

English Language V1.00

ROBONOVA-I



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ROBONOVA-I



ROBONOVА-I Instruction Manual**Index**

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1. Easy to Bulid

Your ROBONOVА-I kit was designed for easy assembly in 6 to 8 hour using only a screwdriver.

2. Servo motors**Completely Designed Servo Only for Robot Operation**

This fully articulating, 12" high, mechanical man is controlled with 16 powerful HSR-8498HB digital servos built specifically for the ROBONOVА-I by Hitec. These custom servos feature "set pin" locking of the servo arms for easy assembly, over-voltage current protection, super strong Karbonite gear trains and "feedback" technology for simple programming.

3. Control Boards, MR-C3024**Micom Board with Flexible Interface**

The control board is the heart of the ROBONOVА-I. Secured to the back of the robot under a strong plastic case, the control board can operate up to 24 servos and 16 accessory modules. Optional devices will eventually include gyro's, acceleration sensors, speech synthesis modules and operational devices such as Bluetooth controllers and R/C transmitters and receivers. This flexible and sophisticated interface allows the user to customize ROBONOVА-I into the robot of their dreams. Firmware can be automatically upgraded connecting with PC.

4. Metal Framework

The custom gold anodized metal servo brackets serve as a strong and lightweight exoskeleton. ROBONOVА-I also features durable plastic body case components that protect the control board and battery from damage.

5. Battery and Charger

Powering the ROBONOVА-I is a 5 cell, environmentally friendly NiMH rechargeable battery that delivers around 1 hour of operational time. The included D/C to D/C charger features a protection circuit to help prevent battery charging mishaps.

6. The Key – "Easy To Operate"

ROBONOVА-I, Robot Programming Made Easy. Users of this exciting robot package have an opportunity to learn robot technology first hand. Programming is simple with the supplied RoboScript and RoboBasic software via the included PC interface cable.

1) RoboScript & RoboRemocon

Beginners to robot programming technology will be pleased to use the supplied RoboScript programming software. Without knowing any programming language at all, users can create operational subroutines with the "click of a mouse". Use the RoboRemocon software to control your ROBONOVА-I with the operational data created with RoboScript

2) RoboBasic

RoboBasic is a programming tool based on the BASIC programming language and is provided for the more advanced users. Containing specific commands for simple robot operation, RoboBasic can also be used in conjunction with RoboScript to increase the performance of the supplied Micom controller board.

3) HMI (Hitec Multi-protocol Interface)

- Upgrading firmware & various settings by connecting with connector of servo motor
- Parameters setting (2 types of Gains, Dead band etc.) and set value change during operation
- Compatible with PWM(Pulse Width Modulation) used in current radio control
- Controlling maximum 128pcs of servo motors by Daisy chain serial interface and PC
- Able to have feedback for voltage, current and position using the HMI

4) Catch & Play Function**Easy Programming Technique**

The simplest way to program ROBONOVА-I is with the "catch and play" function. Using RoboScript or RoboBasic, just move the robot into any position and click the mouse to "capture" that position. Move the robot into another position and repeat the process. The software then links these "captured" positions and once activated, smoothly transitions the robots movements through these programmed positions.

I. Before you begin

- This manual contains an explanation of the ROBONOVА-I hardware and its assembly, the MR-C3024 robot controller and the software used to program the robot.
- Please read this manual carefully and be aware of the products functions and usage. This manual is also provided in the PDF file format on the CD so a copy can be made to hard disk or printed, whichever is required.
- The specifications may be changed without notice to improve the performance of the product or for other reasons. Check the Hitec homepage for the latest updates. (<http://www.hitecrobotics.com>)

Safety Precautions

Precuations are divided into two categories, Warnings and Cautions, according to their bearing on safety.

Read the Warning and Caution notes thoroughly before attempting to assemble the kit.

- Danger:** Applied when the risk of Death, servere injury, or the possibility of property damage may occur if the instructions are not followed
- Warning:** Applied when either user injury or equipment damage may occur when the instructions are not followed.
- Caution:** Applied when there is the possibility of injury or equipment damage.

1. Notes on assembly and operation

This manual contains information on safety to prevent bodily injury or property damage.

**Danger**

- Pay attention to proper safety while the robot is operating.
- Performance and operation is not guaranteed since this is an unassembled kit and if assembled incorrectly injury or damage may occur.
- Assemble the kit in an area with adequate ventilation.

**Warning**

- Keep away from children. Though the product appears to be a toy, it may hurt a small child if left attended.
- Shut down and unplug the battery immediately if a problem occurs. If the product is broken, or exposed to liquid, flame, or heat, shock may occur.
- Never disassemble or modify the battery charger and cables. (Cable repair is supported by customer service.)
- Unplug the battery charger when not in use.
- Never disassemble or modify the servo circuit boards.
- Do not use in hot, wet or cold conditions. This kit consists of precision components. If exposed to extreme conditions, failure may occur.
- Pay close attention to the construction of the robot. Since this is an unassembled kit, safety and performance is not guaranteed. If assembled incorrectly, damage or injury may occur.
- Always make sure the battery charge plug is secure when charging. Remove immediately when the charge process is complete.
- Please read the manual carefully. Note the direction of the servos and brackets when assembling. If assembled improperly, disassemble and reassemble correctly.

**Caution**

- The servos included in the kit require periodic maintenance to maintain optimum performance.
- Best performance is achieved when using the robot on a large, smooth, flat surface. If the surface is irregular or too small, the robot may fall and damage may occur.
- Do not hold the robot when turning it on or during operation.
- Do not turn off the MR-C3024 controller during firmware is being upgraded. The program may fail and damage (Contact repair service)

2. Battery management safety

- This kit contains a NiMH battery for the power source. The NiMH battery is a high power rechargeable battery and requires careful handling and storage. Charging
- Insert the battery charger into an AC source and then connect it to the controller. The battery is charged through the controller. When the charger is connected, the LED will turn red. When the charge cycle is complete, the LED on the charger will turn green.
- To charge the battery outside of the controller, an optional charging cable (Part Number 77102) is required,

**Warning**

1) Battery management

- The battery included in this kit has a minimal charge. A NiMH battery must be stored with some remaining battery power.
- If the NiMH battery is fully discharged and left for a longtime, the battery's performance will decrease.
- The battery must be removed from the board or the battery charger when not in use. Store the battery in a cool, dry place.

**Warning**

2) Charging time

- It takes about 70 minutes for the batteries to fully charge. This time will vary depending on remaining battery power.
- While charging do not leave the battery unattended. Stop the charge process if the battery becomes abnormally hot.
- Overcharging may result in damage to the pack.

**Cautions**

3) Battery handling

- Do not disassemble or modify the battery connector and wiring.
- Make sure that foreign objects do not get into the connector pins and that no bare wires are exposed.
- Do not subject the battery to extreme temperatures or a humid environment. Store the battery in a cool, dry place.
- Keep away from other conducting sources during transport or storage.
- If the battery wires become worn or frayed, replace the battery pack.

**Cautions**

4) First aid and disposal

- In the event that the battery is damaged and vents causing the electrolyte to encounter an area of skin or the eyes, rinse the affected area with water.
- In the case of contact with the eyes, consult a physician as soon as convenient.
- The battery electrolyte is a toxic substance. It is not only harmful to the human body but may also damage home and furnishings.
- If the NiMH batteries no longer hold a charge, dispose of them properly in the trash or according to your countries rules and regulations.
- Do not dispose of them in an incinerator.

II. Assembly notes

ROBONOVA-I KIT Part List

6 PCS	4 PCS	8 PCS	2 PCS	1 PCS	1 PCS	1 PCS
HR1B-0001	HR1B-0002	HR1B-0003	HR1B-0004	HR1B-0005	HR1B-0006	HR1B-0007
Tapped U Type Universal Bracket	Non-Tapped U Type Universal Bracket	I-Type Universal Bracket	H-Type Bracket	Back Body Frame	Front Body Frame	Top Body Frame
1 PCS	1 PCS	1 PCS	1 PCS	1 PCS	2 PCS	2 PCS
HR1C-0001	HR1C-0002	HR1C-0003	HR1C-0004	HR1C-0005	HR1C-0006 (Top Hand)	HR1C-0007 (Bottom Hand)
Front Body Cover	Back Body Cover	Goggle Cover	Front Head Cover	Back Head Cover	Top Hand Cover	Bottom Hand Cover
1PCS	3 PCS	1 PCS	3 PCS	1PCS	1 PCS	1 PCS
HSR-8498HB1R200 (Sticker No.1)	HSR-8498HB1R300 (Sticker No.2)	HSR-8498HB1L200 (Sticker No.3)	HSR-8498HB1L300 (Sticker No.4)	HSR-8498HB2R200 (Sticker No.5)	HSR-8498HB2R400 (Sticker No.6)	HSR-8498HB2L200 (Sticker No.7)
130 PCS	12 PCS	6 PCS	2 PCS	40 PCS	12 PCS	4 PCS
PH/T-2 2*4 NI	PH/T-2 2*5NI	PH/T-2 2*8 NI	PH/T-2 2*26 BK	PH/M 2*4 NI	PH/M 2.6*4 NI	PH/M 3*4 NI
Pan Head Tapping Screw	Pan Head Tapping Screw	Pan Head Tapping Screw	Pan Head Tapping Screw	Pan Head Screw	Pan Head Screw	Pan Head Screw



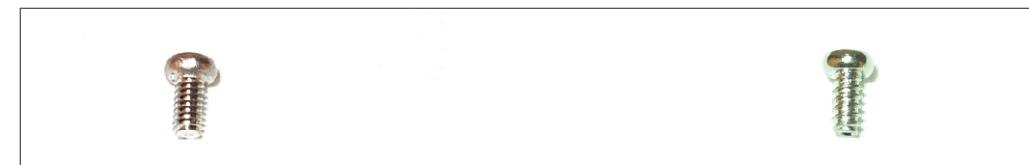
* Above Servo Horns are already installed in HSR-8498HB Servo

1 PCS	1 PCS
Pin Cover	Battery Wire Protector
For MR-C3024	

1 PCS	2 PCS	2 PCS	2 PCS	2 PCS	1 EA
HR1B-0008	HR1B-0009	HR1B-0010	HR1B-0011	HR1B-0012	MR-C3024
Bottom Body Frame	Shoulder Back Universal Bracket	Shoulder Front Universal Bracket	Hand Bracket	Foot Bracket	Controller
1 PCS	1 PCS	1 PACK	1 EA	1 EA	1 EA
HR1C-0008	HR1C-0009	Ni-Mh Battery (1,000mAh/ 6.0V/ 5 Cell)	CD-ROM	Interface Cable	Quick Charger
Right Foot Cover	Left Foot Cover	6.0 V 5Cell	ROBOBASIC & ROBONOVA-I User Manual	MR-C3024 Serial Interface Cable	6V/ 1,000mAh / 100~240V
1 PCS	1 PCS	1 PCS	1 PCS	1 PCS	2 PCS
HSR-8498HB2L400 (Sticker No.8)	HSR-8498HB3R200 (Sticker No.9)	HSR-8498HB3L200 (Sticker No.10)	HSR-8498HB2R300 (Sticker No.11)	HSR-8498HB2L300 (Sticker No.12)	Insert Bolt 3*4
					Insert Bolt
4 PCS	28 PCS	1 PCS	8 PCS	28 PCS	2 PCS
Support 3*5mm	FW 6*2.2*0.5 NI	HSR8498HA2	Cable Tie	Cable Clamp	Lug
Support	Flat Washer	Wheel Horn			

*You can find additional screws and washers at local surplus stores

Difference between PH/M and PH/T screws,



PH/M (Machined Screw)

PH/T (Tapping Screw)

2. Notes on servos and brackets

The HSR-8498HB servo's case, horn, cable lengths, and cable direction are optimized for operation and assembly of each joint. Review the pictures in the manual.

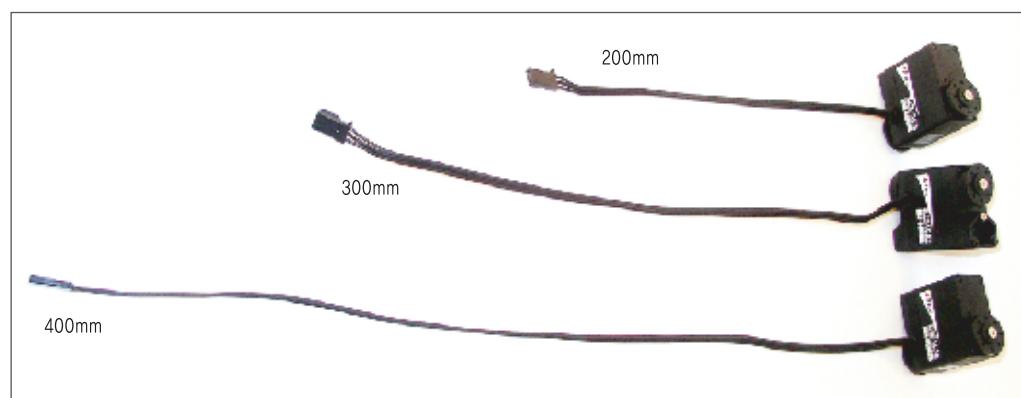
- The servo cable is composed of 3 wires, 2 black and 1 gray. Do not disassemble the connector from the cable.
- During assembly, refer to the included pictures for proper orientation.

The following is a list of servo configurations included in the kit,

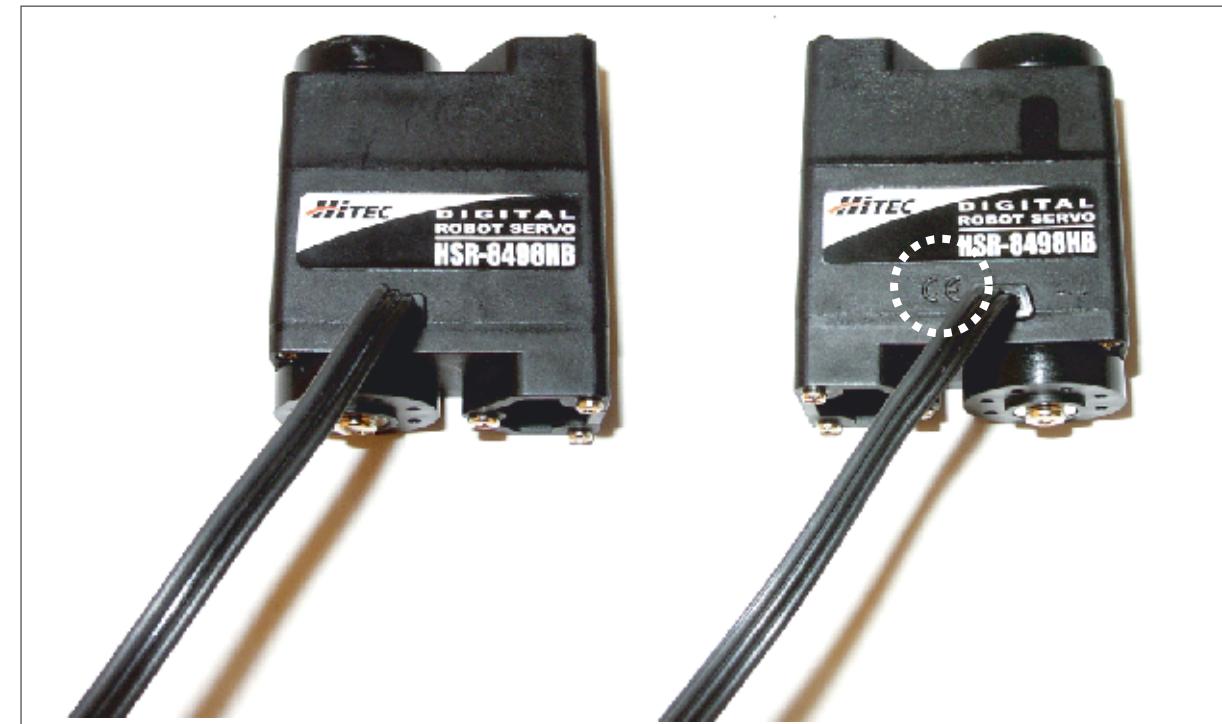
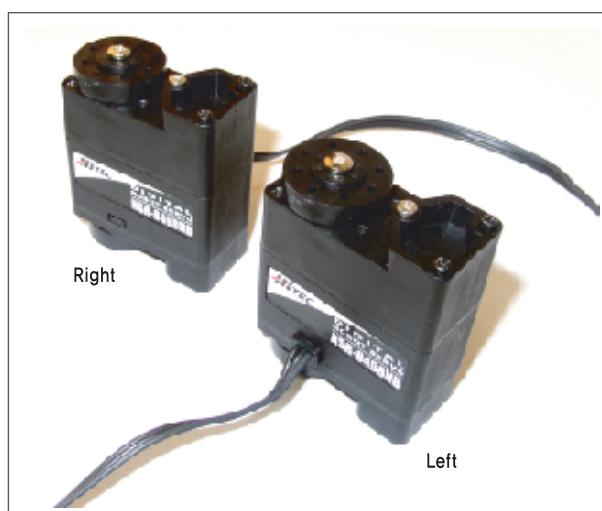
3 different case types are included in the kit



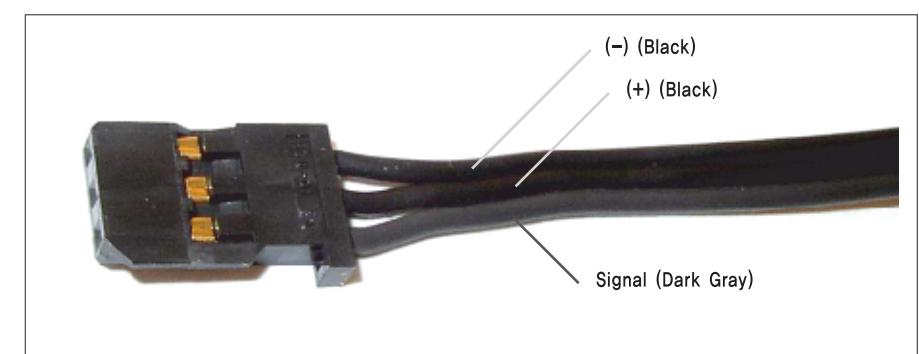
3 different wire lengths are included in the kit



3 different wire orientations are included in the kit

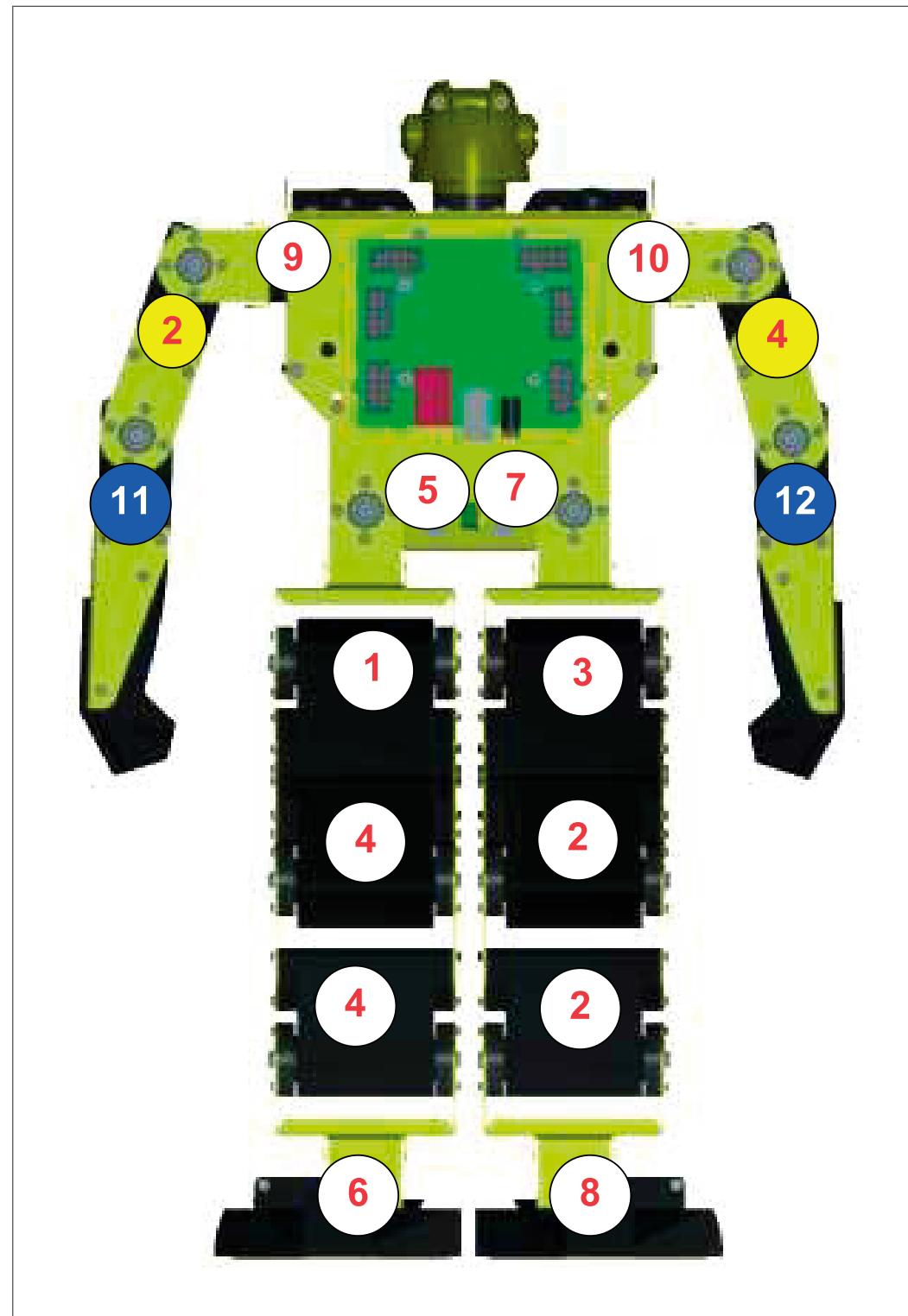


The servo cable is composed of 1 dark gray (signal) and 2 black wires.



