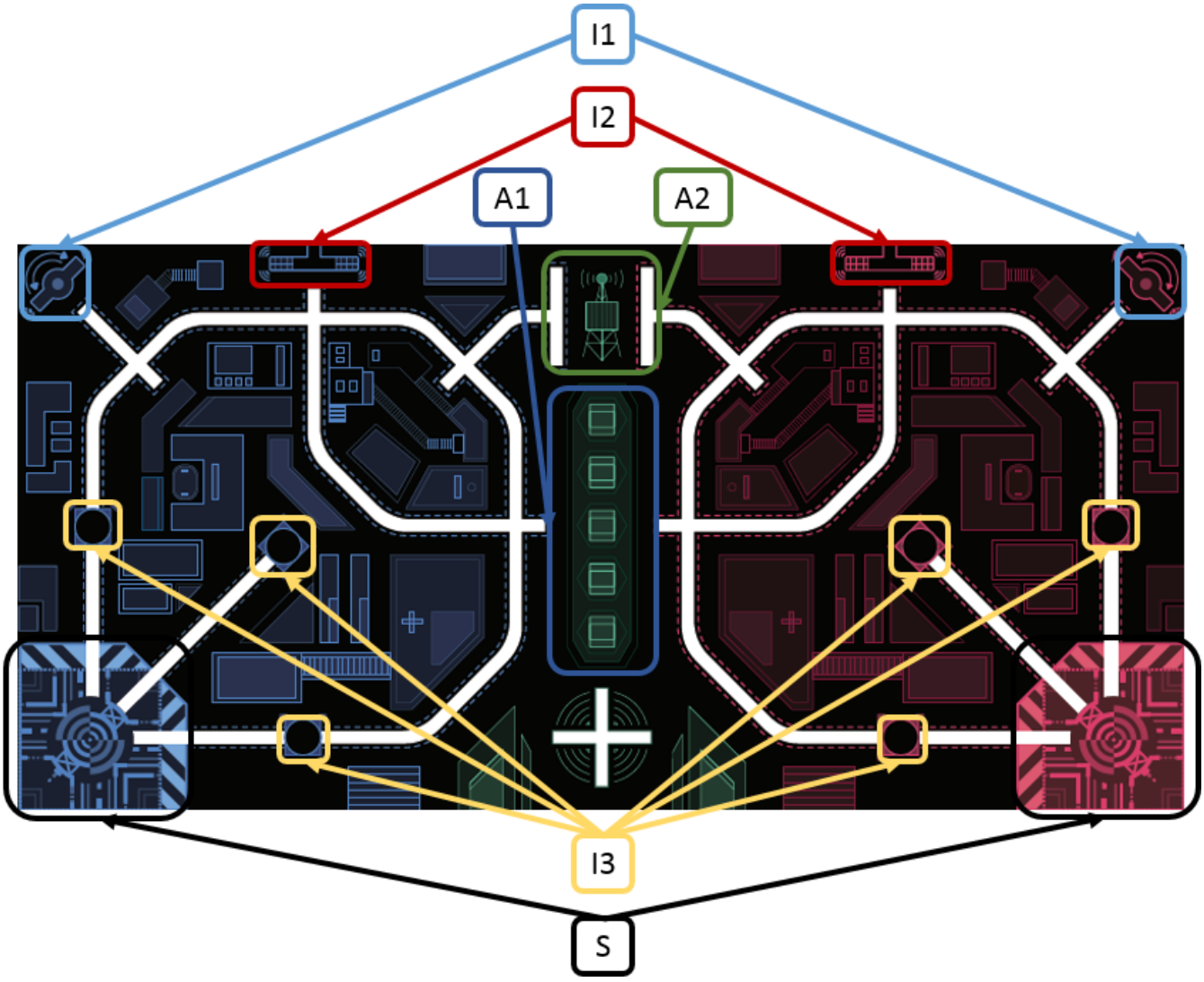


Fig 2.4 Automatic Mission Area - Area Code

In the Automatic Mission Area, the names of the corresponding Area Code and the description of the Area Function are provided in table 2.1 below.

For more information about how to select missions, see 2.6 Mission Selection Method.

Area Code	Area Name	Area Function
S	Starting Area	Initial Position for Start & Restart Robot
I1	Independent Mission Area 1	Initial Position for M01 & M02
I2	Independent Mission Area 2	Initial Position for M03 & M04
I3	Independent Mission Area 3	Initial Position for M05
A1	Alliance Mission Area 1	Initial Position for M06 & M07
A2	Alliance Mission Area 2	Initial Position for M08 & M09

Table 2.1 Automatic Mission Area - Area Description

Manual Mission Area

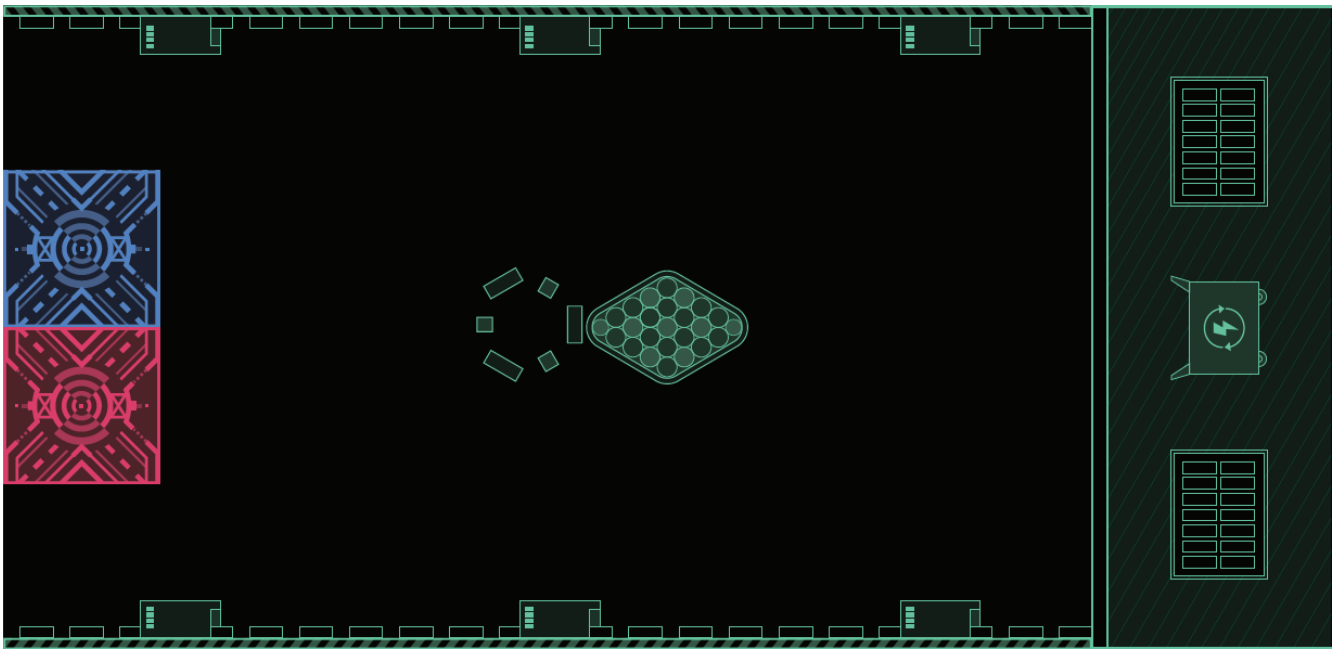


Fig 2.5 Manual Mission Area

There are five types of areas in the Manual Mission Area: A3, C, P, L and S, as shown in Figure 2.6 below.

The division of the above areas is only for naming and location indication purposes, not dimensional positioning. The location of the details is based on the actual Competition Mat.

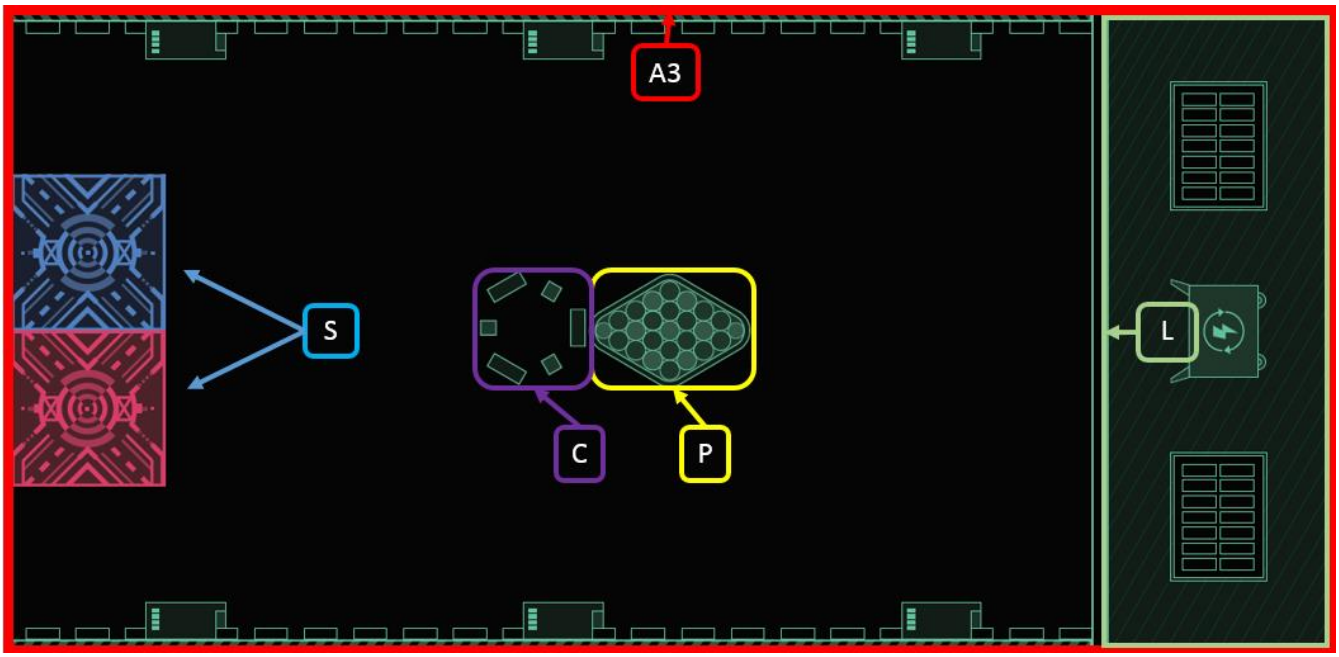


Fig 2.6 Manual Mission Area - Area Code

In the Manual Mission Area, the specific name of the Area Code and the description of the Area Function are shown in Table 2.2 below.

Area Code	Area Name	Area Function
A3	Alliance Mission Area 3	Initial Position for M10
S	Starting Area	Initial Position for Start & Restart Robot
L	Loading Area	A place for Observers to modify Robots or loading balls on their Robots
P	Placing Area	Initial Position of White Balls with a Ball Holder
C	Containing Area	Place & Fasten Container

Table 2.2 Manual Mission Area - Area Description

Starting Area

There are four Starting Areas in the Arena, two on the blue side and two on the red side.

There are two types Starting Area: Starting Areas (surrounded by black dashed lines) in the Automatic Mission Area as shown in Figure 2.7, and Starting Areas (surrounded by black dashed lines) in the Manual Mission Area as shown in Figure 2.8.

