URC2019 Advanced Division Rulebook

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Competition Overview

Title: Robot Soccer

Competitors will build soccer robots that can take the ball from the defenders and shoot it into the goal. When the Olympics come to Tokyo in 2020, we will see the world's best athletes once again gather to compete and display their prowess in sports of all kinds, including soccer. However, in recent years we've also begun to see a new kind of sports competition, where the athletes competing are not humans, but robots. In the Advanced Division, competitors will take a shot at a new kind of sport with a robot soccer game.

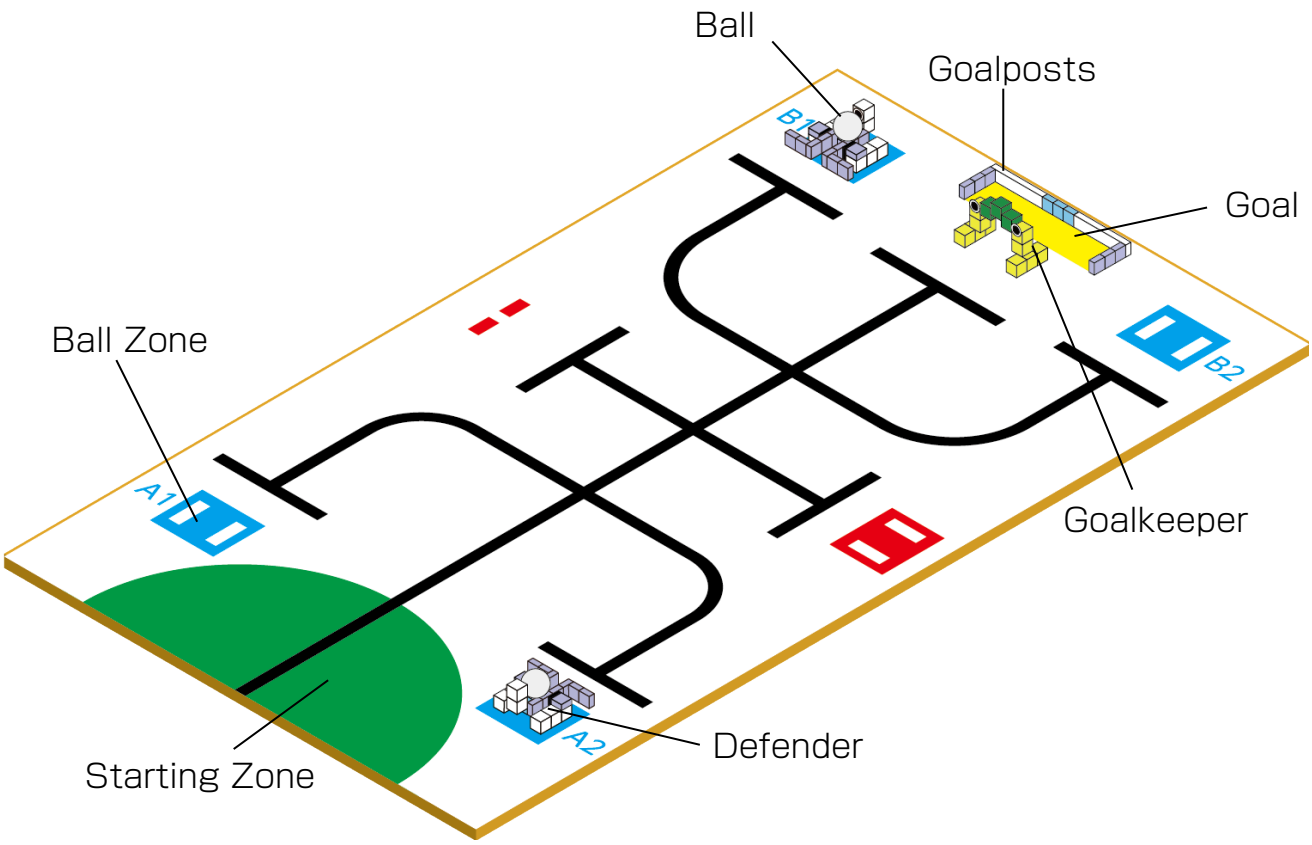


Figure 1. Advanced Division Field

1. The Competition

○ Competition Guidelines

◇ Basic Rules

Robots will set off from the Starting Zone, take balls from the Defenders, and shoot them into the Goal. When the robot turns on its finish light (a blue LED), the game is over.

◇ Special Challenge

The special challenge will be held during finals. The content of the challenge will be announced on the day of the competition.

◇ Competition Objectives

> Robots should act autonomously from the point they leave the Starting Zone until they cease operating.

> Collect all the balls on the field and get them into the goal.

> Complete the game in the shortest possible time.

○ Guide to the Field

◇ Balls

The balls will be 35 mm in diameter and made of glass (see Figure 2).

Figure 2. Ball

◇ Defenders

Defenders, as shown in Figure 3, will be built from Artec Blocks. (See Appendix 3 for building instructions.) Defenders will all be identical, and will NOT be fixed in place on the field.

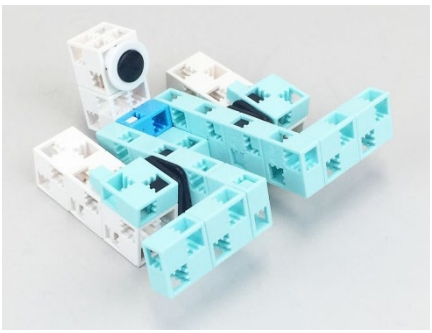


Figure 3. Defender

As shown in Figure 4, the ball can be taken from a Defender by pressing its legs down.