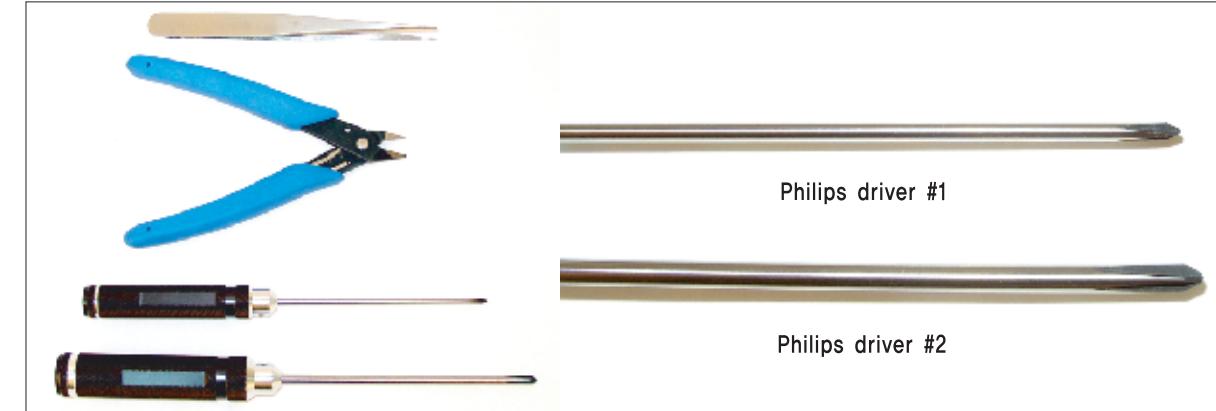
- HSR-8498HB servo placement according to sticker number

(All of the HSR-8498HB servos are numbered with stickers according to case, wire length and direction for easy assembly.)



3. Tools required for assembly

High quality Philips screwdrivers(PH #1 and PH #2), tweezers, nippers and screw lock,



Minimum computer requirements

- Windows based PC
- AMD or Pentium 300MHz
- 60MB hard disk space
- 128MB RAM

4. HSR-8498HB Specifications

■SPECIFICATIONS

- Interface : HMI Protocol, PWM
- Operating Voltage: 6.0V*
- Max Speed: 0.20sec/60° at 6.0V
- Stall Torque: 10kg.cm (138.87oz.in) at 6.0V
- Operating Angle: Max 180°
- Weight: 55g (1.94oz)
- Dimension: 40 x 20 x 47mm (1.57 x 0.78 x 1.85 in)



■PULSE SPECIFICATIONS

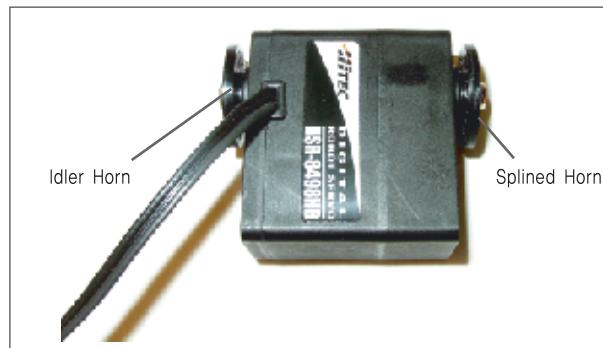
- Control Pulse
- Neutral : 1500 μSec , 0~180° :±1100~1900 μSec
- Pulse Cycle: 12~26mSec (Common : 21msec)

III. Kit Assembly

1. Servo horn adjustment

Four different types of servo horns (two different splined and two different idler horns) are supplied with the HSR-8498HB.

Numbers are embossed on the Splined Wheel Horn,



The numbers can be found on the splined horn near the horn screw,



The splined horns are keyed for easy and accurate assembly,

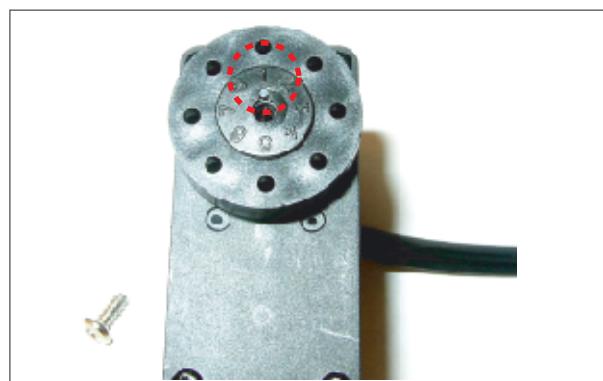
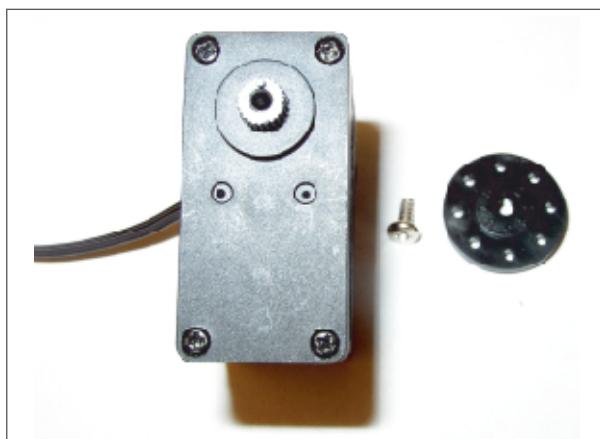


Photo of the servo with the splined horn removed. A BH/T 2,6x6mm screw is used to attach the horn,



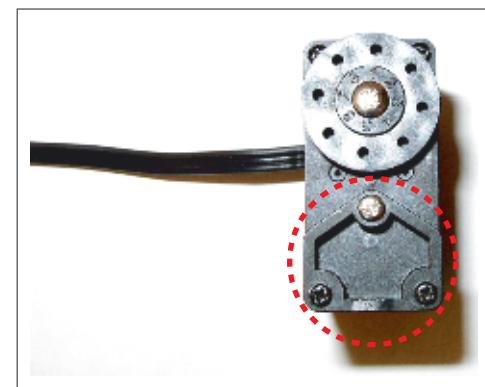
The idler horn spins freely,



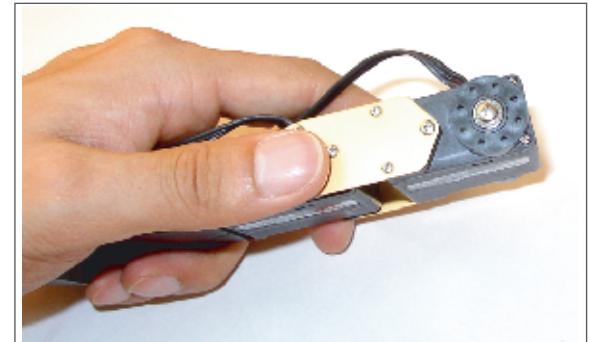
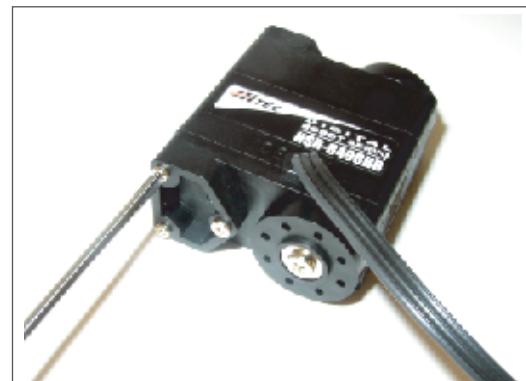
Photo of the idler horn removed, A BH/T 2,6X6mm Screw and one Plain washer(2,8x7,6mm) is used to attach the horn,



HSR-8498HB1 servo has pentagonal shaped bracket mount



To attach a bracket, unscrew the three screws in the pentagon and attach the bracket with them,

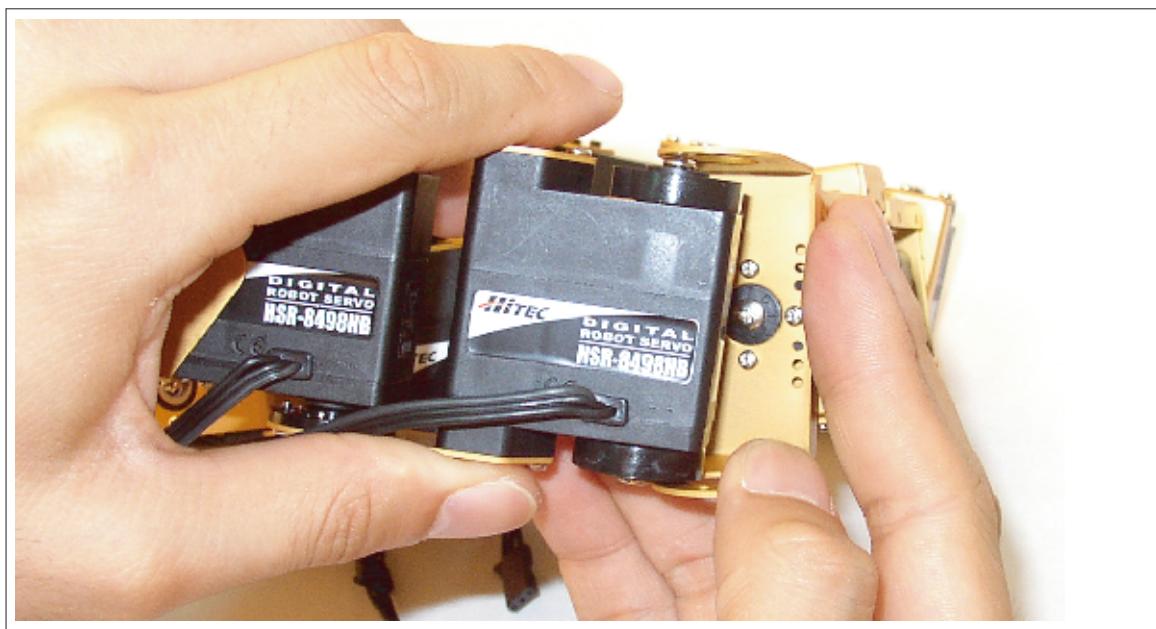


2. Attaching a bracket to a servo.

(1) Place the bracket over the two horns with care, the bracket can be bent slightly to fit over the horns,

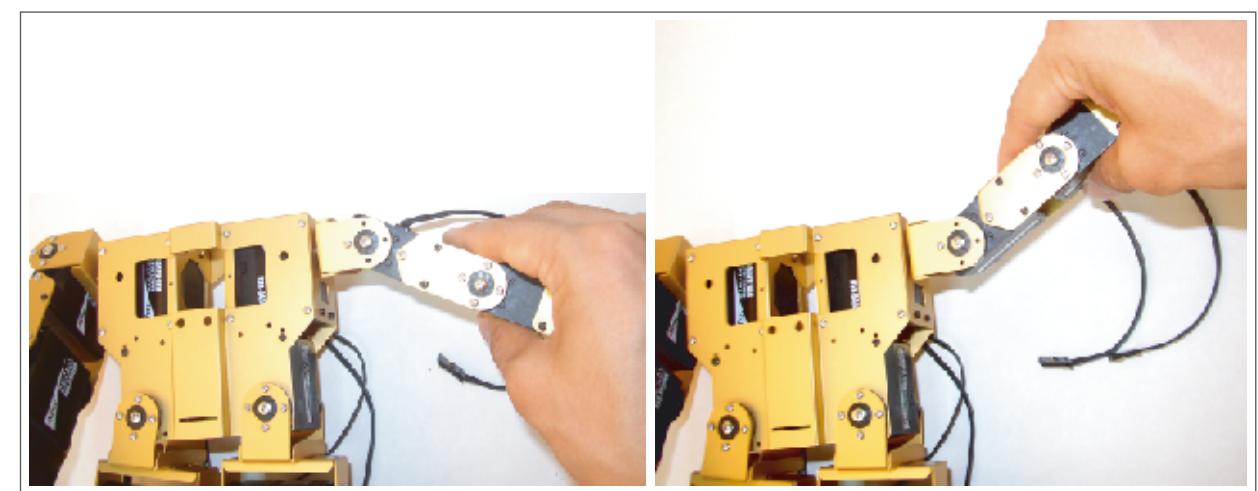
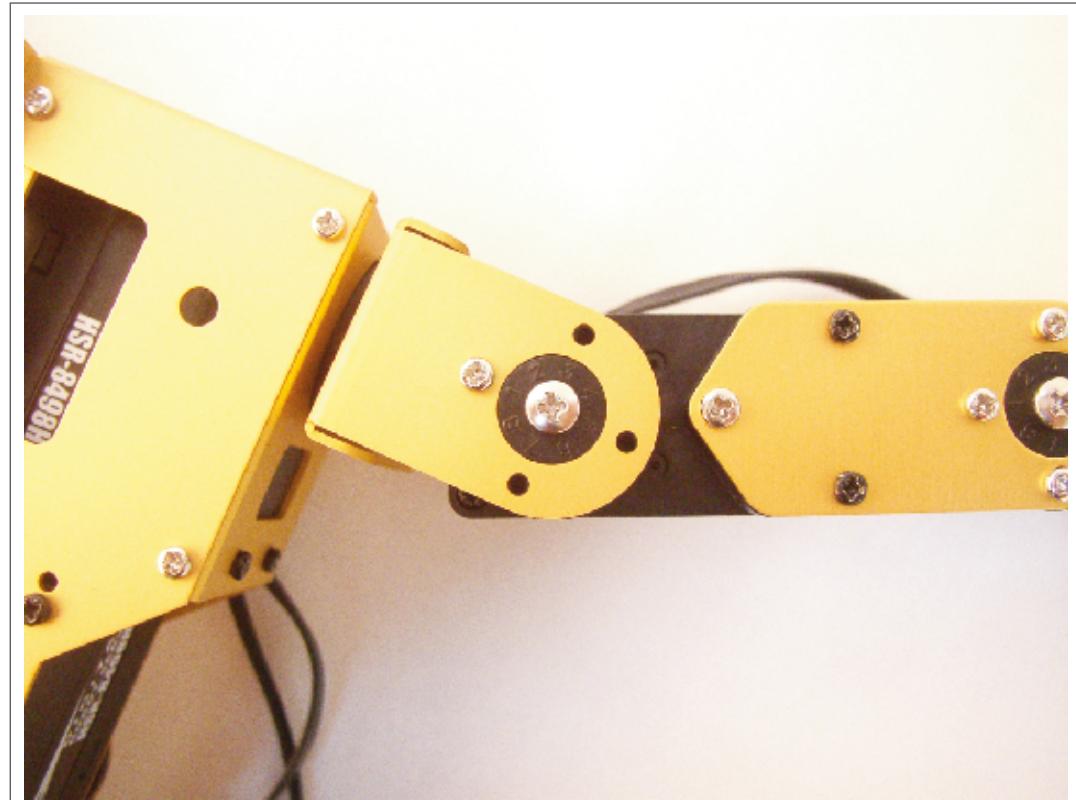


When the screws are attached the bracket will bend back into shape,



(2) Checking range of motion

Check the range of motion by moving the servos by hand,
Refer to section "checking travel range" for the proper range of each joint.



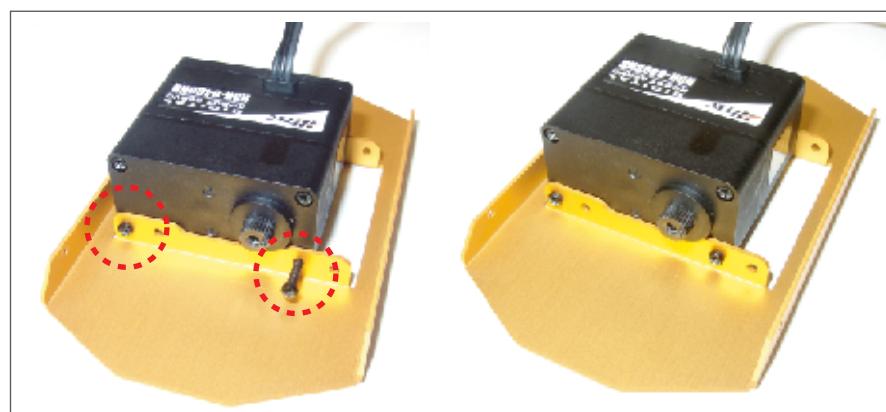
3. Leg Assembly.

(1) Right and Left Foot assembly

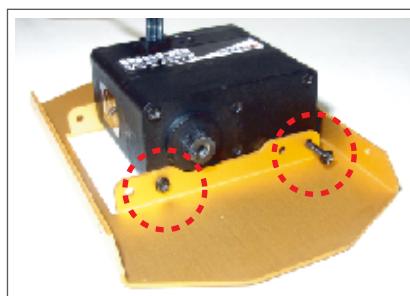
Remove the two black screws from the front, and the two silver screws from the back of the 2L400 (Part # 8, right foot) and 2R400 (Part # 6, left foot) servos where they will connect to the R1B-0012 foot brackets. Remove the screw from the front servo horn and the back idler horn. Detach these horns from the servos. Note the location of the silver and black screws, as these are not interchangeable.



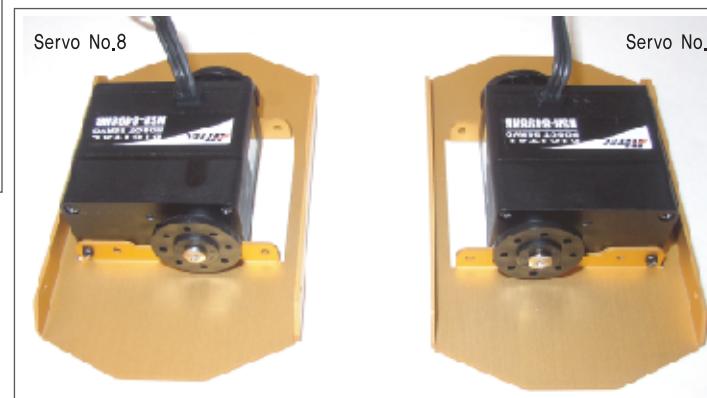
Attach one R1B-0012 bracket to the 2L400 (Part # 8) servo as shown in the picture and reinstall the four screws through the hole in the bracket. Reattach the servo horns to servo. When complete, the servo wire must be at the top of the servo.



