

robotex¹⁸
INDIA

Sumo Challenge
Rules



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1 Introduction

This document defines the rules for the robots of 3 kg Sumo, Mini Sumo, Micro Sumo, Nano Sumo, iRobot Sumo, LEGO Sumo and 3 kg LEGO Sumo. The rules are based on the Baltic Robot Sumo Rules.

2 Robot classes

Only autonomous robots are represented at the Sumo competition of Robotex 2018 in the following classes:

1. 3 kg Sumo;

3 The Competition

3.1 Definition

One operator and one assistant can be registered for every robot. However, only the operator is allowed to guide the robot. Both contestants must follow the competition rules, the terms and conditions of winning and participate using only self-made autonomous robots at the Dohyo area designated beforehand. The winner is announced by the judges.

3.2 Format

The competition format is established by the tournament organisers, depending on the number of participants. If the number of participants is high, sub-groups will be used in order to decide who enters the final tournament. The finals are held in the format of double-elimination tournament. If the number of participants is low, all contestants will immediately compete in the format of final tournament.

3.3 Sub-classes

The organisers of the competition reserve the right to divide the robots into sub-classes according to the age, level or any other characteristic of the participants.

4 Dohyo Jyonai

Dohyo Jyonai (the match ring area) consists of the Dohyo (the match circle) and the Yochi (the outer layer area of Dohyo). The rest of the space will be deemed as area Dohyo Jyogai (outside the Dohyo area). The area of Dohyo Jyogai is surrounded by guards (see Appendix 1. Figure of match area).

The Dohyo (the match circle) is a circle that is covered with a black colour coating.

Table 1 Parameters of the Sumo fields

| Class | Height | Diameter | Court material |
|----------------|--------------|----------|----------------|
| 3 kg Sumo | 5 cm | 154 cm | steel |
| Mini Sumo | 1 - 5 cm | 77 cm | wood/plastic |
| Micro Sumo | 1 - 5 cm | 38.5 cm | wood/plastic |
| Nano Sumo | 0.6 - 1.5 cm | 19.25 cm | wood/plastic |
| iRobot Sumo | 5 cm | 154 cm | steel |
| LEGO Sumo | 1 - 5 cm | 77 cm | wood/plastic |
| 3 kg LEGO Sumo | 5 cm | 154 cm | steel |

4.1 Starting cross

The starting cross is placed in the middle of the Sumo field and it divides the field into four equal sectors. The robots must always be located in two reciprocal sectors (see Figure 1). The robot must cover the area of Tawara (white line) at least partially. The referee removes the starting line from the field once the robots have been fixed. Once the robot has been fixed, it cannot be moved anymore.

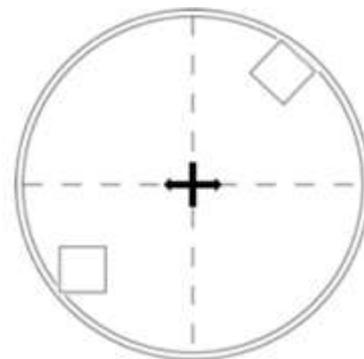


Figure 1 Starting cross

4.2 Tawara (white line).

Tawara is the white line around the Dohyo. Tawara line is a part of the Dohyo.

Table 2 Dimensions of Tawara by competition classes

| Class | Width of Tawara |
|----------------|-----------------|
| 3 kg Sumo | 5.0 cm |
| Mini Sumo | 2.5 cm |
| Micro Sumo | 1.25 cm |
| Nano Sumo | 0.625 cm |
| iRobot Sumo | 5.0 cm |
| LEGO Sumo | 2.5 cm |
| 3 kg LEGO Sumo | 5.0 cm |

4.3 Yochi

Yochi is an area around the Dohyo with a diameter of at least 100 cm for Mikro, LEGO, Mini and Nano Sumo competitions and at least 250 cm for 3 kg LEGO, iRobot and 3 kg Sumo competitions. Yochi colour and material can be freely chosen from all colors besides white