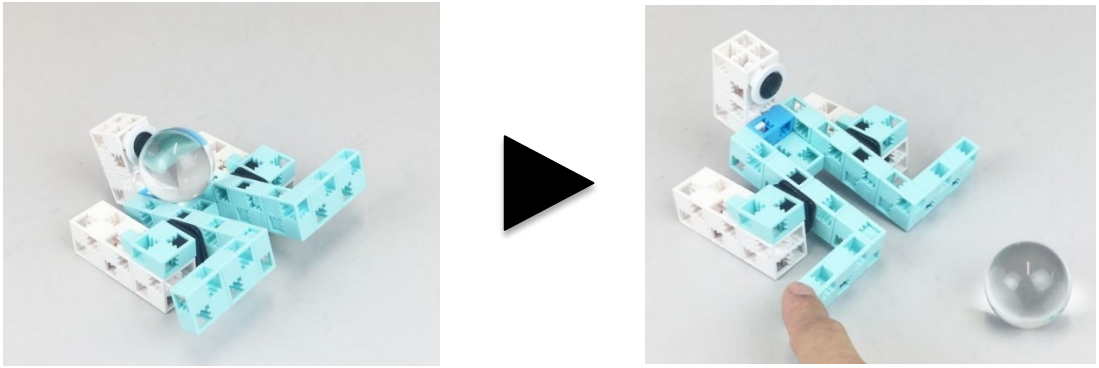


Figure 4. Taking the Ball

Two Defenders will be present on the field. One will be placed in either Zone A1 or Zone A2, and the other will be in either Zone B1 or Zone B2.

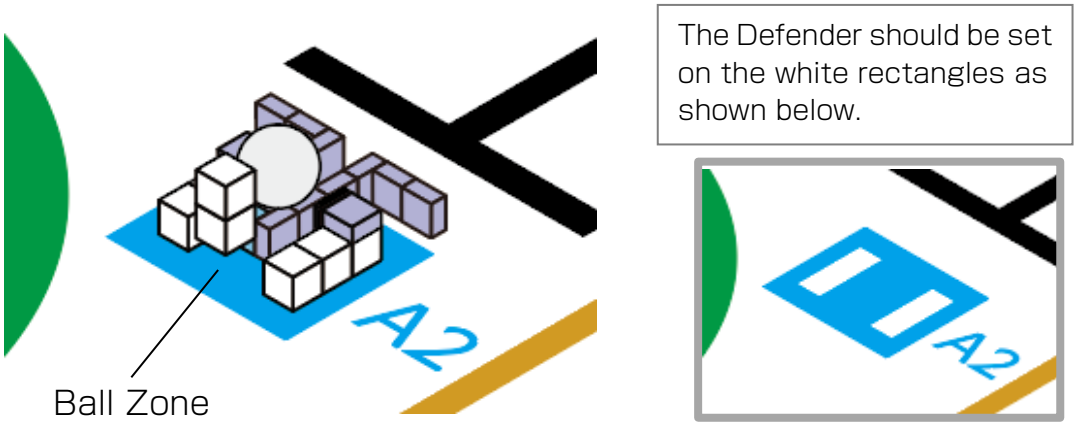


Figure 5. Defender Placement

◇ The Goalkeeper

There will be one Goalkeeper, made with Artec Blocks as shown in Figure 6, set on the field in front of the goal. The Goalkeeper will not be fixed in place on the field.

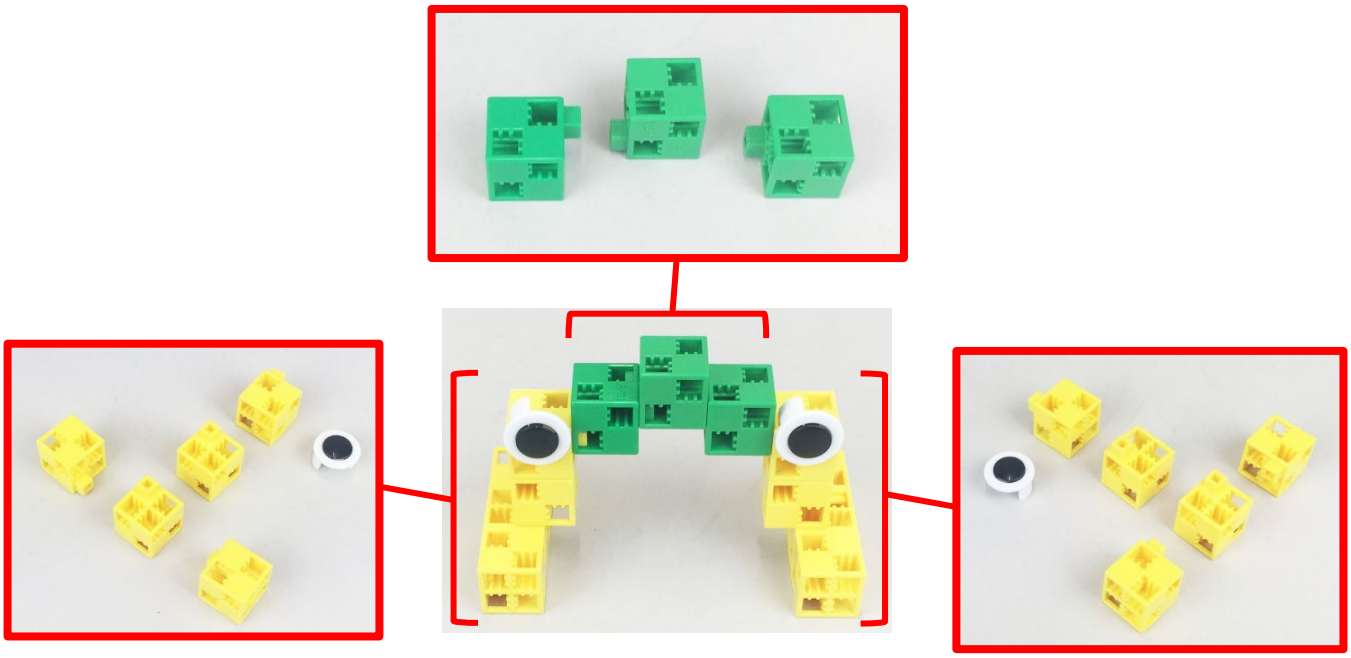


Figure 6. Building the Goalkeeper

◇ Goalposts

Goalposts, made with Artec Blocks as shown in Figure 7, will be placed around the Goal on three sides to act as a net. The Goalposts will not be fixed in place on the field.