Use the same steps mentioned before to assemble the left foot,



When complete, both feet should look the same as those in the picture.

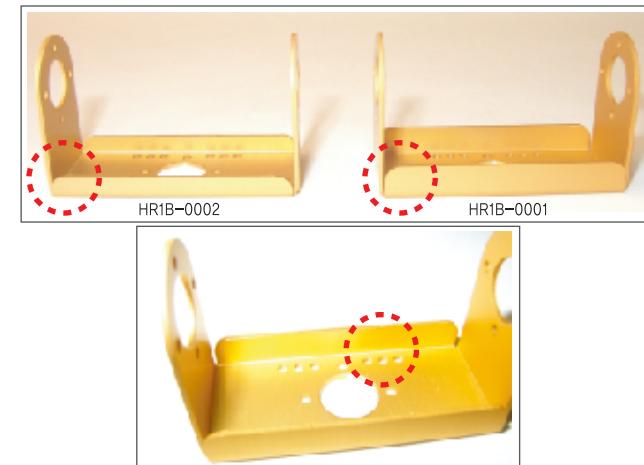


(2) Ankle and thigh bracket assembly, (4 sets)

To tell the difference between the two types of brackets, refer to the picture. The four HR1B-0002 brackets on the left side of the picture do not contain tapped holes. The eight HR1B-0001 brackets on the right side of the picture have four tapped holes each.



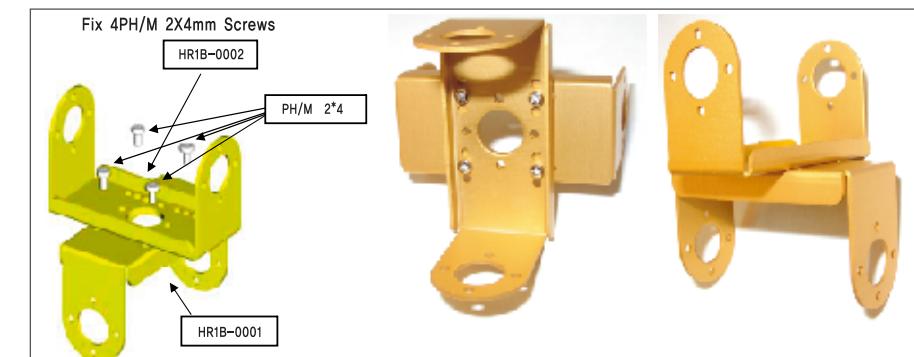
Another way to differentiate between the two brackets is to compare the side flanges. The HR1B-0001 bracket has a wider metal flange than the HR1B-0002.



Four PH/M 2X4mm screws are required to attach a HR1B-0001 and 0002 brackets together.



Assemble the HR1B-0001 and 0002 brackets as shown in the picture using the four PH/M 2X4mm screws to connect them. Pay particular attention to the locations of the screws. Assemble four sets.



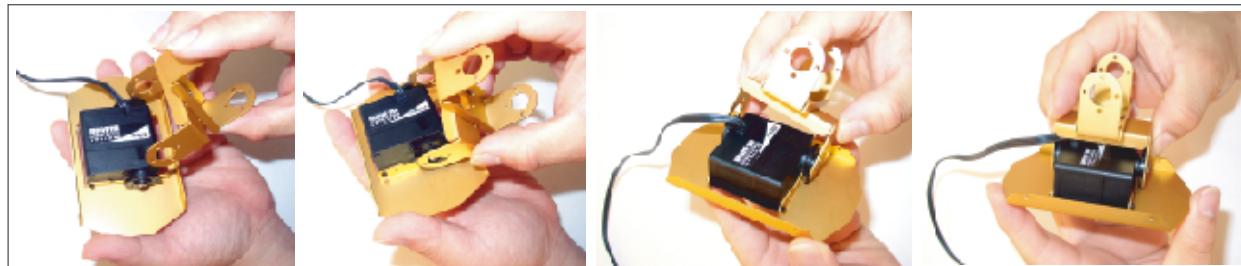
(3) Right and left ankle assembly.

Assembling the right ankle:

Attach the right and left ankles to the preassembled feet. Use one assembled HR1B-0001 ankle bracket and attach it to the front and back servo horns of the 2L400 (right foot) and 2R400 (left foot) servos. Eight PH/T 2X4mm screws are required.



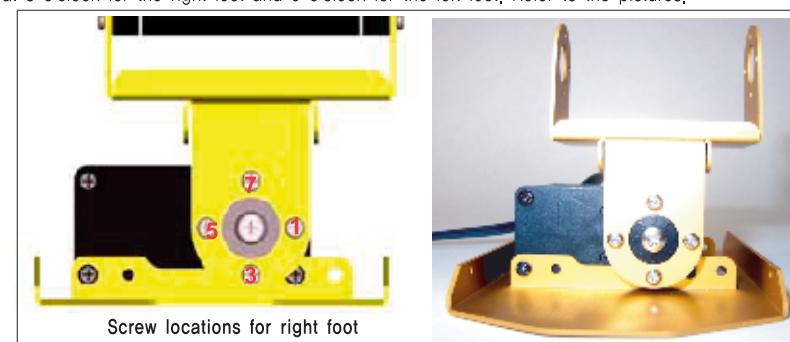
Using the picture as an example, place the ankle bracket over the two horns with care. If required, the ankle bracket can be bent slightly to fit over the horns. When finally attached to the horns with screws, the bracket will bend back into shape.



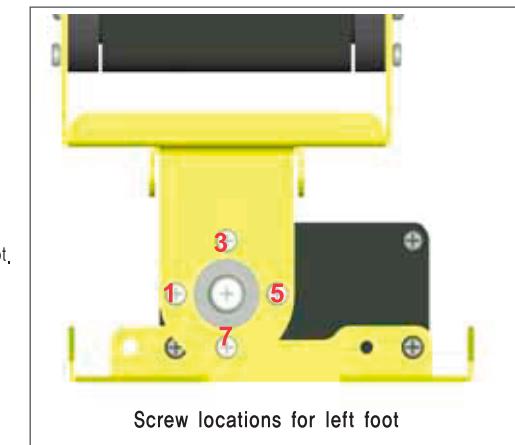
Check the orientation of the servo wire and the shape of the bracket. Use the picture as an example.



Fix the bracket to the front servo horn using four PH/T 2X4mm screws according to the picture. Pay attention to the position of the front servo horn and the bracket. Location # 1 on the horn must be at 3 o'clock for the right foot and 9 o'clock for the left foot. Refer to the pictures.

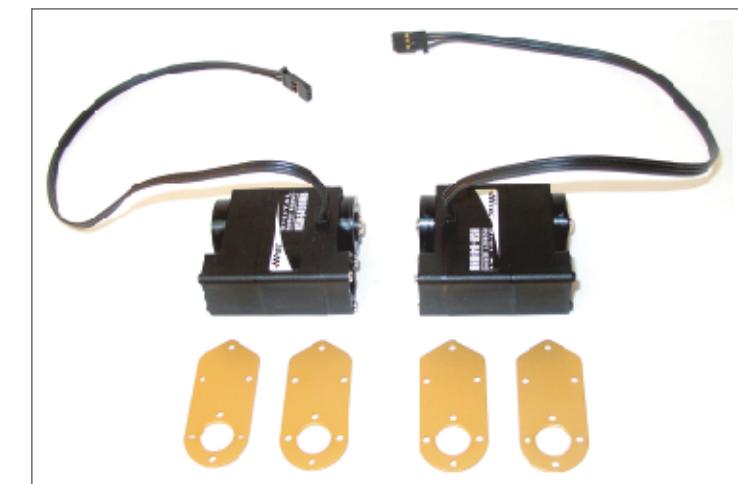


Use four more PH/T 2x4mm screws to attach the bracket to the idler horn,



Left ankle assembly

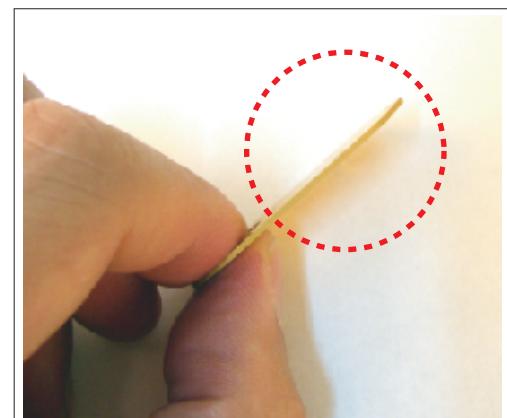
After assembly, the feet and ankles should appear the same as those in the pictures. When complete, the wires for each servo should run toward the inside sole of each foot.



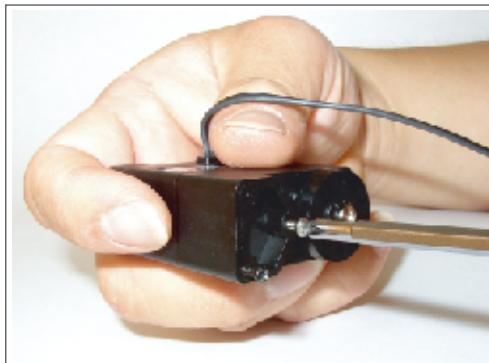
(4) Shin Assembly

Parts required for assembly of the shins:
4- HR1B-0003 brackets and one each
1L300 (Part #4, left shin) and 1R300
(Part #2, right shin) servos,

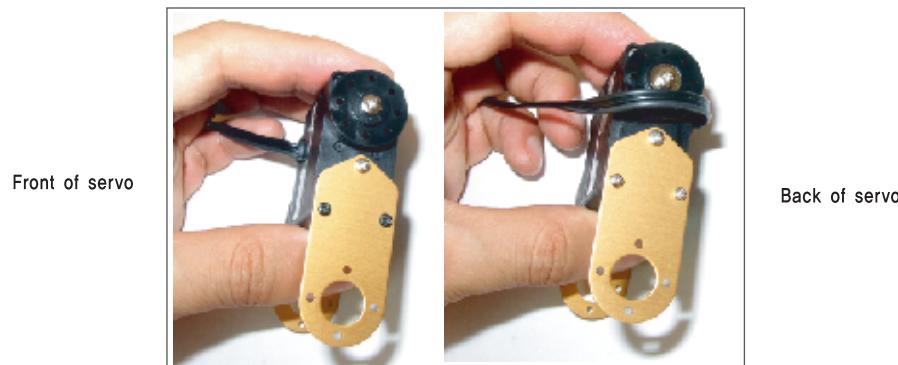
The HR1B-0003 bracket has a soft edged side and a sharp edged side. For safety during operation, the soft edged side of the bracket should be assembled facing toward the outside of the robot.



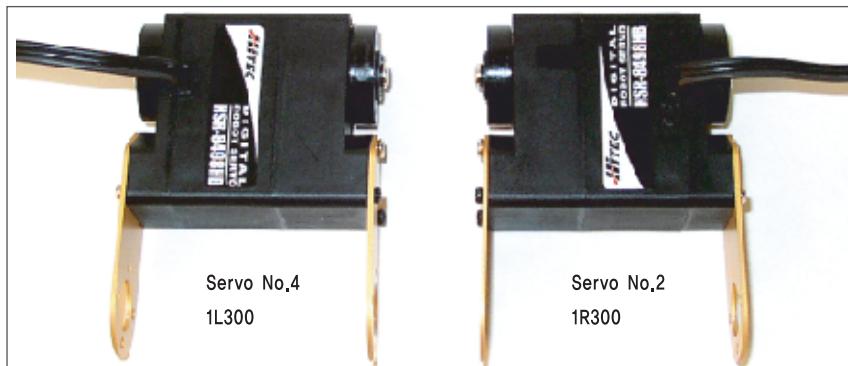
Remove the six screws fixed to the pentagonal parts of the 1L300 servo. There are three silver screws in the back and one silver and two black screws in the front. Place the two HR1B-0003 brackets, one to a side, on the servos and reattach the screws.



Follow the examples in the pictures for proper screw placement. Note the positions of the black and silver screws,

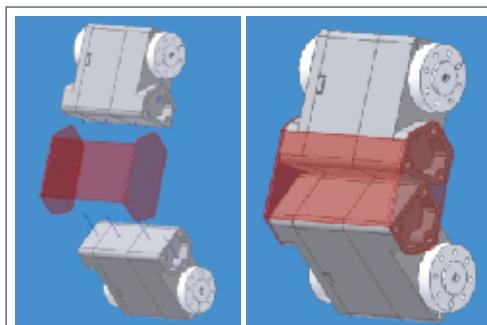


Build the other shin using the 1R300 servo. Both shins are assembled in exactly the same way.

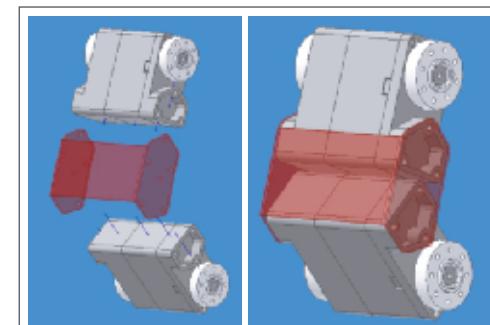


(5) Knee assembly

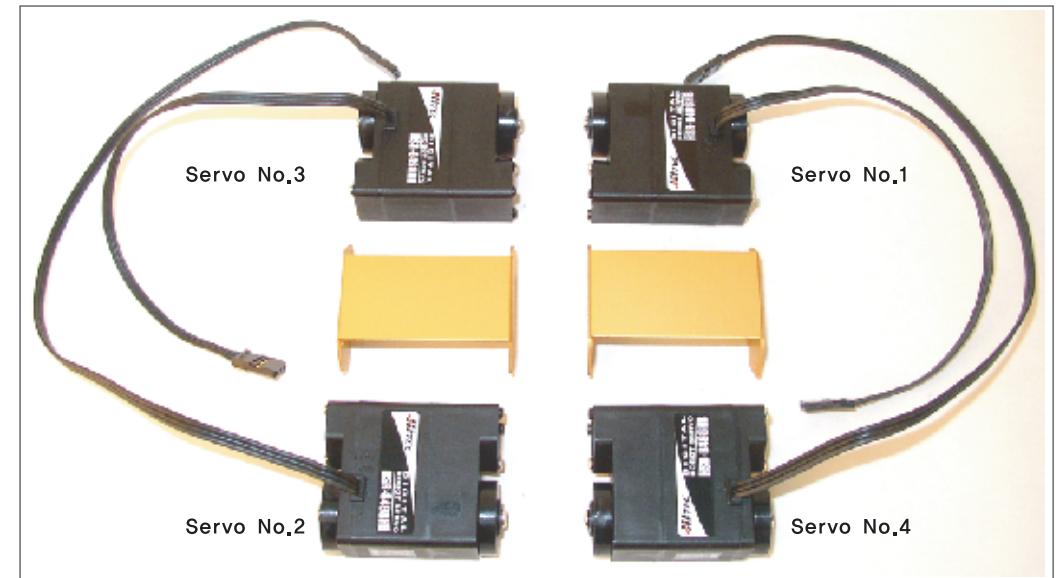
The right knee



The left knee



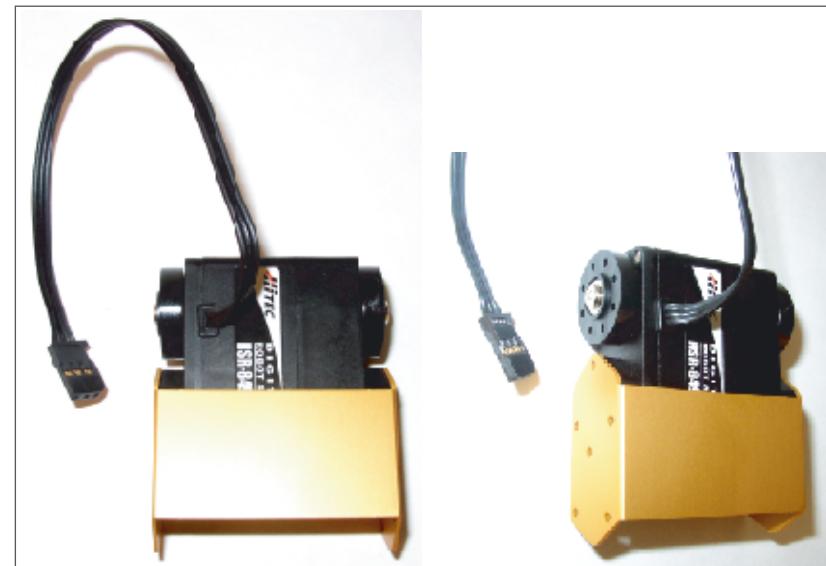
Parts required for assembly: 1-1L200 (Part #3, upper servo of right knee), 1-1R300 (Part #2, lower servo of right knee), 1-1R200 (Part #1, upper servo of left knee), 1-1L300 (Part #4, lower servo of left knee) and 2- HR1B-0004 knee brackets.



Remove the six screws fixed in the pentagonal parts of both upper servos front and back in preparation for knee assembly.



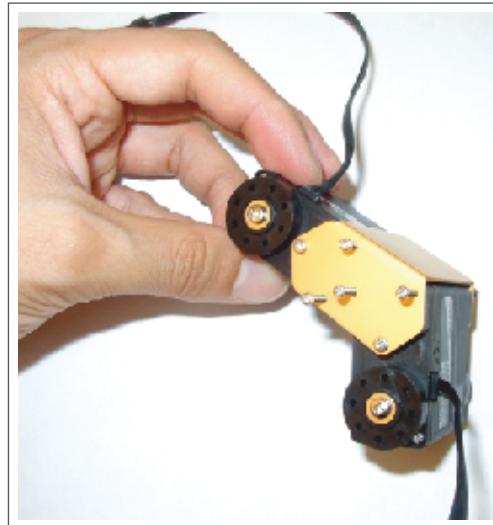
Referring to the picture, attach a HR1B-0004 knee bracket to the No. 3 and No. 1 servos and secure with the previously removed screws noting the location of the black and silver screws.



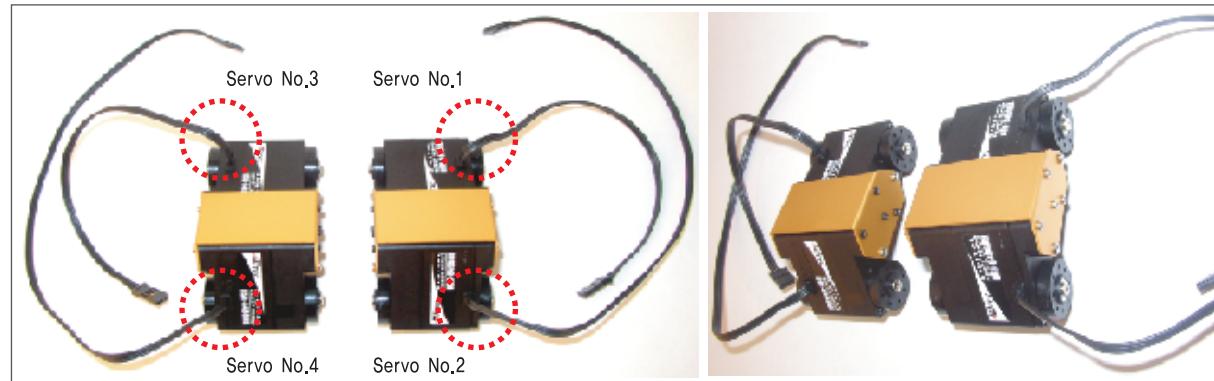
Remove the screws from the front and back pentagonal portions of the 1R300 (Part #2, lower right knee) and 1L300 (part #4, lower left knee) servos. After reviewing the picture carefully attach the 1R300 and 1L300 servos to the HR1B-0004 bracket making sure the servos are situated under the knee in the correct orientation.



