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# Sony Four Legged Robot Football League Rule Book

RoboCup Technical Committee

(As of June 9, 2003)



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## 1.2 Field Color

Color of the football field is shown in Figure 2. Additionally, please refer to “Colors used in the football field” on the web.

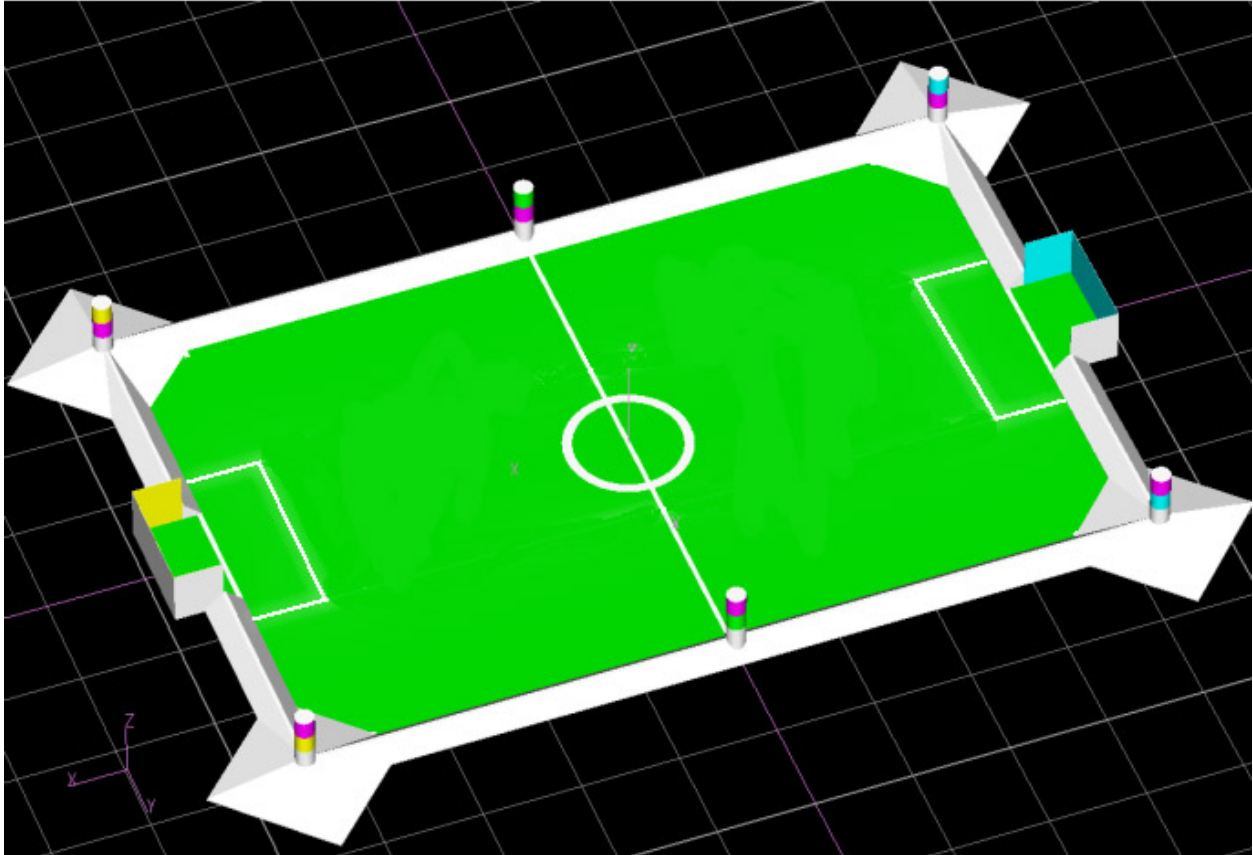


Figure 2: Field Color

## 1.3 The results of spectrum

The results of measuring the spectrum of the color samples is on the web. Note: the lighting condition at the actual competition site will be different.

## 1.4 The Lighting Condition

The lighting condition measured at the last competition is shown on the web. Lighting conditions will be setup in a similar manner at this competition.

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## **1.5 White line**

All the lines on the soccer field (the halfway line, the penalty lines, the goal lines, and the center line) are drawn with a white line of 25mm width.

