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Calibration and PC / Mobile connection Manual

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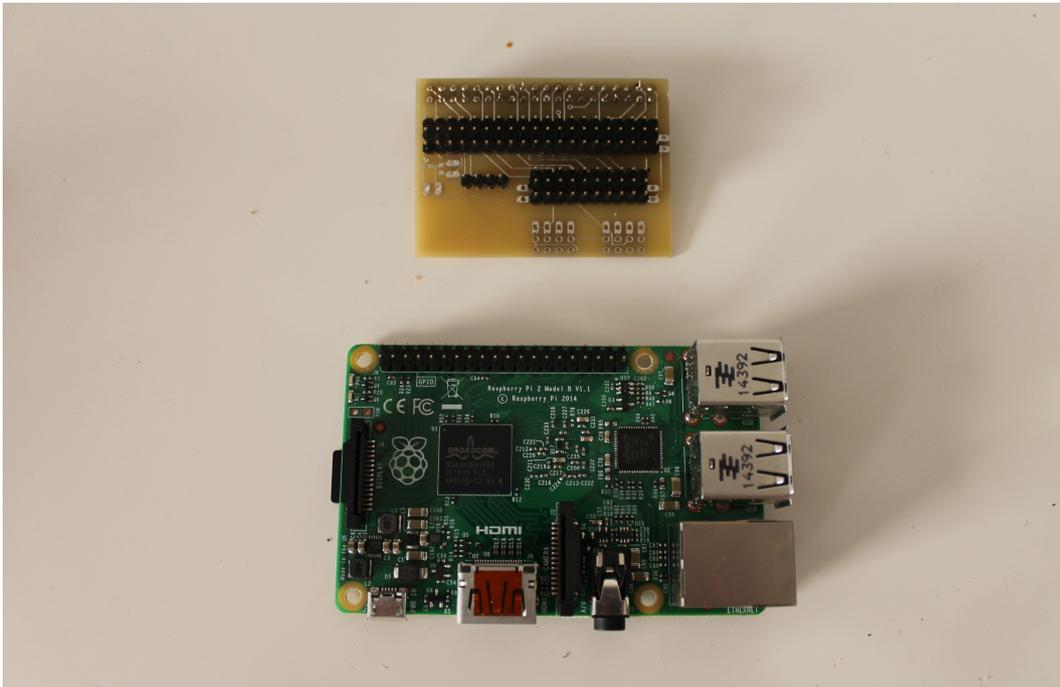
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This manual describes how to calibrate your robot and how to connect your PC or mobile phone to the robot.

1 Starting up the raspberry pi



Plug the PCB on the raspberry Pi:



Power the PCB by plugging in the power cable and switching on the power switch
Connect the WLAN stick to the raspberry
Connect a USB mouse and USB keyboard as well as an HDMI Monitor



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Start Desktop:

No matter what is shown on the screen, enter the following:

```
pi [press enter]
raspberry [press enter]
sudo killall roslaunch [press enter]
[press enter]
startx [press enter]
=> a desktop environment will start up!
```

2 Connecting WLAN / Noting IP Adress

Configure WLAN:

left click on the two pcs in the top right corner

left click your wlan

enter your password [press enter]

wait for the raspberry to connect

then hold your mouse above the WLAN symbol, a window like the following is shown:

```
wlan0: Associated with Split
wlan0: Configured 192.168.178.63/24
eth0: Link is down
```

Note your **IP Adress:** In the example above it is 192.168.178.63

For Information: The IP adress is also shown during every startup of the raspberry, you can see it if a monitor is connected to the raspberry. (but it will be surrounded by a lot of text before and after the IP adress)

Restart:

left click "menu"

left click "shut down"

left click "restart"

left click "ok"

In case no WLAN networks are shown:

left click on terminal (black symbol on top left)

enter following text: sudo nano /etc/wpa_supplicant/wpa_supplicant.conf [press enter]

delete everything beginning with "network={..."

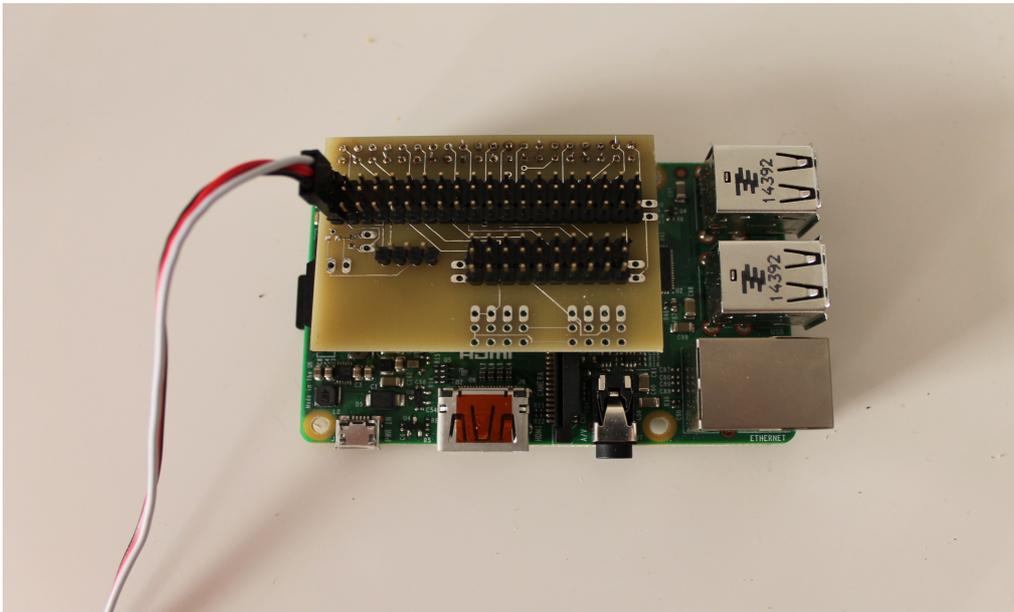
press Strg+x or ctrl+x and save the file.

reboot

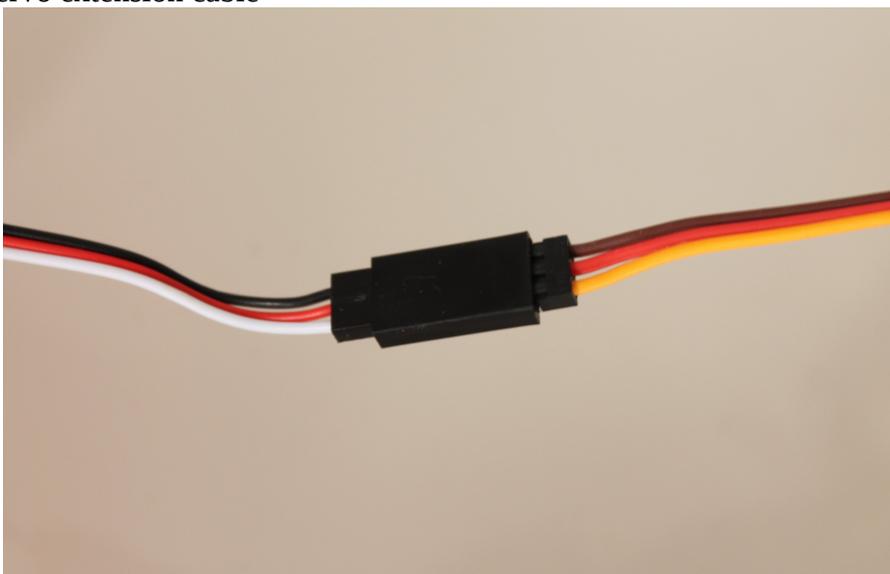
3 Calibrating each Servo

Note: The following steps have to be done for each of the 17 servos! Start here again for each of the 17 servos before assembling the servo into the robot!