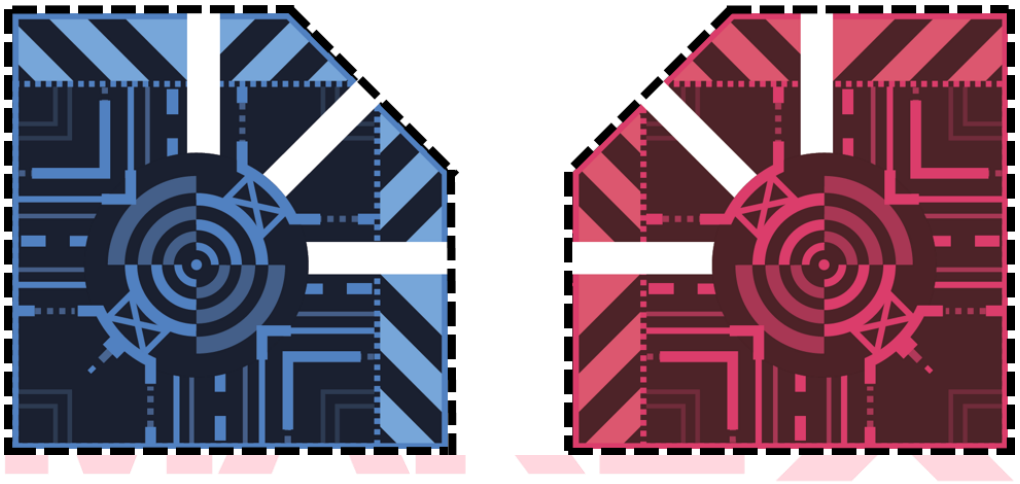


Fig 2.7 Starting Areas (Automatic Mission Area)

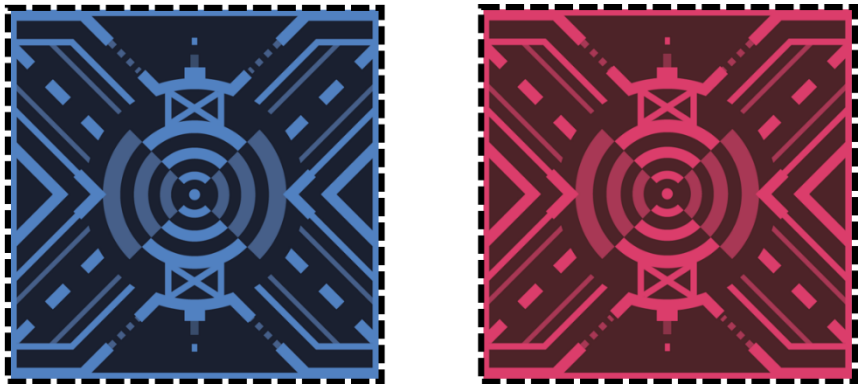


Fig 2.8 Starting Areas (Manual Mission Area)

2.3 Stages

Description of the Duration of the Stages

Each match lasts for 240 seconds, and it consists of the Automatic Stage, Preparation Stage (not counted), and the Manual stage. The duration of the Automatic Stage is at the discretion of the Captain of Alliance, and the duration of Manual Stage is what left after the Automatic Stage.

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 2.3 Actual Durations of the Stages

The Stage switch follows two important principles:

The early end of the Automatic Stage is proposed by the Captain of Alliance and is formally implemented after obtaining the consent of the referee.

The start of the Stage is proposed by the referee and implemented by the Contestants. Contestants are required to follow the instructions of the referee.

For details about the specific process, see 2.7 Single-Match Flow Chart.

Automatic Stage

During the Automatic Stage, the contestants are required to complete Automatic Independent Mission and Automatic Alliance Mission. Core play method: trigger the mechanism or move the balls that are initially placed on top of the metal props to make them fall on the ground of the Arena; then knock down the Duel Cube in the Area, and bypass the cylinders in the Arena.

If a ball-type scoring prop that was initially placed in the Automatic Mission Area is moved to the Manual Mission Area, the upper limit of the points that the team can score in the manual stage is increased.

Preparation Stage

During the preparation stage, the Contestants can move their Robots from the Automatic Mission Area to the Manual Mission Area, modify their robots, and check the connection status of the Bluetooth Controllers. At this stage, the referee will record the scores for the Automatic Stage, and confirm with the Contestants.

The Preparation Stage lasts for 30 seconds and is not counted in the 240-second match time. When the 30-second Preparation Stage ends, the match will start directly and the Contestants must follow the referee's instructions.

Manual Stage

During the Manual Control Stage, the Contestants are required to complete the Manual Alliance Mission Only. Core play method: the contestants control their Robots to move the balls from the Manual Mission Area into the Container.

2.4 Missions

The missions are divided into three parts: the Automatic Independent Mission, Automatic Alliance Mission, and Manual Alliance Mission. The description of each Mission contains the Mission Background, the Score-Category, and the Initial States.

For a detailed description of the scoring statuses, see 2.5 Scoring Explanation.

For the selection of Missions within the Mission's location, see 2.6 Mission Selection Methods.

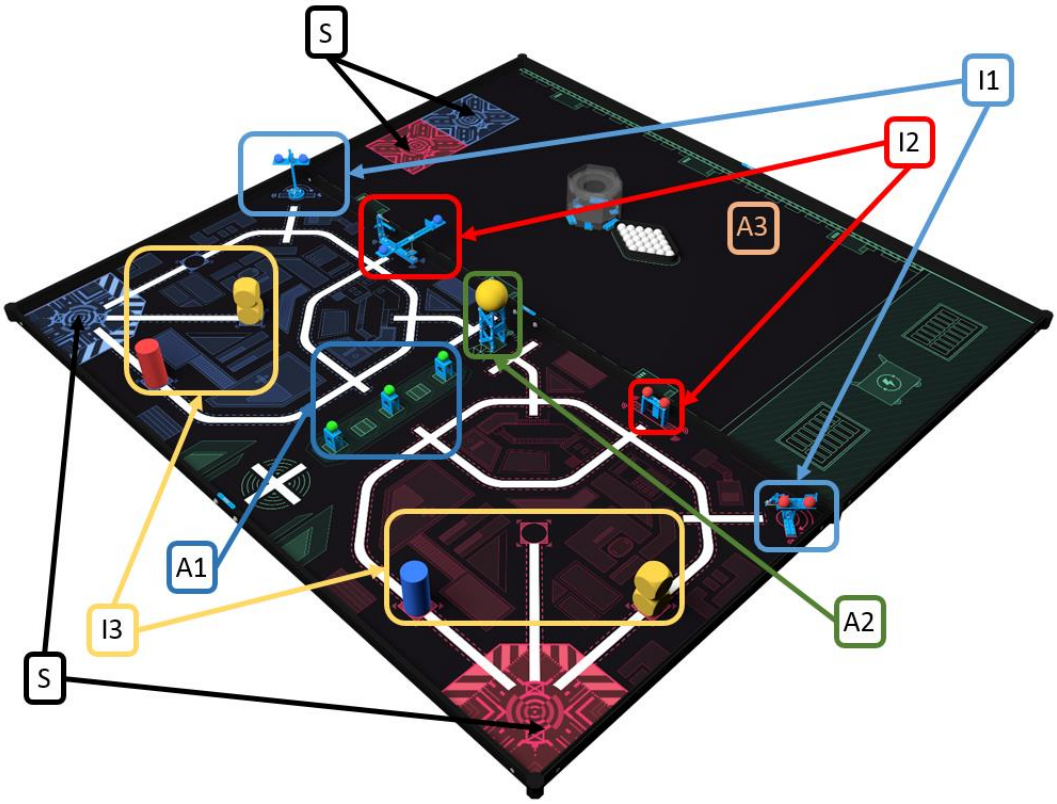


Fig 2.9 Mission's location

Automatic Independent Mission

In an Automatic Independent Mission refers to the robot who must rely on the automatic program to complete the mission independently in a match. After the completion of the mission, the robots can obtain their own Independent Mission scores. There are three types of Automatic Independent Mission: Ball, Cube and Cylinder.

If the Scoring Category of an Automatic Independent Mission is Ball, means the Scoring Prop on the Mission Prop located at the red & blue side Automatic Independent Mission Area are the red &blue balls.

In other word, blue ball represents Blue Automatic Independent Mission Score, red ball represents Red Automatic Independent Mission Score.

M01. Enable Solar Power Station

Mission Background:

On the edge of a city stands a solar power station, which is the city's energy core. Robots needs to enable the solar power station and upload its operation data.

Scoring Category: Ball

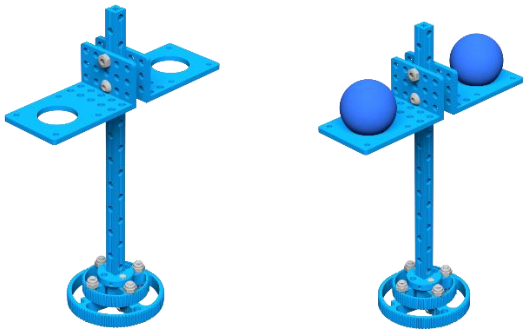


Fig 2.10 Scoring Props placement

Initial state:

The prop for Mission M01 is placed in the I1 Mission Area. Initial state of the prop: the circular base is completely placed in the circle wireframe of the I1 area on the Competition Mat and is in contact with the Arena; and the centerline of the small ball bracket in the upper part is parallel to the I1 wireframe (the two red lines in the following figure shall be parallel to each other), as shown in Figure 2.11 below.

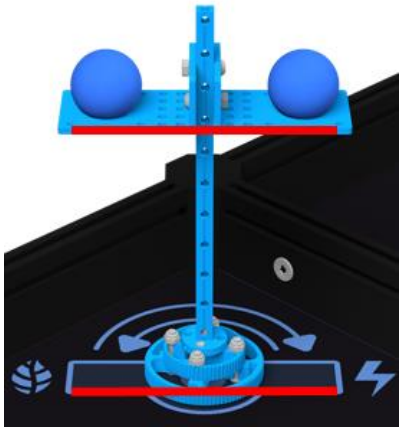


Fig 2.11 Initial State

M02. Sending Traffic Signals

Mission Background:

The transmitter at the edge of the city has failed. Robots need to reactivate the transmitter and make it successfully send data.

Scoring Category: Ball

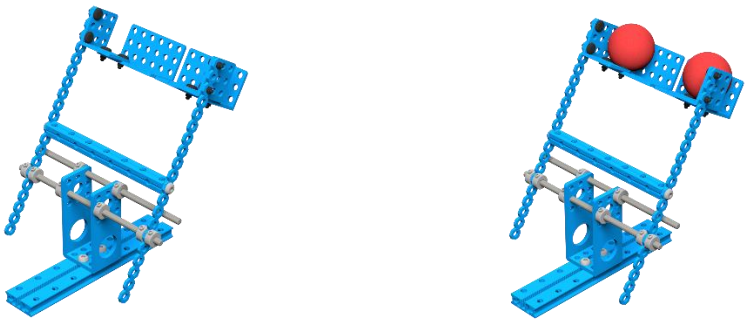


Fig 2.12 Scoring Props placement

Initial State:

The prop for Mission M02 is placed in the I1 Mission Area. Initial state of the prop: the bottom slide beam is completely placed in the rectangular wireframe of the I1 area on the Competition Mat and is in contact with the Competition Mat (to be stuck); the lever trigger at the upper side faces toward the Manual Mission Area. For details, see Figure 2.13 below.