## **2 Robot Players**

### **2.1 Hardware**

All teams must use Sony AIBO ERS-210 or ERS-210A robot hardware. All robots must be the “black” color models. The ERS-210A is recommended as it has a faster processor and is the only model currently being sold that is permitted in RoboCup. Absolutely no modifications or additions to the robot hardware are allowed. No additional hardware is permitted including off-board sensing or processing systems. Additional sensors besides those originally installed on the robots are likewise not allowed.

A computer will be provided by the event organizers for the purpose of forwarding wireless messages between robots.

### **2.2 Teams**

Each team consists of no more than 4 robots including the goalie.

### **2.3 Goalie**

The goalie is the only player who is allowed to stay within penalty area of its own team. The goalie robot must be chosen before the game and will be marked to distinguish it from other players. A goalie must have a mark on it to be easily identified by the referee. This mark will be provided by the event organizers before the games.

### **2.4 Team markers**

Team markers will be provided to each team. The provided team markers must be attached to each robot playing in a game. Refer to “Team Markers” on the web for pictures of the team markers.

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## 2.5 Communications

There are no restrictions on communication between the robots using a microphone or a speaker. The wireless communication shall follow legal regulations of the country where the tournament is held. The wireless communication is allowed only on condition that it observes radio use regulation. Refer to “Wireless Use Rule” on the web. The wireless communication shall follow legal regulations of the country where the tournament is held.

The use of remote processing/sensing is prohibited.

## 3 Game process

### 3.1 Structure of the game

A game consists of three parts, the first half, a half-time break and the second half. Each half is 10 minutes. The clock stops during stoppages of play (such as kick-offs after goals). The extra time over 10 minutes total that results is referred to as “lost time”. The half-time break is also 10 minutes. If the game is a draw, there will be a penalty kick shoot-out employing sudden death (see Section 3.9).

The teams will change the goal defended and uniform color during the half-time break.

### 3.2 Goal

A goal is achieved when the entire ball (not the center of the ball) goes over the field-side edge of the goal line. The restart after the goal shall adopt the same rule as the kick-off.

### 3.3 Game starts/restarts

Robots must be in legal positions before the game will be allowed to start/restart. Robots may be positioned by hand in preparation for a game start. Robots are allowed to move their heads and tails before the game restarts but are not allowed to move their legs or locomote in any fashion.

The referee will signal the game start/restart either verbally or by a whistle. At the referees signal, robots will be started either manually or using Game Controller via wireless. **All teams must implement a manual starting procedure in case of problems with wireless.**

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### 3.4 Stopping robots

Robots may be stopped either via wireless or manually. **All teams must implement a manual stopping procedure in case of problems with wireless.**

### 3.5 Applying penalties

See Section 4.1.

### 3.6 Kick-off

The ball is placed on the center point of the center circle.

All the robots shall be located in their side of the field. Only two robots of attacking team can be placed between the center line and the middle of their side. Putting their leg(s) on the center circle line is allowed, but no leg is allowed to be inside the circle line.

All the other robots (one of attacking team, three of defending team) are placed behind the middle of their side (none of their legs are allowed to go beyond the middle). The attacking team must place their players first, and then the defensive team can place their players.

Robots shall be started as per the usual game start procedure (see Section 3.3).

Note that a goal can never be scored directly from a shot from the kick-off. See Section 4.4 for details.

### 3.7 Free kick

None.

### 3.8 Penalty kick

A penalty kick is carried out using only by a robot of the attacker side. There is no goalie. Other robots should be powered off and stay outside of the field. It is allowed to switch to a specially designed software for a penalty kick. The attacker is given a chance to make a goal within 1 minute. All penalty kicks are taken against the blue goal. The robot should not move his legs before the penalty kick starts. Movement of the robots head and tail is allowed as long as the robot does not locomote. The robot can be started either via wireless or by button press. All the rules

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such as “Ball Holding” and others are also applied during the penalty kick. The initial position of the ball and the kicker depends on the situations. If the penalty kick is due to some kind of foul or violation, the ball is placed centered on the penalty line and the kicker is started on the center circle facing the goal. In the case of a penalty kick in a penalty kick shoot-out, the referee decides the starting position of the robot and ball (see Section 3.9). The penalty kick ends when the kicker scores the goal or the time expires. The time limit for the kicker is 1 minute after the penalty kick starts.