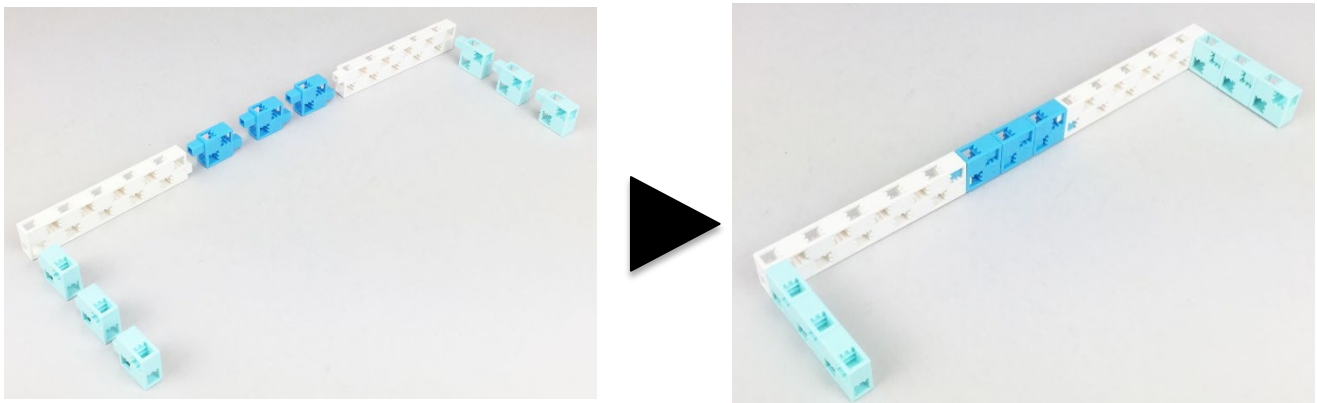
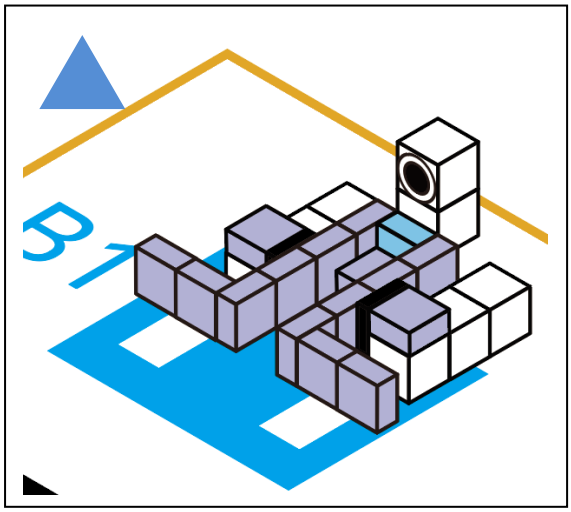


Figure 7. Building the Goalposts

2. Competition Rules

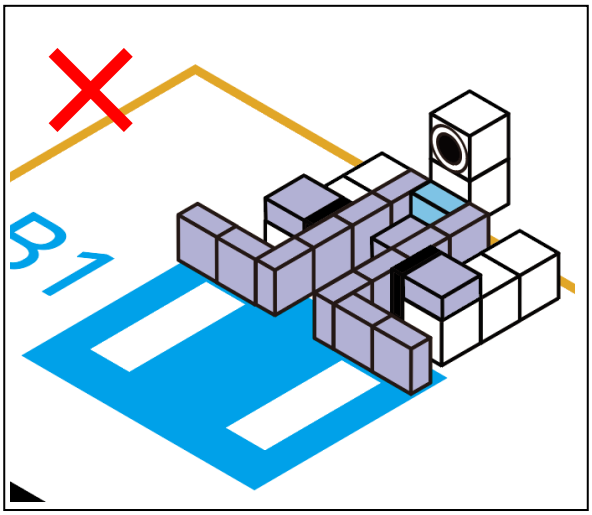
1) Each round of the competition is 180 seconds (three minutes).
2) Robots are placed in the green Starting Zone and start at the sound of the referee's whistle.
3) Robots are not allowed to go outside the Starting Zone, including the air above the field, until the round starts.
4) Once the robot starts moving, competitors are not allowed to touch it until the end of the round.
5) Competitors are not allowed to retry or modify their programs during the round.
6) Defenders will be placed at two different points on the field - one in either Zone A1 or A2, and one in either Zone B1 or B2. (See Figure 8 on page 10 to confirm the location of these Zones.) The positions of the Defenders will not be revealed until the day of competition and are decided fairly by a referee's lottery at each venue.
7) Each ball taken from a Defender by the end of the round is worth 50 points (this includes simply knocking the ball out of the Defender's hold). Be aware that no points will be awarded if the robot moves the Defender's base (made of white blocks) out of the Ball Zone, and only half points will be awarded if it is moved partially out.

Base Partially Moved



Half (25) Points

Base Moved Completely Out



No Points

8) Each ball that touches the yellow Goal area before the end of the round is worth 100 points. There will be no penalties for knocking the Goalposts out of place or for balls leaving the field. Balls that touch the Goal will be collected by the referee. In addition to balls that are shot into the Goal directly, balls that are knocked into the Goal by other balls will also count. Even if the same ball touches the Goal more than once, points will only be awarded for the first touch.

9) If the referee determines that a ball that has already entered the goal once is now obstructing the game, they may choose to retrieve it from the field.

10) For each time the robot touches the Goalkeeper during the round, 50 points will be deducted from the competitor's score at the end of the round. There will be no penalty for balls hitting the Goalkeeper (even if it is knocked out of place).

11) Once all the balls have been shot at the goal, the robot should come to a stop and turn on its finish light. This finish light (LED) must be blue and placed in a location readily visible to the referee. The time recorded at the point the light turns on will be the completion time for the round. In the event the light does not turn on or turns on before the robot stops, the completion time will be recorded as the full 180 seconds.

