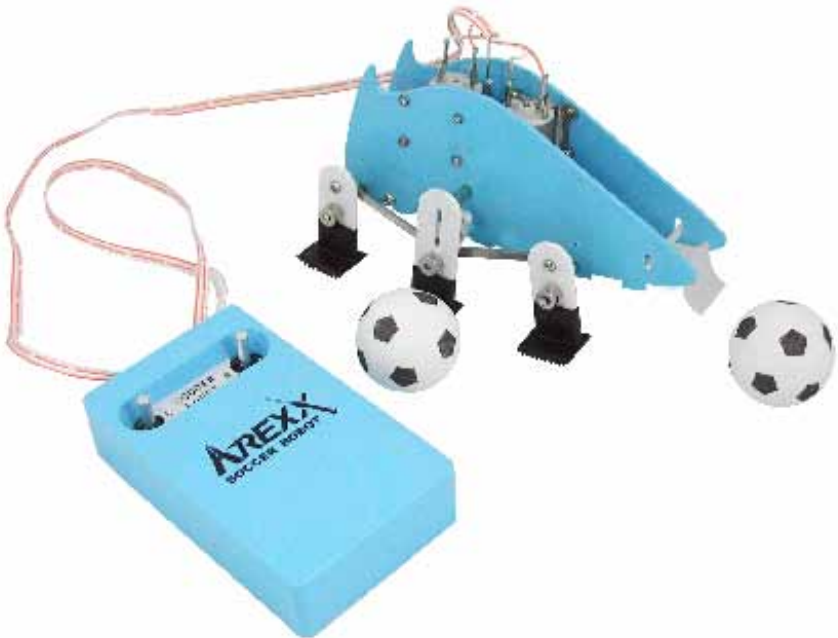




Design Soccer Robot

SOCCER ROBOT

MANUAL: Model SR-129



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European Importer:
AREXX Engineering
ZWOLLE The Netherlands

Technical support:

WWW.AREXX.COM

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1. PRODUCT INFORMATION SOCCER ROBOT

Play your own World Championships of Soccer Robots!

Before the games begin, first you have to assemble the SOCCER ROBOT.

When the SOCCER ROBOT is ready, you can start your own Soccer Championships. First however, an extensive training is necessary because it is not so easy to control this funny, six-legged robot. The controller has two switches to control the two motors. These two motors send the robot in any direction you like.

The performances of this fast robot will certainly appeal to you. In this manual we will show you all robot movements, so you really will get to know the functions of this SOCCER ROBOT.

Specifications:

Power voltage	: 3V (2 Penlite Batteries of 1,5V (Batteries are not included in this kit)
Power consumption	: Approx. 300 mA max
Height	: 100 mm
Length	: 160 mm
Width	: 90 mm
Cable length controller	: 1.5 meter

Warning



- * When you open the plastic bags of the parts the return right is no longer valid
- * Before you start assembling, first read the complete instruction manual
- * Be careful with tools and always keep them away from little children!
- * Keep this product out of reach of children and do not build this kit when children are in the neighbourhood, the tools and parts are dangerous for children
- * Check the polarity of the batteries when you insert them
- * Keep the batteries dry and when the robot gets wet, remove the batteries and let the soccer robot dry for some time
- * Remove the batteries when you are not using the robot for a longer period

2. TOOLS

We strongly suggest to read this chapter first before assembling the product

Assemble the robot in the exact order as described in this manual. This way you will avoid assembly mistakes. If you assemble in the correct order and study the picture on the packaging so now and then, you will build a perfectly functioning robot in no time.

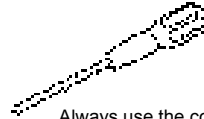
All parts fit perfectly, so there is absolutely no need to use force. Work calmly and read the complete manual before you start to assemble this robot.

Small hammer



With the correct tools
you already solved
half the job!

Screwdriver set



Always use the correct size
for each screw

Long nose plier



We recommend to use electronic pliers (150 mm).

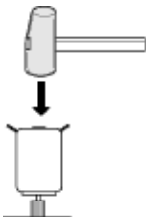
Detaching parts from a frame



When a part is fixed to a plastic frame you have to detach it with a diagonal cutter or a hobby knife. Make sure that you do not cut in the part itself and remove all burrs neatly.

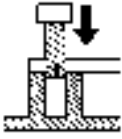
Important !
Do not detach parts from the frame before you need them.

Assembly of shafts and gears



Be always very careful when you assemble shafts and gears. When possible always try to push the gear on the shaft with your hands. When you need to use a hammer, always put a piece of wood between the hammer and the gear or shaft, so you do not damage things.

Self-tapping screws (Parker)



A self-tapping screw looks similar to a wood screw. When you screw it in a hole, it can cut the threads at the same time. Never try to screw it down all the way for a first time, because it may easily become stuck or you will damage its head.

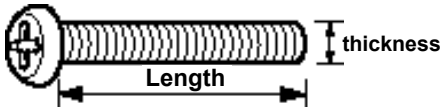


Tapping screws always have a sharp point sometimes with a small carve. The best way is to screw it in and out a bit.

- 1 Screw in
- 2 Screw out a bit
- 3 Screw in further and continue step 1 and 2

Do not screw a tapping screw in and out too often because the screw hole may become enlarged and the screw will lose all grip and proper function.

Screws and nuts



Nut



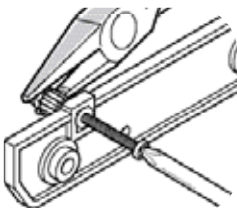
Lock nut

In a moving environment, screws and nuts must be tightened properly. A lock nut is a special nut with nylon inside which will lock itself automatically.

Another easy way to lock a screw is to use ordinary fingernail polish. A big advantage of nail polish is that you always can loosen it quite easily again. A professional way to lock a screw is to use for example lockite a sort of glue especially made for screws, but it is very difficult to unlock such a screw afterwards.

The size of a screw is expressed by thickness and length. A screw with the marking M2 x 10 means 2mm thick. The length of the thread is 10mm. A M2 nut means it is used for a M2 screw so the nut always corresponds with the screw thickness.
