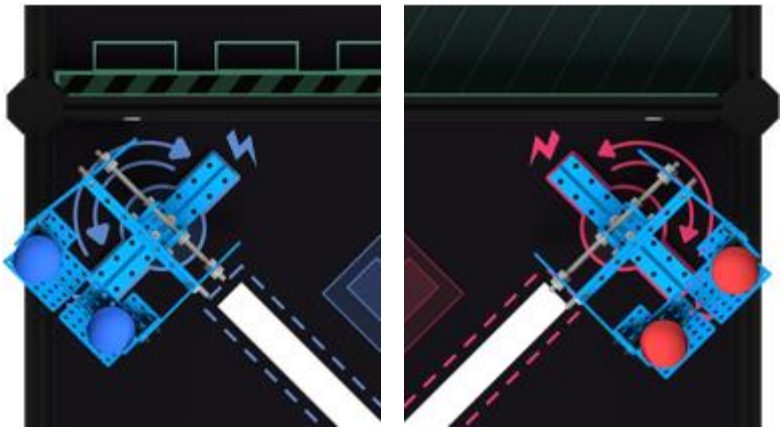


Fig 2.13 Initial State

M03. Rotating Radar

Mission Background:

The radar of the city requires routine maintenance. Robots need to maintain the radar and upload the data collected by the radar.

Scoring Category: Ball

Fig 2.14 Scoring Props Placement

Initial State:

The prop for Mission M03 is placed in the I2 Mission Area. Initial state of the prop: the bottom slide beam is completely placed in the rectangular wireframe of the I2 area, and is in contact with the Competition Mat (to be stuck). Mission props on the red and blue sides are symmetric to each other. The bottom slide beam of the prop is perpendicular to the rotatable beam above. For details, see Figure 2.15 below.

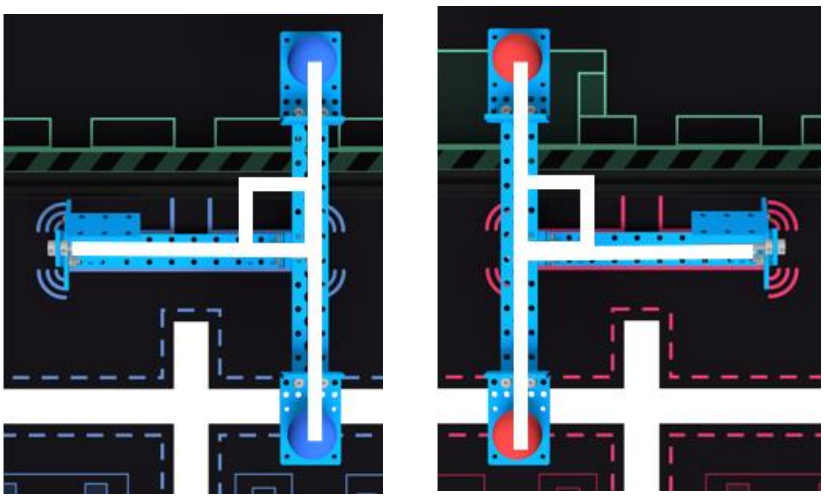


Fig 2.15 Initial State

M04. Activate Door Switch

Mission Background:

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.

Scoring Category: Ball

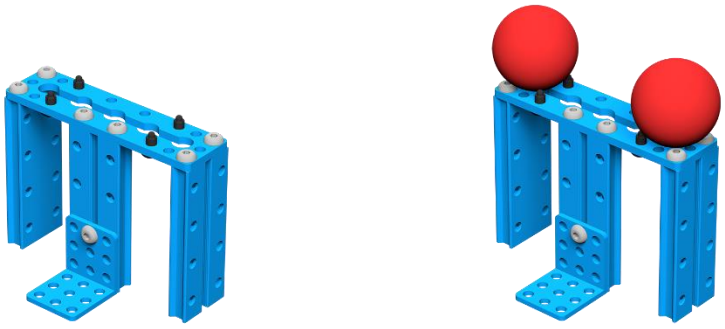


Fig 2.16 Scoring Props placement

Initial State:

The prop for Mission M04 is placed in the I2 Mission Area. Initial state of the prop: the base of the prop is completely placed in the rectangular wireframe of the I2 area and is in contact with the Competition Mat, as shown in Figure 2.17 below.

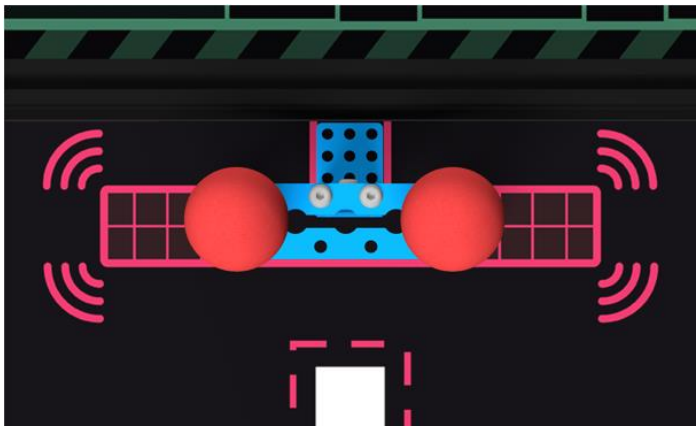


Fig 2.17 Initial State

M05. Identify Obstacles

Mission Background:

As an important part of Smart Links, robots must have the basic function to identify, bypass, or remove obstacles.

Scoring Category: Cube & Cylinder

Initial State:

The props for Mission M05 are placed in the I3 Mission Area. Initial states of the props: the cubes and cylinders are completely placed in the square/circular wireframes of the I3 areas, and are in contact with the Competition Mat, as shown in Figure 2.18 below.

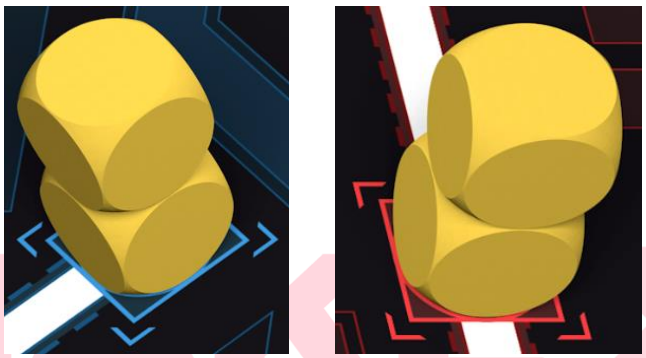


Fig 2.18 Initial State (Duel Cubes)

The color of the cylinders is opposite to the color of the starting area on the same side.

Example: The color of the cylinder in an I3 area on the red side must be blue, and the color of the cylinder in an I3 area on the blue side must be red, as shown in Figure 2.19 below.

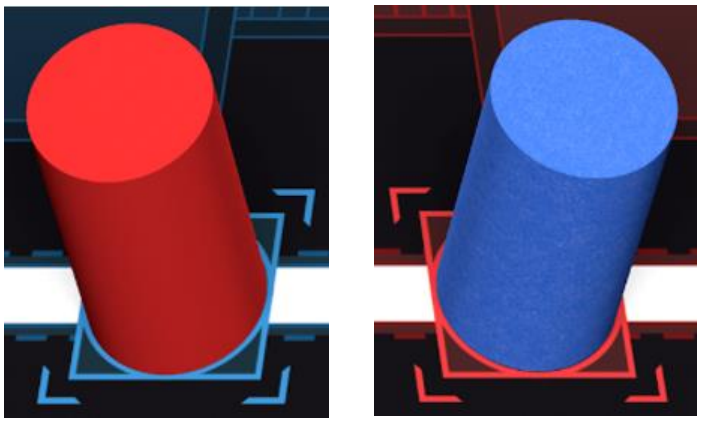


Fig 2.19 Initial State (Cylinder)

Automatic Alliance Mission

Robots must run Automatic programs to collaborate with the Alliance Team on Automatic Alliance Missions. After completion of these missions, they will earn the Alliance Mission Score.

In Automatic Alliance Missions M06 and M07, small green balls will be used as the Scoring Props. In M08 and M09, a large yellow ball will be used as the Scoring Props.

M06. Community Data Inspection

Mission Background:

There are different functional areas in the city, and community data exchange centers are built for low-rise complexes. Robots need to inspect and upload operational data of each community data exchange center.

Scoring Category: Ball

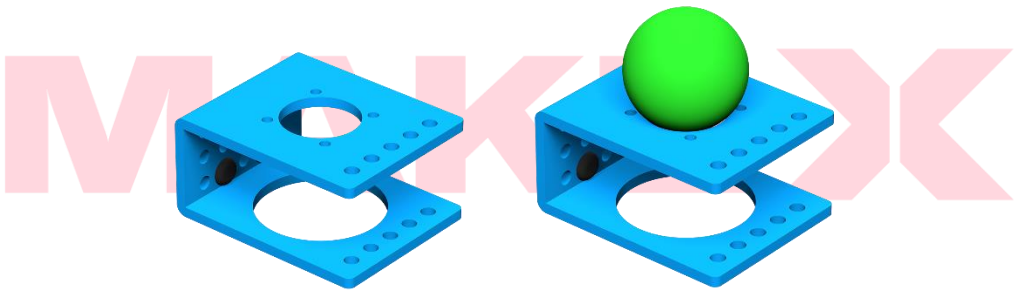


Fig 2.20 Scoring Prop placement

Initial State:

The prop for Mission M06 is placed in the A1 Mission Area. Initial state of the prop: the bottom of the prop is completely placed in the rectangular wireframe of the A1 area, and is in contact with the Competition Mat. Its initial orientation is shown in Figure 2.21 below.

Fig 2.21 Initial State (side view)

M07. Traffic Data Inspection

Mission Background:

There are different functional areas in the city, and 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 Category: Ball

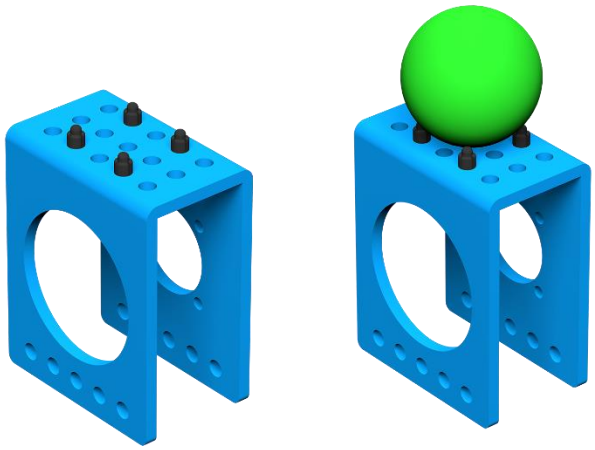


Fig 2.22 Scoring Prop placement

Initial State:

The prop for Mission M07 is placed in the A1 Mission Area. Initial state of the prop: the bottom of the prop is completely placed in the rectangular wireframe of the A1 area, and is in contact with the Competition Mat. Its initial orientation is shown in Figure 2.23 below.