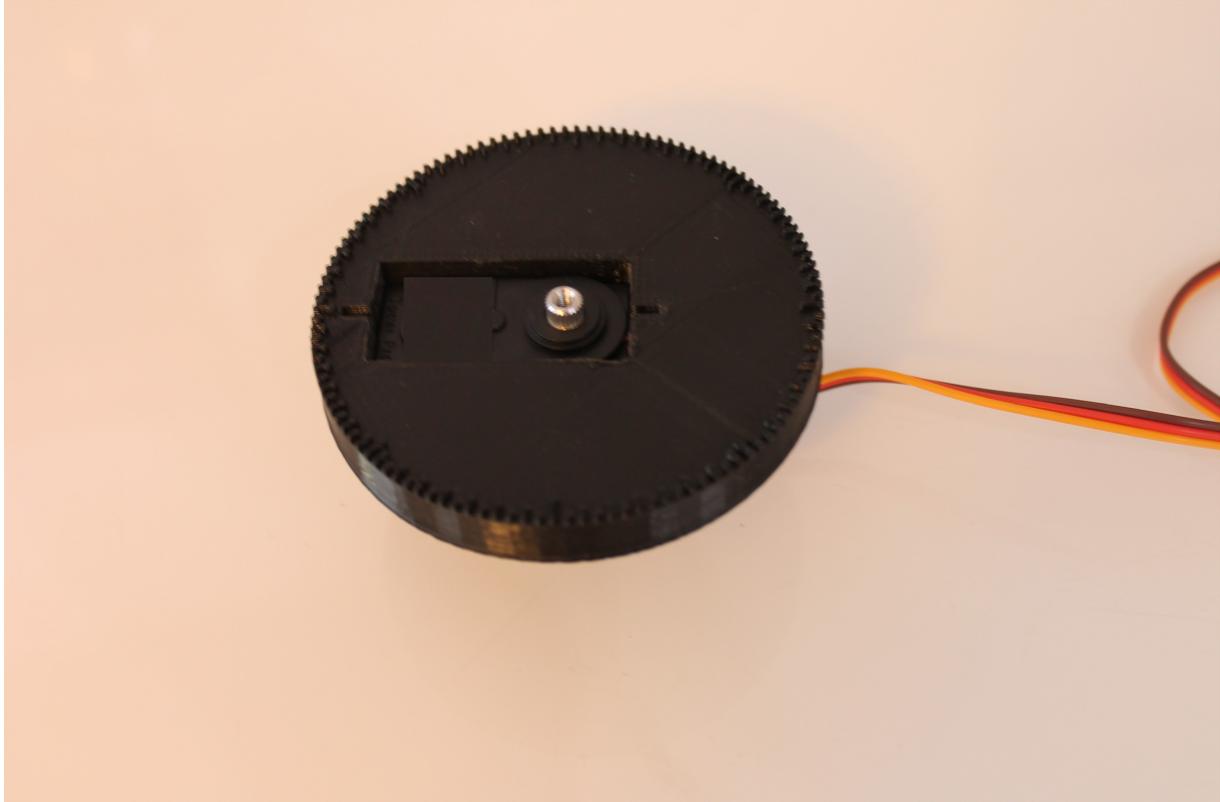
Connect the servo extension cable to the PCB:



plug servo in servo extension cable



assemble plastic calibration on the servo. Be careful to have the servo screw in the middle of the plastic calibration, as seen in the picture (servo could be 180° wrong):



Disassemble one straight bracket from one of the arms. Assemble servo horn "14" on the straight bracket "7" with 2x10:



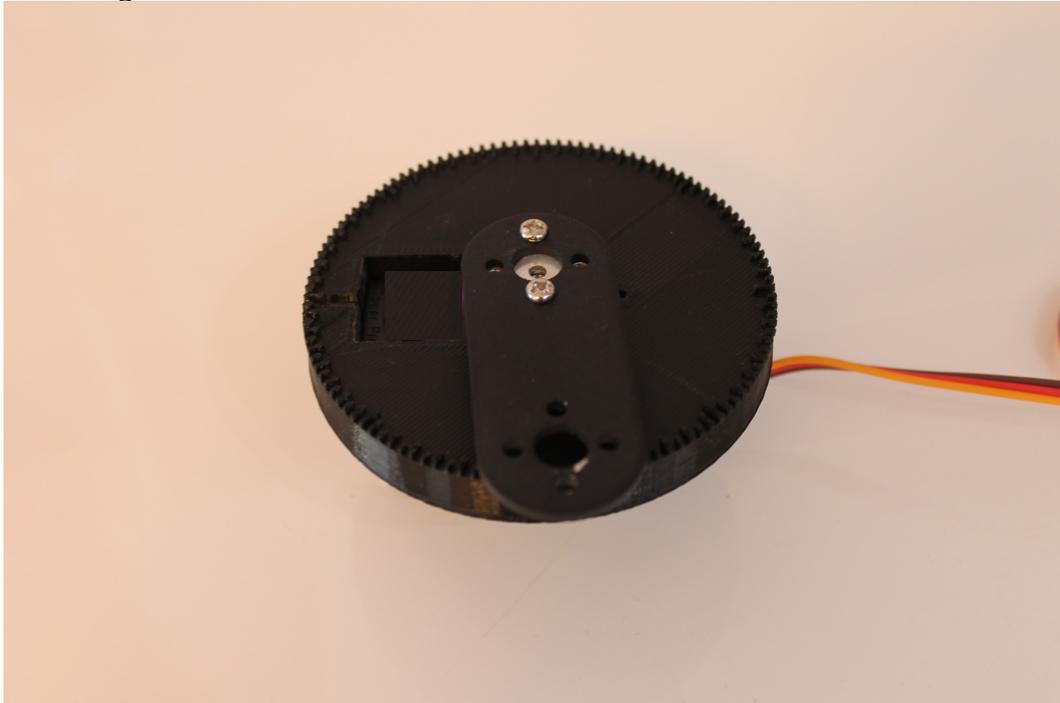


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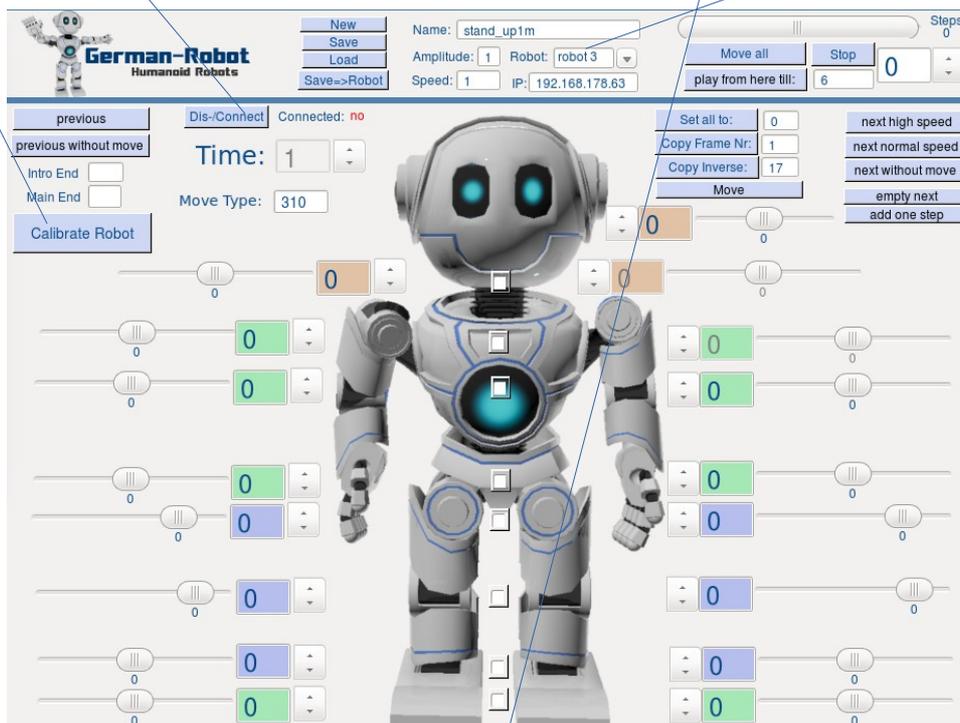
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assemble the straight bracket on the servo



Start the Software, enter the IP adress of the robot in field "IP" of robot 1. Then choose "robot 1".
Click on "Dis-/Connect".
Click on "Calibrate Robot".