Secure with the previously removed screws paying attention to the screw color and placement.

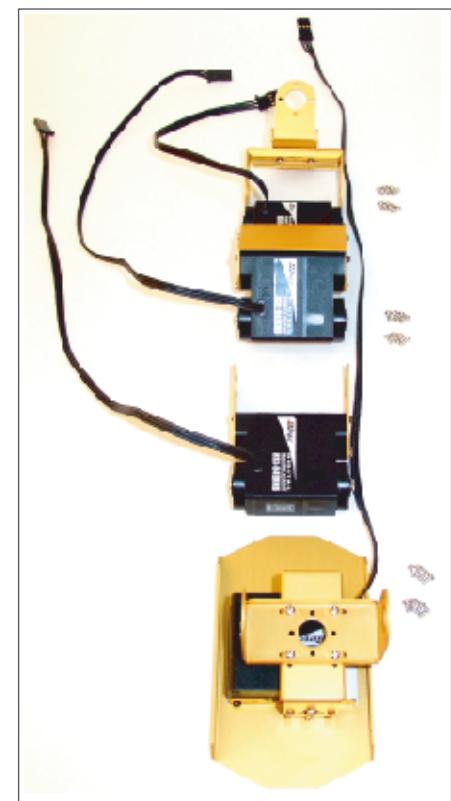
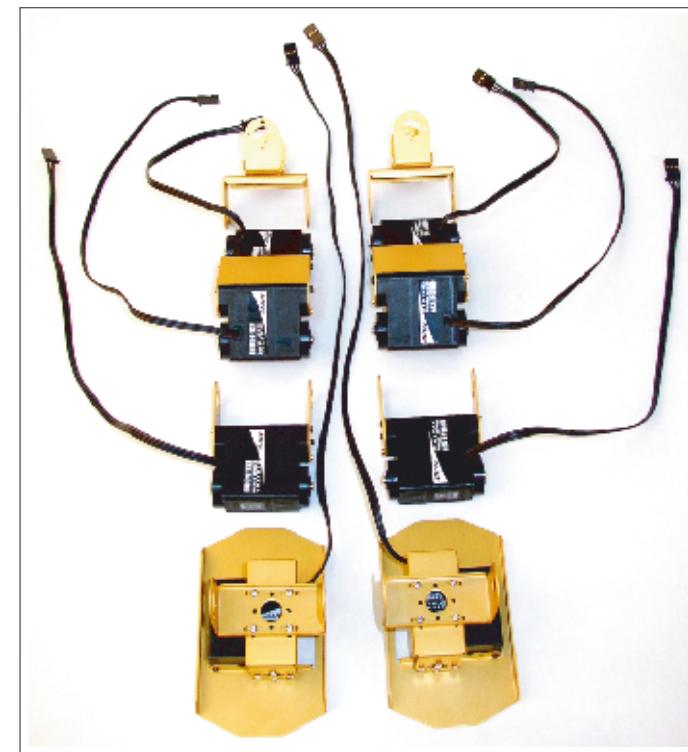


Make sure the wire direction of each servo matches those in the pictures.

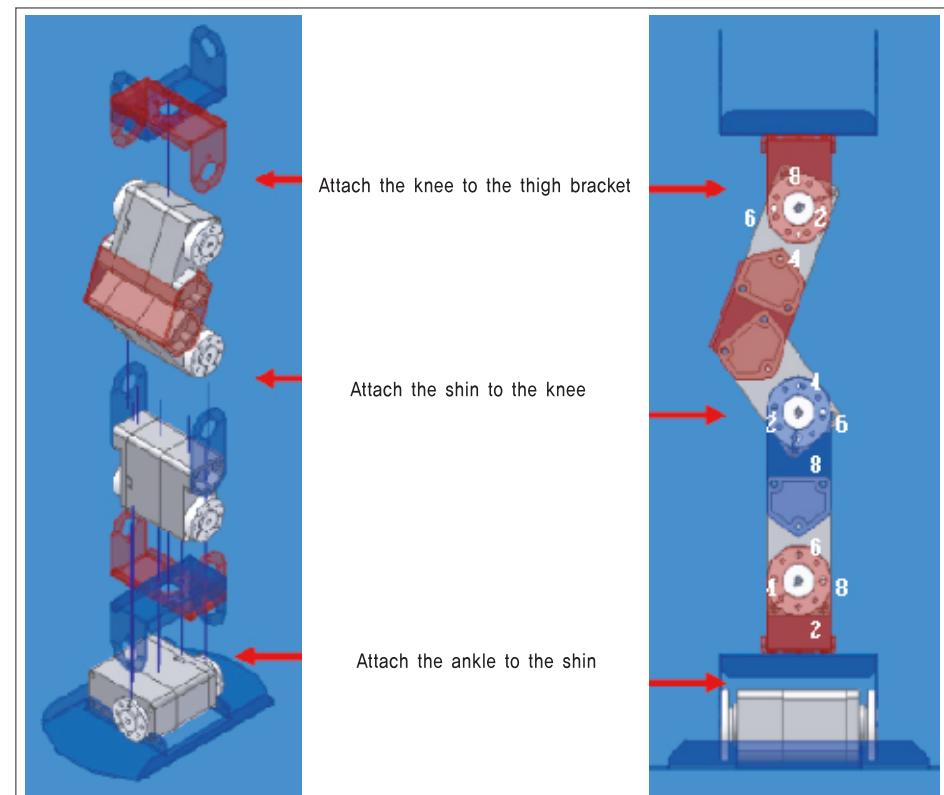


(6) Assembling the whole leg.

Assemble the right leg first. Arrange the parts as shown in the pictures before proceeding to the assembly process.



Position the brackets and the front servo horns according to the numbers molded into the servo horns,



Attaching the foot and shin

- Attach the front servo horn of the right shin servo (1R300, #2) to the right foot bracket.
- Following the picture for correct horn orientation, secure the bracket to the front servo horn with four PH/T 2X4mm screws.
- Secure the bracket to the servo idler horn with four PH/T 2X4mm screws.

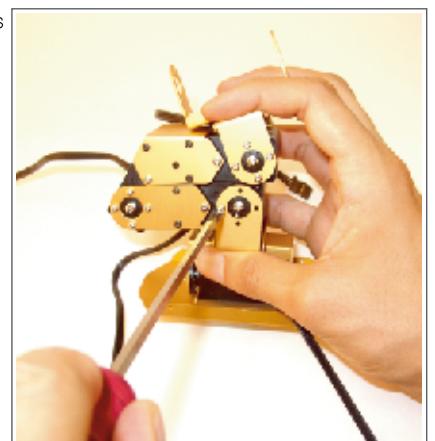


Assembling the shin and knee

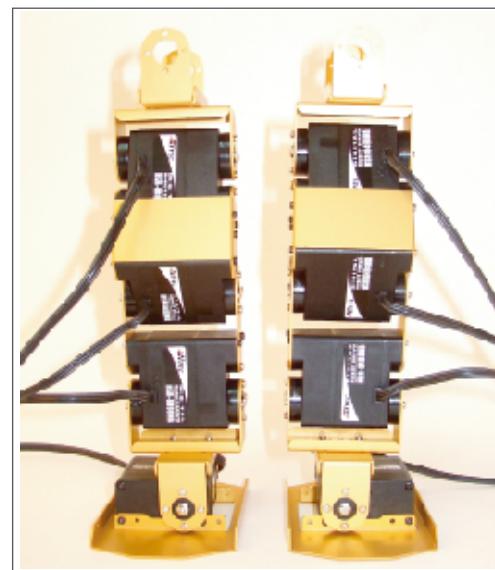
- Attach the HR1B-0003 shin bracket to the servo horns of the servo (1R300, #2) in the lower knee.
- Following the picture for correct horn orientation, secure the bracket to the front servo horn with four PH/T 2X4mm screws.
- Secure bracket to the servo idler horn with four PH/T 2X4mm screws.



If you cannot fold the legs fully as the example in the picture, remove the screws from brackets and adjust the position of the servo horns. Then reattach the bracket with the screws.

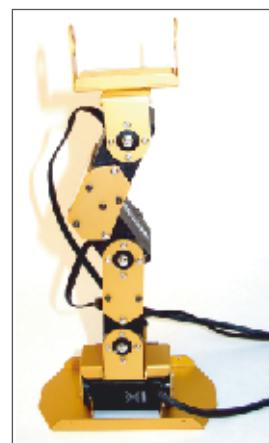


Front view of the assembled legs.

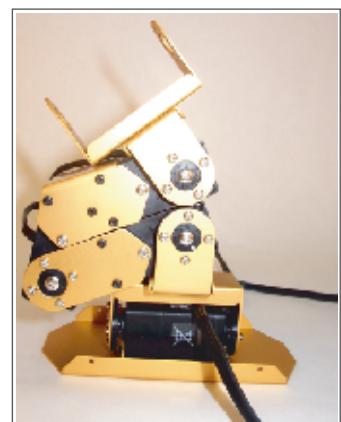


Assembling the knee and thigh

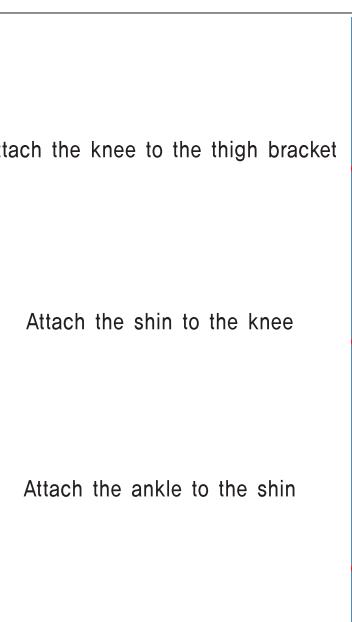
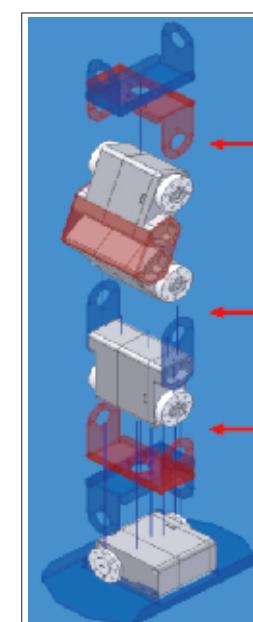
- Attach the previously built thigh bracket to the servo horns of the servo (1L200, #3) in the upper knee.
- Following the picture for correct horn orientation, secure the bracket to the front servo horn with four PH/T 2X4mm screws.
- Secure bracket to the back servo horn with four PH/T 2X4mm screws.



Caution! The legs are built properly if the servos have full range of motion.



The left leg is assembled in exactly the same way as the right leg. Note the position of the numbers on the front servo horns during assembly.



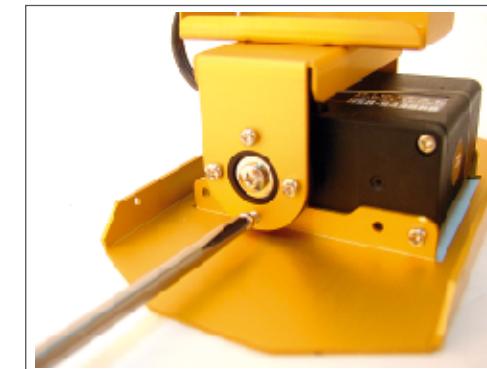
Position the brackets and the front servo horns according to the numbers molded into the servo horns.

(7) Wire arrangement of foot and Foot Cover assembly

This stage is for arranging the servo wires and installing the foot covers on the ROBONOVA-I.

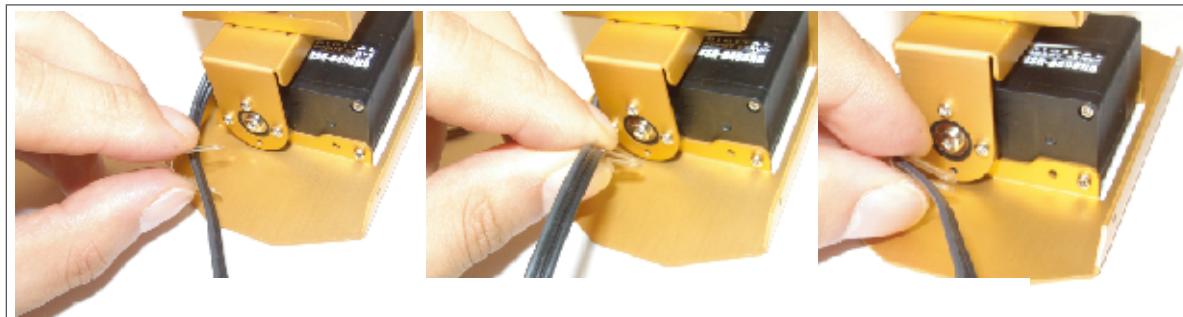


Prepare two cable clamps (transparent straps)
and two 2,2x0,5mm washers.

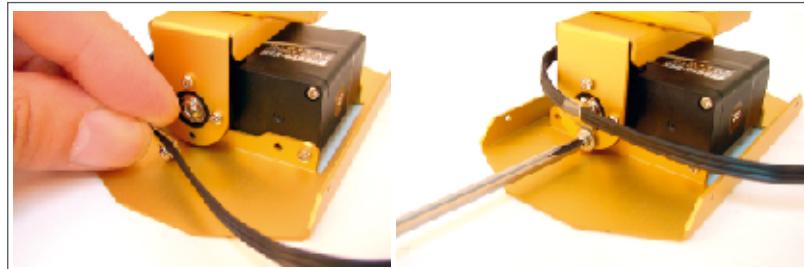


Assemble the right foot first. Remove the screw that is at the bottom of
the idler horn.

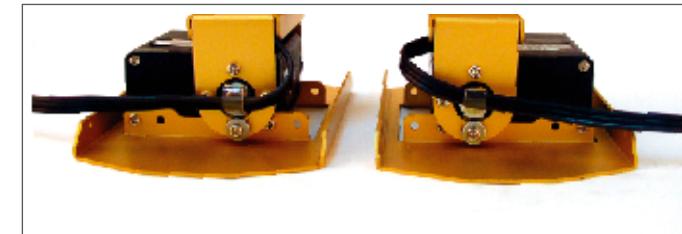
Bend the cable clamp around the cable.



Insert the removed screw, with washer, through the holes in the cable clamp and attach to the idler horn.



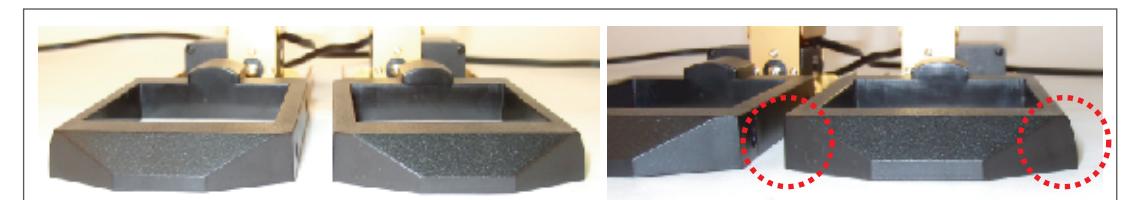
The shape of the foot with cable clamp attached.



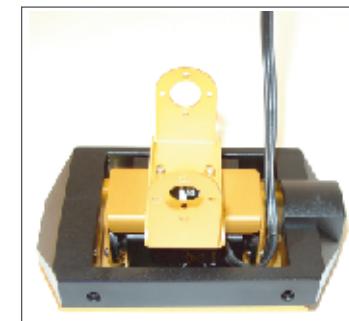
The foot covers HR1C-0008(right side), 0009(left side) can now be attached to the feet with four PH/M 2x4mm screws each.



Slide the foot covers over the legs. The flat edge of the foot cover should face inward and the beveled edge should face toward the outside.



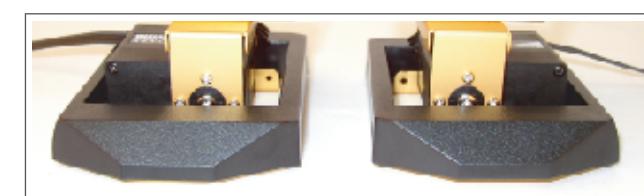
Check the wire direction for each foot.
Do not contact Foot Covers.



Secure to the foot with 4 PH/M 2x4mm screws.



Completed feet,

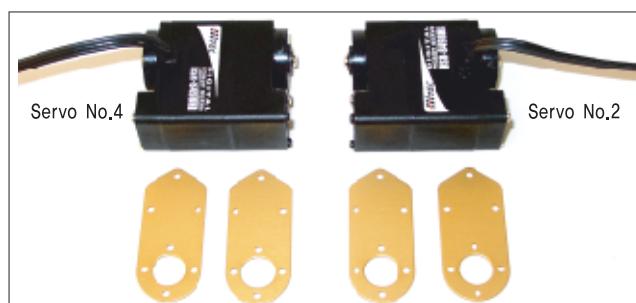


4. Arms assembly

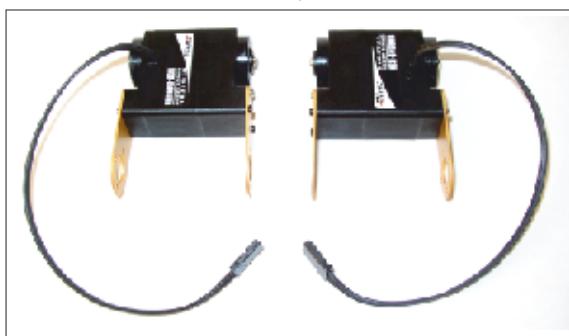
(1) Shoulder assembly

Remove the six screws fixed in the pentagonal parts of the 1R300 (Part #2, left side) and the 1L300 (Part #4, right side) servos and attach the two HR1B-0003 brackets with the removed screws.

Note the location of the black and silver screws.



Assemble two sets, Right and left shoulders are assembled in the same way.



(2) Forearm assembly

Remove four screws from both the 2R300 (Part #11) and 2L300 (Part #12) servos. The screws are located at the bottom of the servos. Do not remove the screws near the servo horns. Attach the HR1B-0011 brackets and secure with the removed screws. Note the location of the black and silver screws when reassembling. Check to make sure the servo wire direction for both servos is towards the outside of the robot,



To assemble right forearm, snap the HR1C0006 and 0007 together and secure to the 0011 bracket with four PH/T 2x5mm screws,

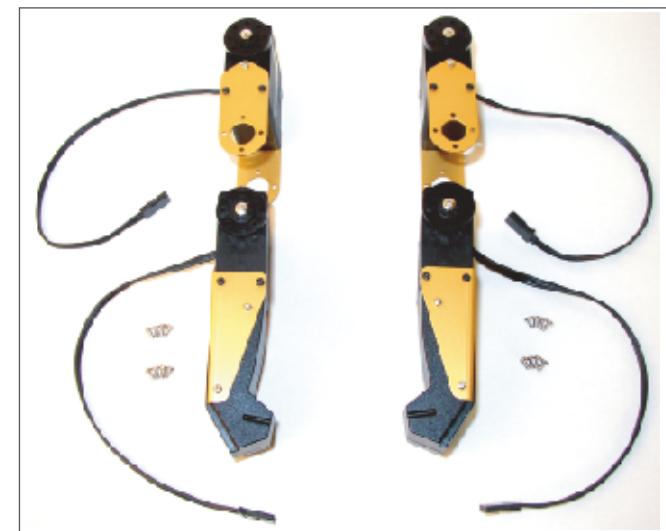


The left forearm is built the same way, HR1C-0006 and 0007 are also used on the left side.