12) Bonus points are awarded for completing the special challenge. No points are deducted for failing the special challenge or not attempting it at all.

13) The referee will declare the round finished in the event of the following:

- The robot turns on its finish light (LED). In the event the light does not turn on or turns on before the robot stops, the completion time will be recorded as the full 180 seconds.
- The round has reached 180 seconds.
- The robot falls while on the course and can't return to the Starting Zone by itself.
- The robot falls apart or is otherwise rendered unable to continue the round.
- Competitors declare, "Stop!"
- The referee determines that a major rules violation has occurred.

3. Competition Flow

1) Each team gets one round during the preliminaries, and two rounds during the finals. In the finals, only the round with the highest score of the two will count towards the team's rank.

2) Teams are given time for a trial run on the actual field before each round. Each team can use this time to adjust their robots and programs. The order of these trial runs is decided by a lottery held by the hosts of the competition.

3) Competitors can also freely adjust their robots and programs on the practice field while other teams are doing their trial runs.

4) Teams will also use their time in 2) and 3) to prepare for special challenges.

5) Robots will be checked by inspectors once all teams have finished their trial runs. All robots which have passed inspection will be placed in a designated location and can't be touched until the round starts. Programs should be transferred prior to inspection, as no changes can be made to any robot after it's been inspected (this includes during the round).

6) Teams will compete in the first round in an order which the hosts of the competition will decide by lottery. After being called, competitors will retrieve their robot and wait in the designated location until the round starts. Robots and programs can't be adjusted during this waiting period.

7) Once the round ends, competitors will immediately move their robots to the designated location to wait.

8) In the finals, there will be an adjustment period between the first and second rounds.

9) Once the adjustment period is over, robots will be inspected again as they were in 5).

10) The second round in the finals will be held in an identical way to the first round in 6). Once the round ends, competitors will immediately move their robot to the designated location and wait until all teams have finished.

11) Ranks are calculated using the results of each team's rounds.

12) In the event different teams have the same score, the team with the shorter completion time gets the higher rank.

4. Robot Specifications

1) Only one robot is allowed per team.

2) See Appendix 1 on page 11 and Appendix 2 on page 12 for the ArtecRobo parts and Artec Blocks competitors can use to build their robots.

3) Each robot can only use one Studuino. There are no restrictions on the number of other parts.

4) Any parts from 2) can't be modified.

5) Competitors are not allowed to reinforce their robots using parts (such as screws, adhesive tape, etc.) other than those listed in 2). However, bundling cords together with rubber bands or cable ties will be permitted.

6) Robots must not exceed 30 cm in width, 30 cm in length, and 30 cm in height at the start of the round.

7) There are no weight restrictions on robots.

8) While robots are allowed to transform at the start of the round, they must stay in one piece.

9) Any programs for the robots must be made using one of the following pieces of software.

- Studuino Icon Programming Environment
- Studuino Software Studuino Block Programming Environment
- Arduino IDE
- Dolittle
- Atmel Studio

10) Robots should act autonomously once the round has started.

11) Competitors aren't allowed to handle the robot once the round has started.

12) Robots must use three AA batteries.

13) Competitors may only use parts and PCs that they've brought themselves to adjust their robots and programs during the trial run before the start of the round. The hosts of the competition will not provide these.

14) Robots and programs can only be built by team members registered to participate in the competition. Any competitors who violate the rules of the competition will be banned from competing for three years (starting with this year's competition).

5. Scoring

① Each ball taken from a Defender is worth 50 points. Only 25 points will be awarded if the Defender's base is moved partially out of the Ball Zone.

② Each ball that is judged to have entered the Goal is worth 100 points.

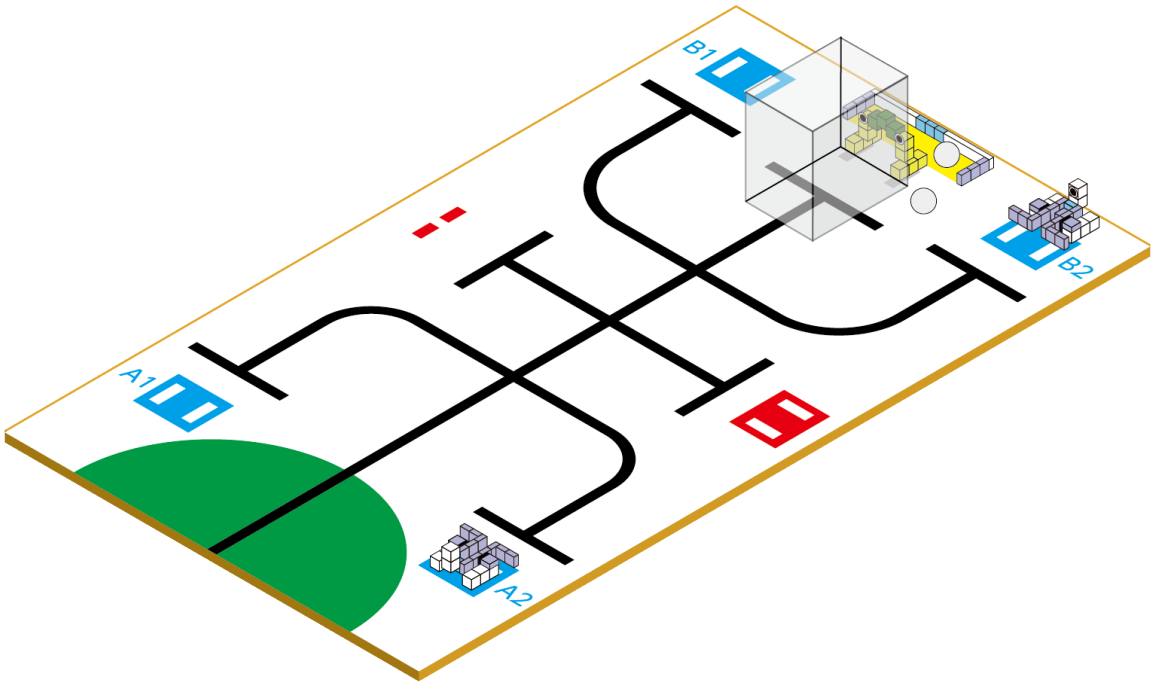
③ A robot touching the Goalkeeper will result in a 50-point deduction.