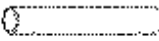









Lock nut fixation



To lock the lock nut in a proper way, use a plier or the spanner which is supplied in this kit. See drawing on the left!

3. PARTS LIST SOCCER ROBOT

Please check all parts before you start assembly:

Self-tapping screw		Screw short		Screw middle		Screw long	
	M2,3 x 5 <input type="checkbox"/> 2 pcs.		M3 x 10 <input type="checkbox"/> 4 pcs.		M3 x 20 <input type="checkbox"/> 2 pcs.		M3 x 35 <input type="checkbox"/> 3 pcs.
	M2,3 x 8 <input type="checkbox"/> 2 pcs.	Screw small		M2 Nut	M3 Nut	Lock nut	
	M2,6 x 6 <input type="checkbox"/> 5 pcs.		M2 x 0,5 <input type="checkbox"/> 8 pcs.		<input type="checkbox"/> 14 pcs.		<input type="checkbox"/> 9 pcs.
	<input type="checkbox"/> 2 pcs.	Pinion gear		Flatspur gear with pinion	Flatspur gear with boss	Crown gear with pinion	Motor
	<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.
	<input type="checkbox"/> 2 pcs.	Motor holder		Crank	Spring washer M2	Collar nut	Hexadiagonal tool
	<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 10 pcs.		<input type="checkbox"/> 6 pcs.
	<input type="checkbox"/> 1 pcs.	Wrench M2 & M3		Spacer 5mm	Spacer 10mm	Spacer 25mm	Shaft 85mm
	<input type="checkbox"/> 1 pc.		<input type="checkbox"/> 4 pcs.		<input type="checkbox"/> 6 pcs.		<input type="checkbox"/> 2 pcs.
	<input type="checkbox"/> 2 pcs.	Washer M3	<input type="checkbox"/> 6 pcs.	Spring washer M3	<input type="checkbox"/> 4 pcs.	Ball	
	<input type="checkbox"/> 6 pcs.		<input type="checkbox"/> 4 pcs.	Screw shaft for leg		Screw shaft thick	Screw shaft thin
	<input type="checkbox"/> 1 pc.		<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.		<input type="checkbox"/> 2 pcs.
	<input type="checkbox"/> 2 pcs.	Cable holder			<input type="checkbox"/> 1 pc.		

Side panel



□ 2 pcs. (Left and Right)

Controller top



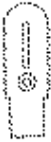
□ 1 pc.

Controller bottom



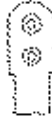
□ 1 pc.

Leg
middle



□ 2 pcs.

Leg
front and rear



□ 4 pcs.

Foot



□ 6 pcs.

Joint strip



□ 4 pcs.

Battery holder



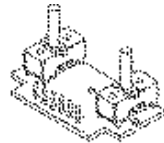
□ 1 pc.

Cable set



□ 1 pc.

Switch PCB



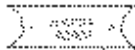
□ 1 pc.

Felt



□ 1 pc.

Sticker



□ 1 pc.

Kicker



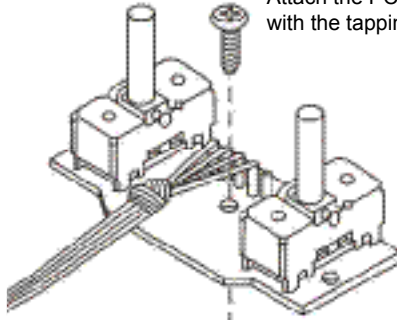
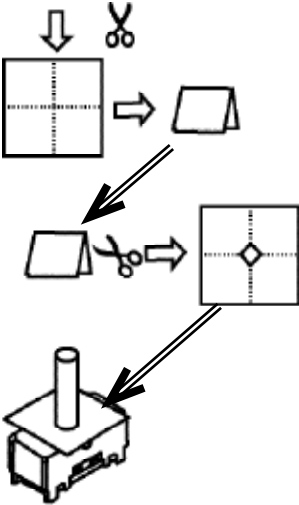
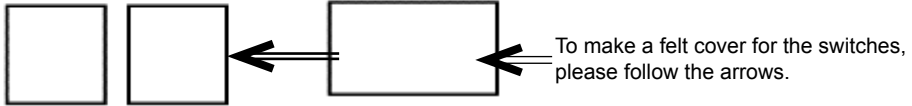
□ 1 pc.

4. ASSEMBLY INSTRUCTIONS SOCCER ROBOT

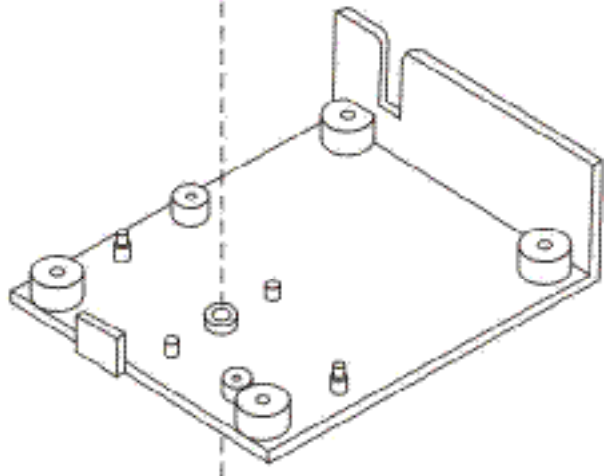
Controller assembly

- 1 pc. Felt
- 1 pc. Switch PCB
- 1 pc. Cable set
- 1 pc. Controller bottom
- 1 pc. Tapping screw 2.6x6mm

For the assembly of the controller you need;



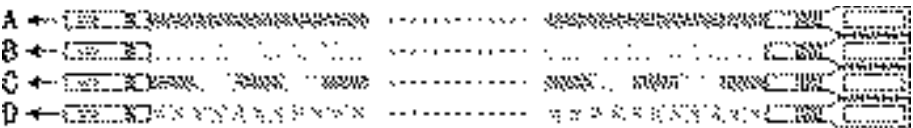
Attach the PCB to the controller bottom with the tapping screw 2.6x6



WARNING:

Do NOT put the batteries into the battery holder yet. Wait until the robot is completely assembled. When you create a short cut and the batteries are already placed, you can start a fire or get hurt by the extreme heat of the batteries.