5 The Robot

5.1 Requirements for the robot

1. Dimension and weight restrictions

Table 3 Dimension and weight restrictions

| Class | Mass | Length* | Width * | Height |
|----------------|--------------|-------------------------|---------|-----------|
| 3 kg Sumo | 3.0 kg | 20 cm | 20 cm | unlimited |
| Mini Sumo | 0.5 kg | 10 cm | 10 cm | unlimited |
| Micro Sumo | 0.1 kg | 5 cm | 5 cm | 5 cm |
| Nano Sumo | 0.025 kg | 2.5 cm | 2.5 cm | 2.5 cm |
| iRobot Sumo | 4.0 kg | original external shape | | unlimited |
| LEGO Sumo | 1.0 kg | 15 cm | 15 cm | unlimited |
| 3 kg LEGO Sumo | 2.0 – 3.0 kg | 20 cm | 20 cm | unlimited |

*Infrared sensor must be placed on top of the robot, not on the side or under the robot (3 kg Sumo, Mini Sumo, Micro Sumo and Nano Sumo).

* The robot may expand after the start of the round, but must stay in one piece.

* NB! LEGO robot measure box is 15 x 15 cm with +2 mm tolerance. The measure box for 3 kg LEGO robots is 20 x 20 cm with +2 mm tolerance.

* The maximum size and weight of Nano Sumo Robots is excluding the size and weight of the starting module (12.5 mm x 10.5 mm x 4 mm, 1 g).

2. Autonomous robots – starting the movements

Table 4 Starting the movements

| Class | Starting method |
|----------------|---|
| 3 kg Sumo | Official infrared remote control operated by the referee. See the technical specification of the compulsory receiving device from Appendix 2. Start and stop remote control system. |
| Mini Sumo | |
| Micro Sumo | |
| Nano Sumo | |
| iRobot Sumo | 5-second timer. The timer can be activated by the operator of the robot by pressing a button or via remote control system. |
| LEGO Sumo | |
| 3 kg LEGO Sumo | |

3. Autonomous robots – stopping the movements

Table 5 Stopping the movements

| Class | Stopping method |
|----------------|---|
| 3 kg Sumo | The referee stops the robots by using official infrared remote control. See the technical specification of the compulsory receiving device from Appendix 2. Start and stop remote control system. Additionally, the operators of the robot can use their remote controls to stop the robot. |
| Mini Sumo | |
| Micro Sumo | |
| Nano Sumo | |
| iRobot Sumo | The operator of the robot stops the robot by pressing a button or via remote control system. |
| LEGO Sumo | |
| 3 kg LEGO Sumo | |

4. Requirements for blade use

It is not forbidden to use double blades. It is forbidden to use any components that may separate from the robot when it moves, or comes into contact with another robot.

5.2 Movements of autonomous robots

The movements of the robot should be designed to detect the movements of the opponent and respond/attack accordingly. If there is any doubt in the autonomy of the robot, the referees have the right to inspect the control logic of the robot.

5.3 Use of remote control devices with autonomous robots

During the competition (round), the remote control devices must be placed on a previously designated area. The devices may only be used to stop the robot, when the referee gives a corresponding command. The official infrared remote control device is held by the referee.

5.4 Prohibited components of the robot

1. Any components that may disturb the operation of the opponent (for example, flashlights or jamming devices such as IR LEDs intended to saturate the opponents IR sensors).
2. Any components that may damage or scratch the surface of Dohyo. An exception is when the robots collide.
3. Any components that are designed to damage the opponent.

4. It is forbidden to use any liquids, powders and gas as a weapon against the opponent.
5. It is not allowed to use any inflammable materials in the robot.
6. The robot must not include any throwing devices (for example throwing a net on opponent).
7. The robot must not include any parts, which fix it onto the Dohyo (for example, glues, suction cups, etc.). Magnets that improve the grip of the wheels are only allowed in 3 kg Sumo class.

5.5 Additional requirements for iRobot Sumo class

1. The following iRobot models are allowed to participate in iRobot Sumo class:
 - iRobot Roomba®;
 - iRobot Scooba®;
 - iRobot Create®.
2. The original wheels of the Robot are the only driving elements that may touch the surface of Dohyo. The original wheels may only be driven by original power sources, motor controllers, and a power supply unit.
3. The following modifications are allowed:
 - Devices that are used only for cleaning may be removed.
 - Computing elements and electronic devices may be added.
 - Electromechanical components may be added.
4. After modification, it must be possible to identify the original model of the robot.
5. As an exception to the general rules, an external computer and a remote autonomous algorithm may be used in iRobot Sumo class.