④ Completing the special challenge during finals is worth a maximum of 100 points.

⑤ The final score is the sum of items ① to ④.

(Scoring Example)

The Defenders have been placed in Ball Zones A2 and B2.



○ Taking the Balls

· Defender inside the Zone: 1 ball ⇒ 50 points x 1 = 50 points

· Defender partially outside the Zone: 1 ball ⇒ 25 points x 1 = 25 points

○ Scoring Goals

One goal ⇒ 100 points x 1 = 100 points

○ Touching the Goalkeeper

Touched once ⇒ -50 points x 1 = -50 points

Final Score: 125 points

6. The Competition Field

A set including the same competition field, balls, and blocks (for the Defenders, Goalkeeper, and Goalposts) used for the competition can be purchased from the local host of your block, listed on the official competition website.

★The width of black lines are all 20 mm. ★All units are in mm.

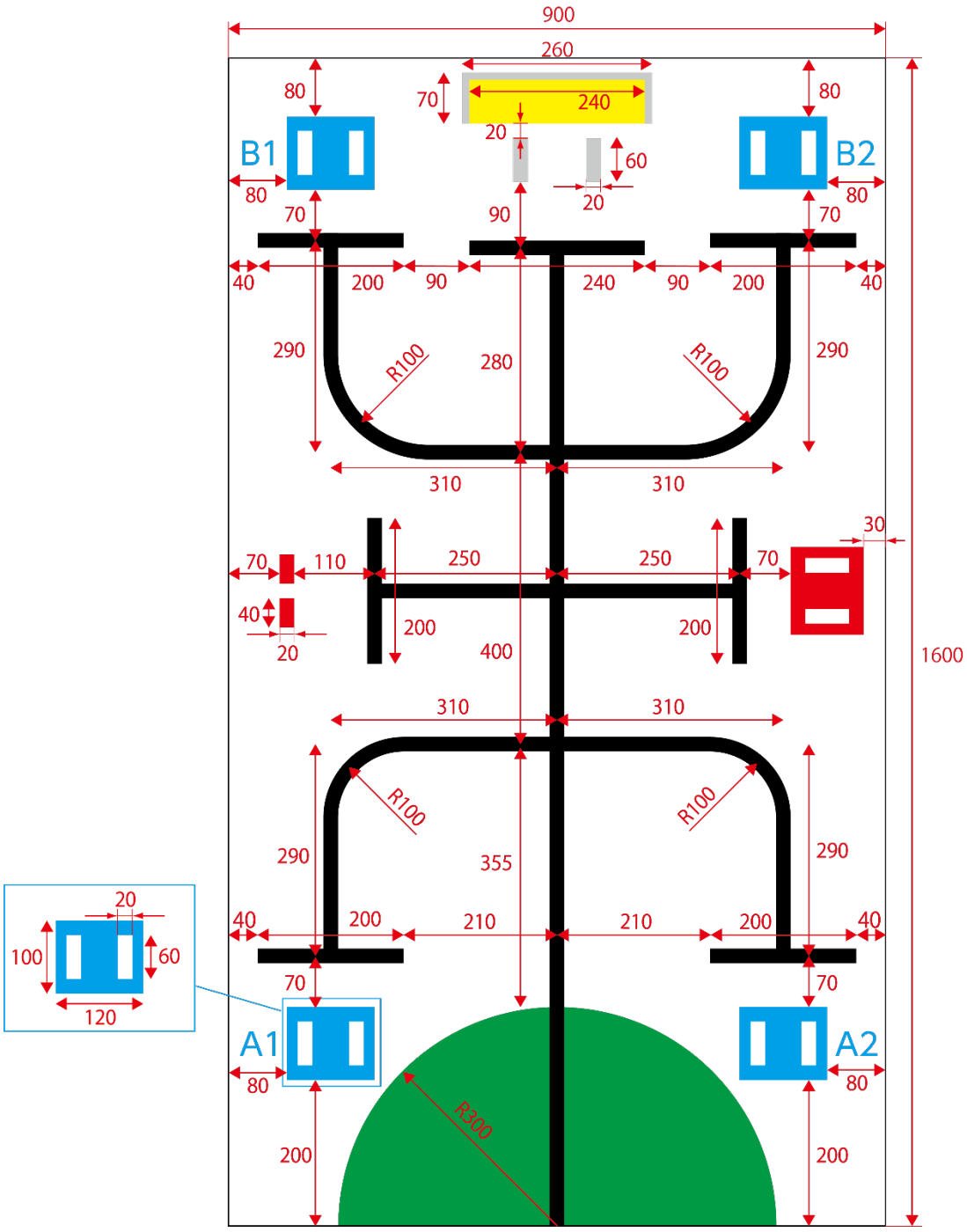
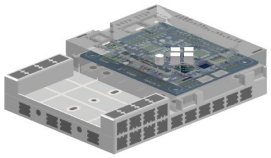
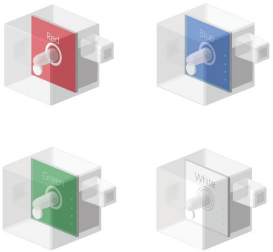
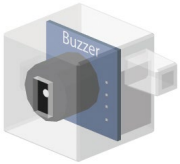
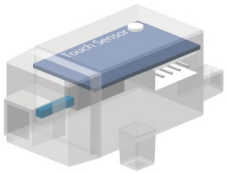
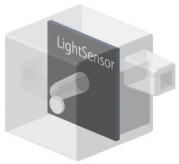
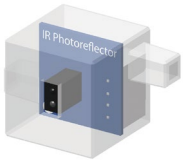
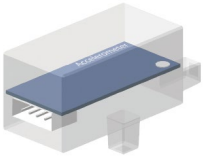
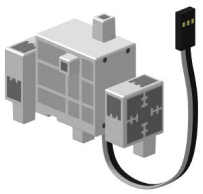
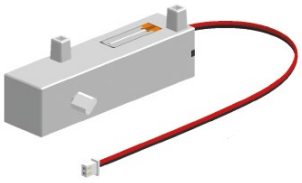
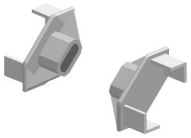