Connect the cable to the correct terminal on the PCB. Pay utmost attention to the correct cable marking on each wire and make a connection to the pin with the corresponding letter.

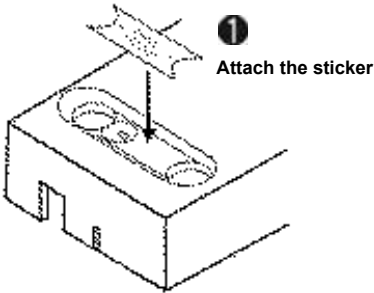


Final assembly of the Controller :

For the final controller assembly you need;

- 1 pc. Assembled controller bottom
- 1 pc. Battery holder
- 2 pcs. Tapping screw 2.3x8mm
- 1 pc. Controller top
- 1 pc. Sticker
- 4 pc. Tapping screw 2.6x6mm

Assemble the controller as shown on the pictures blow and in numerical order:



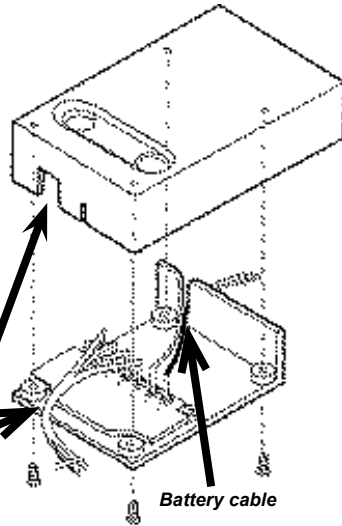
- 2 Connect the battery wires to the correct + and - terminals on the PCB (see drawing) and PCB marking.
- Black = - (Blk)
 - Red = + (Red)

IMPORTANT

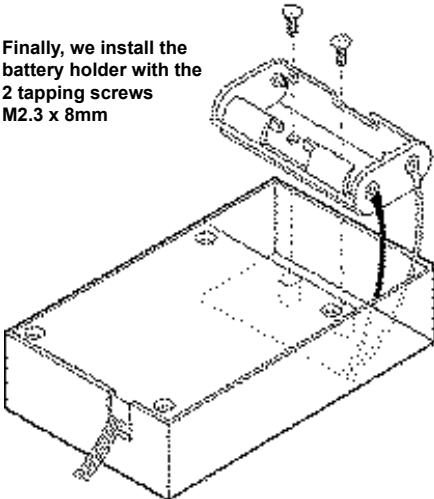
Be sure that the cables are guided through the correct holes.

Motor cable

Battery cable

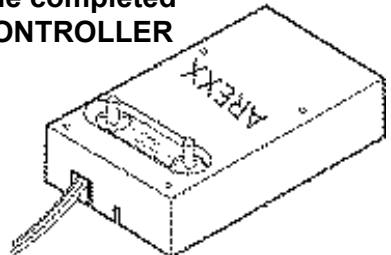


Finally, we install the battery holder with the 2 tapping screws M2.3 x 8mm



- 3 Install the battery bottom with the 4 tapping screws M2.6 x 6mm.

The completed CONTROLLER



Assembly of the motors:

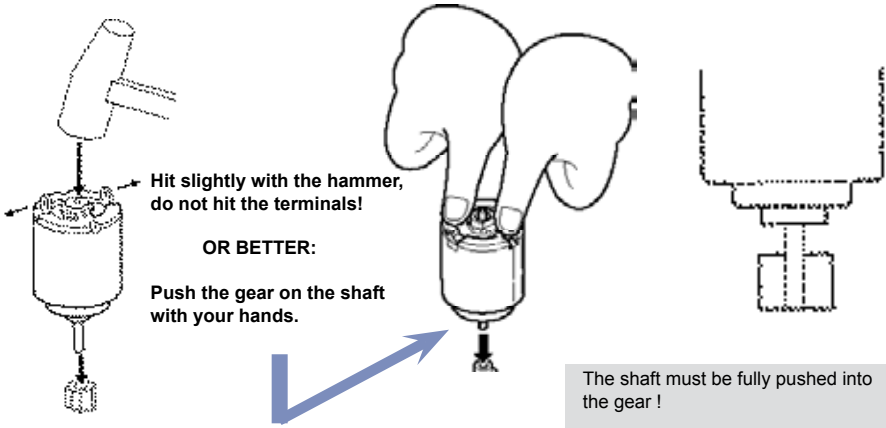
To assemble the motors you need;

- 2 pcs. Motor
- 2 pcs. Pinion gear
- 2 pcs. Motor holder
- 2 pcs. Tapping screw M2.3 x 5mm

Assemble the gear to the motor shaft as shown on the picture below.

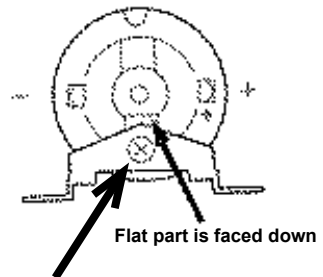
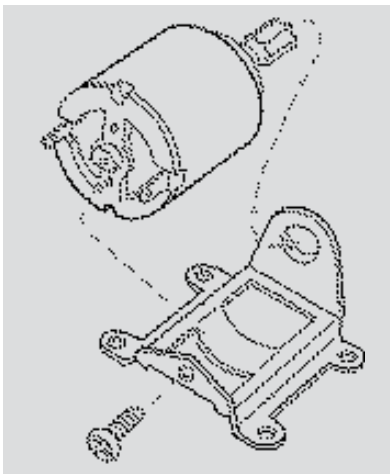
MAKE 2 SETS!

Be careful not to damage the gear or motor shaft. When you use a hammer, be very gentle and put a piece of wood between hammer and gear or better use a plastic hammer. Best way is to push the gear on the shaft with your hands.