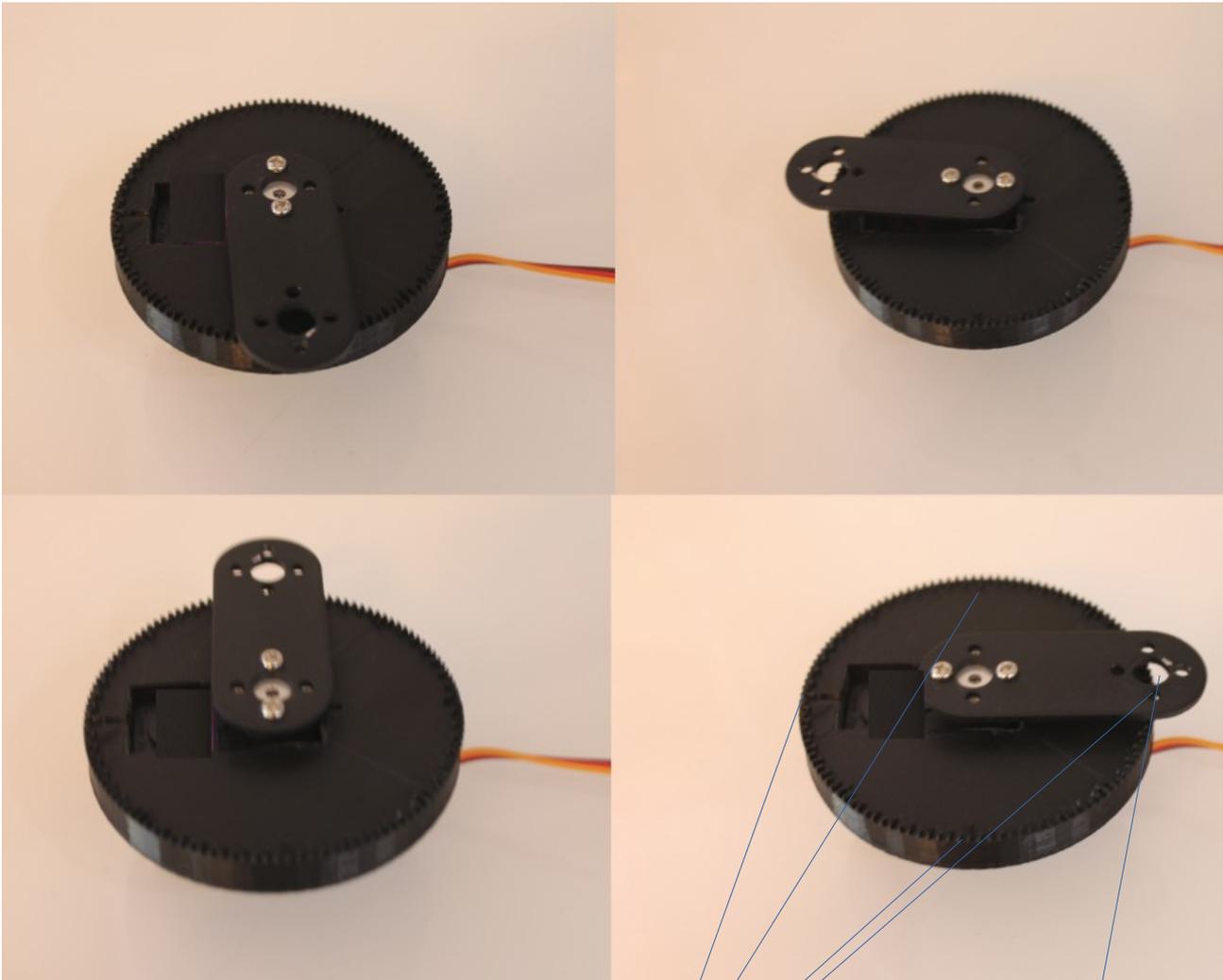
Click on "Assemble Servos".

Be sure to have "Set Servo Direct" not checked. Reduce "Servo min position" until the servo stops moving.

increase it by 1 step (=10 μ s) to be in the "moving" range

Take the straight bracket away from the servo.

Then try all four 90° positions as seen in the picture. Place the straight bracket always a bit clockwise from the 90° position or exactly at the 90° position. One of the 4 positions will either be exact at 90° or it will be very near to it. Assemble the straight bracket in this nearest position to 90°.



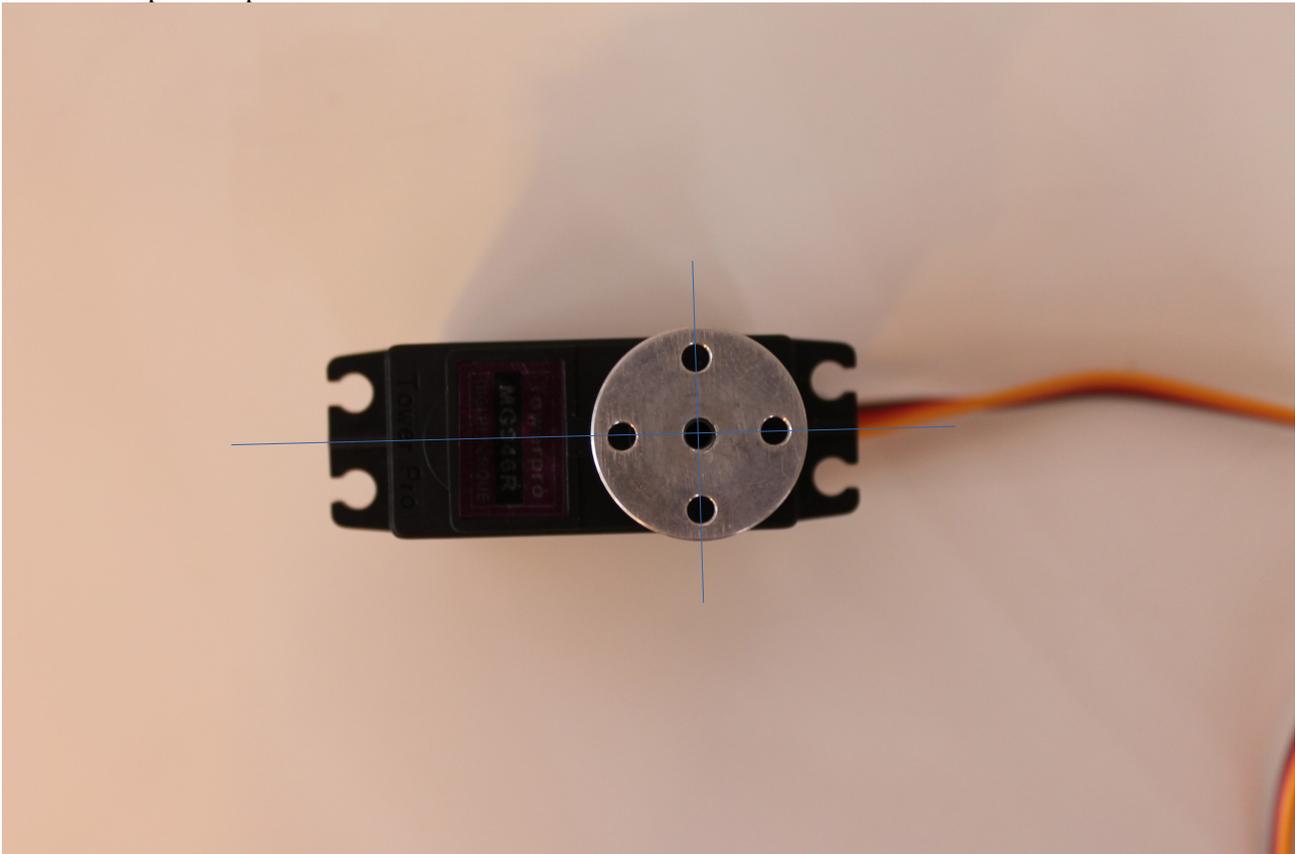
Now increase the "servo min position" value until the bracket is exactly at the 90° position. You can find the 90° position by finding one of the 4 long marks exactly in the middle of the big hole.