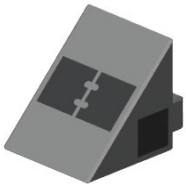
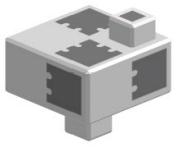
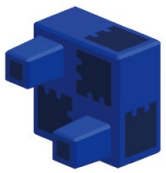
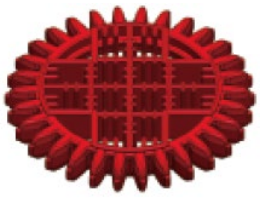
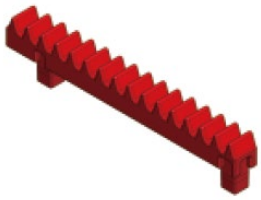
Figure 8. Field Dimensions

Appendix 1. Permitted ArtecRobo Parts

Studuino	Battery Box	LEDs (red, blue, green, white)	Buzzer
 *The Studuino may have a face plate sticker attached.			
Touch Sensor	Light Sensor	IR Photoreflector	Accelerometer
			
Gyroscope	Servomotor	DC Motor	DC Motor Connectors
			
Sensor Connecting Cable (S) 3-wire, 15 cm	Sensor Connecting Cable (M) 3-wire, 30 cm	Sensor Connecting Cable (L) 4-wire, 50 cm	Extension Cable for Servomotors
			

Appendix 2. Permitted Artec Blocks

*There are no restrictions on the color of the blocks.

Basic Cube	Triangle	Half A	Half B
			
Half C	Half D	Axle	Wheel
			
Beam	Disk	Gear (L)	Small
			
Gear Rack	O-ring	Tire	
			

Appendix 3. Defender Assembly Instructions

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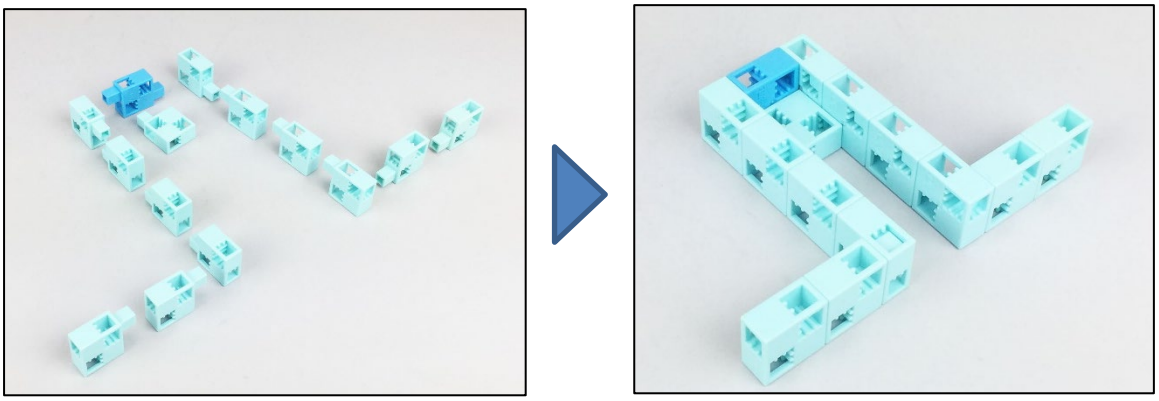

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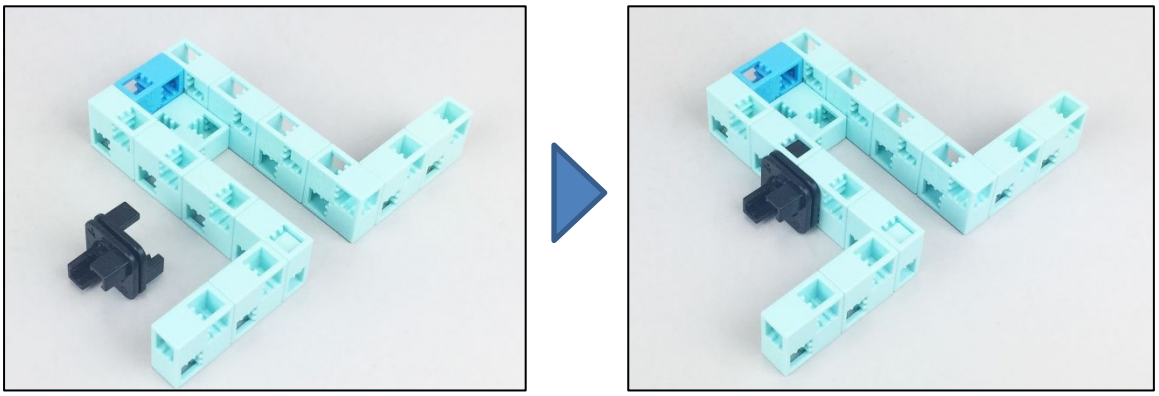