Attach the motors to the motor holder with a tapping screw M2.3 x 5 mm.

MAKE 2 SETS!



Be sure the motor is fixed properly with the 2.3 x 5 mm tapping screw.

Assembly of the side panels:

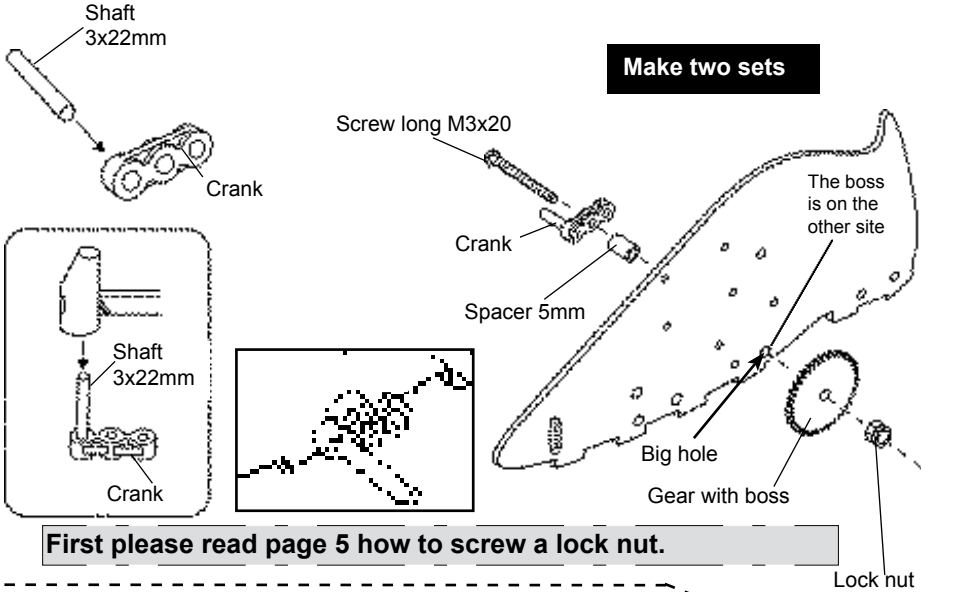
For the assembly of the side panels you need;

- 2 pcs. Side panel L&R
- 2 pcs. Gear with boss
- 2 pcs. Crank
- 2 pcs. Shaft 3x22mm
- 2 pcs. Spacer 5mm
- 2 pcs. Screw shaft (thick)
- 2 pcs. Screw shaft (thin)
- 2 pcs. Lock nut
- 2 pcs. Screw long M3x20
- 4 pcs. Nut M2

ATTENTION

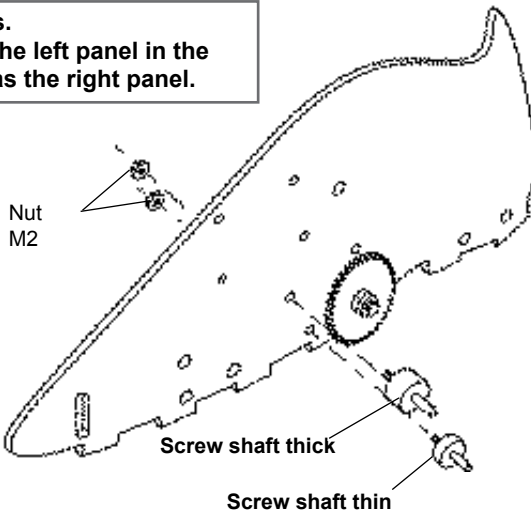
Screw the lock nuts real tight!

Keep the lock nut in position by holding it with a plier or a well-fitting spanner



Make 2 sets.

Assemble the left panel in the same way as the right panel.



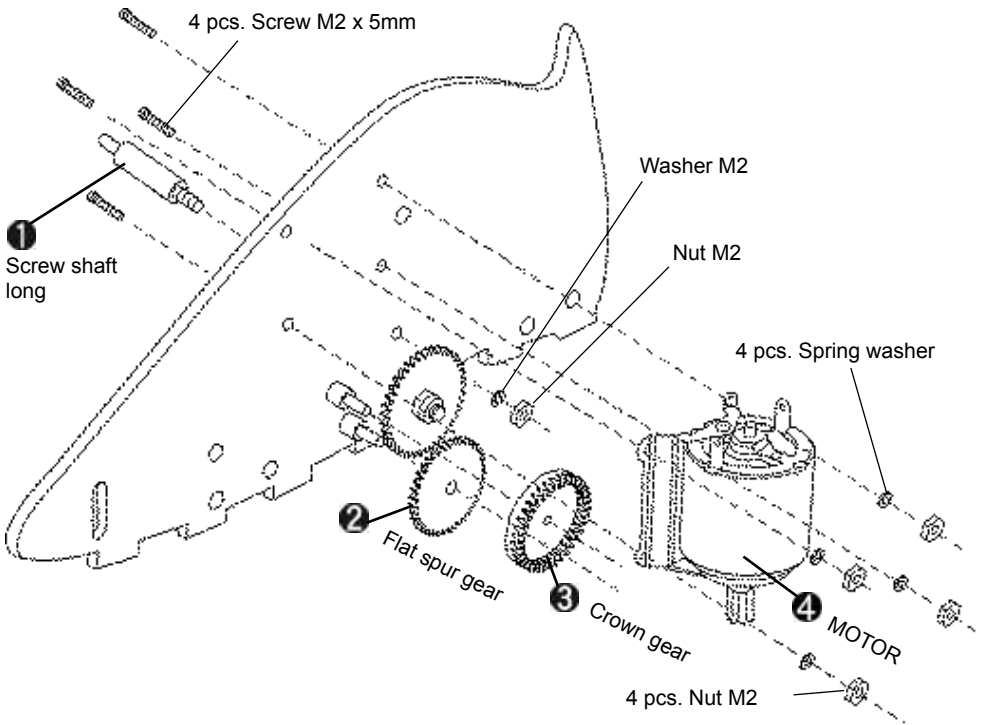
Assembly of the gears:

For the assembly of the gears you need;

- 2 pcs. Assembled side panels L & R
- 2 pcs. Flat spur gear with pinion
- 2 pcs. Crown gear with pinion
- 8 pcs. Screw M2
- 8 pcs. Nut M2
- 8 pcs. Spring washer M2
- 2 pcs. Screw shaft long
- 2 pcs. Washer M2
- 2 pcs. Nut M2

Assemble the gears and motor as shown on the drawing below.