5.6 Additional requirements for LEGO Sumo class

1. The robot must be constructed exclusively of the licensed parts of LEGO® original or HiTechnic®. There is an exception for wires used in the robot, wires must be the licenced parts of LEGO® original, HiTechnic® or Mindsensors.
2. The parts used must be in their original condition and must not be modified.
3. The robot must only use batteries or cells that are recommended by LEGO®.

5.7 Additional requirements for 3 kg LEGO Sumo class

1. The robot must be constructed exclusively of the licensed parts of LEGO® original or HiTechnic®. There is an exception for wires used in the robot, wires must be the licenced parts of LEGO® original, HiTechnic® or Mindsensors.
2. The parts used must be in their original condition and must not be modified.

3. The robot must only use batteries or cells that are recommended by LEGO®.

6 Match principles

1. The match generally contains three rounds and lasts up to three minutes. The team who will be first to earn two Yuko points (effective points) during the time of the match, will be the winner. Match time is measured during rounds, not between them.
2. If only one Yuko point has been earned by the end of the match time, the winner is the team who earned it.
3. If neither team wins any rounds during the match time, the winner will be announced according to the situation of Yusei (dominance), see paragraph 8.3. If Yusei cannot be decided or the number of rounds that has been won is the same for both teams, the match time will be extended by three minutes. If one team earns one or more Yuko points during the extended time, then this team will be the winner.
4. The contestants have a maximum of 30 seconds between the rounds to maintain their robot.

7 Organizing the competition

7.1 Safety requirements

For safety purposes, the referees and contestant must wear gloves and goggles according to the robot class.

Table 6 Safety requirements

| Class | Gloves | Goggles |
|----------------|--------------|--------------|
| 3 kg Sumo | required | required |
| Mini Sumo | required | not required |
| Micro Sumo | required | not required |
| Nano Sumo | required | not required |
| iRobot Sumo | required | not required |
| LEGO Sumo | not required | not required |
| 3 kg LEGO Sumo | not required | not required |

7.2 Starting the match

The match starts with the referee's signal. The contestants will bow to each other before they enter the area of Dohyo Jyonai.

Before each round and with the signal from the referee, the contestants place their robots simultaneously on the Dohyo. The robots must be placed in reciprocal sectors and at least some part of the robot must stay on the white line (see Figure 1 Starting cross). The robots are not allowed to move after they have been placed on the Dohyo.

The round begins with a method that has been described for each robot class.

Table 7 Start method

| Class | Starting method |
|----------------|--|
| 3 kg Sumo | The participants leave the area of Dohyo Jyonai after they have placed their robots there. The referee starts the round by sending a start command via official infrared remote control. The robots may start moving after they have received the start command. |
| Mini Sumo | |
| Micro Sumo | |
| Nano Sumo | |
| iRobot Sumo | After the signal of the referee, the operators start the 5-second timer in the robot and immediately leave the area of Dohyo Jyonai. The robots may start moving in 5 seconds after they have received the start command. |
| LEGO Sumo | |
| 3 kg LEGO Sumo | |

In case the Dohyo area is scratched or becomes dirty, the referees decide whether to continue the match on the same Dohyo or replace it.

7.3 Ending the match

1. The referee gives a signal to end the match and stop the robots. The stopping method is separately designated for each class.

Table 8 Stopping method

| Class | Stopping method |
|----------------|---|
| 3 kg Sumo | The referee stops the robots by sending a stop command via official infrared remote control. Additionally, the operators of the robots can use their own methods to stop the robot. |
| Mini Sumo | |
| Micro Sumo | |
| Nano Sumo | |
| iRobot Sumo | The robot is stopped by the operators of the robot. |
| LEGO Sumo | |
| 3 kg LEGO Sumo | |

2. The match ends officially after a corresponding signal from the referee. The participants must take their robot from the Dohyo, bow to each other and leave the area of Dohyo Jyonai.