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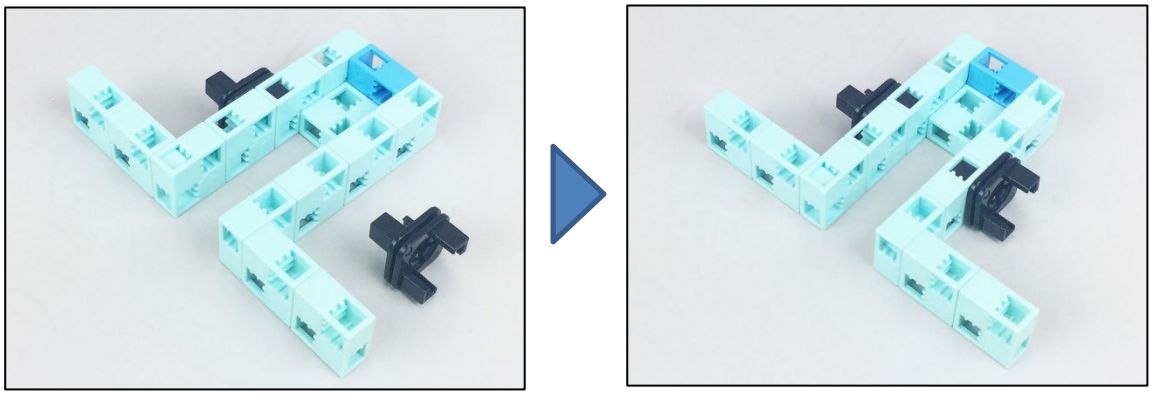

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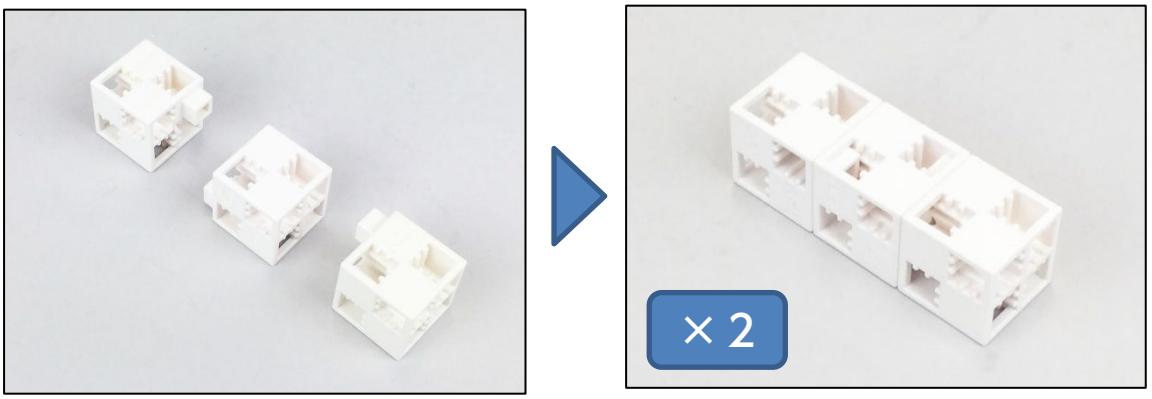

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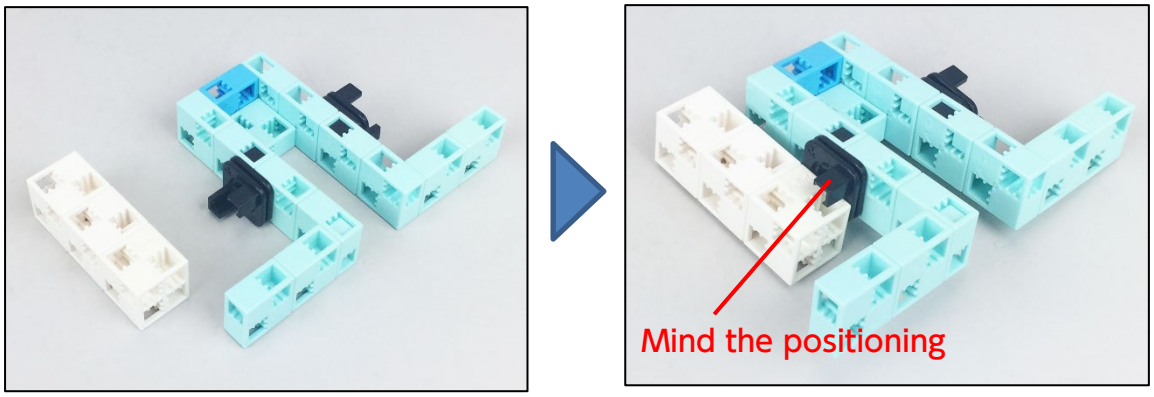

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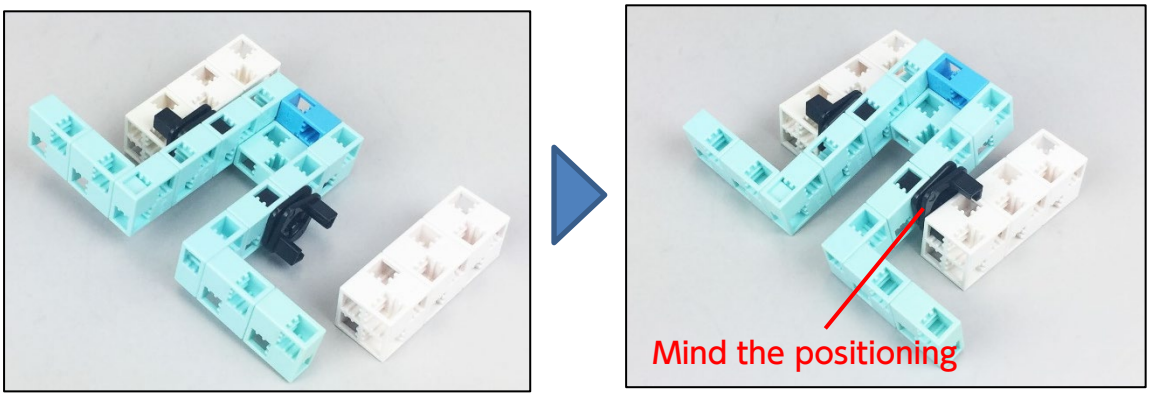