Assemble in numerical order.

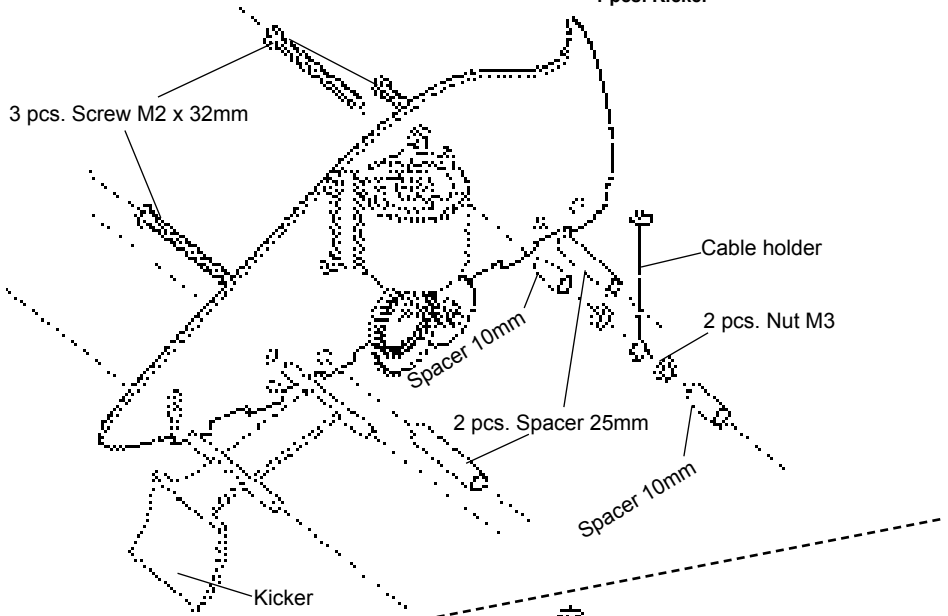


Assemble the left and right side in the same way

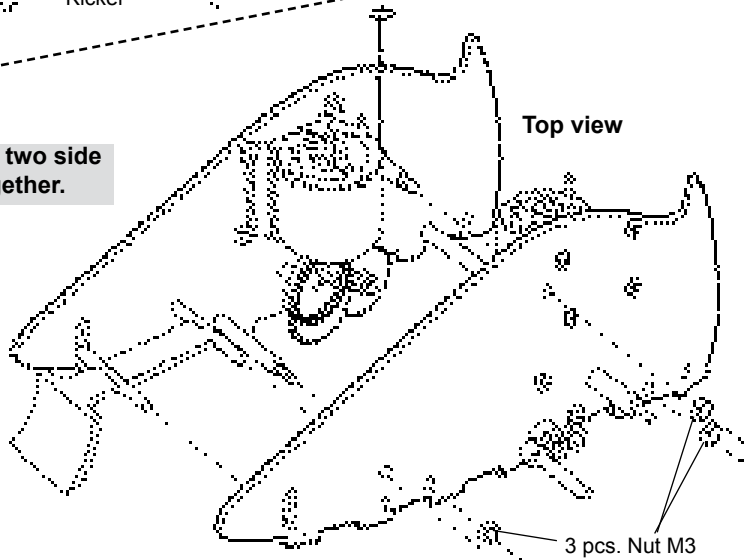
Final side panel assembly:

For the final side panel assembly you need;

- 2 pcs. Assembled side panel L and R
- 3 pcs. Screw M3 x 32mm
- 5 pcs. Nut M3
- 2 pcs. Spacer 25mm
- 2 pcs. Spacer 10mm
- 1 pcs. Cable holder
- 1 pcs. Kicker



Attach the two side panels together.



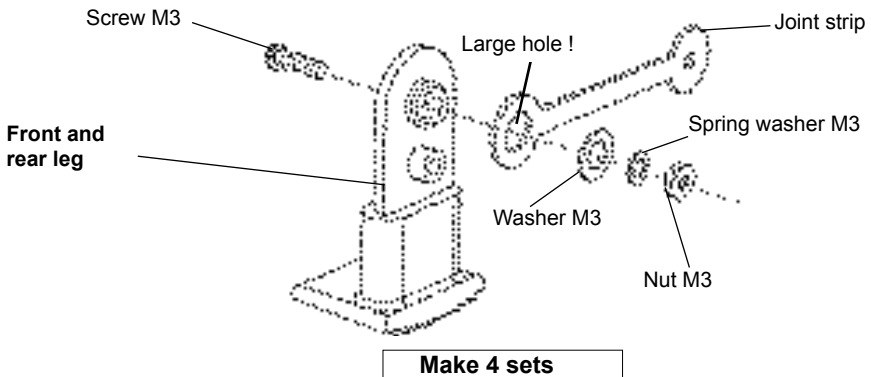
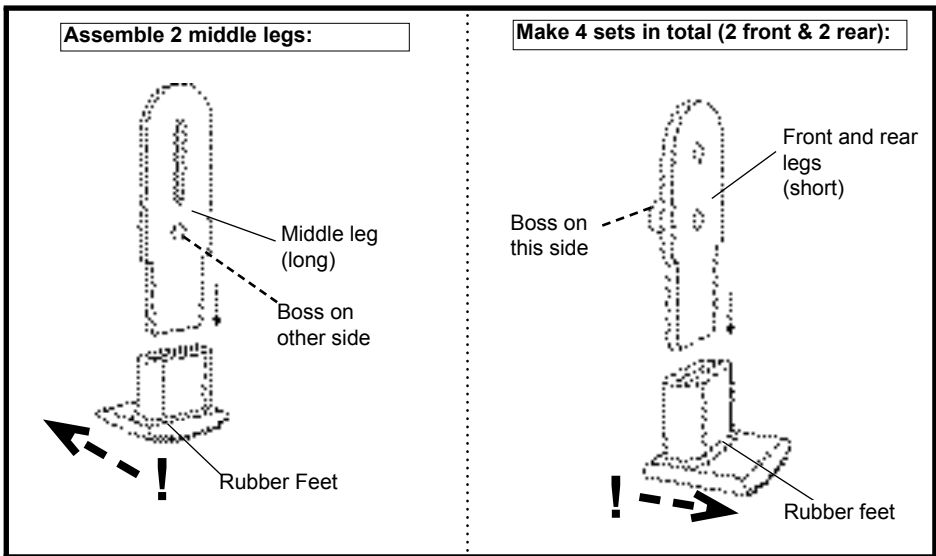
After this step we will name this assembled part the CHASSIS.