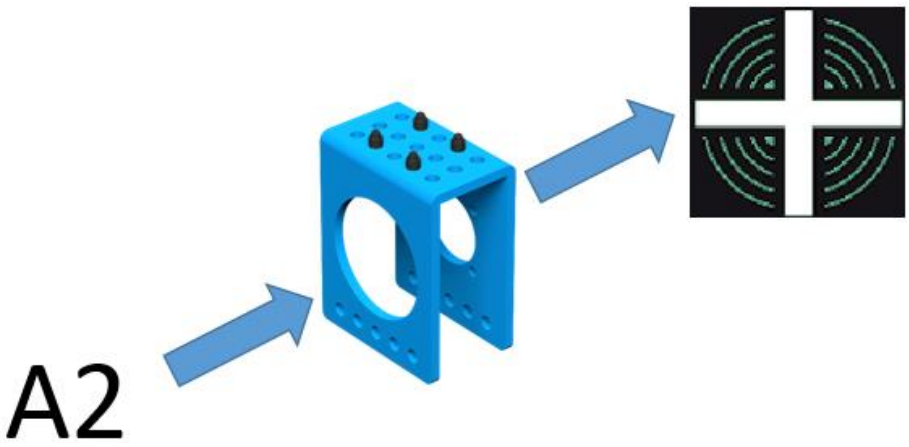


Fig 2.23 Initial State (side view)

M08. Unlock Base Stations

Mission Background:

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.

Scoring Category: Ball

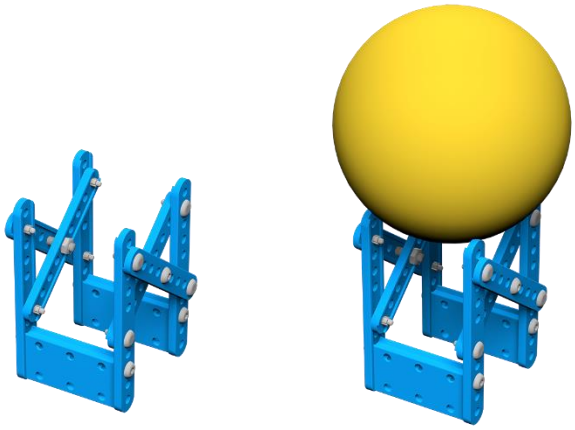


Fig 2.24 Scoring Prop placement

Initial State:

The prop for Mission M08 is placed in the A2 Mission Area. Initial state of the prop: the bottom of the prop is completely placed in the rectangular wireframe of the A2 area, and is in contact with the mat. The slide beams on both sides of the prop must be parallel to the guidelines on both sides of the A2 Area. The blue lines in Figure 2.25 represent the slide beams, and the red lines represent the white guidelines.

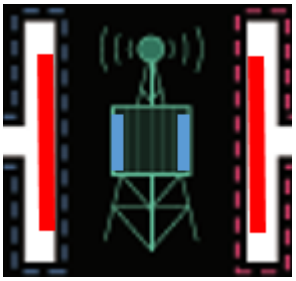


Fig 2.25 Initial state (top view)

M09. Unlock Elevated Base Stations

Mission Background:

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.

Scoring Category: Ball

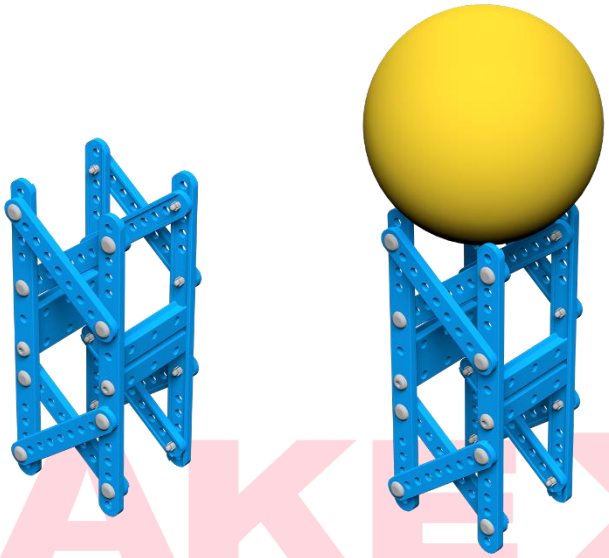


Fig 2.26 Scoring Prop placement

Initial State:

The prop for Mission M09 is placed in the A2 Mission Area. Initial state of the prop: the bottom of the prop is completely placed in the rectangular wireframe of the A2 area, and is in contact with the Competition Mat. The slide beams on both sides of the prop shall be parallel to the guidelines on both sides of the A2 Area. The blue lines in Figure 2.27 represent the slide beams, and the red lines represent the white guidelines.

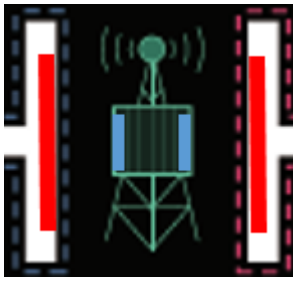


Fig 2.27 Initial State (top view)

Manual Alliance Mission

Robots must be controlled manually to collaborate with the Alliance Team on manual alliance missions. After completion of these missions, they will earn the Alliance Mission scores.

M10. City Data Collection

Mission Background:

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.

Scoring Category: Ball

Some of the ball scoring props may be moved to the Manual Mission Area during the Automatic Control Stage. This will increase the upper limit of the points that the team can score after completing the manual mission.

Regardless of whether the ball-type scoring Props are moved to the Manual Mission Area, the initial positions of the white balls do not change before the start of the Manual Stage, as shown in Figure 2.28 below.

If an unpredictable situation causes the white balls to leave their original positions before the start of the Manual Stage, the white balls will remain in that state until the Manual Stage starts. The scores and penalties for the white balls will give as usual, regardless of whether the Manual Control Stage.

Fig 2.28 Scoring Props placement

Initial State:

The props for Mission M10 are placed in the A3 Mission Area, and the props include a Ball Holder and a Container, the positions as shown in the following figure.

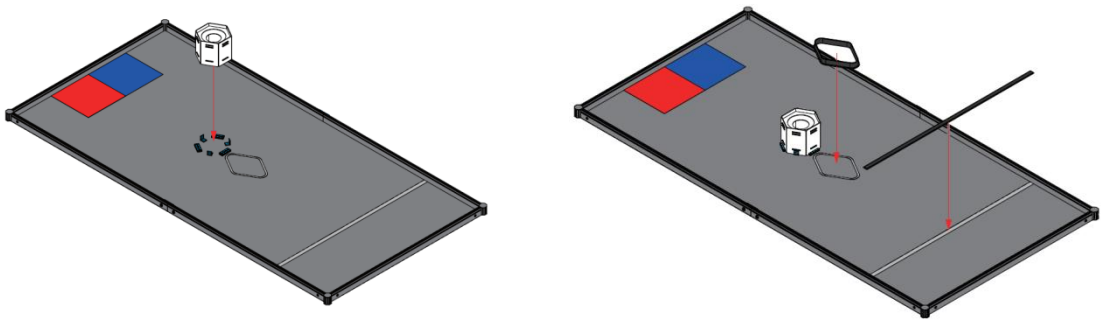


Fig 2.29 Initial State

To prevent the white balls from becoming scattered due to collision with balls brought into the manual control area by robots during the Automatic Stage, the ball holder will not be taken away from the arena before the start of the Manual Stage. The long diagonal width of the Ball Holder is 288±5 mm, and the short diagonal width is 200±5 mm.

Before the Manual Stage begins, the Container is displaced by some unforeseen factor then the Container must be moved to its initial position by the referee.

Fig 2.30 Ball Holder

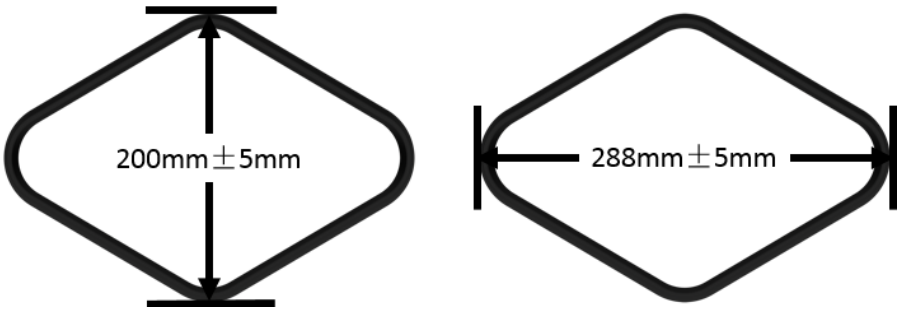


Fig 2.31 Top view of the Ball Holder

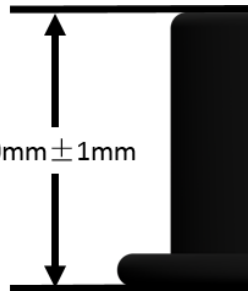


Fig 2.32 Side view of the Ball Holder

The main materials of the Container are 3mm thick acrylic plates. The height of the container is 150±1 mm. Its edge width is 172±3 mm and the diagonal width is 197±3 mm. The diameter of the circle in the center of the top acrylic plate is 130±1 mm, and the diameter of the circle in the center of the second acrylic plate is 80±1 mm.

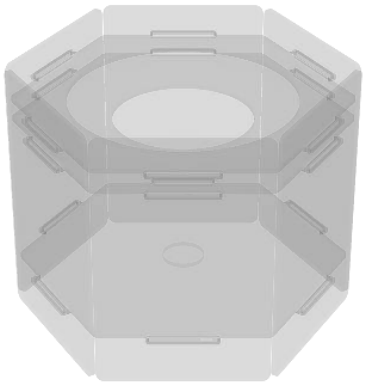


Fig 2.33 Container

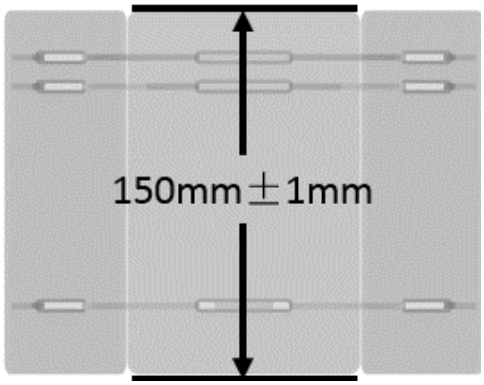


Fig 2.34 Container Height

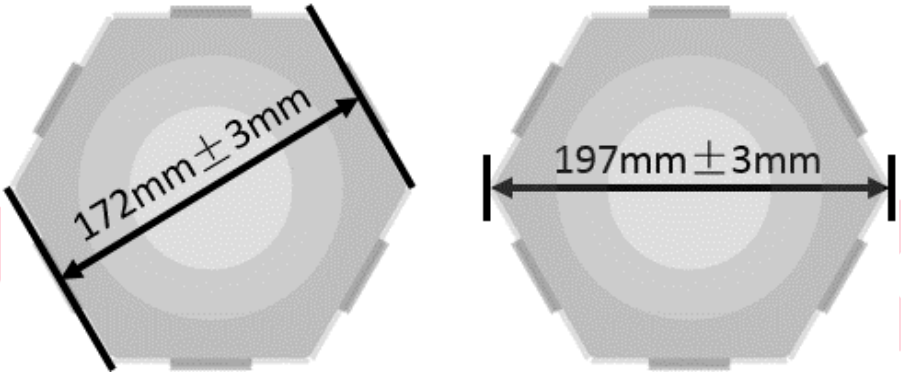


Fig 2.35 Top view of the Container width

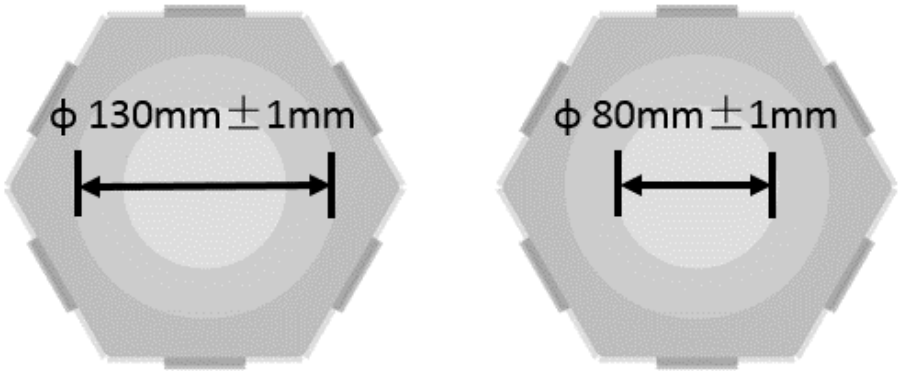


Fig 2.36 Container circle diameter

2.5 Scoring Explanation

Throughout the entire match, the referee calculates scores at only two moments: the end of the Automatic Stage and the end of the Manual Stage.