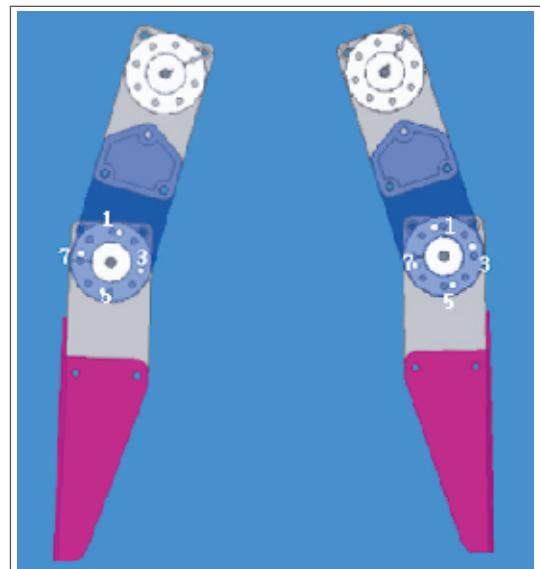


(3) Whole arm Assembly

Connect the previously built shoulder and forearms using eight PH/T 2x4mm screws per arm,



The servo wires for the shoulders and forearms must face towards the outside. Using the picture as a reference, adjust the front servo horns so the molded numbers correspond to the picture and secure with four PH/T 2x4mm screws to the bracket. Secure the servo idler horns with four PH/T 2x4mm screws,



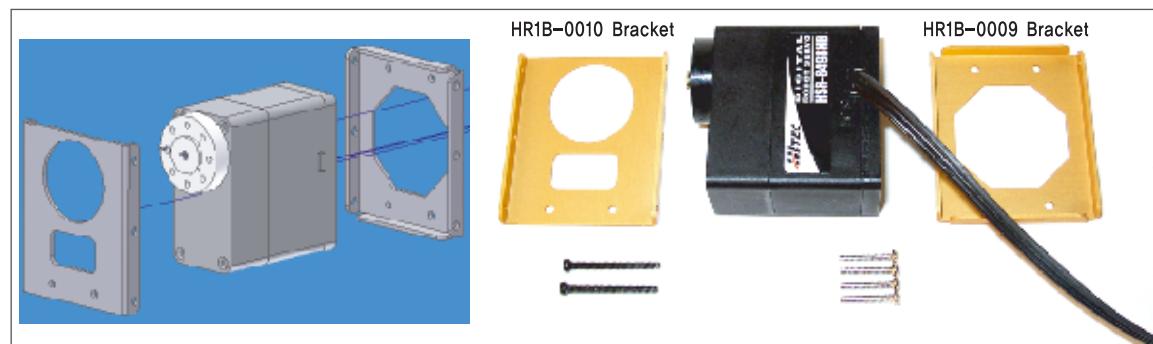
When completed, the arms should resemble the picture.



5. Body assembly

(1) Attaching the shoulder to the inside of the body

Remove the bolts from the 3R200(No.9) and 3L200(No.10) servos. Next, fit the HR1B0009 and 0010 brackets to the servo

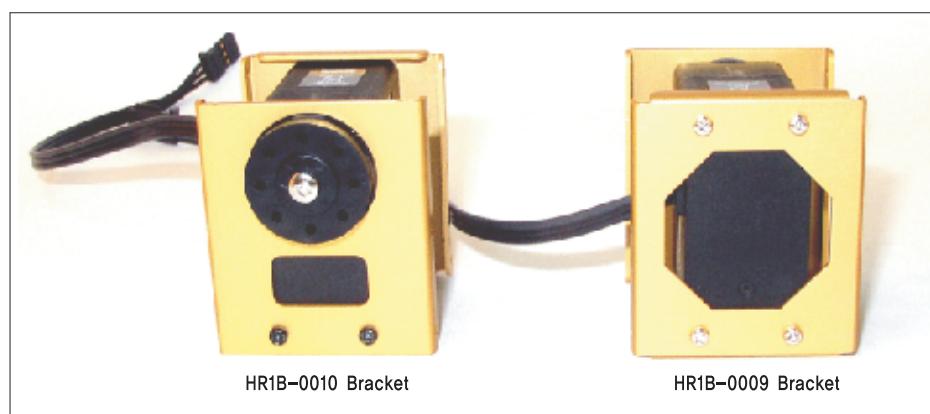


Using the picture as a reference, remove the two black screws from the front of the 3R200(No.9) and 3L200(No.10) servos.

Do not remove the two screws near the servo horn. Attach the HR1B-0010 bracket to the servo by reinstalling the screws.

To install the HR1B-0009 brackets to the servos, remove the four silver colored screws from the backside of each servo and secure the bracket by reinstalling the four screws.

Assemble two.

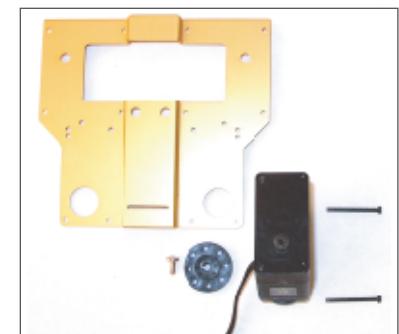


(2) Front pelvis Assembly

Prepare the 2R200 (Part #5, left pelvis) and the 2L200 (Part #7, right pelvis) servos for assembly.

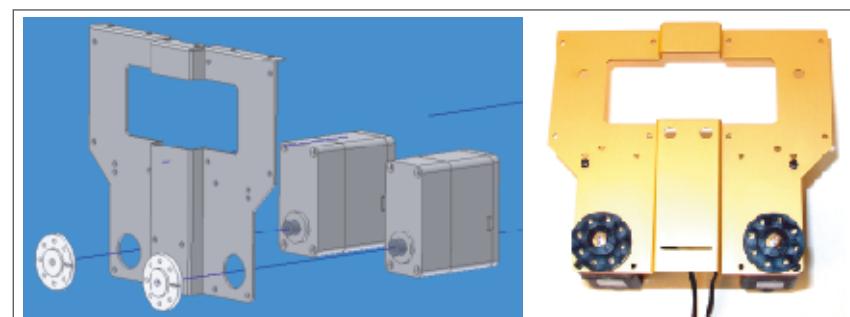


Remove the front servo horns from each servo and remove the two black screws from the front outside edge.



Attach the servos to the HR1B-0006 body frame by reinstalling the screws and servo horns,

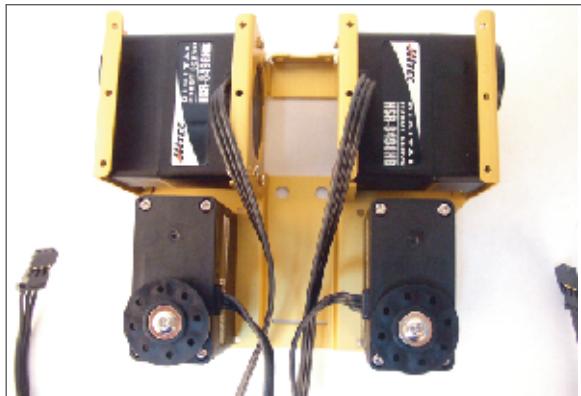
The servo wires must be facing towards the inside of the body.



Secure the two shoulders to the front body frame with four PH/M 2X4mm screws each.



Note the direction of the servo wires. Both must be facing towards the inside of the body.

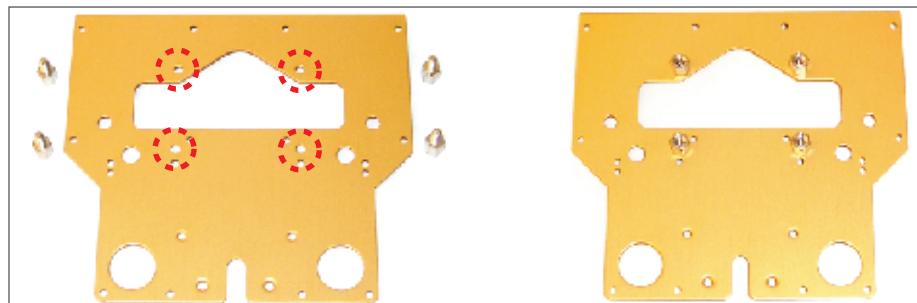


Completed shape.

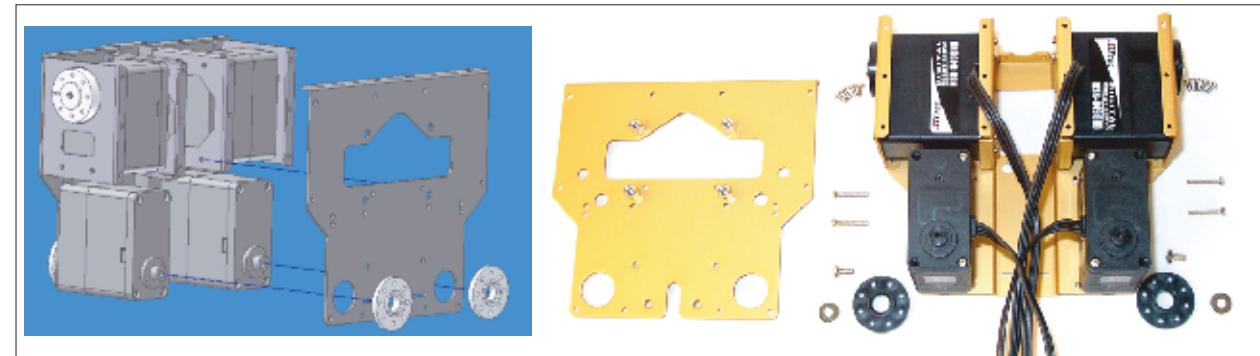


(3) Back pelvis assembly

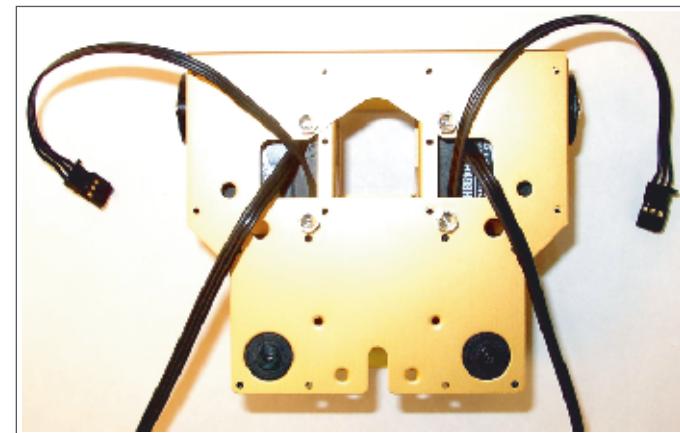
Attach the "nut" shaped 5mm-3Ø support to the HR1B0005 back body frame to support the MR-C3024 controller.



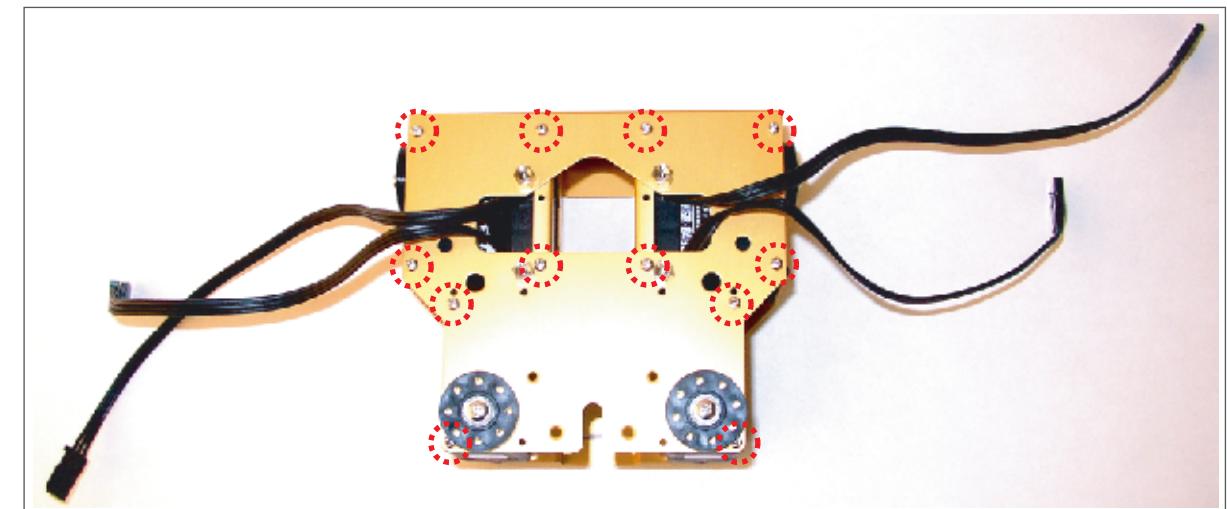
Remove the servo idler horns from the 2R200 (No. 5) and 2L200 (No. 7) servos.
Remove the two screws located on the outer edge from servo,



Using the picture as reference, place the HR1B-0005 back body frame against the main body.

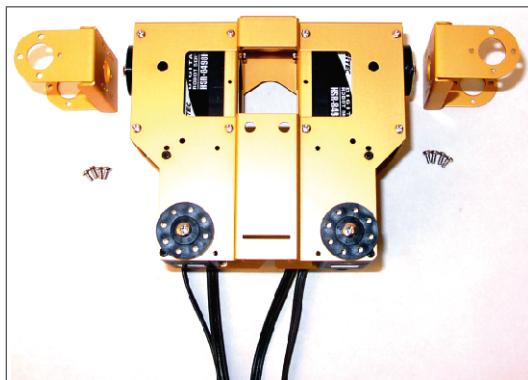


Use eight PH/M 2X4mm bolts to secure HR1B0005 back body frame to the shoulders and reinstall the four previously removed pelvis screws.
Reattach the servo idler horns,

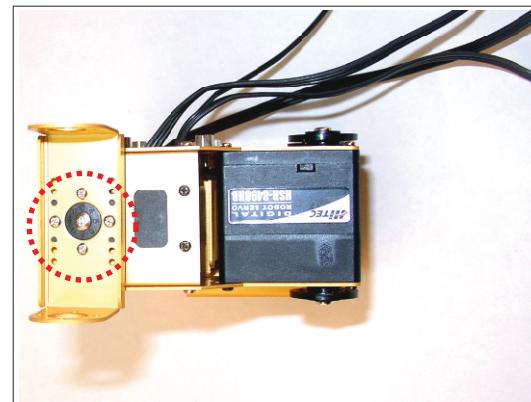


(4) Shoulder Assembly.

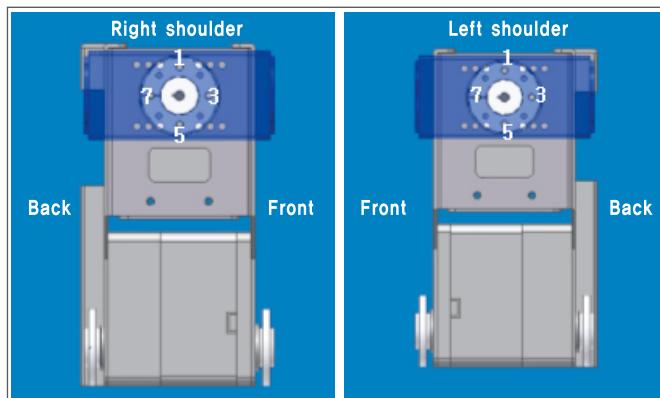
Attach one HR1B-0002 bracket to each 3L200 (Part #10, right shoulder) and 3R200 (Part #9, left shoulder) servo installed in the body.



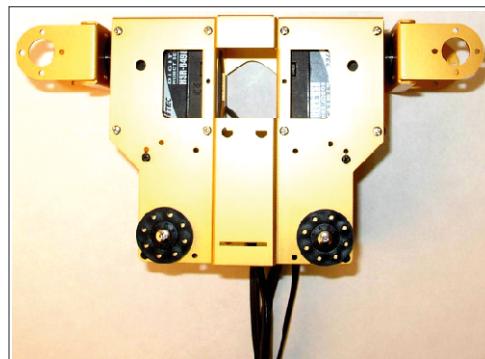
Using the picture as a reference, secure the brackets to each servo horn with four PH/T 2X4mm screws.



-This picture details the horn position to the brackets.

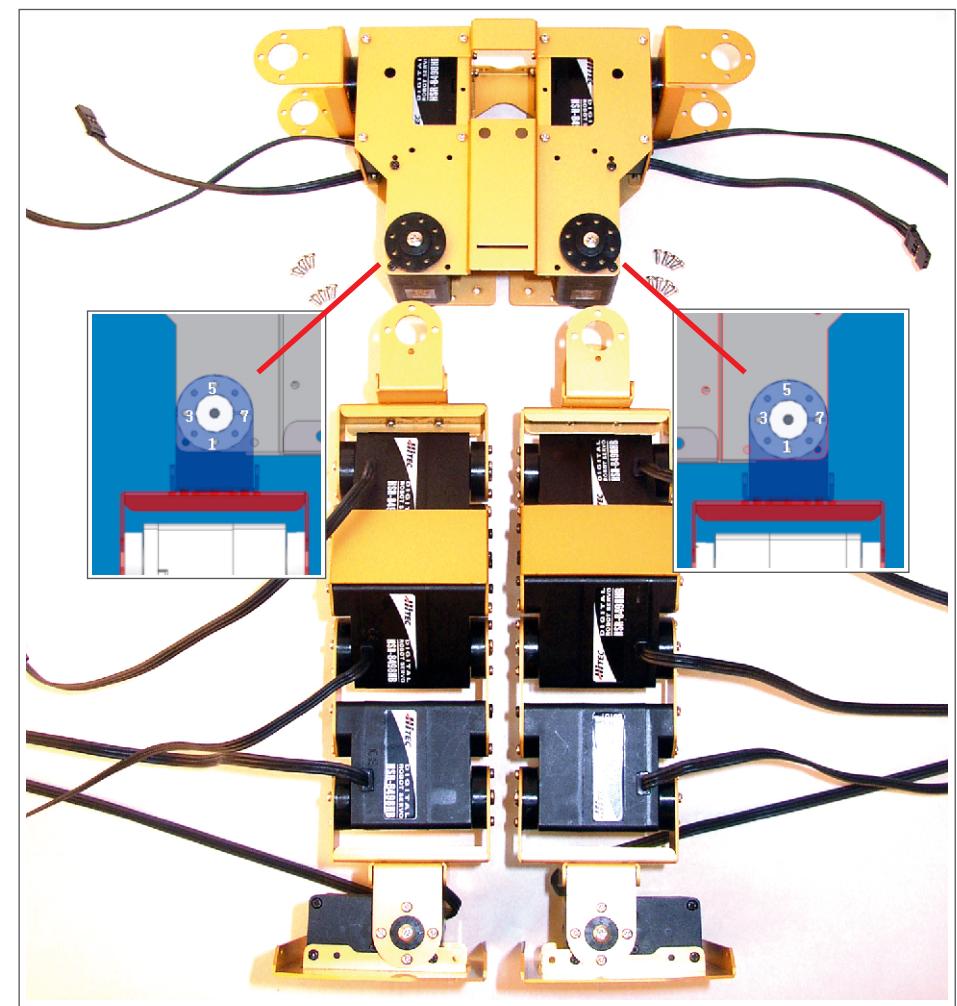


The completed shape of the body.