Leg assembly:

For the leg assembly you need;

- 6 pcs. Rubber feet
- 4 pcs. Leg short (front and back)
- 2 pcs. Leg long (middle)
- 4 pcs. Screw M3 x 10mm
- 4 pcs. Nut M3
- 4 pcs. Spring washer M3
- 4 pcs. Washer M3
- 4 pcs. Joint strip

Assemble the parts as shown on the drawings below:



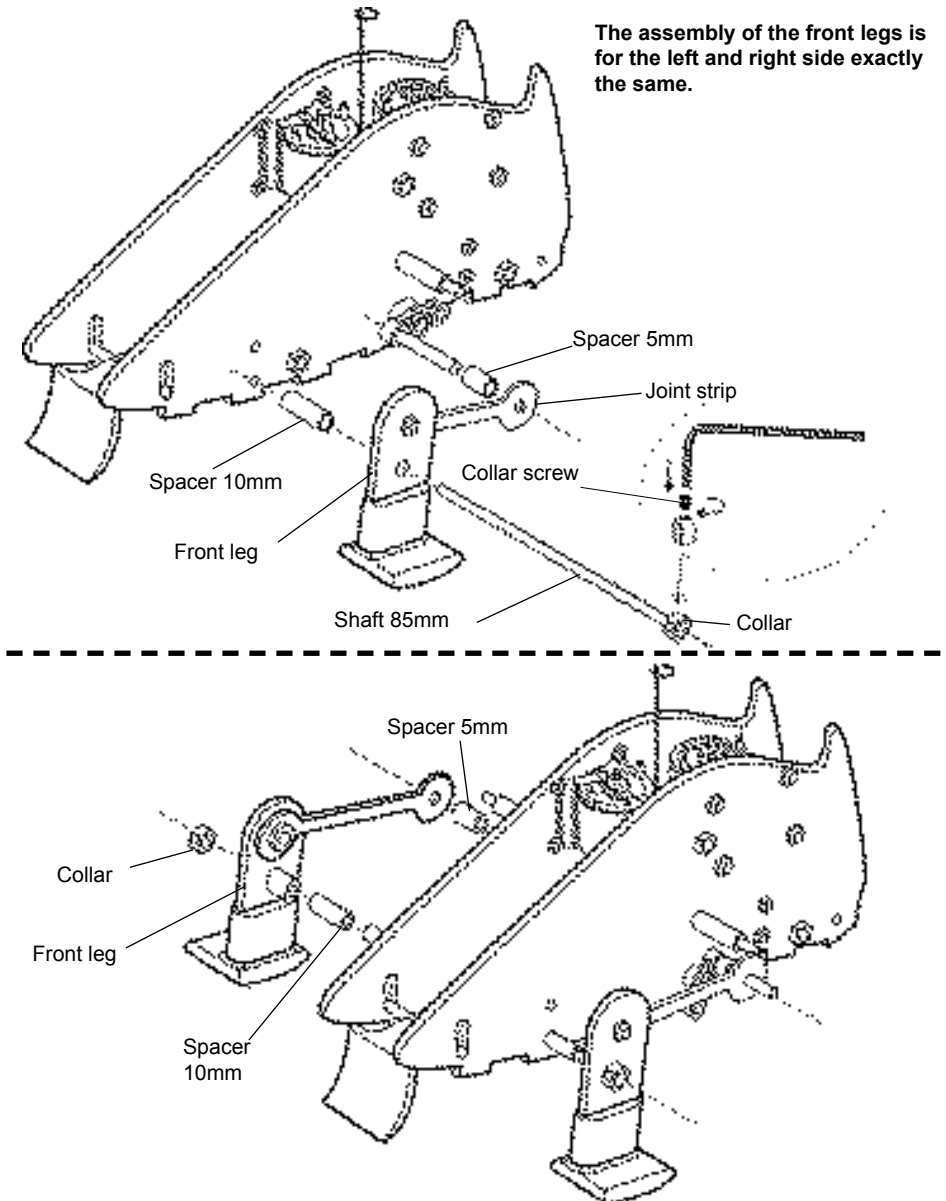
Assembly of the front legs:

- 1 pc. Chassis
- 2 pcs. Assembled front leg
- 2 pcs. Shaft 85mm
- 2 pcs. Spacer 5mm
- 2 pcs. Spacer 10mm
- 2 pcs. Collar

For the assembly of the front legs you need;

Assemble the front legs on the left side and right side as shown on the drawing. Also notice the small detail-drawing!