Score in Automatic Stage

The referee will calculate the scores of both sides in the Automatic Stage during the preparation stage that follows the automatic stage, based on the states of the props. 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. The scores are divided into three categories: Ball, Cube and Cylinder.

Duel Cube Scoring Explanation:

When Duel cubes that were initially in the red I3 area are in the scoring status, the red side scores for the automatic independent mission. Likewise, when Duel Cubes that were initially in the blue I3 area are in the scoring status, the blue side scores for the Automatic Independent Mission.

The thin red lines in the following tables represent the ground of the arena, the gray rectangle represents the Competition Frame, and the yellow blocks represent the Cubes.

When Duel Cubes on the Arena are separated, either Completely or Partially Separated, they are considered as in the scoring state. Cubes that are in contact with the Competition Frame or the Table of the arena are also considered as in the scoring state. For details about the scoring states of cubes, see Table 2.4, Table 2.5 and Table 2.6. If the cube on the top layer does not fall from the one at the bottom, it cannot be considered as partially separated.

The initial number of cubes in each Duel Cubes on the Arena is 2. Each pair of separated Duel Cubes on the Arena are considered as in the scoring state. If a cube is out 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. If the cube on the top layer does not fall/drop from the one at the bottom, these cubes cannot be considered as in the scoring status.

For example, if a cube that was initially placed in the I3 area on the red side is out of the arena, the red side cannot score for this part of the Automatic Independent Mission. Likewise, if this happens to the blue side, the blue side cannot score either.

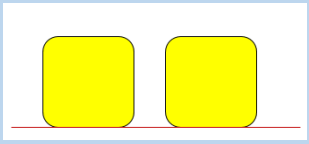
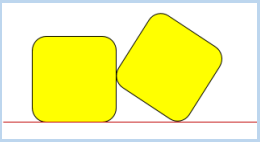
Status	Completely Separated	Partially Separated
Figure		
Score Or Not	✓	✓

Table 2.4 Scoring detail of the Duel Cube (side view)

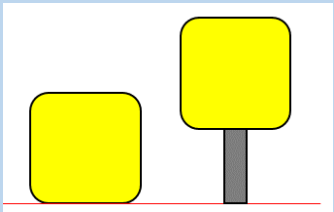
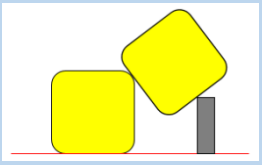
Status	Completely Separated	Partially Separated
Figure		
Score or Not	✓	✓

Table 2.5 Scoring detail of the Duel Cube (side view)

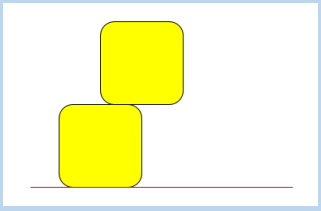
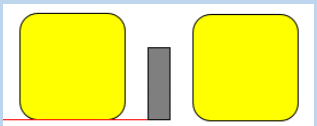
Status	Not Dropped	Completely Out of the Arena
Figure		
Score or Not	✗	✗

Table 2.6 Scoring detail of the Duel Cube (side view)

Cylinder Scoring Explanation:

When the blue cylinder that was initially placed in an I3 area on the red side is in the scoring status, the red side scores for the Automatic Independent Mission. Likewise, when the red cylinder that was initially placed in an I3 area on the blue side is in the scoring status, the blue side scores for the Automatic Independent Mission.

The black ring in the Tables below represent the initial ring, the thin red lines represent the Competition Table, and the gray rectangles represent the Competition Frame.

The cylinder must be Completely In or Partially In the initial ring to be considered as in the scoring status at the end of Automatic Stage, as shown in Table 2.7. When the cylinder tangents to the initial ring, it is considered as Partially In.

When a cylinder Completely Out its initial ring, it cannot be considered score, as shown in Table 2.9. If a cylinder has a status of Fell Down, Lean on Prop, or Lean on Frame, this cylinder cannot be considered score, regardless of whether it Completely In or Partially In its initial ring. For details, see Table 2.8, Table 2.10, and Table 2.11. Props referred to this paragraph include all mission props and scoring props in the Arena. Table 2.10 does not list all these props.

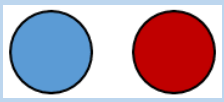
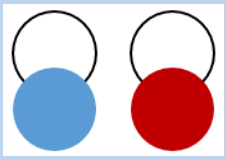
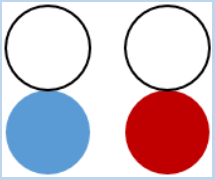
Status	Completely In	Partially In	Partially In
Figure			
Score or Not	✓	✓	✓

Table 2.7 Scoring detail of the Cylinder (top view)

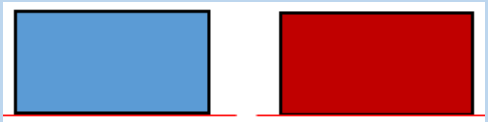
Status	Fell Down
Figure	
Score or Not	✗

Table 2.8 Scoring detail of the Cylinder (side view)

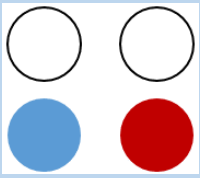
Status	Completely Out
Figure	
Score or Not	✗

Table 2.9 Scoring detail of the Cylinder (top view)

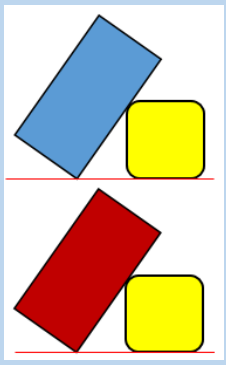
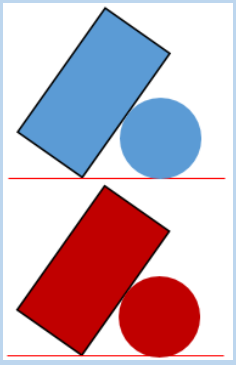
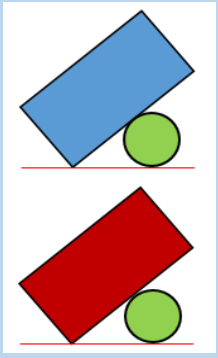
Status	Lean on Props(Cube)	Lean on Props(Cylinder)	Lean on Props(Ball)
Figure			
Score or Not	✗	✗	✗

Table 2.10 Scoring detail of the Cylinder (side view)

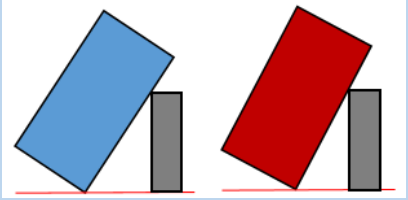
Status	Lean on Frame
Figure	
Score or Not	✗

Table 2.11 Scoring detail of the Cylinder (side view)

Ball Scoring Explanation:

When a small red ball is in the scoring status, the red team scores for the automatic independent mission. Likewise, when a small blue ball is in the scoring status, the blue team scores. When the small green ball and the large yellow ball are in the scoring status, both teams score for the automatic alliance mission.

In Table 2.12, Table 2.13, Table 2.14, and Table 2.15, the thick black lines and gray rectangles represent the Competition Table, the gray blocks and red lines represent the Competition Table, the green circles represent all ball-type scoring props, and dotted circles represent ball-type scoring props Completely Out the Arena.

When a ball-type scoring prop is Completely or Partially In the Arena; on top of the Competition Frame, as shown in Tables 2.12 and 2.14, it is considered as in the scoring state.

When a ball-type scoring prop is completely out of the Arena; in contact with the Competition Frame; or in contact with the Table as shown in Table 2.13 and Table 2.15, it cannot be considered as in the scoring state.

Both the Automatic and Manual Mission Areas are parts of the Arena.

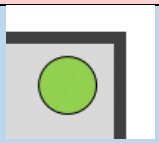
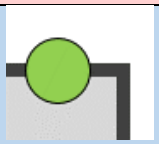
Status	Completely In	Partially In
Figure		
Score Or Not	✓	✓

Table 2.12 Scoring detail for Balls (top view)

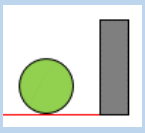
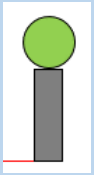
Status	Completely In	Partially In
Figure		
Score Or Not	✓	✓

Table 2.14 Scoring detail for Balls (side view)

Status	Completely Out	Contact Frame	Contact Table
Figure			
Score Or Not	✗	✗	✗

Table 2.13 Scoring detail for Balls (top view)

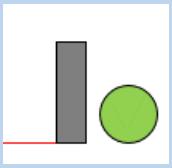
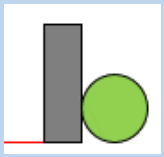
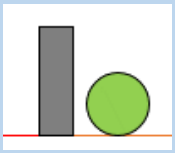
Status	Completely Out	Contact Frame	Contact Table
Figure			
Score Or Not	✗	✗	✗

Table 2.15 Scoring detail for Balls (side view)

Principle of Scoring in Automatic Stage:

All scoring methods in the Automatic Stage follow the same principle of "category-based propagation". When multiple scoring props of different scoring categories (Ball, Cube or Cylinder) are static, and one of them is considered as in the scoring state, other scoring props of the same category will also be considered as in the scoring status.

The scoring states of stacked props in the Arena are as shown in Table 2.16 and 2.17 below, and there is no additional point for scoring props in the stacking state.

Stacked props include all the mission props and scoring props in the Arena. Tables 2.16 and 2.17 do not list them all.

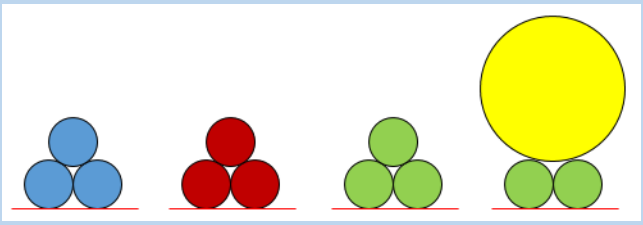
Status	Stack Props (Balls)
Figure	
Score or Not	✓

Table 2.16 Scoring detail of the Balls (side view)

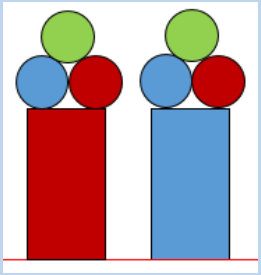
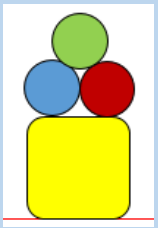
Status	Stack Props (Cylinder)	Stack Props (Cube)
Figure		
Score or Not	✗	✗

Table 2.17 Scoring detail of the Balls (side view)

Score in Manual Stage

During the Manual Stage, the referee monitors the course of the match in real time and records warnings and violations. When the Manual Stage is over, the referee calculates the scores based on the quantity and color of the scoring balls in the Container.