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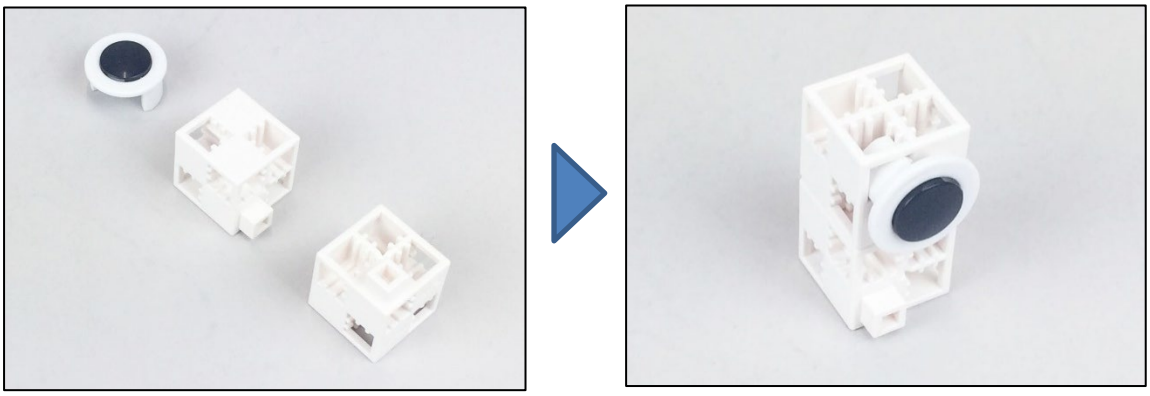

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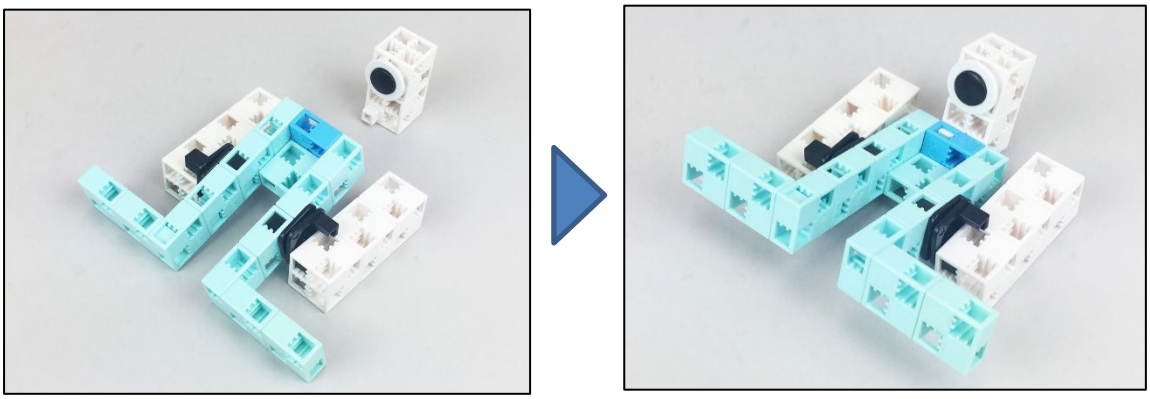

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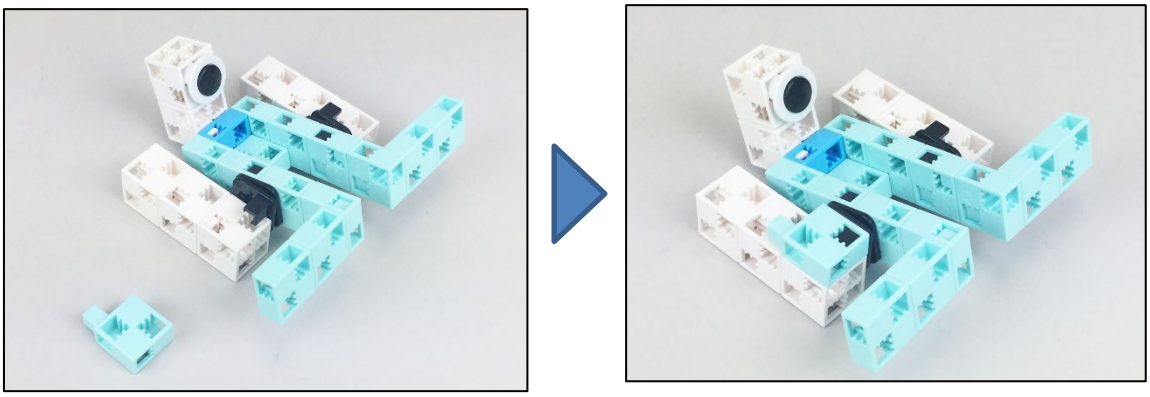

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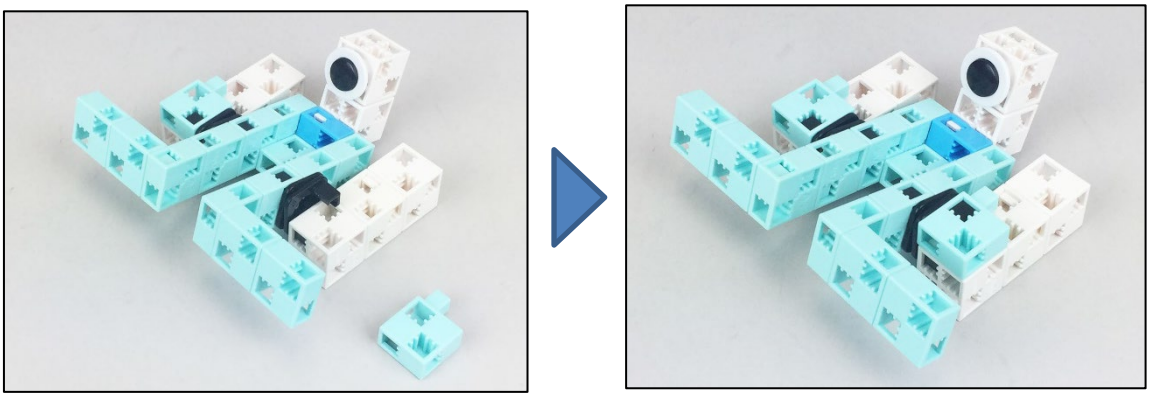

Complete