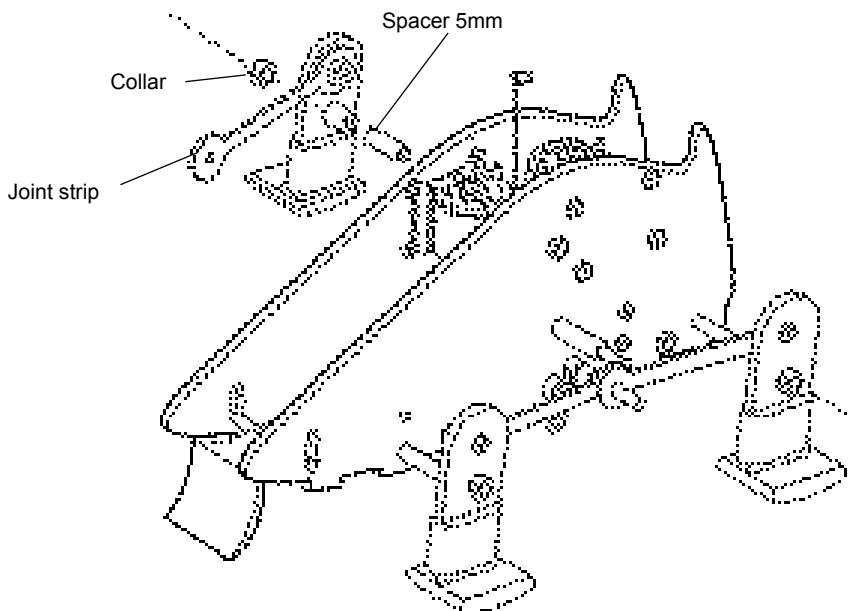
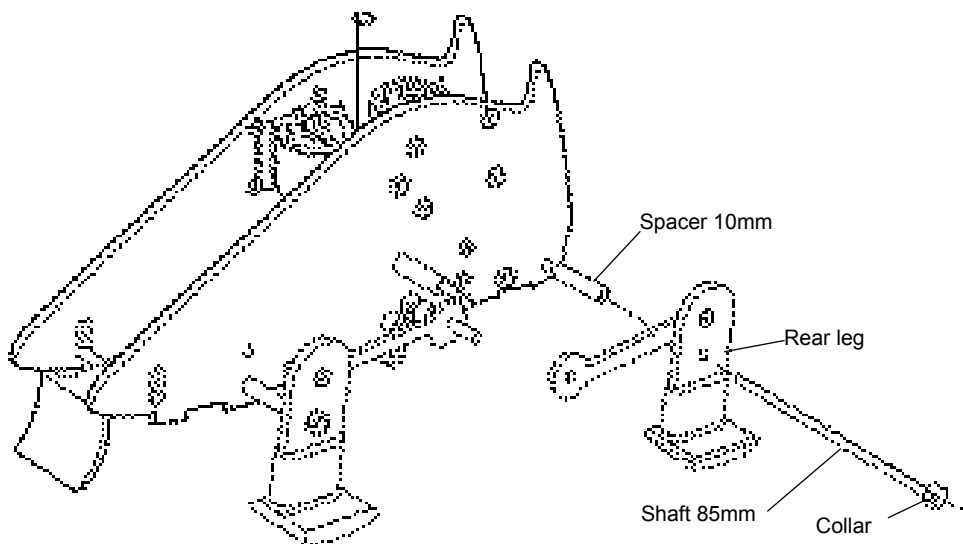
The assembly of the front legs is for the left and right side exactly the same.



Assembly of the rear legs:

For the assembly of the rear legs you need;

- 1 pc. Chassis
- 2 pcs. Assembled rear leg
- 1 pc. Shaft 85 mm
- 2 pcs. Spacer 10mm
- 2 pcs. Collar

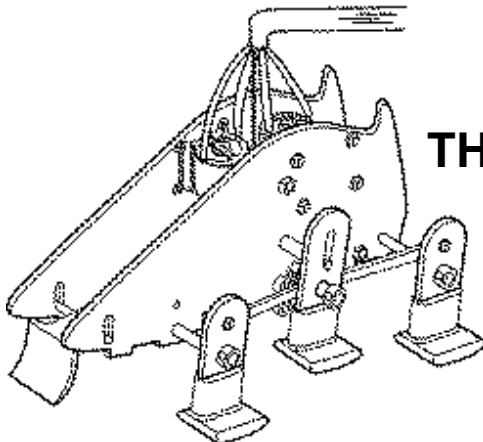
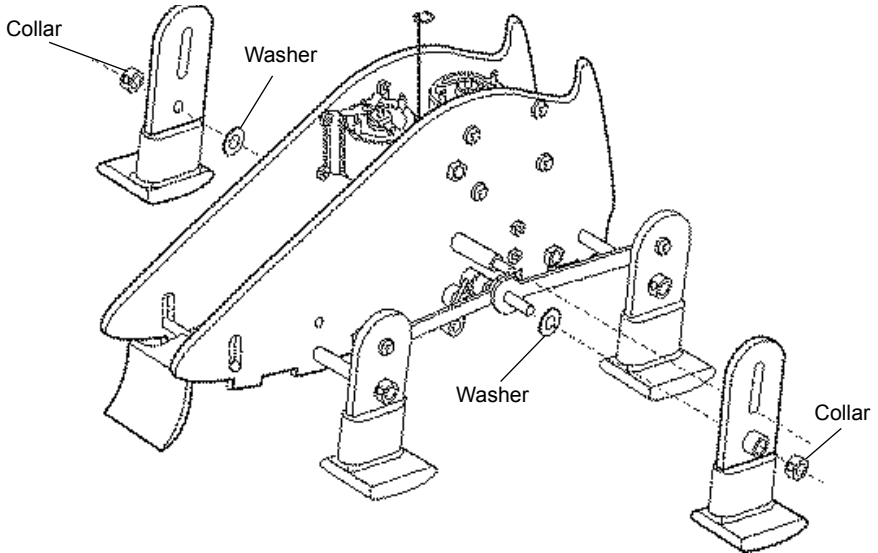


Assembly of the middle legs:

- 1 pc. Chassis
- 2 pcs. Middle leg
- 2 pcs. Washer M3

For the assembly of the middle legs you need;

Assemble the middle legs to the left and right side as shown on the drawings:

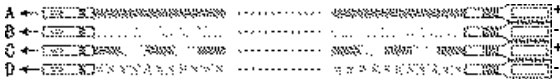


**THE COMPLETED
SOCCER
ROBOT!**

5. FINAL ASSEMBLY

Wiring of the motors

IMPORTANT: Please check the correct marking on the wires!