7.4 Torinaoshi (repeat of the round)

The round is repeated in the following situations.

1. Both robots are facing each other and their movement is hindered or they do not move at all
2. Both robots fall out of the Dohyo at the same time.
3. Other situations in which it is not possible to determine who has won or lost.
4. If it is not possible to announce the winner after Torinaoshi, the referee may place the robots himself or herself and continue with the match within the allocated time.

7.5 Handling the robots between the matches

For the time between the matches in the same sub-group, the robots must be placed on a table assigned for it and can only be removed from there for the duration of the match. It is forbidden to leave the competition area with the robot between the matches, except for when a corresponding permission has been given (e.g. the robot needs fixing). During the sub-group tournament, it is not allowed to modify the robot. The purpose of this requirement is to guarantee a smooth course of the competition.

NB! If the robot cannot be found from the designated table at the right time or if the team itself is not present, the match will result in a loss.

8 Yuko (effective) point, Shinitai and Yusei (dominance)

8.1 Yuko (effective) point

The winner is announced in the following situations.

1. If the opponent has been pushed out of the Dohyo (the robot touches the area outside of the Dohyo).
2. If the opponent falls out of the Dohyo and touches the area outside of the Dohyo.
3. In the situation of "Shinitai".
4. In the situation of "Yusei (dominance)".
5. If "Keikoku (warning)" is given twice to the opponent.
6. If there is a case of "Hansoku (violation)".
7. If the winner is announced without a match, the winner earns two Yuko points (if the winner already has one Yuko point, he or she earns only one more). The existing Yuko point(s) of the opponent who lost remain effective.

8.2 Shinitai

"Shinitai" situation means that one or several wheels of the robot roll out of the Dohyo and the robot is unable to return to the Dohyo. In this case, the opponent earns one Yuko point.

8.3 Yusei (dominance)

In a situation of "Yusei" (dominance), the referee may grant a Yuko point to the team according to the strategy, movements and skills of the robot.

9 Hansoku (violation) and penalty

9.1 Keikoku (warning)

A contestant who acts as indicated below gets a "Keikoku" (warning). If the contestant gets two Keikokus (warnings), the opponent earns one Yuko point.

1. If the operator or some item of the operator (for example, remote control) ends up in the area of Dohyo Jyonai before the round ending signal of the referee.
2. If the robot moves before the beginning of the round (movement or changing its shape).
3. If the participant violates the requirements for the use of remote control.
4. If the robot is replaced after it is placed on the Dohyo.
5. If the participant does not comply with the safety requirements.
6. In case of any other action that is considered unfair.

9.2 Hansoku (violation)

In the following situations the opponent or both parties earn one Yuko point.

1. If some parts, with total weight of more than 5 grams fall off from the robot.
2. If the robot does not move.
3. If both robots move, but do not collide.
4. If the robot is on fire or a situation, which resembles that the robot is on fire.
5. If the participant wants to end the round.

9.3 Hansokumake (defeat due to violation)

The participant who violates the following rules, loses the match due to violation.

1. If the contestant fails to show up at the designated Dohyo at the beginning of the match or the participant exceeds the time given from maintenance, see paragraph 6 Match principles.
2. If the contestant sabotages the match. For example, by deliberately breaking or deforming the Dohyo.
3. If the participant violates the requirements provided for "The Robot" in paragraph 5. If the robot does not make autonomous movements.
4. If the participant does not comply with the requirements provided in paragraph 7.1 Safety requirements, even after paragraph 9.1 "Keikoku" (warning).

9.4 Sikkaku (disqualification)

In the following cases, the participant will be disqualified – he or she must leave the competition and is not added to the list of competition results.

1. If the participant's robot does not comply with the requirements provided in paragraph 5.1 Requirements for the robot .
2. If the participant behaves in an undignified manner. For example, swears or offends the opponent or the referees.
3. If the participant deliberately injures the opponent.

10 Suspending the match

1. If the participant is injured and the match cannot be continued, the participant may demand the suspension of the match.
2. In the event of the previously described situation, the referees make necessary arrangements for the match to be immediately resumed.
3. If the arrangements do not enable the match to continue, the opponent wins the competition without a match.