In Table 2.18 and Table 2.19, the red lines represent the Competition Table; the light blue wireframe represent the Container; the yellow circles represent the large yellow ball; the white, green, red, and blue circles respectively represent the white balls, green balls, red balls, and blue balls.

All small scoring balls must be Completely In the Container to be considered as in the scoring status, as shown in Table 2.18. The large yellow ball is considered as in the scoring status when it is either Completely In or Partially In the Container, as shown in Table 2.19.

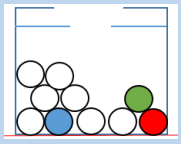
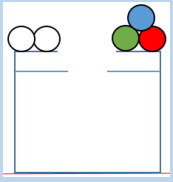
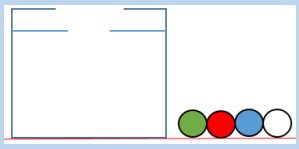
Status	Completely In	Partially In	Completely Out
Figure			
Score or Not	✓	✗	✗

Table 2.18 Scoring detail of the Balls (side view)

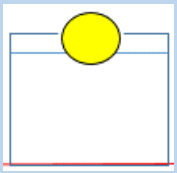
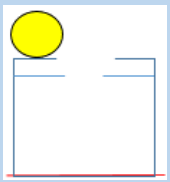
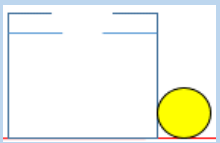
Status	Completely In	Partially In	Completely Out
Figure			
Score or Not	✓	✓	✗

Table 2.19 Scoring detail of the Balls (side view)

Some Contestants may need to use robots to move the balls (Not include Yellow Ball) that are scattered in the Manual Mission Area to the Loading Area, and then load the balls (Not include Yellow Ball) on the robots with the help of the Observers (this operation is allowed only when both the robot and the scoring balls (Not include Yellow Ball) are Completely In the loading area at the same time). Then the robots will send the balls into the Container.

Scoring balls (Not include Yellow Ball) must be completely moved into the loading area before they can be touched by the observer.

A robot must be Completely In the loading area before the Observer can load the balls on it.

No matter the Yellow Ball is in the loading area or not , it cannot be touch by the Contestants. If the Contestants touch it the penalty will be as usual.

Status	Completely In	Partially In	Completely Out
Figure			
Can be touch or Not	✓	✗	✗

Table 2.20 Ball & Loading Area (top view)

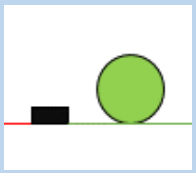
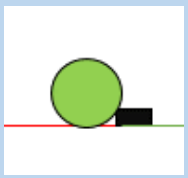
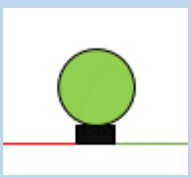
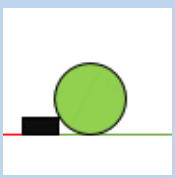
Status	Completely In	Partially In	Partially In	Partially In
Figure				
Can be touch or Not	✓	✗	✗	✗

Table 2.21 Ball & Loading Area (side view)

Specific Score

There are three scoring categories: Ball, Cube and Cylinder. The quantities and scores of the scoring props are shown in Tables 2.22 and 2.23 below.

Props Name	Quantity	Score for Each Ball
Rad Ball	4	20 Points
Blue Ball	4	20 Points
Green Ball	3	20 Points
Yellow Ball	1	30 Points
White Ball	25	10 Points

Table 2.22 Scoring Props Introduction (Ball)

Props Name	Max Quantity Per Match	Score for Compete
Duel Cube	4	20
Red/Blue Cylinder	4	20

Table 2.22 Scoring Props Introduction (Cube & Cylinder)

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 - 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 - Violation Points for Red Team- Violation Points for Blue Team.

2.6 Mission Selection Method

In each regional competition, points race or 2020 MakeX (World) Championship, the contestants from one team need to complete 3 Automatic Independent Missions (AIM), 2 Automatic Alliance Missions (AAM) and 1 Manual Alliance Mission (MAM).

In each regional competition, points race or 2020 MakeX World Championship, the Authorized Organizer or MakeX Robotics Competition Committee will select specific missions from the alternative missions， according the Mission Selection Method, and publish the selected missions before the competition take place. Alliance teams will encounter same Automatic Independent Missions.

The Mission Selection Methods for Elementary Group (age 6 to 13) and Intermediate Group (age 12 to 16) are same, but the selected missions may vary according the difficulty level.

Mission Selection Method is as follows:

Missions Area	Alternative Missions		Selection Method
I1	M01	M02	Pick 1 form 2 alternative
I2	M03	M04	Pick 1 form 2 alternative
I3	M05		Compulsory Mission
A1	M06	M07	Pick 1 form 2 alternative
A2	M08	M09	Pick 1 form 2 alternative
A3	M10		Compulsory Mission

Table 2.24 Mission Selection Method

In an actual competition, the two alliances will complete the same Automatic Independent Missions in their own areas.

For example: If the mission of the red side in the I1 Area is M01, then the mission of the blue side in the I1 area must also be M01. This rule applies to other areas, too.

Initial Position Selection Rules for Mission M05:

The I3 areas of the red and blue teams are subdivided into six small area: A, B, C, D, E and F, as shown in the following figure.

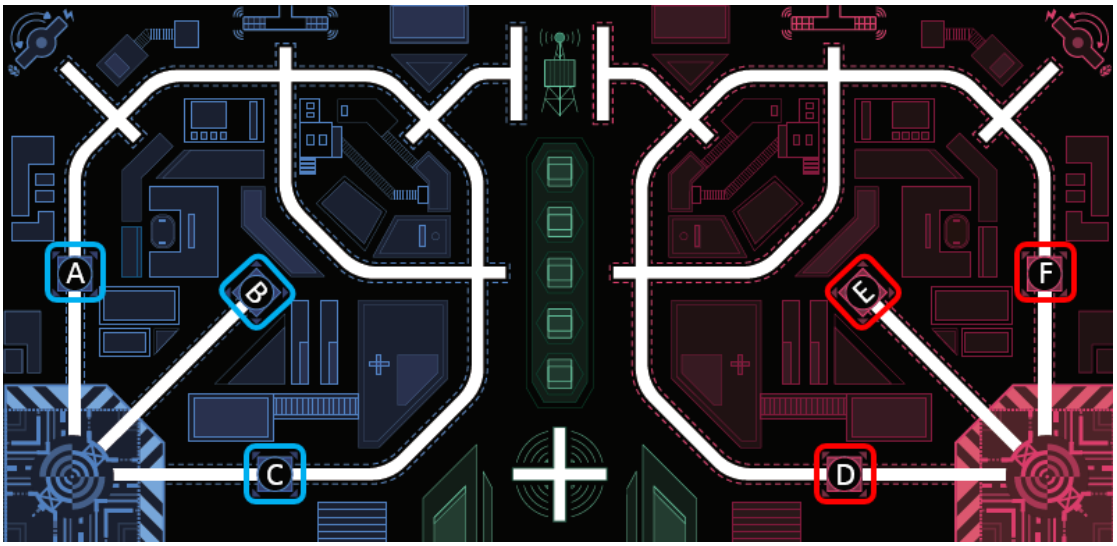


Figure 2.37 I3 Areas selection

In areas A, B, and C on the blue side, two of them will be selected before each match as the initial positions to place the duel cubes or red cylinders. Likewise, in areas D, E, and F on the red side, two of them will be selected before each match as the positions to place the duel cubes or blue cylinders. That is, two of the three areas will be selected on both sides.

The maximum number of Duel Cubes(X) and red/blue Cylinders(Y) that may co-exist in the Arena complies with the following equation:

$$X + Y = 4$$

X represents the maximum number of Duel Cubes that may exist in the Arena, with a value range of [0, 4]. Y represents the maximum number of red/blue cylinders that may exist in the Arena, with a value range of [0, 4].

In other words, in these two selected areas of each side, there could be: one is Duel cube in each of the two areas (two Duel Cubes in total); one red/blue cylinder in each of the areas (two cylinders in total); or one Duel Cube in one area, and one red/blue cylinder in the other.

During the competition, the props and prop's location which being selected in red side maybe different than the blue side.

Mission M06/M07 Initial State Extraction Rules:

The Automatic Alliance Mission Area A1 is subdivided into a total of five small areas, numbered 1 to 5. The details are shown in the following figure.

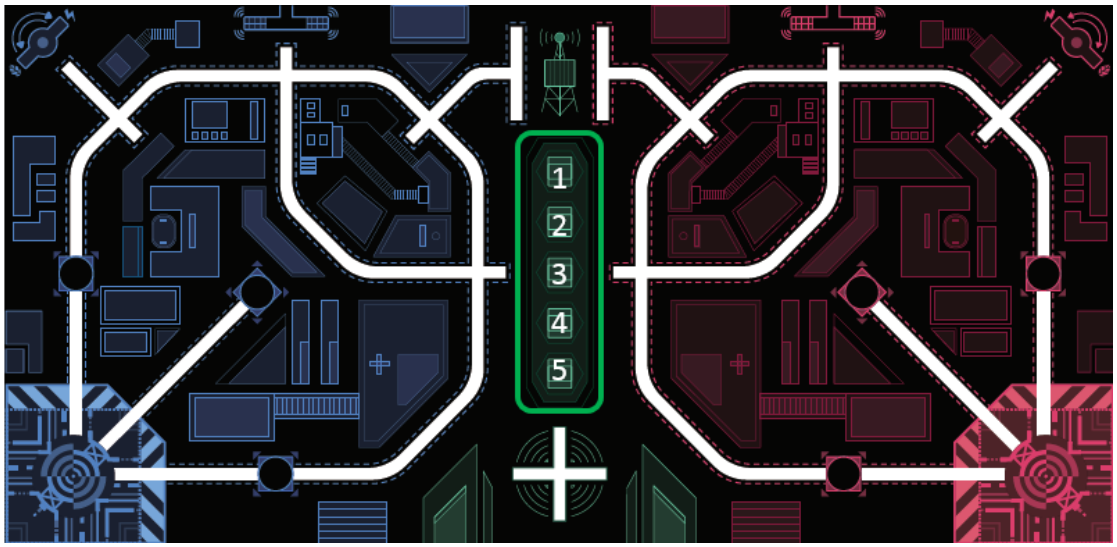


Figure 2.38 A3 Areas selection

Among the five small areas of the Automatic Alliance Mission Area, three are selected before each match as the initial positions of props for Mission M06 and Mission M07.