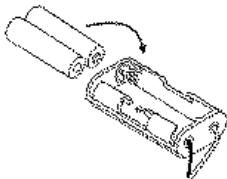
Notice the correct polarity (+ & -) of the controller cable:

- A = + Rear motor
- B = - Rear motor
- C = + Front motor
- D = - Front motor

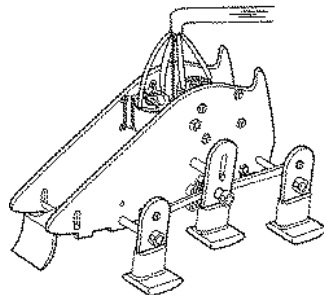


Battery installation

Insert the batteries into the battery holder.
 Notice the correct polarity (+ & -) of the batteries.



Finally pass the wires through the cable holder



6. TROUBLESHOOTING

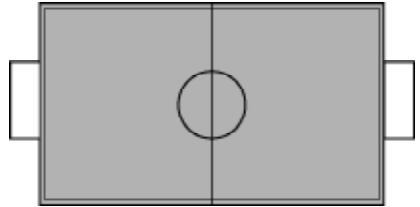
Problem:	Check:
The motors are not running.	<ul style="list-style-type: none"> • Check the batteries, are they really full • Check the battery polarity (+ and -). • Check the wires on the switch PCB. • Check the wires on the motors.
No leg movement.	<ul style="list-style-type: none"> • Check the gears and especially the lock nuts (tighten them a bit more or less). • Check the side panels, all gears and their position (rotate motor pinion by hand).
The robot movements do not correspond with the controller	<ul style="list-style-type: none"> • Check all wire markings and connections • Change motor wire + & - so they will rotate in reverse. • Change motor wires from front motor to rear motor

7. SOCCER ROBOT GAME

In this chapter we describe some soccer robot games you can play:

SOCCER FIELD

A great field for our game is a ping pong table (table tennis table). Make some fences around it and make goals for both sides. Now you can a game with 2 robots or when you have only 1 robot try to make as many goals as you can in 5 minutes.



SOCCER GAME

First make teams with 1 or 2 players and shoot the ball in the opponents goal as often as possible during a certain period of time.

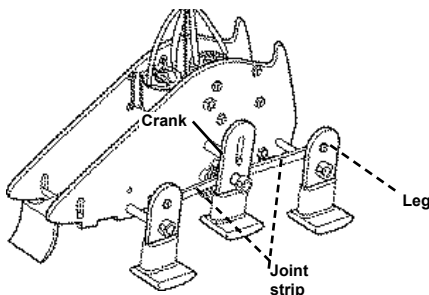
SOCCER POOL GAME

For this you need about 10 table tennis balls. Try to shoot as many goals as possible in 5 minutes of time using all balls. You also can number the balls and try to make a the highest score counting the numbers on the balls!

8. HOW DOES THE SOCCER ROBOT MOVE?

On the next page you find some background information about gears. Here we explain how the soccer robot can walk with his six feet.

Crank Mechanism



The SOCCER ROBOT can walk because of the presence of the crank. The crank converts a rotational movement into a reciprocating movement.

The robot is constructed in a way that the front and rear legs only make a forward and backward movement.

The middle leg is designed to make a vertical slide movement, the crank circular movement is directly conveyed to the toe of the middle leg.

So when the middle leg goes up, the front and back legs go backwards and the robot moves forward.

When the robots does not function well yet or when the gears do not have a good grip, please check the troubleshooting table on page 18. Please check all assembly steps again.

When your robot still does not function well, just take it apart and assemble it again. Check and double check all assembly steps by studying each drawing. This way you might find the problem.

9. INFORMATION ABOUT GEARS

The mechanics of the SOCCER ROBOT consists of two parts. The first part is the gear box, which takes care that the power from the motor shaft is converted to the crank. The second part is to convert the rotation of the crank into a movement of the feet.

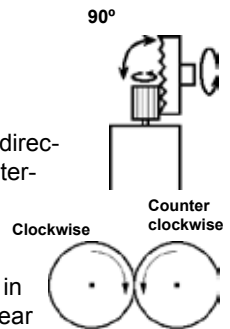
The transmission of power

Gears, transmission belts, shaft, crank, chains: They all can transmit power. In the soccer robot four gears transfer the motor power into the crank. Such a transmission is called a gear box. The power is transmitted by the teeth of the gears. At the same time three conversions take place:

- a. Change in rotating direction
- b. Change in rotating speed
- c. Change in torque

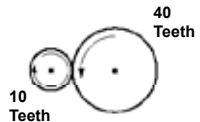
a. Change in rotating direction

When two gears are connected, there will be a change in rotation direction. One gear will rotate clockwise, the other gear will rotate counter-clockwise.



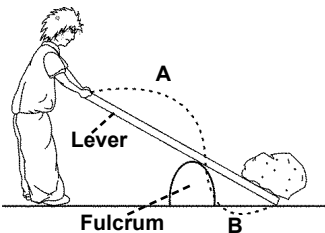
b. Change in rotation speed

The change in rotating speed depends on the relation of the teeth in the gear. As an example we describe a gear with 10 teeth and a gear with 40 teeth. When the first gear (10 teeth) makes a full rotation, the second gear 40 (teeth) only makes a quarter of a rotation. So before the second gear makes a full rotation, the first gear already makes four rotations. You may understand that this effect also changes the rotating speed.



c. Change in torque

The torque can be seen as a lever construction with a fulcrum. Imagine a person who lifts a stone with a lever.



The person who lifts the lever must use more power when the distance A gets shorter or when the distance B gets longer.

$$\text{Gear ratio} = \frac{\text{Motor rotation}}{\text{Number of last gear rotation}}$$

This is about the same for gears. The power on the teeth increases on the inner side of the gear. For that function we are using spur gears.