11 Objections

The decision of the referees are not subject to appeals. Complaints must be submitted during or immediately after the match. Any later complaints will not be accepted. In case of any conflicts or disputes, the final word will be said by the referees and/or the organisers.

12 Marking the robots

12.1 Markings on the robot

The robots must be marked with number stickers. The stickers are provided by the organisers of the competition. The sticker cannot be placed on the plow of the robot, or on any other component, where it may disturb the work of opponents sensors.

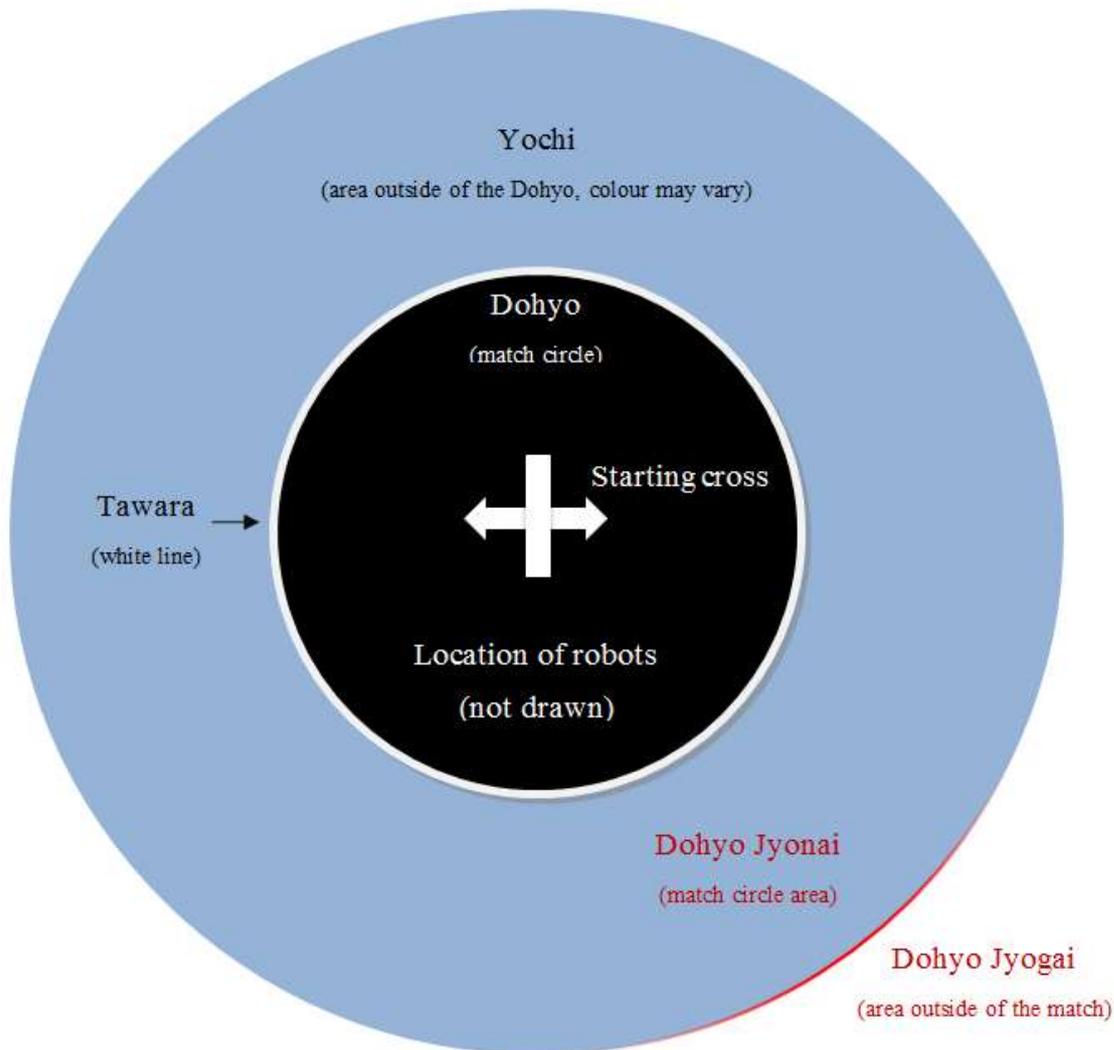
12.2 Participant marking

The participants must wear vests or other clothing that has been given to them by the organisers of the competition to ensure that they are easier to find. If necessary, stickers with the same number will be attached to the clothing as are on the robots of the participants.