In a next step we look for the correct "servo max position" which is at 180°. Increase the "servo max position" value in the software until the bracket is exactly 180° further than in the "servo min position". Again one of the 4 long marks is exactly in the middle of the big hole.

Press "Servo finished"

disassemble the servo bracket from the servo and also disassemble the plastic calibrator.

Assemble a new servo horn to the servo. It has to be assembled in a way, that the 4 holes are on the 2 axes of the servo. Try all 4 positions by starting with one position and then turning the servo horn by 90° and trying second position. One of the 4 positions will have the 4 holes (nearly) exactly as seen in the picture parallel to the 2 servo axes:



End of the calibration. Repeat above steps for each servo before assembling the servo into the robot!

4 Assembling the servos into the robot

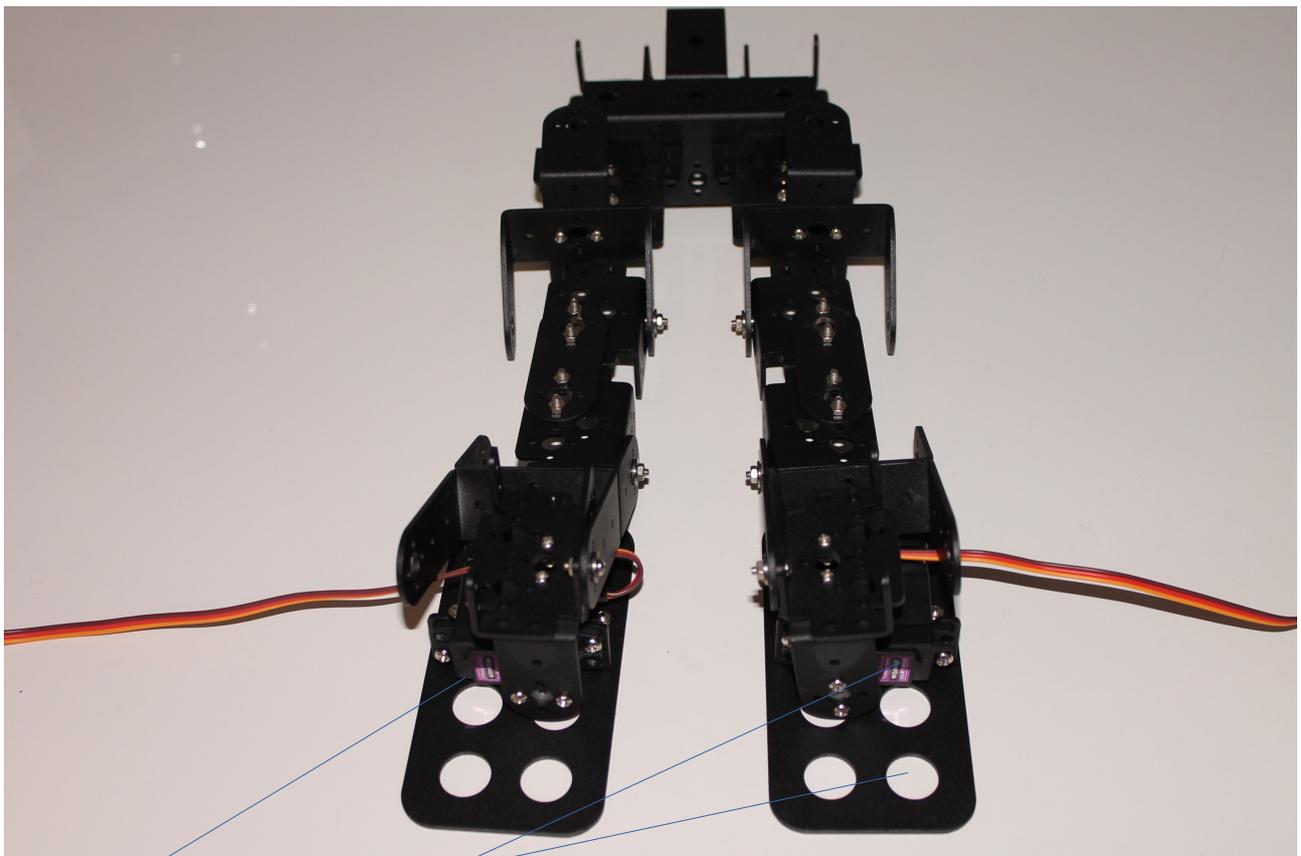
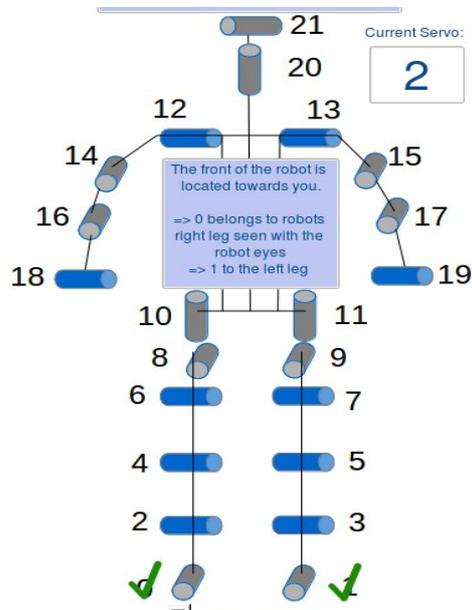
Now place the servo with its servo horn into the robot at the correct number as shown below. Note that servos 10, 11 and 18, 19 and 21 are not used at the moment.



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Servo 0 (left) and-servo 1(right) are assembled in the picture. Note that the feet are located in a way to have the four holes in the feet as in the picture towards you! **Also make sure to have the brackets that are screwn to the servo in the same position as seen in the picture and not turned by 90°!**