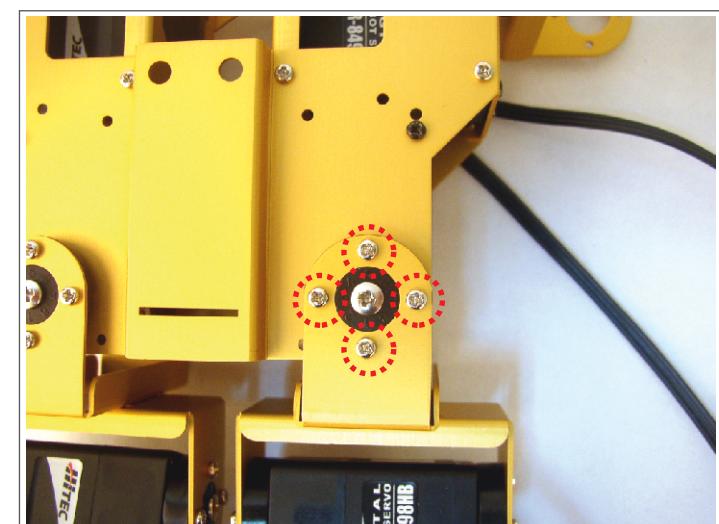
6. Attaching the legs and arms to the body

(1) Body and leg assembly

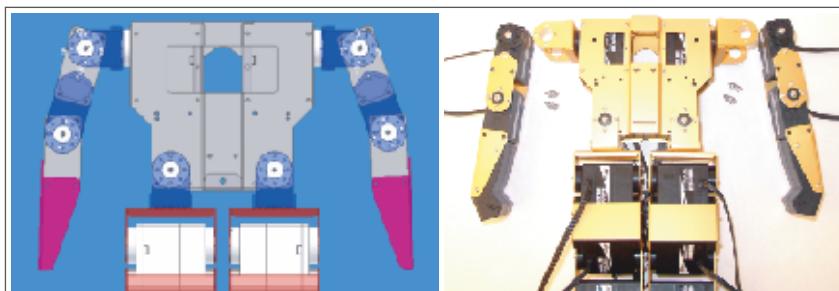


Refer to the picture for the proper horn positions when attaching the legs to the body.

Secure the bracket to each servo horn (Splined and Idler) with four PH/T 2X4mm bolts,



(2) Body and Arm Assembly



Refer to the picture for the proper horn positions when attaching the arms to the body.

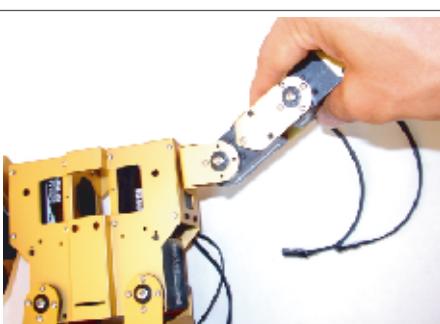
Secure the bracket to each servo horn

(Splined and Idler) with four PH/T 2X4mm bolts,

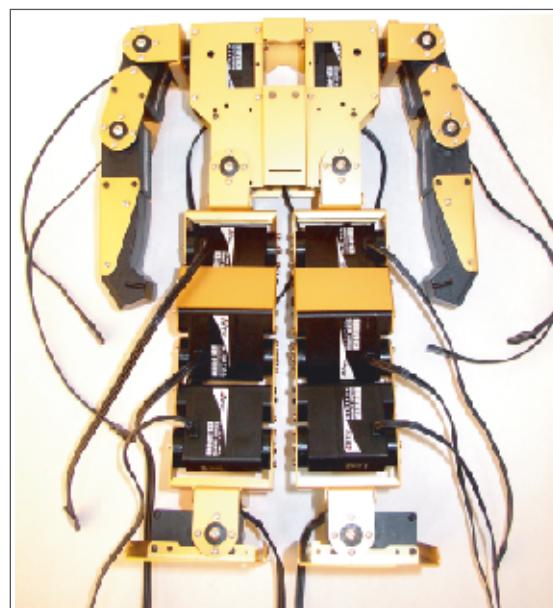


After securing the servo horns to the bracket, check the range of motion by moving the servos by hand,

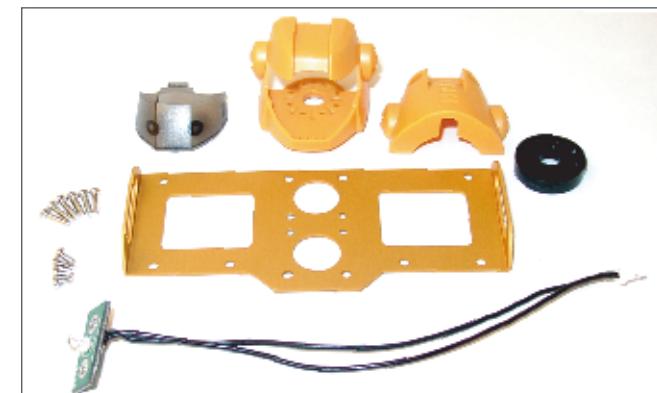
The arms are properly attached when 180° of rotation is possible,



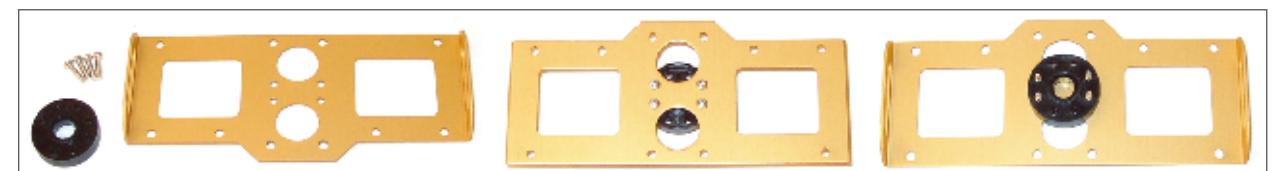
Completed shape



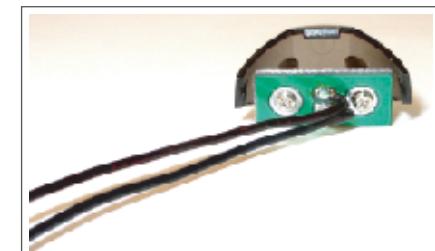
7. Head and body assembly



Attach the HSR8498HA2 servo horn to the HR1B-0007 top body frame with four PH/T 2X8mm screws.



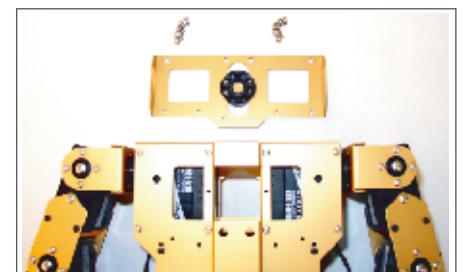
Attach the LED board to the visor (part # HR1C-0003) with two PH/T 2X4mm screws.



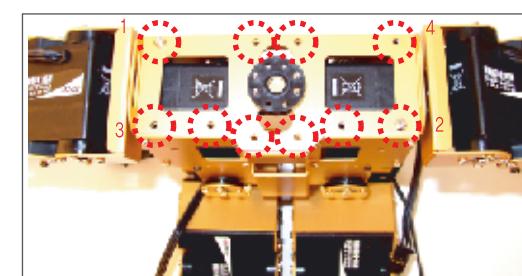
Slide the goggle into the head from the front carefully.



Secure the HR1B-0007 bracket to the body using ten PH/T 2.6X4mm bolts,



To fit the HR1B-0007 properly, begin with a screw in each corner positioned diagonally from each other. Then install the remaining screws,



ROBONOV-A-I

Secure the front part of the head to servo horn with two PH/T 2X8mm screws. Do not over tighten.



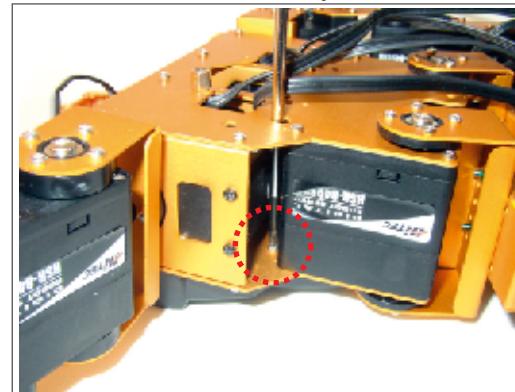
Attach the back part of the head to the front of the head with two PH/T 2X5mm screws.



The shape of the Robot,

ROBONOV-A-I

Using a long thin Phillips screwdriver, screw the two PH/T 2x4mm screws through the back of the robot into the front body cover.



Completed front body cover assembly.



8. Attaching the front body cover.

The front body cover protects the body

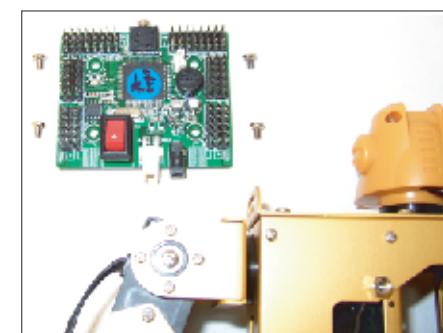


The HR1C-0001 front body is attached to the body with two PH/T 2X4mm screws.

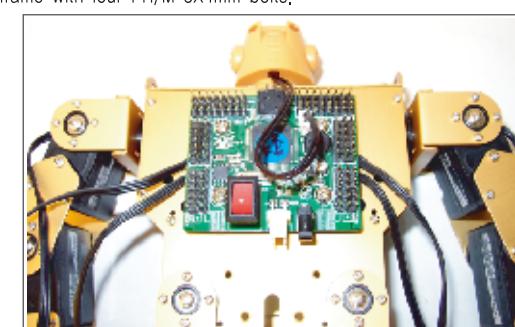
This picture shows the location of the screw holes in the cover.



9. Attaching the controller to the robot.



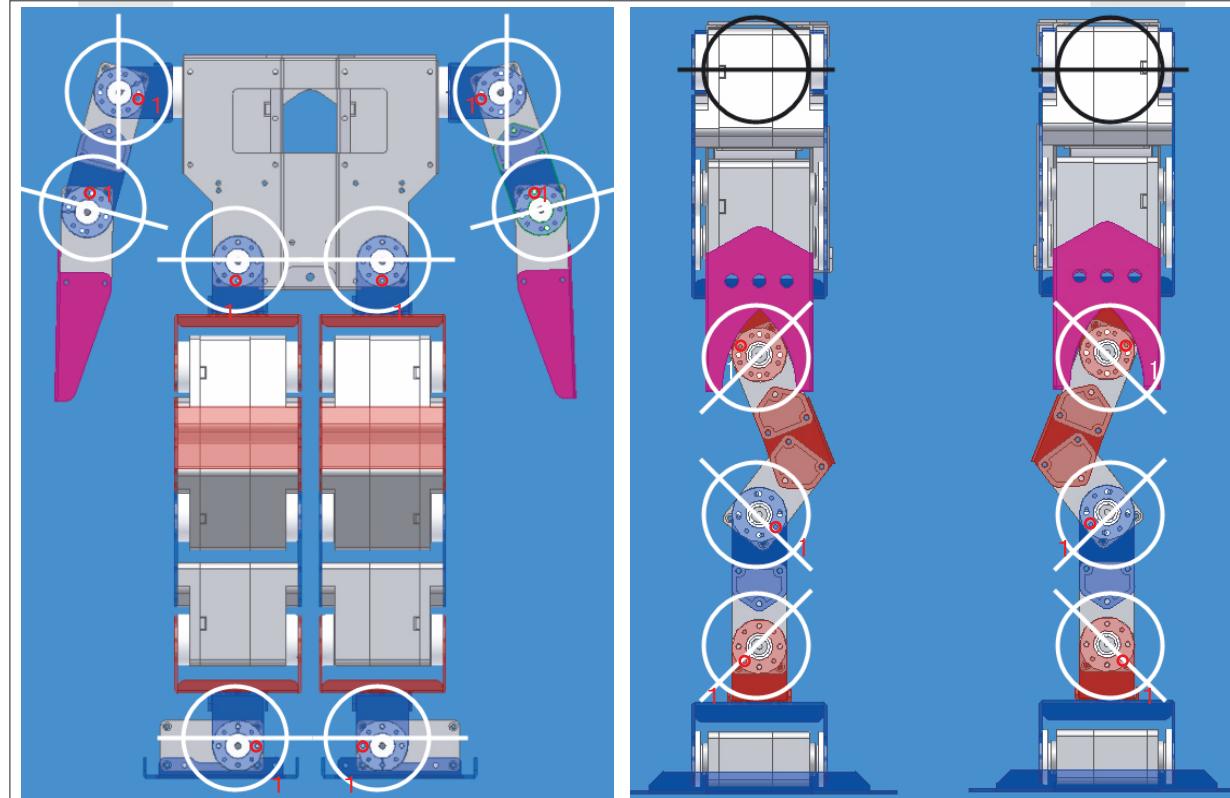
Secure the MR-C3024 to the back body frame with four PH/M 3X4mm bolts.



Travel range check

*As in the pictures, servos have 180 degrees of movement.

*Move each joint of the robot by hand checking for proper servo motion.

**10. Servo wire arrangement**

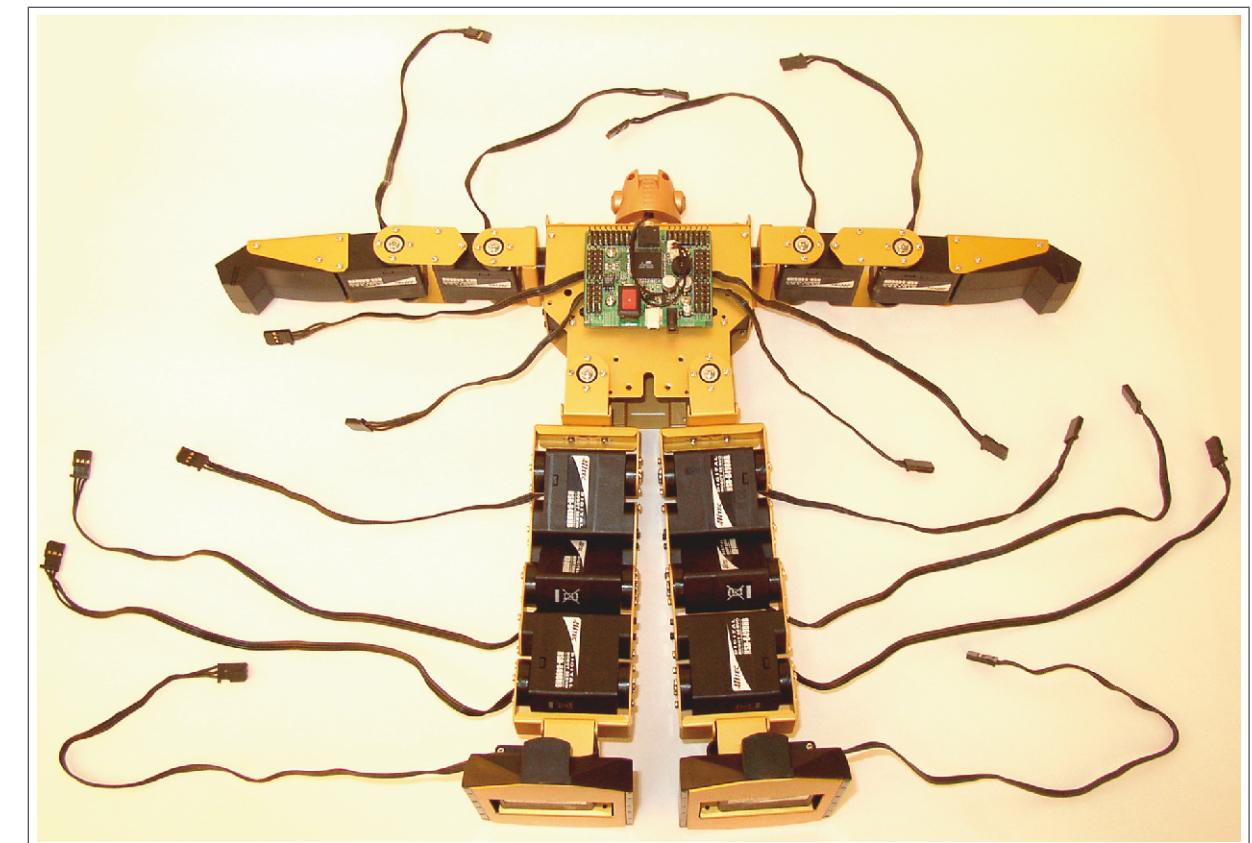
The RoboNova-I has 16 wires that connect to the controller.

It is important for the operation of the robot to have these wires neatly attached to the body.

Cable connection to the MR-C3024 Port and positions of cable clamp and cable tie

(1) Cable arrangement with cable tie

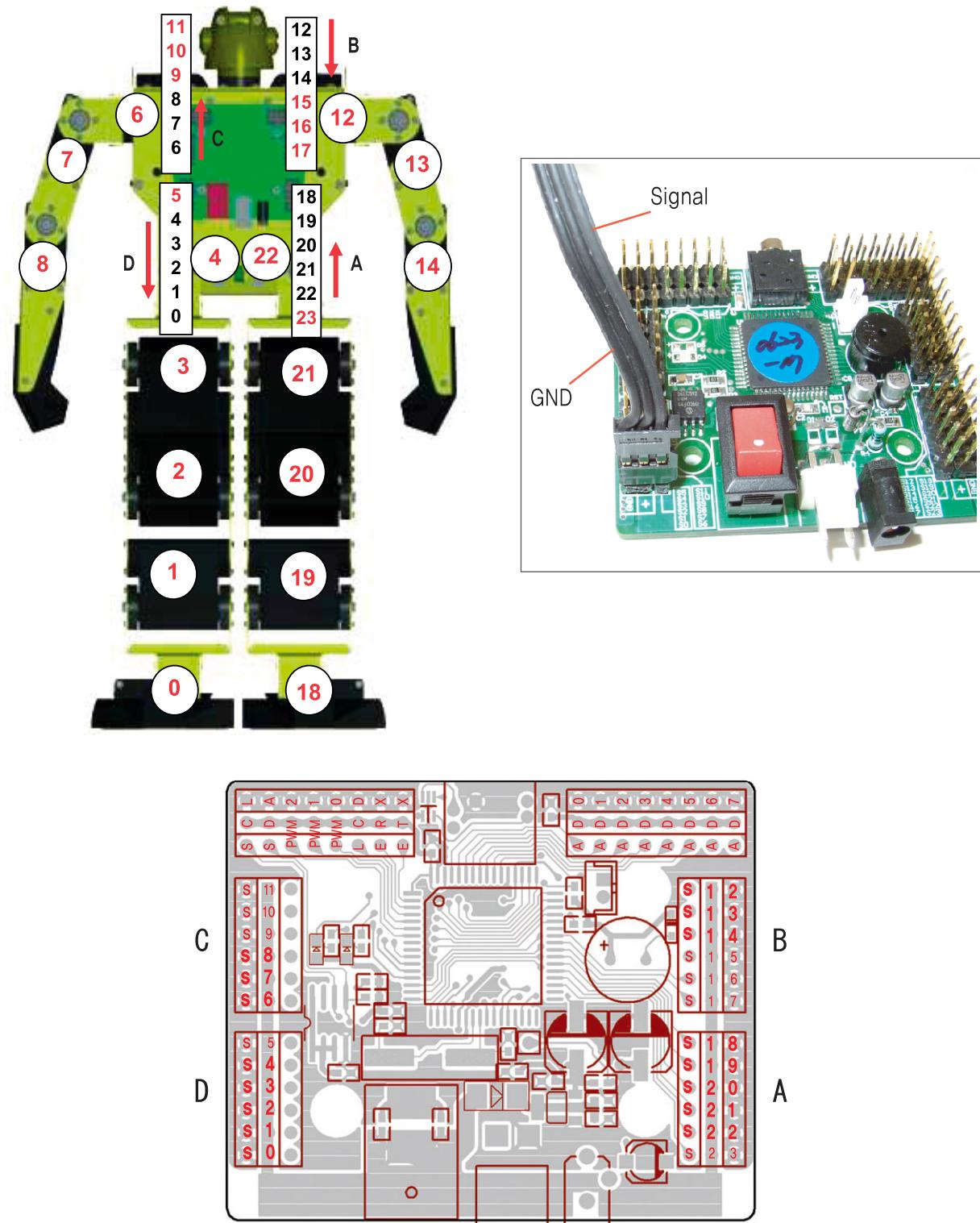
Arrange the wires to prepare for their installation into the controller



ROBONOVA-I

Refer to the servo diagram for proper placement of the servo connectors in the controller.