### **3.9 Penalty kick shoot-out**

A penalty kick shoot-out is used to determine the outcome of a tied game. The penalty kick shoot-out is a sudden death contest. Each team selects a robot and a memory stick to be used for the penalty kick shoot-out. The memory stick cannot be changed in between kicks. The referee decides on an initial position for the robot and the ball. The initial positions are marked with small pieces of black tape or other suitable mark which will be unobtrusive to the robots. Each team then takes one penalty kick against the blue goal from this starting location. The penalty kick follows the normal penalty kick rules (see Section 3.8). If one team scores within the allotted time and the other doesn't, the scoring team wins. If both teams score, the referee selects a new, more difficult starting location for the robot and ball and the process is repeated. If both teams fail to score, the referee selects a new, easier starting location for the robot and ball and the process is repeated. In the preliminary stages of RoboCup, the penalty kick shoot-out may be limited to a preset number of kicks (different starting locations).

### **3.10 Throw-in**

None. When the ball goes out of bounds, it shall be replaced inside of the field where it goes out.

### **3.11 Game stuck**

#### **3.11.1 Local game stuck**

In the event of no substantial change in the game state (as shown in Figure 3) for 30 seconds, the referee shall pick up the robots which are jamming around the ball and move to the half way line. The referee does NOT replace the ball. If the ball is accidentally bumped when removing the robots, the ball should be replaced where it was when the game stuck was called. As a special exception, if the goalie is involved in a game stuck situation while having 3 feet on its own half (on half line or closer to goal), the goalie will not be removed from the game stuck situation. In this case, only the other robots involved will be removed.

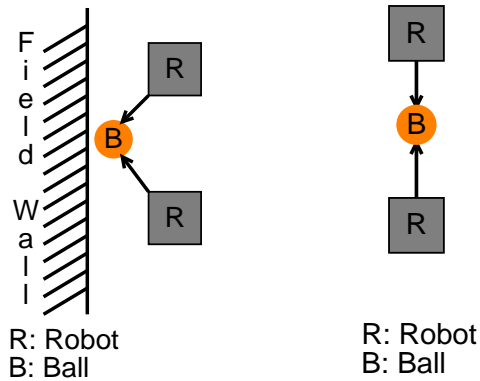


Figure 3: Local Game Stuck

### 3.11.2 Global game stuck

If no robot touches the ball for 30 seconds, the referee shall stop the game and restart the game from the kick-off formation. The kick-off will be awarded to the team defending the side of the field the ball is on when the game stuck is called.

## 3.12 Robot problems

Either team may request that one of their players be picked up only for hardware dysfunction at any point in the game (called “Request for Pick-up”). It is permitted to change batteries, fix mechanical problems or, if necessary, reboot the robots, but not to change or adjust their program. Any strategic “Request for Pick-up” is not allowed. The referee will indicate when the robot is no longer affecting play and can be removed from the field. The robot will be replaced on the half way line after 30 seconds following the normal replacement procedure used after the standard removal penalty (see Section 4.2).

## 3.13 Winner and rankings

The team which scored more goals than the other is the winner of the match. If two teams scored the same number of goals, the game will be a draw. The draw will follow the same system defined in Section 3.1. Total (and final) standings will be decided on points as follows (the points will be given based on the result of each game):

Win = 3 pts	Draw -	Win PK = 2 pts	Lose = 0 pts
		Tie PK = 1.5 pts	
		LosePK = 1 pts	



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If a team's obtained points is the same as another team's after the preliminary round is complete, the following evaluations will be applied in order to qualify the finalists.

1. The points obtained
2. The average difference between goals for and goals against per game
3. The average goals for per game
4. Game result between the teams directly

## **4 Forbidden actions and penalties**

The following actions are forbidden. In general, when penalty applies, the robot should be replaced, not the ball. For penalties which are timed, the penalty time is considered over whenever the game time stops (for goals, half-time, and game stuck).

### **4.1 Penalty procedure**

When a robot commits a foul, the head referee shall call out the infraction committed, the jersey color of the robot, and the jersey number of the robot. Each robot will be labelled with a jersey number before the game. The penalty for the infraction will be applied immediately by the assistant referee or others. The head referee should focus on continue to watch the game for further infractions. The other referees should perform the actual movement of the robots for the penalty so that the head referee can continue focusing on the game. The person running the wireless will send the appropriate signal to the robot indicating the infraction committed.