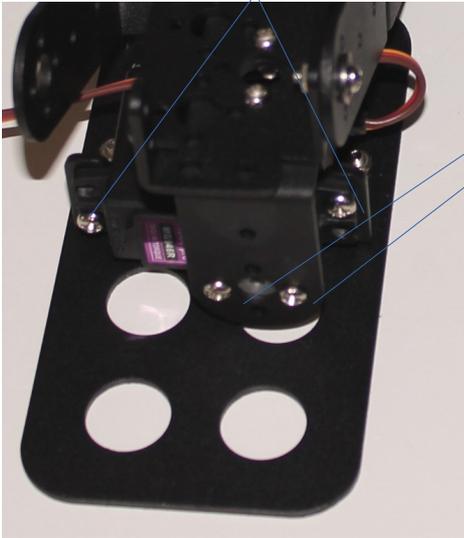


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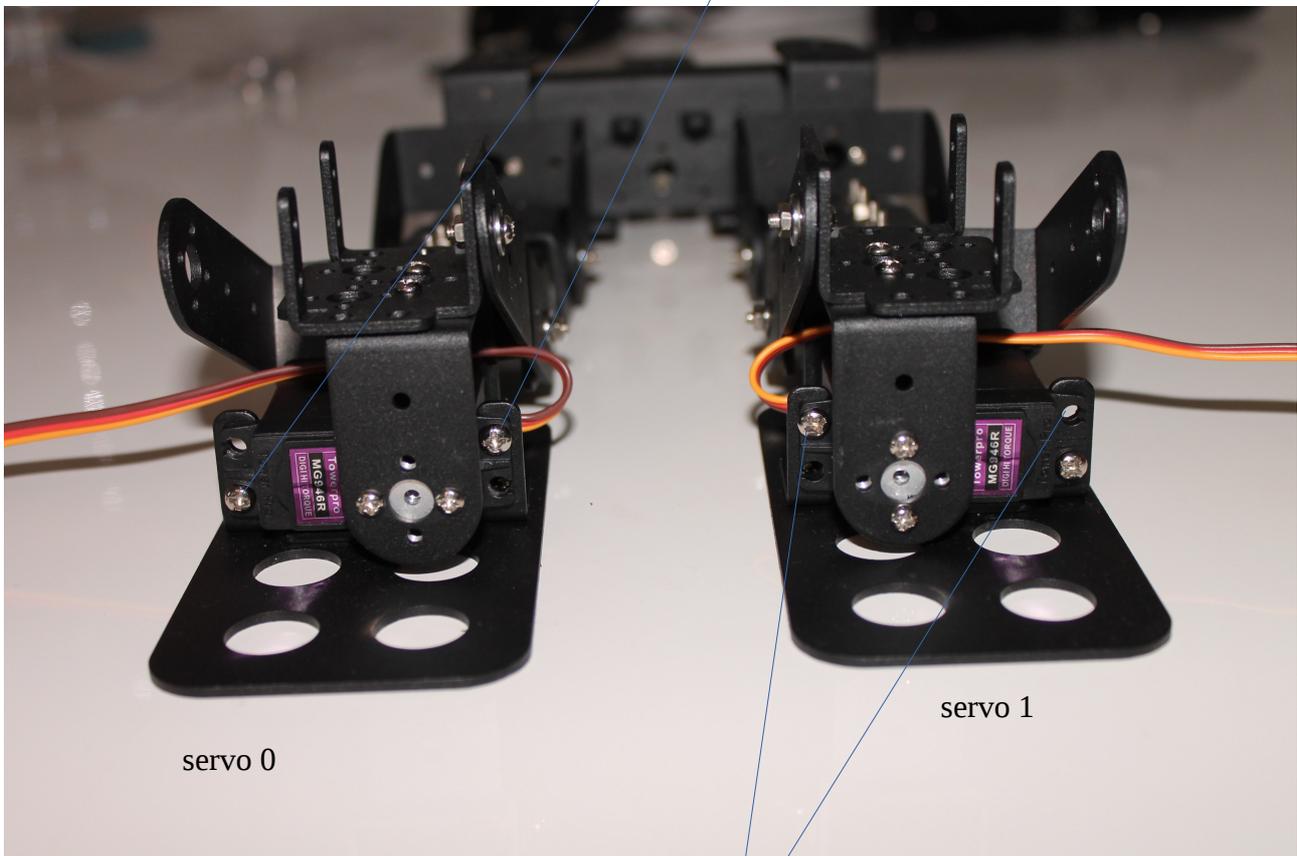
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Fix the servo with 2 screws and fix the servo horn with 2 screws.



Be sure to use 2 holes that are located in the opposite edges:



e.g. do not use the two holes that are indicated by this lines as they are not located in the opposite edges.



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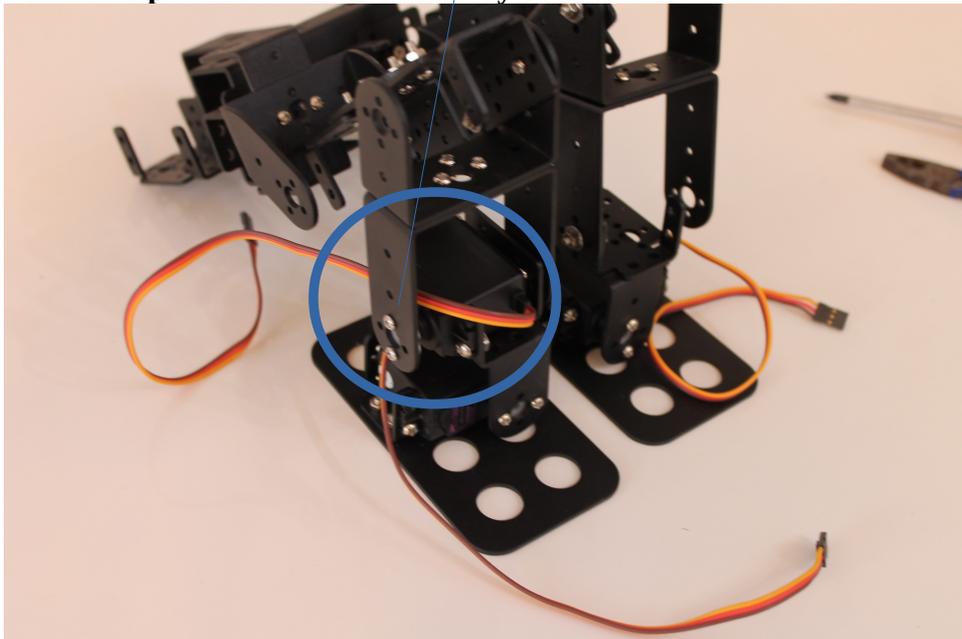
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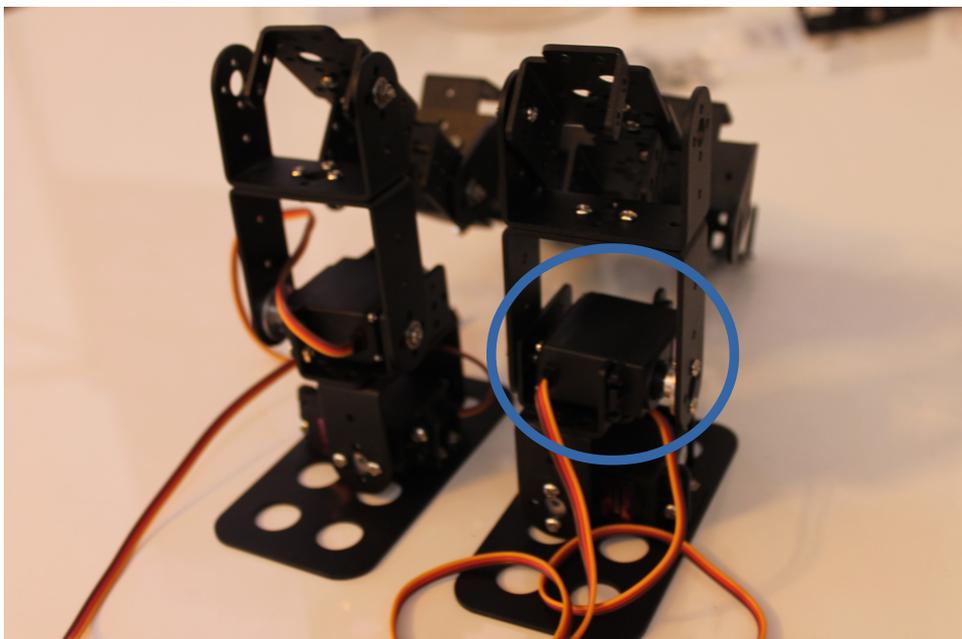
Continue with the same steps for all further servos.