Note that the gray wire is the signal wire.

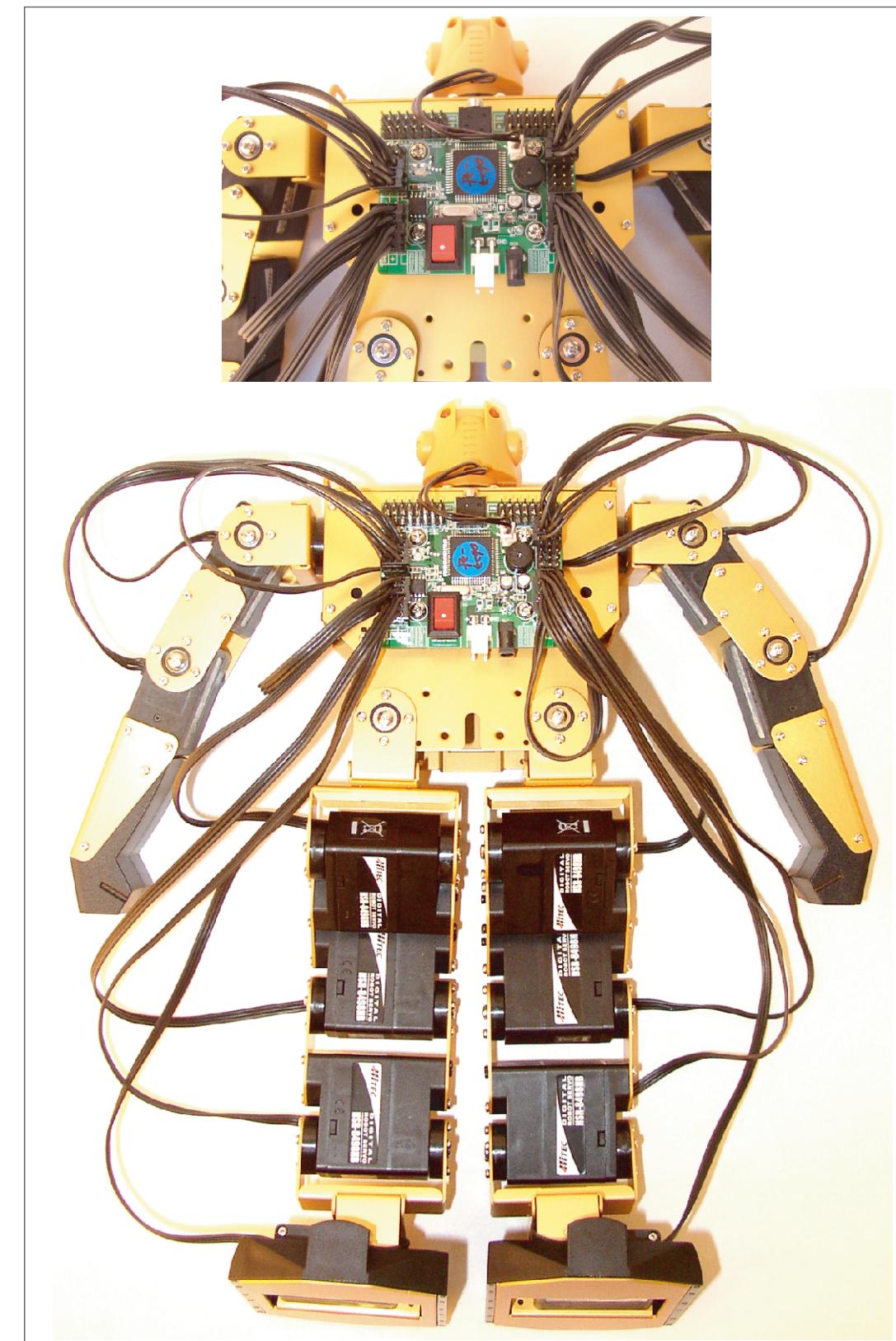


This diagram shows the pinout for the MR-C3024 controller board.

ROBONOVА-I

Plug the servos into the corresponding pins of the controller board.

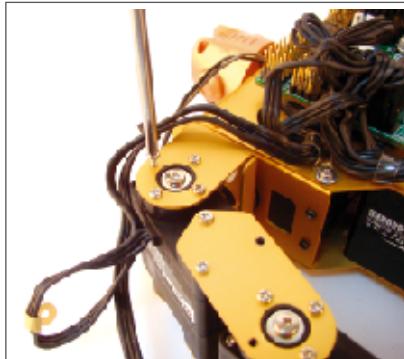
Refer to the diagrams for proper pin placement



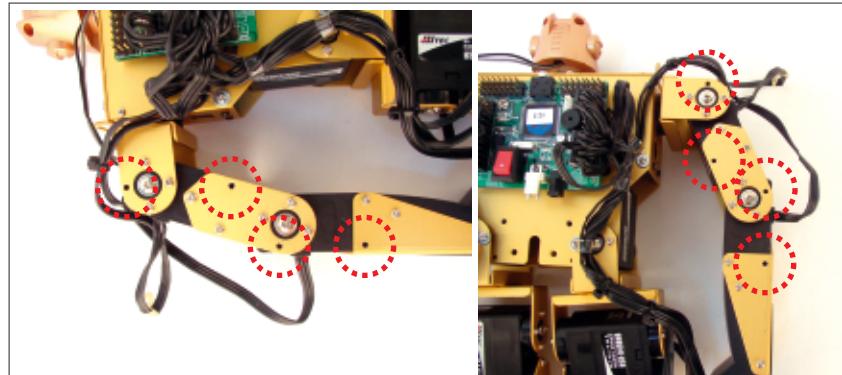
2) Installing the cable clamps.

Installing cable clamps will prevent the wires from interfering with the robots movement. Refer to section one for information on attaching the clamps.

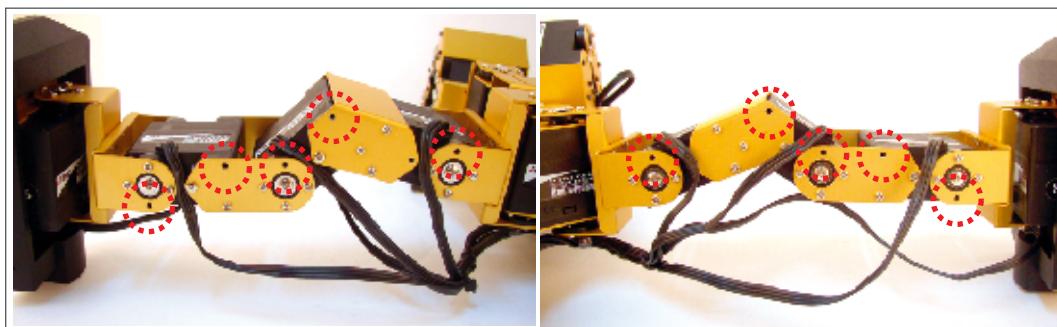
Using the picture as a reference, remove the screws to install the cable clamps



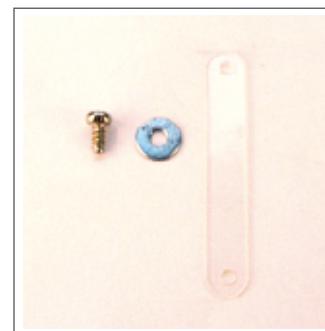
This picture shows the locations of the cable clamps on the right and left arms,



This picture shows the locations of the cable clamps on the right and left legs,



Parts required to attach a clamp to a servo horn,



Install a cable clamp on the body at the locations noted in the pictures,



For the No.2 and No.4 servos in the arms, use a Lug (Bright gold color part) and a cable clamp.

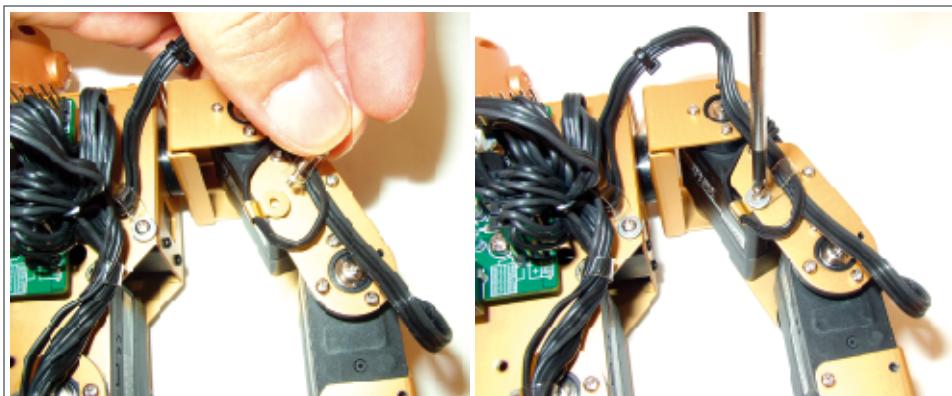


Roll the Lug around the servo wire first,

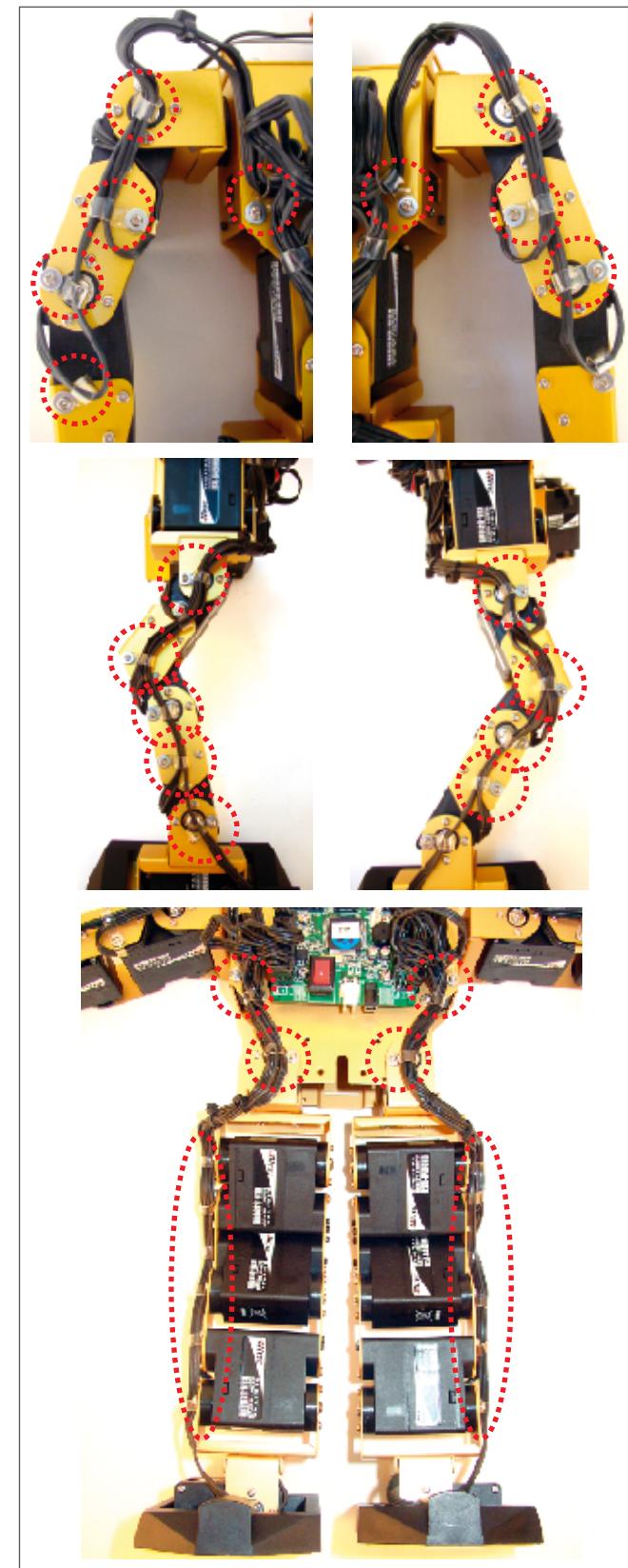


ROBONOV-A-I

Use the picture as an example to connect the lug and cable clamp.



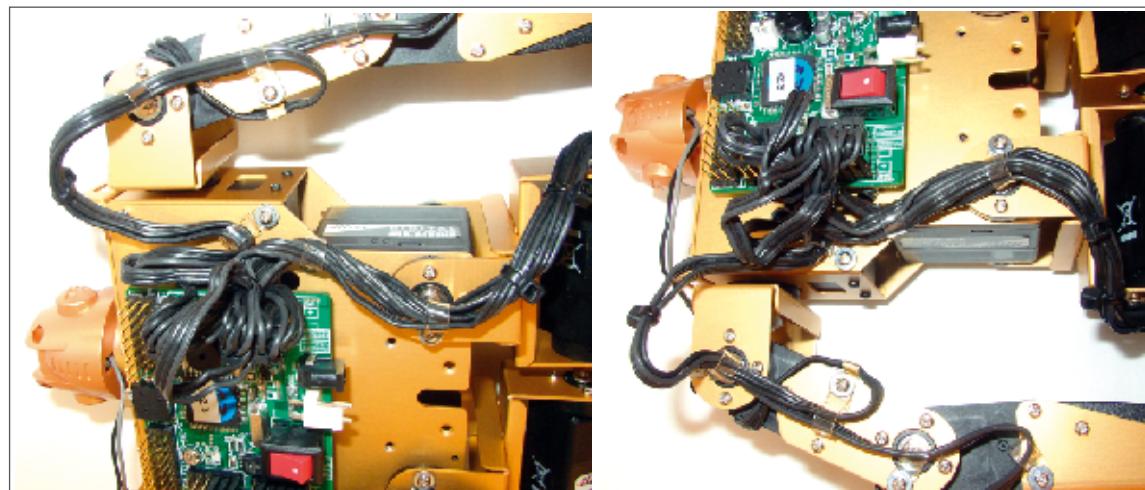
Completed clamp assembly.



Finished clamp and lug assembly.



Attach clamps to each of the pelvis horns as shown in the picuture.



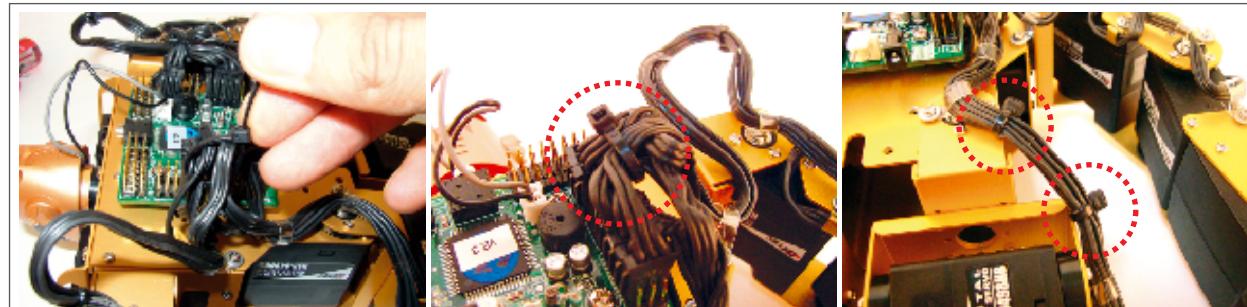
ROBONOV-A-I

Firstly, pull out the wires which come out from the arm and tie them up with cable tie,

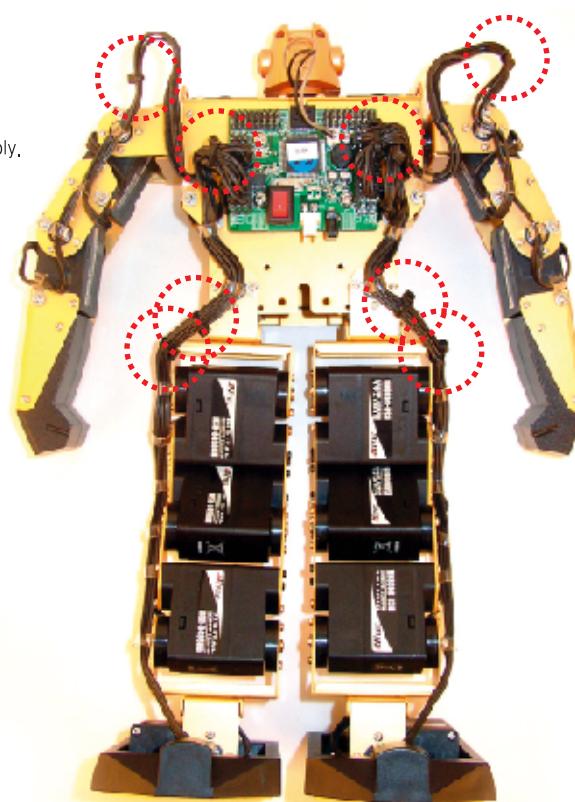
Loosen the bolts of MR-C3024 controller and push 3~4 of longest wires into under side of MR-C3024 then tighten the bolts again,



Arrange the rest wires around the controller as picture, Tie up the wires which connect the leg and body with cable tie to reduce the friction with bracket,

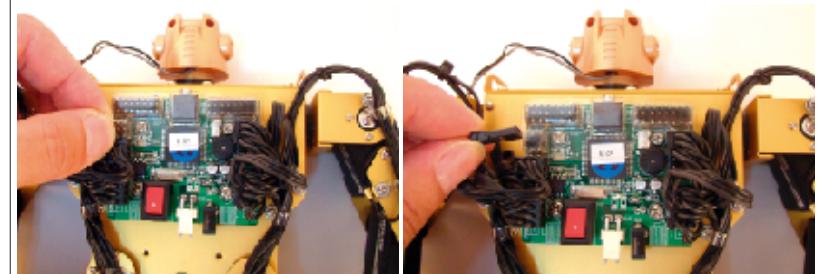


Completed cable ties assembly.

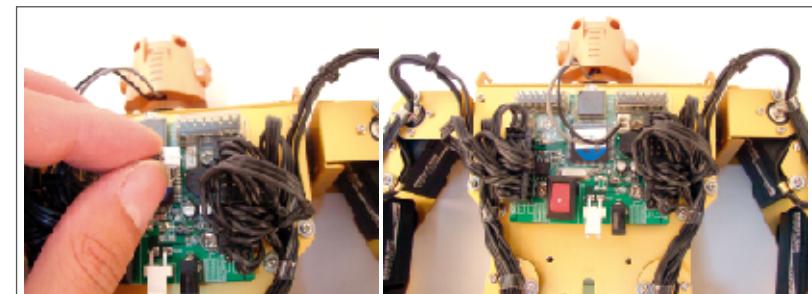


(3) Attaching the PIN cover and LED.

Disconnect upper left servo from the controller and place the transparent pin cover on the controller. Reconnect the servo.



Plug the LED connector into the controller as shown in the picture,



11. Final assembly for hardware

Place the back body cover over the MR-C3024 controller. The back cover snaps into the front cover. Making sure that there are no pinched wires, install two PH/T 2x26mm screws into the top of the cover and two PH/M 2,6x4mm screws into the bottom,



Completed back cover assembly.



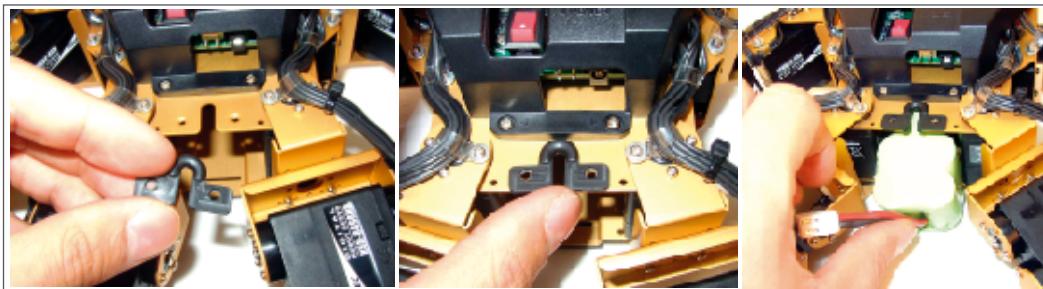
(2) Battery installation

Prepare the 6V 1,000mAh Ni-MH battery, two 3x4mm thumb screws and the HR1B-0008 Bottom body frame and Battery wire protector.