2.7 Single-Match Flow Chart

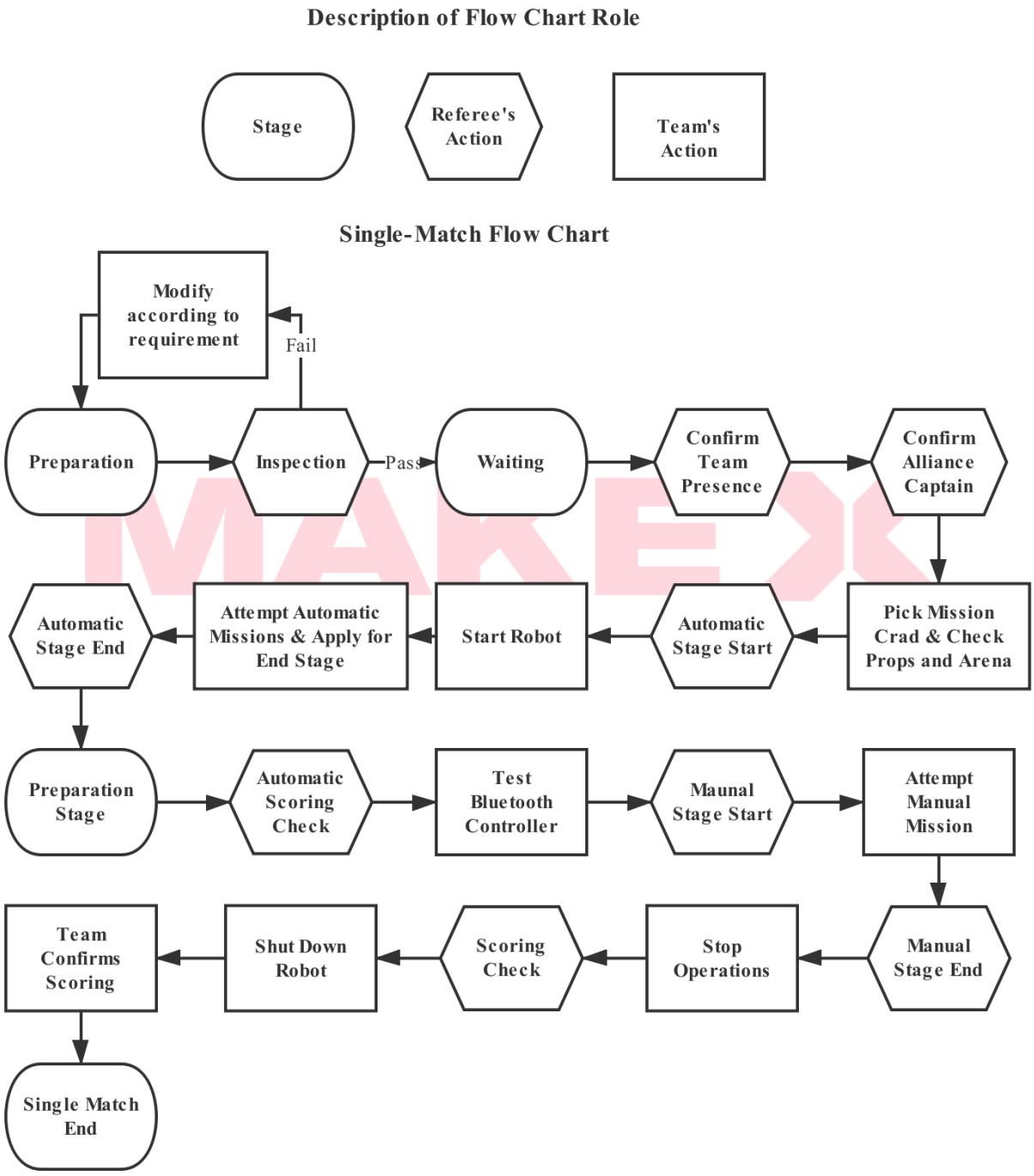


Figure 3.19 Single-Match Flow Chart

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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.), it 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 protection.

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 be pre-checked through the Robot Self-Checklist.

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 size of the robot must not exceed the limit at any time in any stage of the competition include before and after modify.

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
Maximum Extension Size	280mm (Length) 280mm (Width) 300mm (Height)	1. During the whole process of the competition, 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. 2. During Inspection, the teams should show and check the maximum extension size of the robot. 3. The single-axis fixed structure must be tightened and ensure that the angle cannot be easily changed. Otherwise re-inspection by maximum extension size of the active part.

Table 3.1 Robot Size Requirements

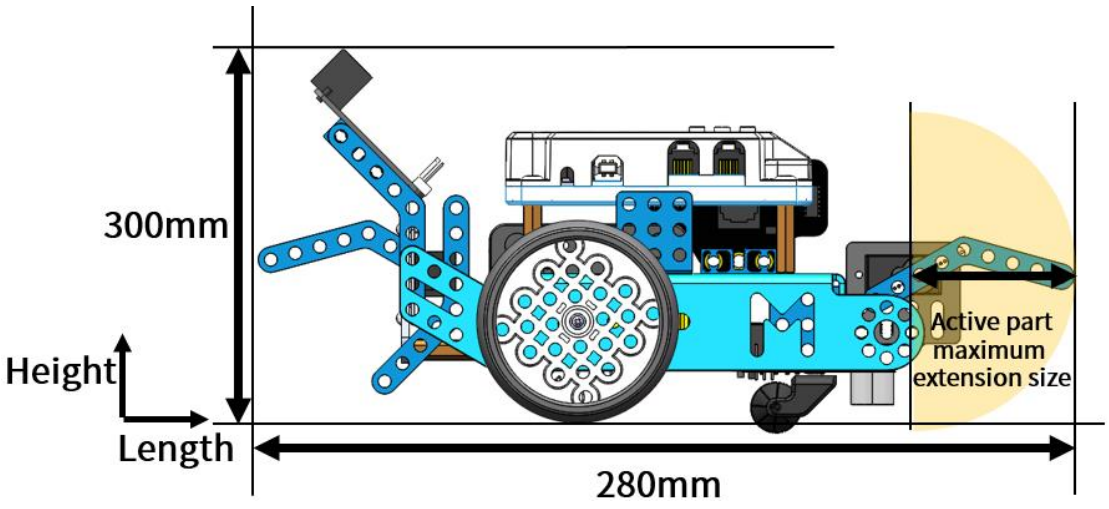


Figure 3.1 Maximum Size Top View

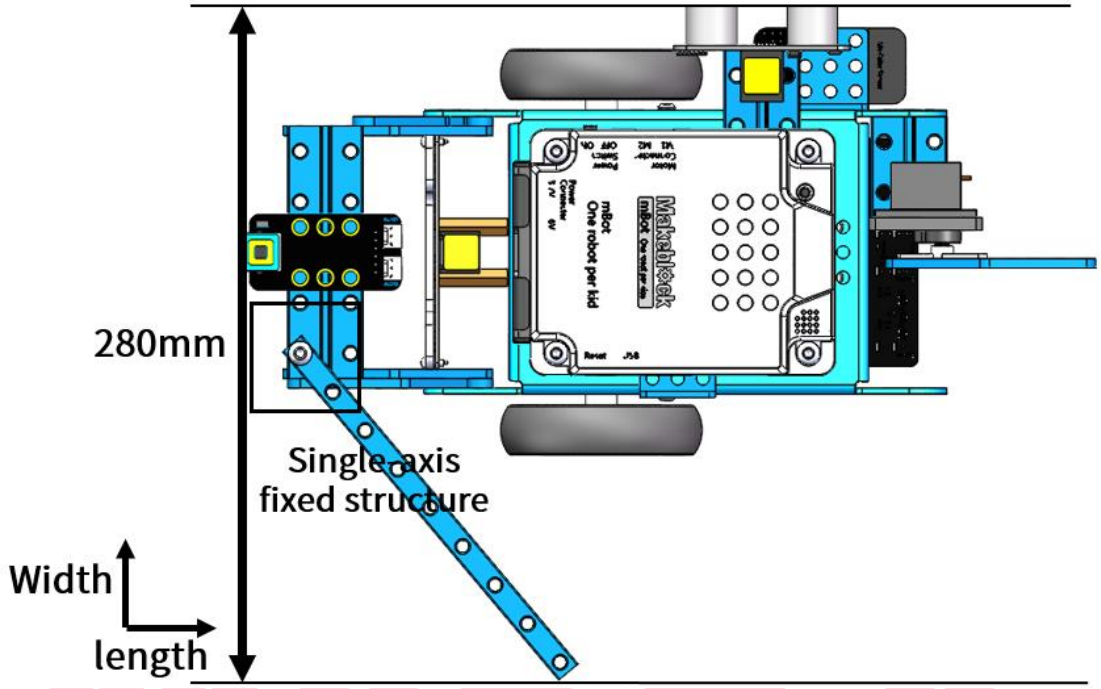


Figure 3.2 Maximum Size Side View

Weight of the Robot

T18. Weight of the Robot refers to the net weight of the robot at any time during the competition (include subsystem 1 2 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. The robots should use the specific robot chassis (the mBot chassis manufactured and sold by Shenzhen Makeblock Co., Ltd, Quantity: Only 1) which must not present any cutting or twisting operations, etc. to change its physical form.

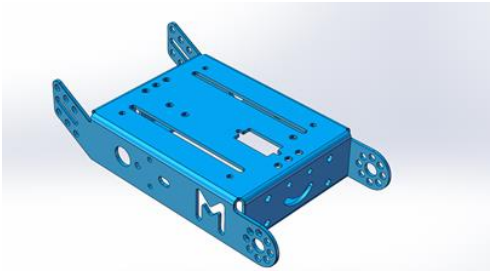


Fig 3.3 Robot Chassis

T27. 3D printing parts are allowed to use for following purpose: counterweight, decorative, functional or structural.

T28. The robot is allowed to use purchased or self-made non-electronic parts as counterweight. Those parts should not have magnetic or any impact on the electronic sensors or mainboard.

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), and the battery must be securely fixed on the robot.

		
Allowed	Prohibited	Prohibited

Table 3.2 Allowed and Prohibited Model of mBot Battery

T30. To ensure the fairness of the competition, robot is prohibited to use 6V Power Connector (for AA battery holder).

T31. To ensure the fairness and safety of the competition, the 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.

 	 	   
✗ Allowed	✓ Prohibited	✗ Prohibited

Table 3.2 Allowed and Prohibited Model of Vision Senor Battery

T33. mBot battery and mBuild battery cannot be used at the same time in Smart Camera.

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 Safety

Robot's Safety

R01. The design and construction of the robots by the teams should meet the Technical Requirements.

R02. Each part of the robot should be used safely under the guide of the mentor.

R03. The robot should not eject or launch any parts from itself on purpose.

R04. Robots should not use double-sided adhesive tape or glue to paste the Arena Props throughout the whole match.

R05. 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

R06. 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.

R07. In the preparation process, the team must follow the instructions of the mentor and should not perform any dangerous action without mentor's authorization.

R08. The team should pay attention to safety when using dangerous tools (screwdrivers, sharp knives) and must use under the guide of their mentors.

R09. During the competition, teams should wear goggles; long hair should be tied up; teams are prohibited from wearing slippers into the competition arena.

R10. During the competition, teams should not press the table heavily or perform other dangerous actions (e.g. damage the arena or props).

R11. 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.

4.2 Operation

Late Arrival

R12. 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

R13. 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.

R14. 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. The dimension of area may vary according to the actual size of the competition venue.