Servo 2:

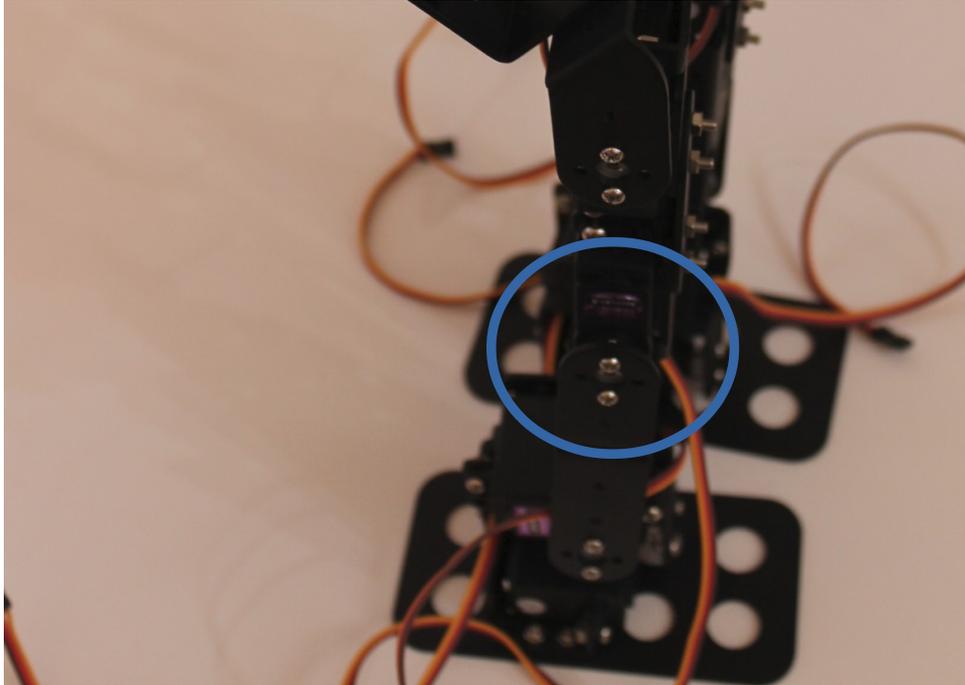
Again make sure for each servo to have the bracket that is fixed to the servo in the same position as seen in the pictures and not turned by 90°!



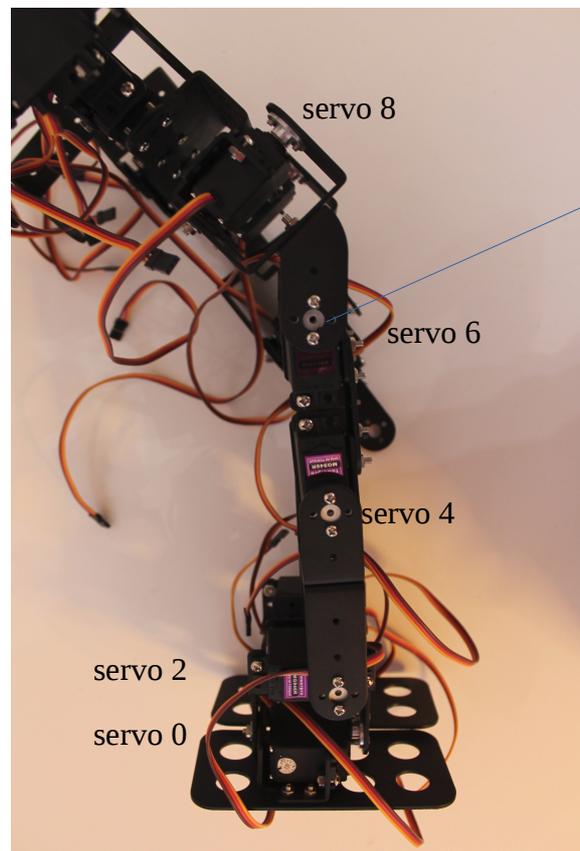
Servo 3:



Servo 4:



Note to have all brackets located as in the picture when assembling the servos! Picture shows the right side:



needs to
be 45°

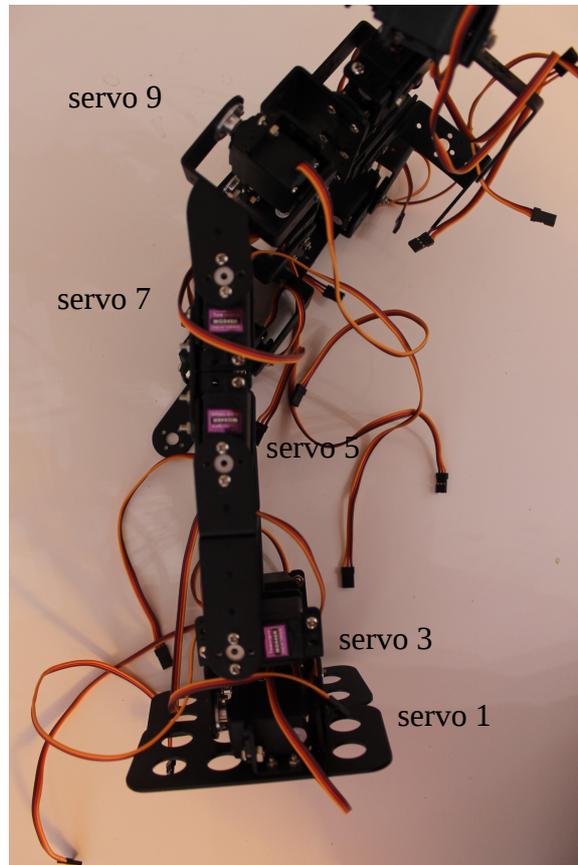


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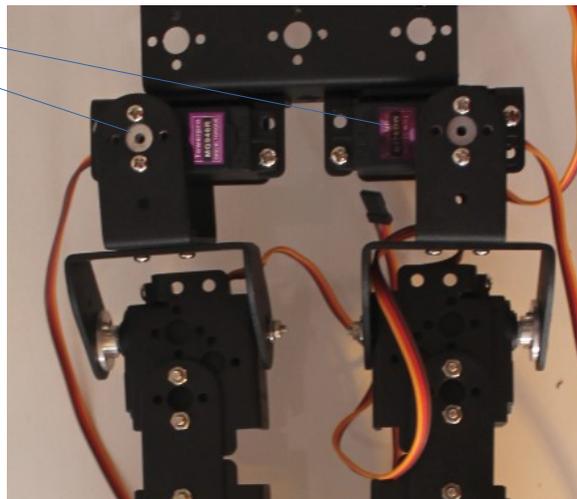
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Note to have all brackets located as in the picture when assembling the servos! Picture shows the left side:



Servo 8 and 9 look as follows from the front:





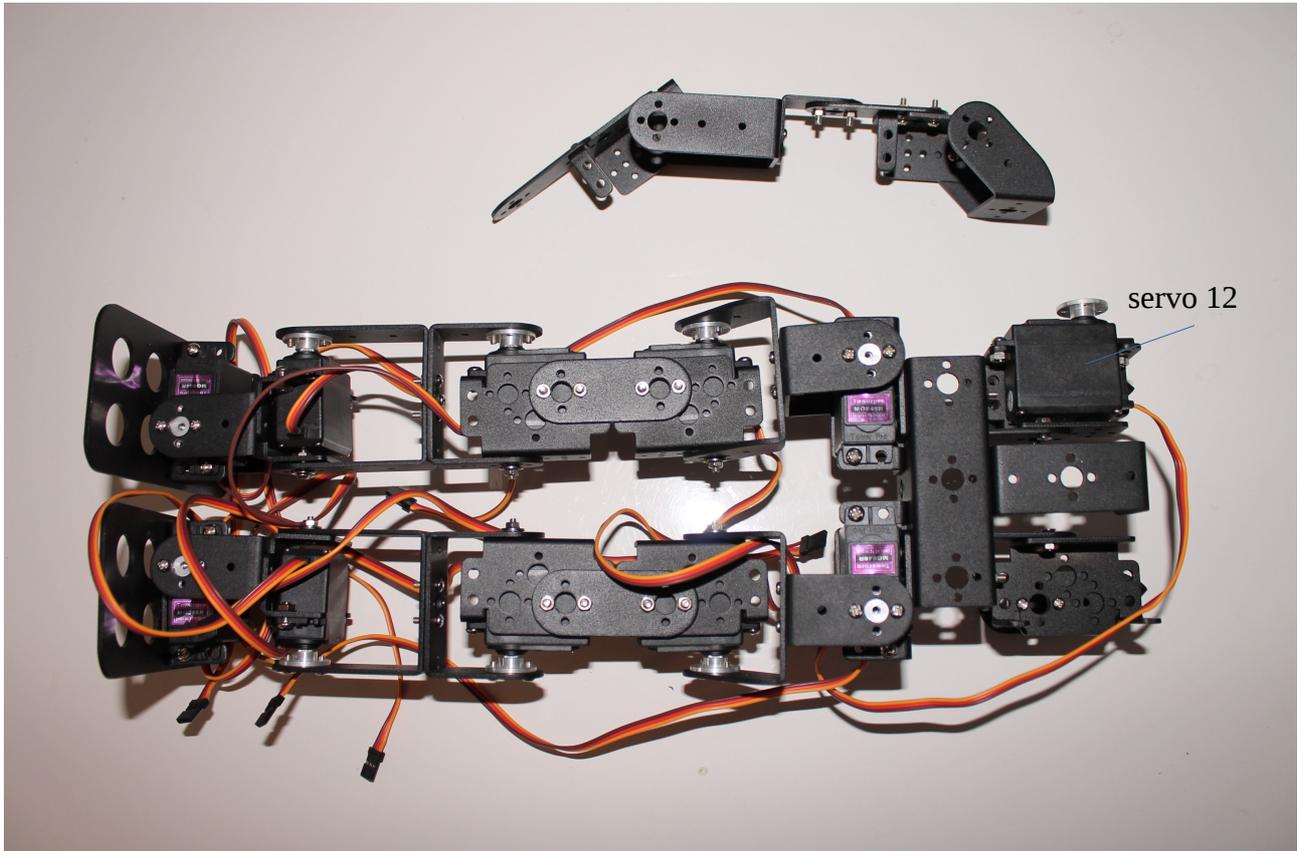
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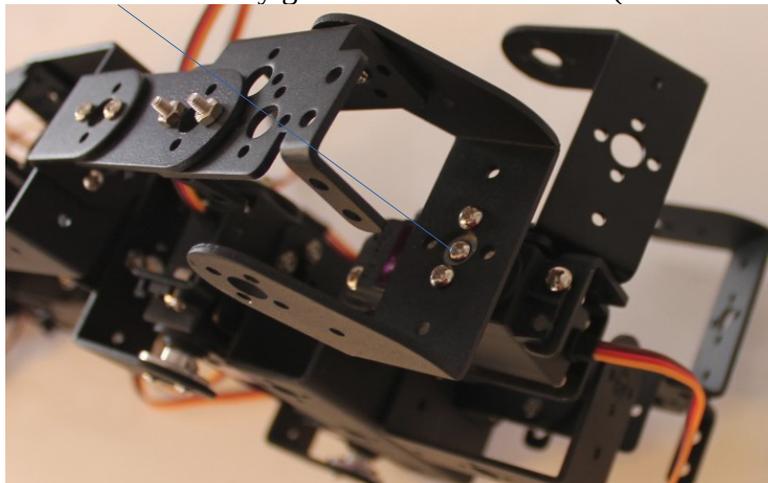
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Servos 10 and 11 are not used.

Servo 12:



Be sure to fix also the middle screw very good for servo 12 and 13 (use screw 10 for this)!



All other middle screws can be assembled at the end.

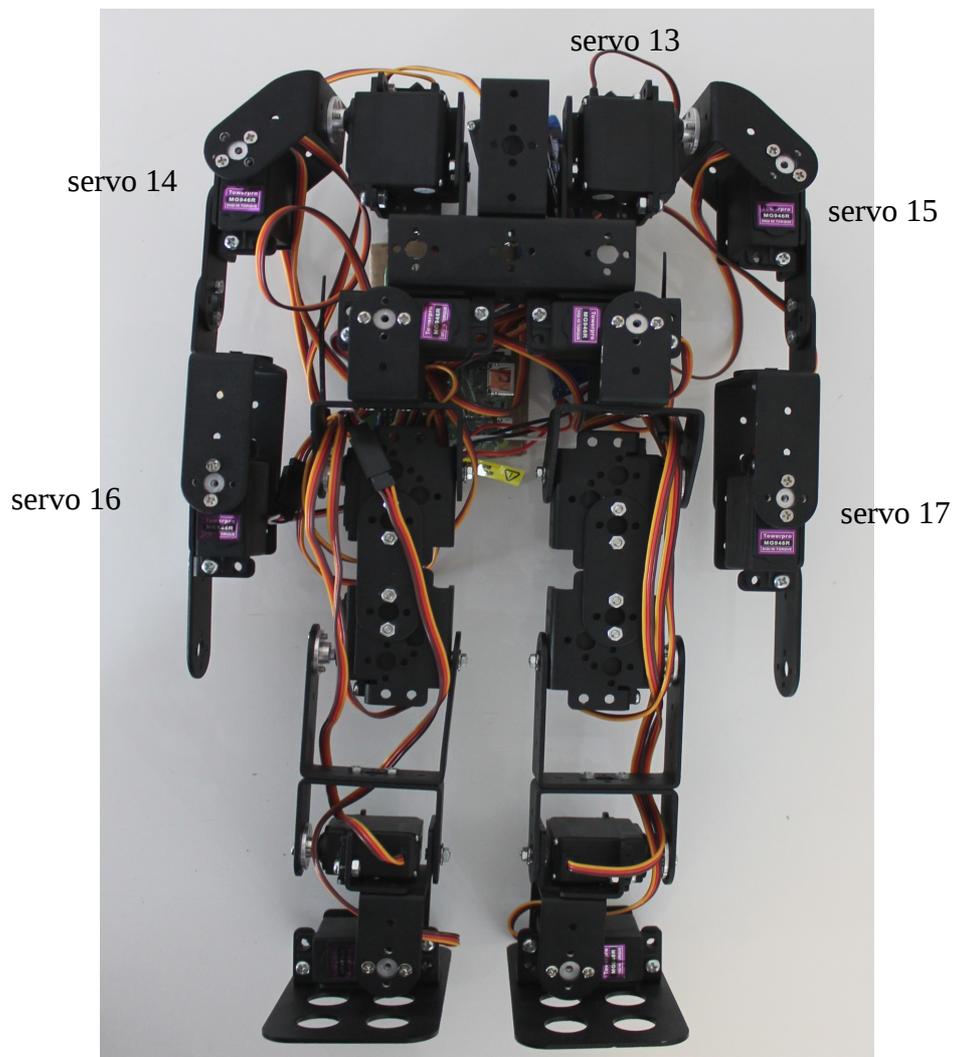


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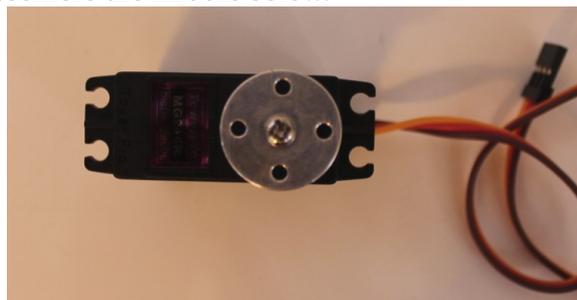
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Assemble servos 13, 14, 15, 16, 17 as seen below (**remember to calibrate each servo before assembly**):



Assemble all middle screws (screw 10).