13 Changes and cancellations in the rules

Changes and cancellations made to the rules are adopted by the main organiser of the competition according to the regulation of the regulatory committee of the competition.

14 Appendix 1. Figure of match area



2 Match area

Figure

15 Appendix 2. Start and stop remote control system

The same start and stop remote control system applies to Robotex 2017 Sumo as used in the competitions of RobotSM and RobotChallenge. The aim of the system is to ensure fair and quick start of the round. For safety purposes, the system is equipped with a stop switch. Using one and the same control system in different competitions is convenient for the participants.

The system is based on the infrared transmitter, which is operated by the referee, and on infrared receivers, which are located on top of the robots. The protocol used for the infrared transmitter is RC-5. RC-5 code is a Manchester coded bitstream modulated at 38 kHz. Message payload consists of a 5-bit address and a 6-bit command, which contains the remote commands (programming, start and stop) and Dohyo ID. Dohyo ID is used to differentiate close matches that take place at the same time.

Following table lists the remote commands and their respective payload content:

Table 9 Remote commands

| Command | RC-5 message field |
|-------------|--|
| Programming | Address[4..0] = 0x0B, Command[5..1] = Dohyo ID |
| Start | Address[4..0] = 0x07, Command[5..1] = Dohyo ID, Command[0] = 1 |
| Stop | Address[4..0] = 0x07, Command[5..1] = Dohyo ID, Command[0] = 0 |

The programming commands are used in order to write a new Dohyo ID in the infrared receivers of the robots immediately before the match. The infrared transmitters of the referee are equipped with separate low-power IR LED in order to ensure that only nearby robots could receive specific commands. The programmed Dohyo ID is used with a purpose to filter start and stop commands.

Start and stop commands have the same message address, however, only the first bit of the command field is used to determine the action. The infrared receivers of the robot must verify that the Dohyo ID of the message is the same as the one programmed into the robot and take corresponding action if it is the same.

The components of the infrared receiver must be placed on top of the robot in a way that the robot is able to receive the messages from any direction.

The robot or infrared receiver must be equipped with clearly visible LEDs in order to verify whether it has received the command of the infrared transmitter of the referee or not. In case of a programming command, the LED must quickly flash twice. If the robot receives the start command, then the LED flashes constantly; if it receives the stop command, it starts to flash slowly. More information about the remote control system can be found here: <http://www.startmodule.com>.

16 Revision history

1. 02.05.2016 – Rules for 3 kg LEGO Sumo have been added.
2. 02.05.2016 – Table 1 Parameters of the Sumo fields. Changes in the heights and materials of the fields.
3. 02.05.2016 Paragraph 7 clause 7.5. A rule about handling the robots between the matches has been added.
4. 25.09.2016 Paragraph 5 clause 5.1. Changes in the limits of 3 kg LEGO sumo mass.
5. 25.04.2017 Added Nano Sumo rules.
6. 08.05.2017 Paragraph 12 clause 12.1. Added a clarification about the location of the marking on the robot.
7. 08.05.2017 Paragraph 5 clause 5.4. Added a rule about damaging opponents robot.
8. 08.05.2017 Paragraph 7 clause 7.5. Added a rule about modifying the robot between the matches.
9. 09.05.2017 Paragraph 5 clauses 5.6 and 5.7. Added a clarification about the condition of allowed components.
10. 16.05.2017 Paragraph 11. Added a clarification about complaints.
11. 16.05.2017 Paragraph 9 clause 9.2. Specified the maximum allowed weight of parts that can fall of the robot during the match.
12. 13.10.2017 Paragraph 5 clauses 5.6 and 5.7. Added a clarification about wires that are allowed in Lego Sumo robots.