### **4.2 Standard removal penalty**

Most infractions in this league result in the removal of the infringing robot from the field of play for a period of time. This process is called the standard removal penalty. When the head referee indicates a foul has been committed that results in the standard removal penalty, the assistant referee or team robot handler will remove the robot immediately from the field of play. The robot should be removed in such a way as to minimize the movement of the other robots and the ball. If the ball is inadvertently moved when removing the robot, the ball should be replaced to the position it was in when the robot was removed.

The removed robot will be placed outside of the field facing away from the field of play. The assistant referee will keep track of the time of the penalty. When the penalty time has expired, the

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assistant referee will indicate that the robot may be put back on the field. The team robot handler or assistant referee will then replace the robot on the field on the halfway line as close to the sideline as possible. The robot should be pointed towards the opposite sideline. The robot should be placed on the side of the field opposite the side the ball is on when the robot is replaced. If there is another robot already in this position, the robot should be replaced at a nearby location along the sideline facing towards the opposite sideline. If there are no practical locations nearby, a location along one of the sidelines should be found that is away from the ball (the robot should be set down facing the opposite sideline). When finding a nearby location, locations away from the ball should be preferred.

### **4.3 Manual Interaction by Team Members**

Manual interaction with the robots, either directly or via some communications mechanism, is not permitted except during kick-off, restart, and finish of the game or when ordered by referee. Manual interaction is also allowed after the referee has granted a Request for Pick-up (the robot must be removed from the field and all work on the robot done off of the field) or to manually start a robot that has failed to start or otherwise become paused. All other manual interactions are forbidden.

### **4.4 Kick-off shot**

A “kick-off shot” can never score a goal. A “kick-off shot” is a shot taken after a kick-off before the entire ball out of the center circle, including the boundary line. The ball must touch a player from the kick-off team after leaving the center circle before a goal can be scored by the team taking the kick-off. If a kick-off shot enters the goal (either directly or via contact with an opposing robot), no goal will be scored and a kick-off will be awarded to the defending team (as per Section 3.6).

### **4.5 Ball holding**

The goalie is allowed to hold the ball for up to 5 seconds as long as it has 2 feet inside in its own penalty area. In all other cases, robots are allowed to hold the ball for up to 3 seconds. Holding the ball for longer than this is ball holding and is not allowed. The definition of holding is given on the web. Intentional continual holding is prohibited even if each individual holding time doesn't continue for up to the time limit. In this case, the continual holding is regarded as a continuous hold from the very beginning and the holding rule is strictly applied. The violation of this rule will result in having the penalized robot removed from the field for 30 seconds as per the standard removal penalty (see Section 4.2 for details). In case of a violation by the goal keeper, the robot will be removed for 0 seconds as per the standard removal penalty, i.e. he will be placed on the halfway line immediately (no need to be kept outside of the field). The ball should be removed from the

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possession of the robot and placed where the foul occurred. If the robot that held the ball has moved the ball before the robot can be removed, the ball shall be replaced where the foul occurred. For example, a robot holds the ball and before the referees can remove the robot the robot shoots the ball into the goal. The goal will not be counted and the ball will be replaced where the robot held the ball.

## **4.6 Goalie pushing**

When the goalie is in its own penalty area (2 feet on or inside line), no more than 1 attacker may be in contact with the goalie at any one time. If a second attacker makes contact with the goalie while another attacker is already in contact with the goalie, the second attacker will be removed for 30 seconds as per the standard removal penalty (see Section 4.2).

When the goalie is in its own penalty area (2 feet on or inside line), an attacker is only allowed to make sustained contact with the goalie while in the process of going for a nearby ball. Sustained contact is contact that is substantially continuous for at least 2 seconds. Contact is allowed if the attacker is going for a nearby ball and only one attacker is contacting the goalie. This penalty is applied even if the goalie initiates the contact. “Nearby” means roughly a robot length or two. A robot which violates this rule will be removed for 30 seconds as per the standard removal penalty (see Section 4.2).

## **4.7 Damage to the field/robots/ball**

A robot that damages the field and/or other robots will be removed from the field for the remainder of the game. Similarly a robot that poses a threat to spectator safety will also be removed. In such a case, a penalty kick will be awarded to the opposing team.

