Robotic Arm 5 DOF

Assembly Guide
Robokits India
http://www.robokits.co.in
info@robokits.co.in

Robokits World
http://www.robokitsworld.com
Overview:

5 DOF Robotic Arm from Robokits is a robotic arm with 4 degrees of freedom joints and a Gripper. Its actuated using 5 Standard size servos out of which 3 are normal Nylon gears standard and 2 are Metal Gear High Torque servo motors.

This robotic arm is controlled by USB (optional wireless Bluetooth) Servo Controller. It and be controlled by PC or other microcontrollers.

The power requirement for this robotic arm is 5 to 6V DC 10 Amp power supply. It could be either battery or a AC power supply rated at 5-6VDC. You can also use a modified computer SMPS supply, it is available for sale on Robokits website and you can also modify it yourself if you have one. There are many tutorials available for this modifications on internet.

Before starting the assembly we recommend to read the documentation of Servo Controller so that it will be easy to understand all electric connections and controls. If you have this document on CD then it should be in the same folder as this document otherwise you can download it from here:

http://www.robokits.co.in/documentation/USB%2016%20Servo%20Controller.pdf

After assembling the robotic arm you will be able to control it from a Windows PC. However if you want to control it with a microcontroller you can directly generate C code for it from servo controller software. This generated code is directly programmable to our Rhino Robot Control Board, if you want to use other microcontroller or compiler it could be translated easily if you are good at C language and embedded programming.

Let’s start with the basic assembly of robotic Arm. Some basic tools like screw drivers, pliers, small spanners, soldering iron, wire cutter, nipper, stripper are required to complete the assembly.

The notations used in this document for screws, nuts & bolts  are like these.

1. 3x6 mm cap screw – 3mm small screw
2. 3x8 mm cap screw – 3 mm mid screw
3. 3x10 mm cap screw – 3 mm big screw
4. 3x8 mm csk head screw – csk screw
5. 3 mm Nylock Nut – Lock nut
6. 3 mm nut – nut
Fix four 10 mm studs to base with four csk screws. You may have to push hard the screw from bottom.
Fix six 50 mm spacers to the base with csk screws just as before.
This is how the base will look after fixing all the studs.
Now take a circle plate with holes for servo and castor wheels, 9 locknuts and 9 M3 long screws.
Fix three castors on the base as shown in above picture. Now take a servo, 4 M3 Long screws, and 4 lock nuts.
Fix the servo motor to the base as shown. The final assembly will look like the picture above.
Take assembled plate with servo and castors and six M3 small screws.
Fix the plate and servo controller pcb to the base as shown. The base assembly is now complete.
Now take the parts as shown above. The screws in your accessories pack may be in black colour. There will be 3 round servo horns in 3 Nylon gear servo accessory pack. The fourth one will be in the nut-bolt pack.
Fix the servo horns to the plates as shown in above picture. Take precaution while fixing them to the round plate. The round plate has 2 countersunk holes towards the edge. The horn should be fixed to the countersunk holes side only.
When these parts are seen from top, they will look like the picture above.
Attach 4 L clamps on the round plate. Note that 2 M3 Long screws are inserted from top and locknut is fixed from bottom, for the holes on the edge side 2 csk screws are inserted from bottom and locknut is on top side. See next picture for bottom view.
Note that 2 CSK screws are inserted from bottom and nut is on top side. This is important otherwise the castor will touch the screw and restrict the movement of base rotation.
Now take a Nylon gear servo with back attached. Put it through a hole made in the plate shown above. If the servo is not going in properly even after applying force, you may cut or file the back part (towards opposite side of hole) of the edge of servo back.
Also put the second servo the same way. This time take the metal gear servo. In the metal gear servo also attach 4 rubber spacers available in the accessory pack of servo. Note the shaft directions of both servos.
Now take the plate with cuts for 2 servos and holes and fix it on top of the servo with help of 4 M3 long screws and 4 locknuts for each servo.
Fix two 20 mm studs in between 2 plates with 4 M3 small screws. The final assembly should look like the picture above.
Power on the servo controller with 5 to 6 VDC power supply. Connect it to PC with USB or Bluetooth. We have used a Bluetooth Servo Controller so it's connected to PC wirelessly. It should be same when connected through USB, only a USB cable from PC to servo controller is attached.

Connect 4 servos (3 in the assembly and 1 metal gear) to the servo controller and put them at centre position. You can click Centre All button in the software to do this. (See servo controller’s manual for full details) You can also test that all the servos are working correctly.

Once all the servos are connected and neutralized assembly can be done.
Keeping the power on for servos fix the base plate with 2 L clamps to the base servo. The imaginary line between 2 L clamps should be near to parallel with edge of base. Once done put a lock screw which is available in servo accessory pack to the servo shaft. This will secure the servo with top plate.

Make sure that you don’t fix the screw so hard that the plate cannot move. Move sliders from the software to confirm the tension of screw. If the plate is not rotating smoothly open the screw slightly, if plate is loose close it slightly and adjust.

After doing this the base rotation servo may be powered off.
Now fix a servo motor to the clamp on the base plate as shown. Use 4 M3 long screws and 4 locknuts to do this.

This servo can also be mounted in such a way that the shaft comes to the centre of round base plate. This will give smooth operation, good stability and a little higher payload but decrease the reach of arm by around 20 mm.
Take the wire of the servo motor and pass it through the bottom of servo to the back side.
Now attach a part with 2 servo horns to the metal gear servo keeping the servo on and neutralized. The part should be attached at an approximately 45 degrees angle from base.
Now secure the servo with lock screw which is available in servo accessory pack. Also attach 2 50 mm spacers using 2 M3 small screws.
Now keeping 3 servos powered on attach the assembly of 2 servos to the first joint at an approximate 100 degrees angle between them. Also fix the lock screw on the second joint servo.
Fix the back plate of first joint using 2 M3 small screws as shown in the picture above.
Fix 2 10mm studs to part shown in above picture.
Attach a second plate to it with 2 M3 small screws as shown in picture.
Assemble and attach gripper to this assembly using 4 M3 MID screws and 4 simple nuts. Putting locknuts here will block the insertion of servo motor for actuating gripper.
Neutralize the last Nylon gear servo and attach it to the gripper, keeping the gripper in approximately half open position. When done put a lock screw from other side and secure the servo.
Attach the small piece prepare before to the last joint servo. Try to keep it parallel to the previous joint. Servo should be powered on and neutralized during this period.

After this lock the piece with servo lock screw and secure it. Also attach a 50 mm stud to it with 3 mm small screw as shown in picture.
Now fix the gripper assembly to the last joint as shown in picture. The gripper may also attached in opposite direction, details are given in next 2 pages.
When the gripper servo is downwards, the robotic arm is more stabilized, but it's sometimes unable to pick up small objects as servo is on bottom. See next page for alternate configuration.
When the gripper servo is on top, arm may become a little un-stabilised when extended but this allow small objects picking easy as the gripper can touch the ground.
The mechanical assembly is complete. Now it is time to organize the wires properly. First of all connect 2 servo extension cables to gripper and last joint servo.

Follow the next pictures which shows how to organize servo cables. Use cable ties included in package and make sure that you keep the movement of any joint is not restricted after cable is tied.
Start from the last joint.
Arrange the cables.
Pass through a joint.
Make sure no movement is restricted after cables are tied.
Cables coming from last 3 servos to the base servo.
Arrange the extra cables.
The assembly is now complete. Go through the servo controller document for programming and using the robotic arm.
Service and Support
Service and support for this product are available from Robokits India. The Robokits Web site (http://www.robokits.co.in) maintains current contact information for all Robokits products.

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