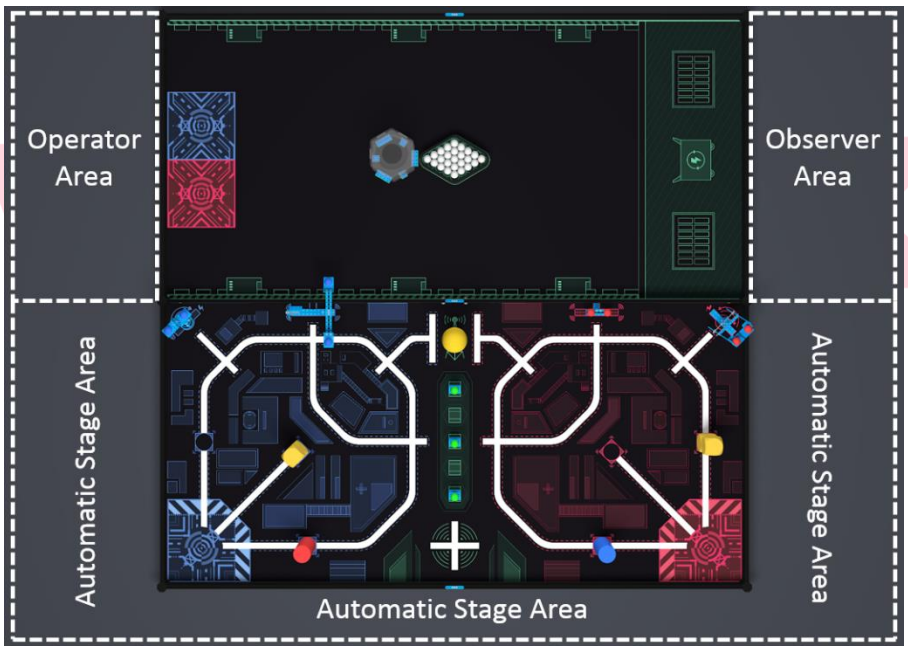


Fig 5.1 Operation Area

R15. In the manual stage, if the operator and the observer need to exchange their roles, they should apply to the referee and announce, “Red team exchange role” or “Blue team exchange role”. After the referee responds, “Agree Red team Exchange” or “Agree 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.

R16. If the contestants violate this rule, the team will get Warning for the first time, and get Violation for each time after first time. In some serious

cases, the referee has the right to disqualify the team for this single match. If violate this rule brings scoring advantage, it will be invalid and the scoring related prop will become Invalid Prop. When this rule is violated, the existence of direct or indirect contact will also trigger the Invalid Prop.

Robot Start in Advance

R17. 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 Warning for the first time and the competition will restart. If the robot is started in advance for the second time, the referee has the right to disqualify the team for one Single Match.

Robot Restart

R18. 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 chassis is within the starting area), the team can start or switch the robot's program.

R19. If the robot is started outside the starting area, the team will get a Warning for the first time. For the second time, the team will get a Violation. If the robot is started outside the starting area and it brings scoring advantage, this advantage will be invalid and the scoring related prop will become Invalid Prop, and the prop cannot be scored.

R20. If the robot is not started Completed In Starting Area, it will consider as robot started outside the starting area.

Robot enters the wrong mission area

R21. 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.

R22. Once the robot is completed enter the area different from its stage (see R19), Contestants must immediately apply to restart and remove their robot. It will get a Warning at the first time, and consider as violation each time after the first time. In some serious cases, the referee has the right to disqualify the team for this single match.

R23. If the contestant refuses to apply for restart robot, the referee has the right to disqualify the team for the single match. When this rule is violated, the existence of direct or indirect contact with the scoring props will trigger the Invalid Prop.

Restart and Modification of the Robot

R24. During the competition, the contestants can restart and modify the robot at any time.

R25. If the contestants choose to restart or modified their robot, the contestant of the Red team should raise his hand to the referee and announce, “Red team requests Restart”. The contestant of the Blue Team should raise his hand to the referee and announce, “Blue team requests Restart”. After the referee responds, “Agree Red team Restart” or “Agree Blue team Restart”, the robot can be taken out by contestants for restart or modification.

R26. 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.

R27. 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.

R28. It will be warning at the first Indirect Contact, and consider as violation each time after first 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.

R29. 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.

Special Case

R30. After agreed by the contestant from both alliance teams, the Captain of Alliance can apply to the referee announce “Automatic Stage Completed (or Manual Stage Completed) and record the used time.

R31. If the robot completes alliance team's Automatic Independent Mission, both alliance teams cannot score for that Scoring Prop.

R32. 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.

R33. If the robot moves any props Completely Out the Table, the corresponding props will become an Invalid Props and cannot put back on Table.

R34. During Automatic Stage, if the contestant indirect controls the robot, the referee has the right to disqualify teams for one Single Match.

Violation Due to Contact with the Robot

R35. 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.

R36. 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.

Robot Keep in Contact with Props

R38. When a scoring prop is in contact with a robot, the scoring prop does not score regardless of whether it is in the scoring status.

Violation Due to Mentoring

R39. 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

R40. 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

R41. 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.

Using Programming Tools

R42. 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.

Wireless Remote-Control Operation

R43. 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.

R44. 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.

Uncertainty of Props and Arena

R45. 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.

R46. 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.

4.3 Punishment

Warning

R48. The referee gives the team an oral notice, Warning, and requires the team to stop violating the rules and obey the referee's instructions. During the Warning, the competition will be timed normally.

Violation

R49. The referee gives the team a noted punishment, Violation with 20 points deducted for the team. When the referee discovers that the team has corresponding violated performance, the Violation will be given immediately. During the Violation, the competition will be timed normally.

R50. 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

R51. 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. The referee should have the right to determine whether the props are invalid or not according to the contents of this Guide and the behaviour of the teams.

R52. The Invalid Props will not be removed from the Arena and it will be penalty as usual.

R53. 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.

4.4 Similar Robot

R54. 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

R55. The competition venue emerges problems that might affect the safety of teams or robot.

Damage of Arena or Prop

R56. The props or arena are damaged accidentally, and the competition cannot continue.

Re-competition

R57. Referees have the right to discuss and determine if a Re-competition is necessary according to the actual situation.

R58. 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

R59. 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.

R60. During the competition, all matters not specified in the Technical Guide are decided by the referee team.

R61. This Technical Guide is the reference for the referee. During the competition, the referee has the right to give final decision.

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

Appendix 1: Terms

Roles

Contestant: Participant who registered and participated in the 2020 MakeX Robotic 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

Recognition: Through sensors, robot obtains the color information of the props on the arena.

Clamping: The robot has direct contact with the competition props or controls competition props.

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

Robot Chassis: Part of subsystem 1.

Parts: In addition to the robot chassis, 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

Automatic: The robots execute the program in an autonomous way.

Manual: The operator controls the robot through the Bluetooth Controller.

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's Area: During the manual stage, the area where the operator is allowed to stay.

Observer's 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.

Competition Mat: The field where all the competition elements are placed, including missions, track, 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.

Automatic Independent Mission: The mission which requires the robot execute an automatic program in the automatic mission area. The team scores Independent Mission Points for the Red/Blue Team by completing this mission.

Automatic Alliance Mission: The mission which requires the robot executes an automatic program in the automatic area. The team scores Alliance Mission Points by completing this mission.

Manual Alliance Mission: The mission which requires contestants to complete it by controlling the robot through Bluetooth Controller in the manual Mission Area. The team scores Alliance Mission Points by completing this mission.

Mission Background: Introduction to mission's story.

Scoring Category: Special refers to the classification of Scoring Props. Scoring Props who have the same Scoring Category will share the same scoring method.

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

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

Robot Start: The contestants switch on the power of the robot and let the robot start from the starting area.

Robot Restart: With the permission of the referee, the Contestants take the robot from the arena and restart it.

Robot Modification: With the referee's permission, the Contestants take the robot out of the arena and change the robot parts.

Refereeing

Competition Start: The referee gives the instruction, “Competition Start”, to the contestants.

Automatic Stage End: The referee gives the instruction, “Automatic Stage End”, to the contestants.

Manual Stage Start: The referee gives the instruction, “Manual Stage Start”, to the contestants.

Competition End: The referee gives the instruction, “Competition End”, to the contestants.

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.

Completely Separated: There is no Direct Contact between the Arena Props and other Arena Props.

Partially Separated: There is direct contact between the Arena Props and the other Arena Props.

Not Dropped: The upper surface of the bottom object has Direct Contact with the lower surface of the top object, and the top object can remain Stationary State without

the support of other objects.

Completely Out of the Arena: There is no Direct Contact between the Arena Props and the Arena.

Fall Down: The bottom of the Arena Prop does not touch to the Arena completely and remains Stationary State.

Lean on Prop: The Arena Props has Direct Contact with another Arena props, and the props needs to rely on another Arena Props as support to maintain the Stationary State.

Lean on Frame: There is direct contact between the Arena Props and the Competition Frame and need to rely on the Competition Frame as support to maintain the Stationary State.

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.

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 large yellow balls.

Mission Props: An object that carries a Scoring Props.

Appendix 2: Competition Resources

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

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

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

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.

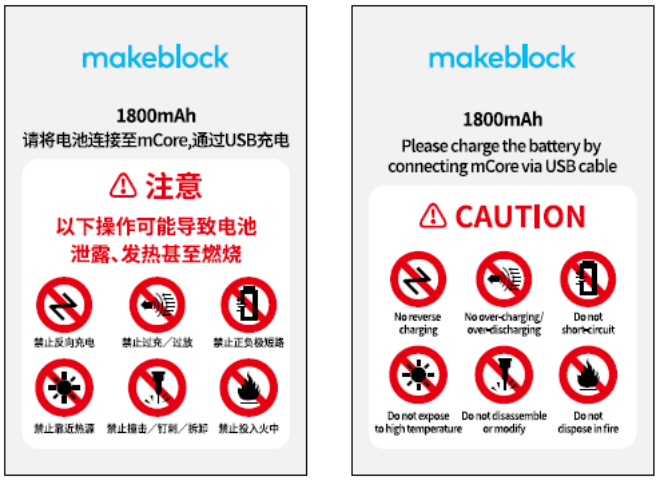


Fig. A Battery Safety Instruction

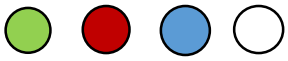
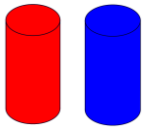
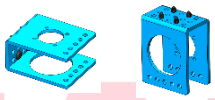
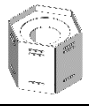
Appendix 3: MakeX Starter Robot Self-Check List (Smart Links)

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.	

Number, Size and Weight of Robots			
No.	**Items**	**Specific requirements**	**Status**
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.	
Parts of Robot			
No.	**Items**	**Specific Requirements**	**Status**
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	3D printing parts	In addition to 3D printing parts, other mechanical parts must be manufactured or sold by Shenzhen Makeblock Co., Ltd.	
16	Counterweight parts	The robot is allowed to use purchased or self-made non-electronic parts as counterweight. Those parts should not have magnetic or any impact on the electronic sensors or mainboard.	
17	Battery	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). 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[1]	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

[1] Prop's size has unavoidable error, please read Competition Rules R45 & R46 for details.

* Please refer to the real prop for the size.

MAKEX

MakeX Robotics Competition Committee

TECHNICAL GUIDE

Email:
makex_overseas@makeblock.com

Official Website:
(CN): www.makex.cc
(EN): www.makex.io

Instagram:
makexofficial

Facebook:
MakeX

Facebook Official Account