Assemble servo 20. First assemble the middle screw.



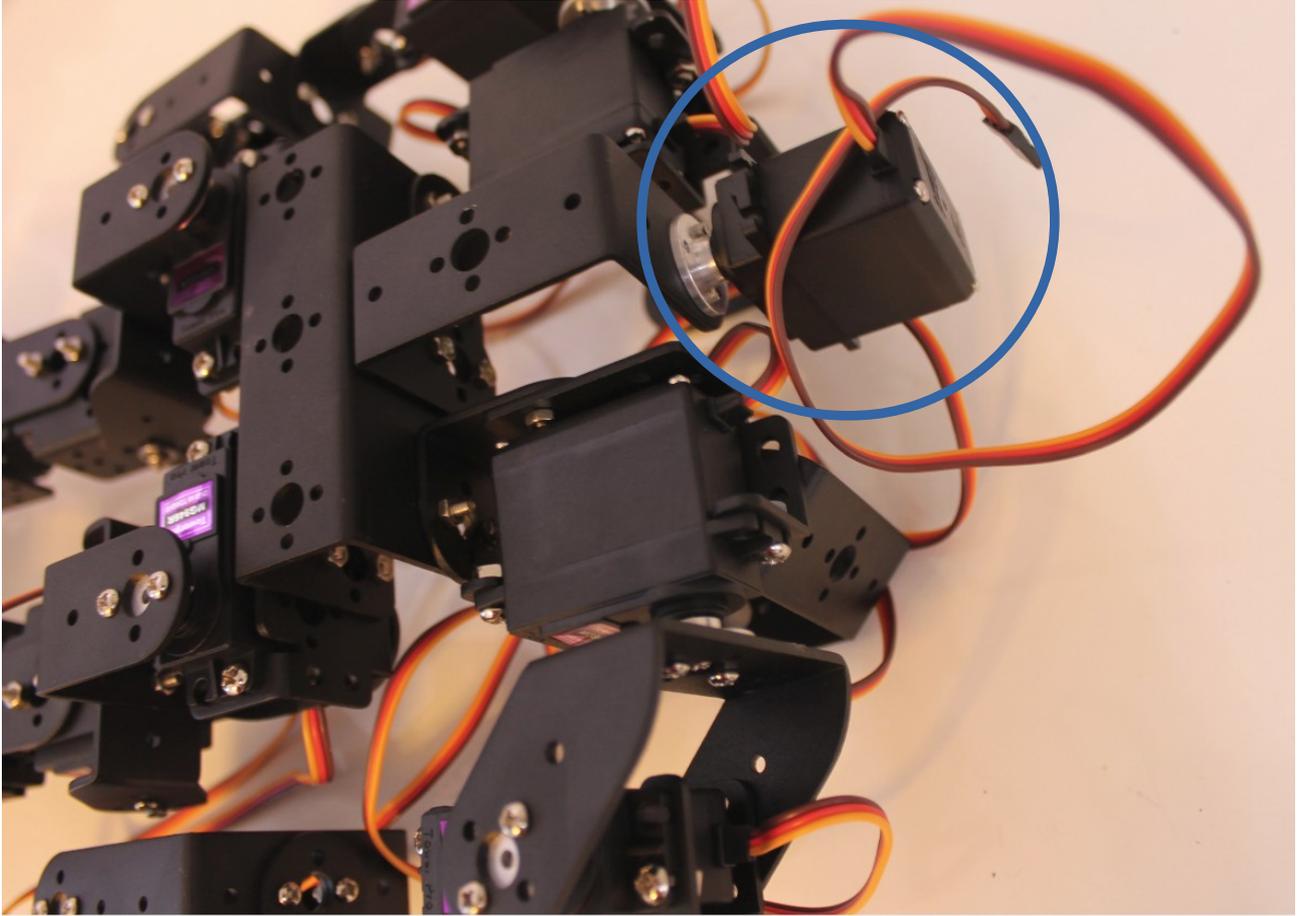
Fix the servo horn with 2 screws "10":



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5 Cable holders

put the cables into the holders.

Mark every cable, so that in case of an error you know wich cable to check.



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6 Connect to the Robot with your PC & Mobile

Note that for all these steps to work, your robot needs to be connected to your local network and receive an IP address from your router. In order to make that happen, please see instructions in chapter 2 (if not yet done)

A Connect the PC SW to the robot

see above chapter 3

B Connect to the robot control center

In your browser enter the IP address of the robot extended by :8000

Example: 192.168.178.63:8000

C Connect to the robot PC (raspberry pi via desktop)

Linux: Enter "vncviewer Your_robot_IP:1", e.g. "vncviewer 192.178.168.63:1" in the terminal

Windows: Download tight vnc viewer

Start "tight vnc viewer" and enter the IP address, "Your_robot_IP:1", e.g. "192.178.168.63:1"

The password is "raspberrry"

D Connect your mobile phone

- Switch on the WLAN Hotspot on your mobile device. See your mobile device instructions for help on this. Your mobile device will then create an own WLAN network to that the robot can connect.

- Either connect to the robot pc as described in "C" or as described in chapter 1.

- left click on the WLAN symbol in top right corner

- left click your phones wlan network

- enter your password [press enter]

In case you connected to the robot pc with method "C", your connection will be lost now, as the



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robot pc is now connected to your new wlan network of your phone. But this is no problem, as you are connected already.

- In the settings of your mobile phones WLAN Hotspot, you can see a list of connected devices including their IP adress. Note the IP adress of the robot PC.

- In your mobile device browser enter the IP adress of the robot extended by :8000

Example: 192.168.178.63:8000

- The robot control page will show up on your mobile device.

Note: Depending on which network is available, your robot PC will connect next time automatically to either your local WLAN or your mobile device WLAN Hotspot. Make sure your mobile device WLAN Hotspot is switched off, in case you need to connect to the robot with your normal PC via your local WLAN.

7 Warnings

A Hot areas of the robot

the following parts of the robot can get hot (up to $\sim 175^{\circ}\text{C}$) during operation. Do not touch them:

- The voltage regulator and fuse on the PCB
- The servo motors

B Use of the battery and charger

Before using the battery and charger, the manuals of both have to be read. Do not connect the battery to the charger when you can not pay attention for the charging. Do not connect the battery to the robot when you can not pay attention to the robot as long as it is connected to the battery. After use of the robot, disconnect the battery from the robot. For charging of the battery, the battery has to be taken out off the robot.

C Risks of the used components

The robot uses a lot of single components, where some of them are delivered with an instruction manual. Read all instruction manuals to ensure awareness of the contained risks and hints for a



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correct use.

D General

Only use the robot while you can watch and pay attention for it. Do not leave the robot switched on when you leave the room.

E Mechanical Risks

The robot can move its arms, legs and head. It has no sensors to detect any blocking items while moving. So in case a finger or arm is clamped by the robot, it is not detected. Injury can occur due to these moving parts, so stay away from the robot while it is moving.

Also in case of falling over, the robot could be damaged. Check the robot for correct function every time before its used.

Some parts of the robot are sharp and spiky, be careful when handling the robot in these areas.

F Wireless LAN module

The USB-Stick for WLAN may not be integrated in the robot, it must stay outside as shown in the build up manual. During operation, a distance of 20cm to the WLAN Stick has to be kept.

G Build up

The safety of the robot depends on a correct build up and use of all parts. Please ensure this.

H Edges

The robot has sharp edges. Be careful when handling the robot to not harm yourself.