## **4.8 Illegal defender**

Only the goalie can be within the penalty area of his side. Having three legs inside the penalty area is the definition of being in the penalty area and that situation is not allowed for the field players. When other robots enter the area, they will be removed for 30 seconds as per the standard removal penalty (see Section 4.2). This is called the “Illegal Defender Rule”. This rule will be applied even if the goalie is outside of the penalty area. In the case that this “remove and replace” operation advantages the robots to be penalized (typically, the ball is near the halfway line), this rule may not be applied.

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## 4.9 Illegal defense

The vertical projection of the goalie to the goal line should not occupy more than 50 percent of the length of the goal mouth. Those robots that commit this action (intentionally) will be replaced immediately on the halfway line as per the standard removal penalty for 0 seconds (see Section 4.2). Robots may violate this rule for brief periods of time to, for example, block a shot. These brief periods of time should be around 2 seconds or less and must not be done continually as per the holding rule (see Section 4.5).

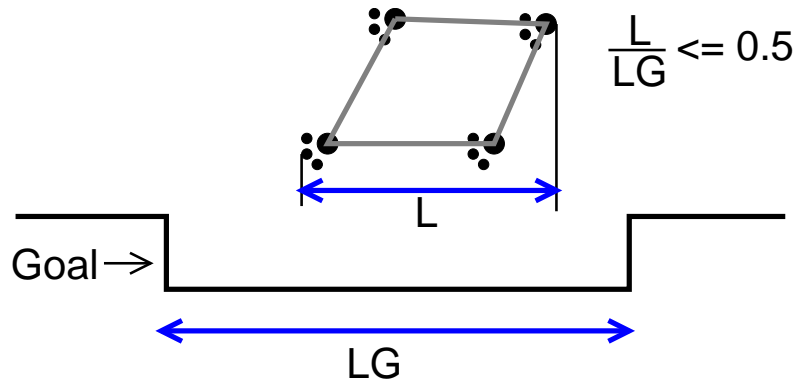


Figure 4: Illegal Defense

## 4.10 Obstruction

Note that this rule is for the field players and will never be applied to the goalies staying inside the penalty area (2 feet on or inside line): if the robot to be removed is the goalie inside the penalty area, this rule will not be applied to him, but may be applied to other players. In case the goalie is outside of the penalty area, he is treated as just a normal field player.

### 4.10.1 Among the players of the same team

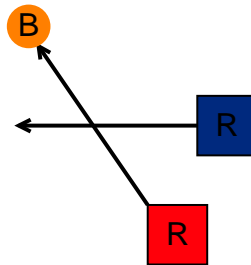
When two or more robots of the same team make physical contact with each other and the same situation continues for 30 seconds, all the robots involved shall be removed and left outside the field for 0 seconds as per the standard removal penalty (see Section 4.2).

### 4.10.2 Among the players of both teams

When two or more robots of both teams make physical contact with each other and this situation continues for a while, a) in case that at least one robot is aware of the position of the ball and

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is heading for it, those robots that are clearly unaware of the ball position will be removed for 0 seconds as per the standard removal penalty (see Section 4.2), i.e. it will be immediately replaced on the half line, b) in case that all the robots involved seem unaware of the ball position, and this situation continues for 30 seconds, or in case that all the robots seem aware of the ball position and this situation continues for 30 seconds, then all of them shall be removed for 0 seconds as per the standard removal penalty (see Section 4.2).



R: Robot  
B: Ball

Figure 5: Obstruction

## 4.11 Jamming

During the match any robot shall never jam communication and sensor system of opponents. The usage of equipments which may cause interference of communication or sensors should be negotiated between two teams before the match.

# 5 Judgement

## 5.1 Selection of the referee

Every team participating in a tournament must name at least two team members to serve as referees for matches. The named persons must have good knowledge of the rules as applied in the tournament. The persons should be selected among the more senior members of a team, and preferably have prior experience with games in the RoboCup Four-Legged Robot league.

## 5.2 Referees during the match

The referee and assistant referees should wear black or white clothing/shoes and avoid reserved colors for the ball, the goals, and player markings in their clothing. The referee and his/her assis-

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tants will be close to but off the field during play. The referee and the assistants may enter the field in particular situations, e.g. to reposition the robot when applying a penalty or stuck. The referee and his/her assistants should avoid interfering with the robots as much as possible.

## **6 Questions/Comments**

Questions or comments on these rules should be mailed to [legged\\_tech@pdp.crl.sony.co.jp](mailto:legged_tech@pdp.crl.sony.co.jp)