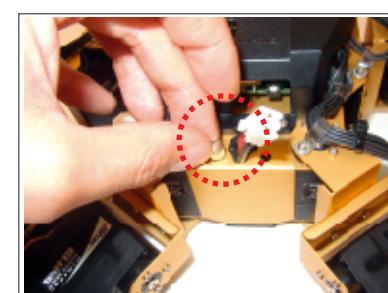


Firstly, install battery wire protector to body frame as picture.

Insert the battery into the bottom of the robot. Pay attention to the orientation of the pack.



Attach the battery cover and secure with the two 3x4 thumbscrews.



Plug the battery connector into the controller.



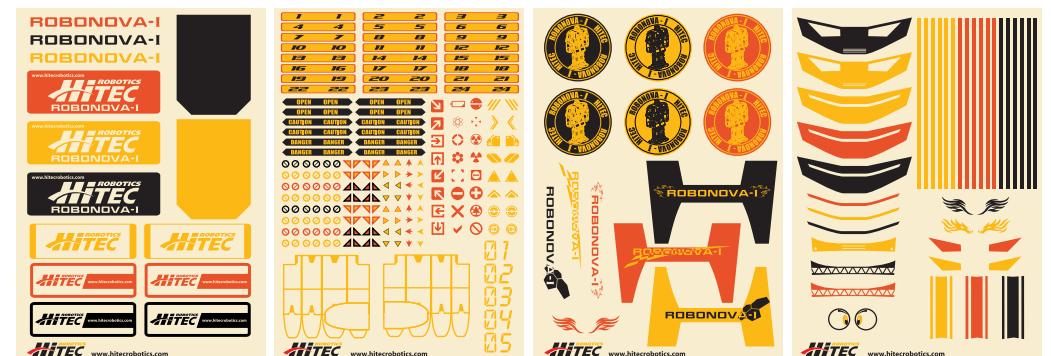
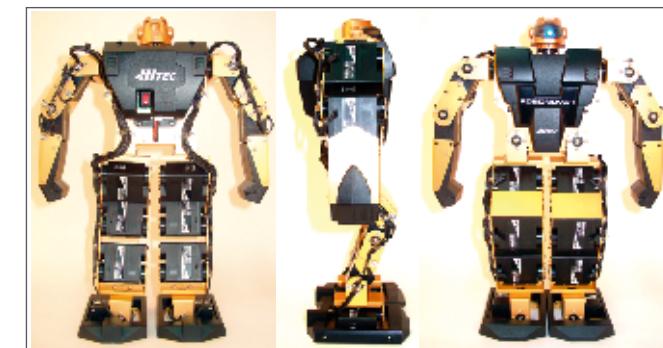
To charge the battery, plug the charge connector into the controller and plug the charger into a wall socket.



The charger has a red LED to indicate that it is charging. When finished a green LED will display.

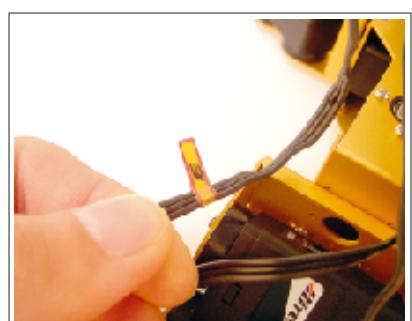
(3) Finishing

When complete the RoboNova-I should look like the example in the picture.



The Robonova-I kit comes with 4 different sets of stickers to customize your robot.

Included are number stickers for quick wire designation.



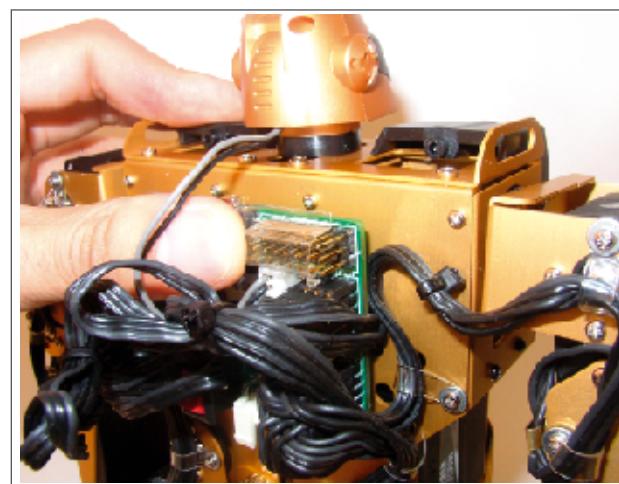
12. Installing the Remocon and IR Sensor.

*The Remocon and IR Sensor are not included in all Kit versions.

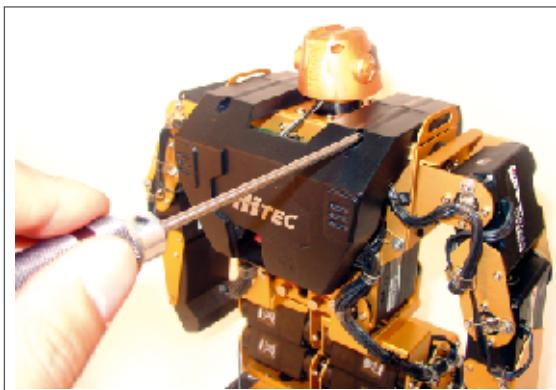
ROBONOVA-I can be controlled with the exclusive Remocon and IR Sensor.
To install the Remocon system, the IR Sensor and double sided tape is required.



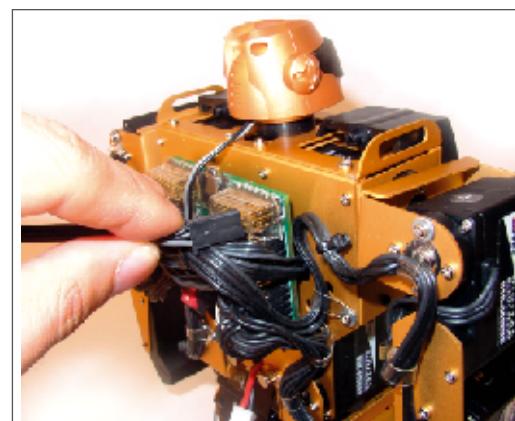
Reattach the pin cover.



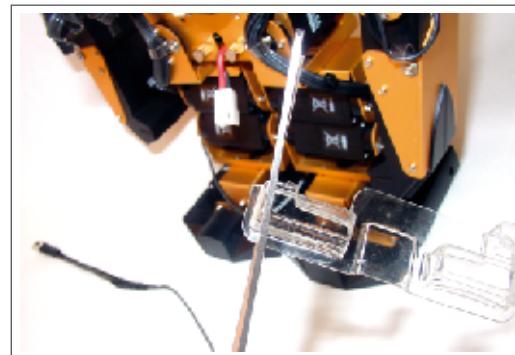
Open the back body cover of the RN-I.



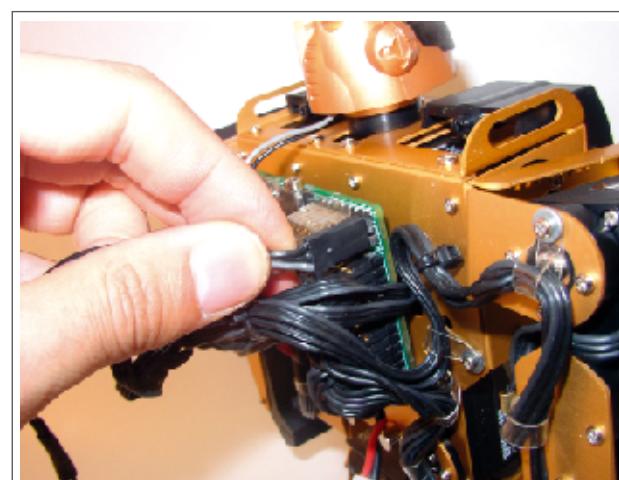
Insert the connector of the IR Sensor into "AD7" port which located in upper right side of MR-C3024 controller.



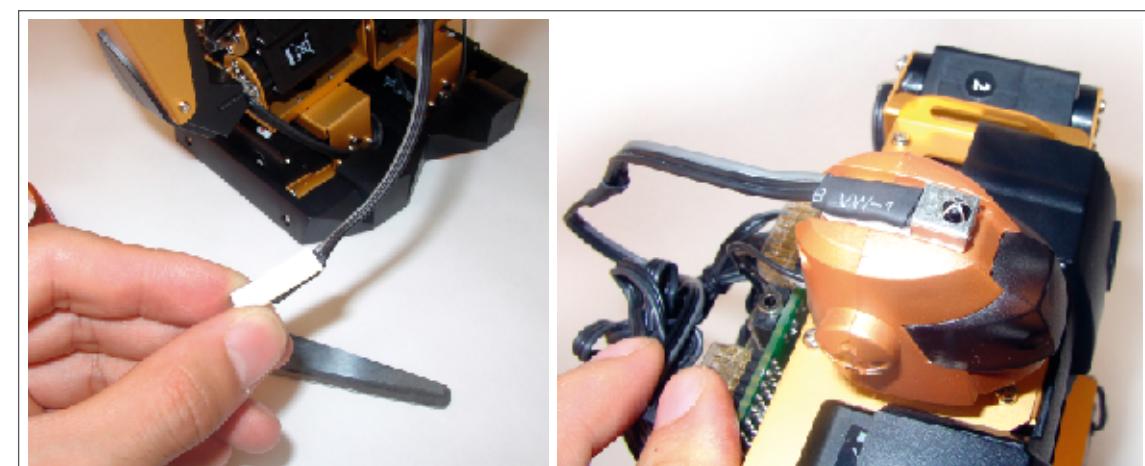
Before inserting the connector, remove the pin cover from the MR-C3024 and cut away part of the pin cover.

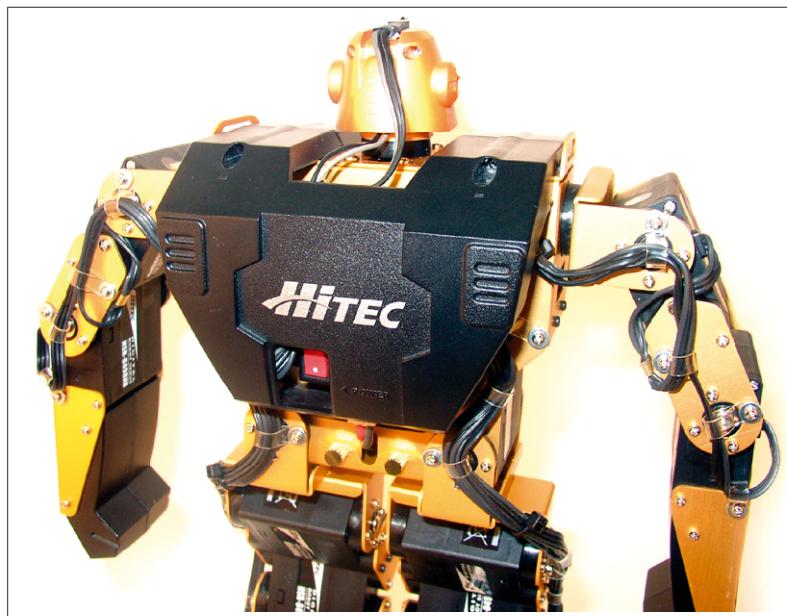


Connect the IR Sensor to the MR-C3024. The Dark gray wire of the connector must be at the bottom,



Attach some 15X8mm double-sided tape to the back of the IR sensor.
Attach the IR Sensor to the top of the RN-I,





Reattach the back body cover to the RN-I.

The next step is the remocon programming setup. Open roboBASIC and either create a new file or open action_auto.bas found in the templet folder of the CD.

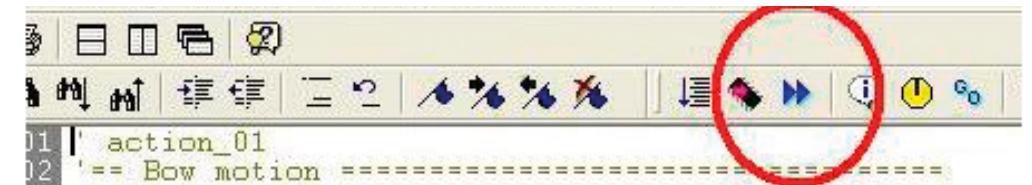
In the template program find 'A = REMOCON(0) and change it into A = REMOCON(1)

```
MAIN1:  
A = REMOCON(1)  
A = A - ID  
ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20  
GOTO MAIN  
'
```

Connect the ROBONOVA-I to a PC with the Serial Interface cable.



Click the "Run All" (integrated execution) button to upload to the controller.



```
01 ' action_01  
02 '-- Bow motion =====  
03  
04 DIM A AS BYTE  
05  
06 PTP SETON  
07 PTP ALLON  
08  
09 '-- motor direction setting =====  
10 DIR G6A,1,0,0,1,0,0  
11 DIR G6B,1,1,1,1,1,1  
12 DIR G6C,0,0,0,0,0,0  
13 DIR G6D,0,1,1,0,1,0  
14  
15 '-- motor start position read =====  
16 GETMOTORSET G6A,1,1,1,1,1,0  
17 GETMOTORSET G6B,1,1,1,0,0,0  
18 GETMOTORSET G6C,1,1,1,0,0,0  
19 GETMOTORSET G6D,1,1,1,1,1,0  
20
```

The Remocon can be identified with an ID between 1and 4. This allows up to four ROBONOVA-I robots to be controlled by different remocons at the same time without interference.

Turn on the ROBONOVA-I and with the Remocon pointed toward the IR Sensor, press the "P1" button placed in upper left side of the Remocon. Then press the desired ID number (choose from among the "1~4" buttons). Hold both buttons for 2 seconds.

When you replace the batteries, the ID number should be reset,



IV. Preparations before operation of the ROBONOVА-I

* RoboBasic must be installed before operating the ROBONOVА-I

' Refer to "(2) Installation of RoboBasic" in section "1. Installation and execution of RoboBasic".

1. Basic movement setup and applications,

(1) Initial setup of RoboBasic for the ROBONOVА-I

It is important to setup the RoboBasic software for proper operation.

1) Port settings for the controller and PC, Controller selection ' Refer to "(3) Execution of RoboBasic" in section "1. Installation and execution of RoboBasic". The controller will automatically be set for the ROBONOVА-I,

2) Explanation of the zero settings and procedures ' Refer to "(5) Zero setting of RoboBasic" in section "1. Installation and execution of RoboBasic".

(2) The list of commands found in the template program,

1) Command "goto AUTO" (RoboBasic command manual p44 in CD)

goto AUTO

Move to the template program.

Sentence structure

- English sentence : goto AUTO

Explanation of command

Command to begin the included template program.

Example of command

Goto AUTO 'Move to the template program .

Note: This command is for the MR-C3024 controller and Robonova-I Robot only.

```

0009 GOTO AUTO
0010 FILL 255,10000
0011
0012
0013
0014 DIM RR AS BYTE
0015 DIM A AS BYTE
0016 DIM A16 AS BYTE
0017 DIM A26 AS BYTE
0018
0019 CONST ID = 0      ' 1:0, 2:32, 3:64, 4:96,
0020
0021 '== Action command check (50 - 82)
0022 IF RR > 50 AND RR < 83 THEN GOTO action_proc
0023
0024 RR = 0
0025
0026 PTP SETON
0027 PTP ALLON
0028
0029 '== motor direction setting =====
0030 DIR G6A,1,0,0,1,0,0
0031 DIR G6B,1,1,1,1,1,1
0032 DIR G6C,0,0,0,0,0,0
0033 DIR G6D,0,1,1,0,1,0
0034
0035

```

< The "GOTO AUTO" command is found at the top of the Template program >

Open the "Overall Template Program,bas" file in the "Template Program for roboBASIC" folder of the CD.

→ Refer to 1. Template program in section VI. Application of Programs

Click on "RUN ALL" (Integrated execution) to upload the file into the controller.

After the uploading process, the Piezo speaker will make a sound and the ROBONOVА will move to a standing position.

- If the ROBONOVА does not stand properly adjustment to the zero settings are required,

' Refer to (5) Zero setting of RoboBasic in section V. How to use the software for ROBONOVА-I

- If there is a large discrepancy between the standing position of the ROBONOVА and the picture below, make sure that the servos, servo horns, and brackets are assembled properly.

- After double checking the assembly, turn on the switch. If the performed position is the same as the photos (Refer to (5) Zero settings of RoboBasic), the 29 basic actions within the template program can be performed, (Refer to the REMOCON table for the key assignments.)

Check the RoboRemocon software setup or IR REMOCON (Refer to (4) Using ROBOREMOCON with RoboBasic in section 1. Installation of RoboBasic).

2) Table for remocon setup and actions

- The movements that are installed in the MR-C3024 can be operated with the RoboRemocon software or an IR REMOCON (not available in some kit versions).

(Refer to section "11. Installation of the IR REMOCON" for IR REMOCON installation and settings)

(Refer to section "3. Installation and settings of RoboRemocon" for using the RoboRemocon software)

REMOCON key assignment table

ACTION	key	Motion	Variable	Code
0	power	ON : motor on → Basic Position OFF: Sitting Position → motor off	A16	16
1	1	Bow → Basic Position		1
2	2	Raise arms → Basic Position		2
3	3	Sit → Basic Position		3
4	4	Sit → Raise arms → Basic Position		4
5	5	Raise a leg → Basic Position		5
6	6	Spread the legs → Extend arms → Right-left tilt → Basic Position		6
7	7	Flap arms like a bird		7
8	8	Kick		8
9	9	Handstand		9
10	0	Walk fast		10
11	*	Left turnabout		22
12	#	Right turnabout		24
13	▲	Forward		11
14	◀	Left move		14
15	■	Sit(→)Stand up	A26	26
16	▶	Right move		13
17	▼	Reverse		12
18	△	Front tumbling		21
19	◀	Left cartwheel		28
20	□	Front attack		29
21	▷	Right cartwheel		30
22	▽	Rear tumbling		31
23	A	Left attack		15
24	B	Right attack		20
25	C	Left front jab		17
26	D	Right front jab		27
	E,F,G	27,28,29 Spare 18,32,23		18

V. Software manual for ROBONOVA-I

1. Installation and Operation of roboBASIC v2.5

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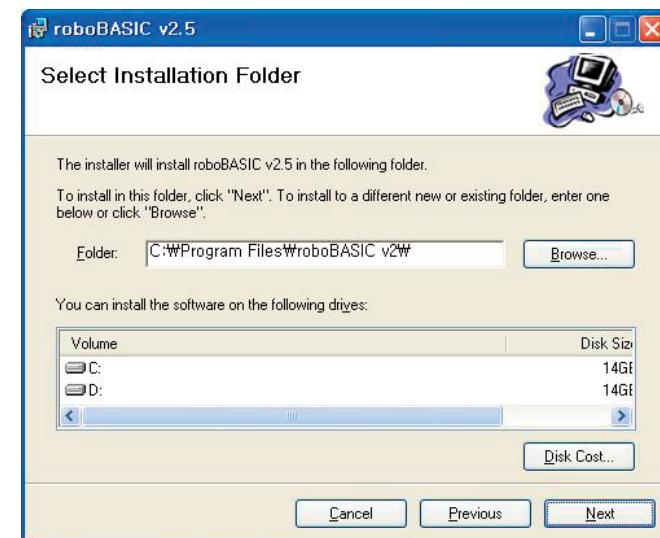
Windows is a registered trademark of the Microsoft Corporation

Notice

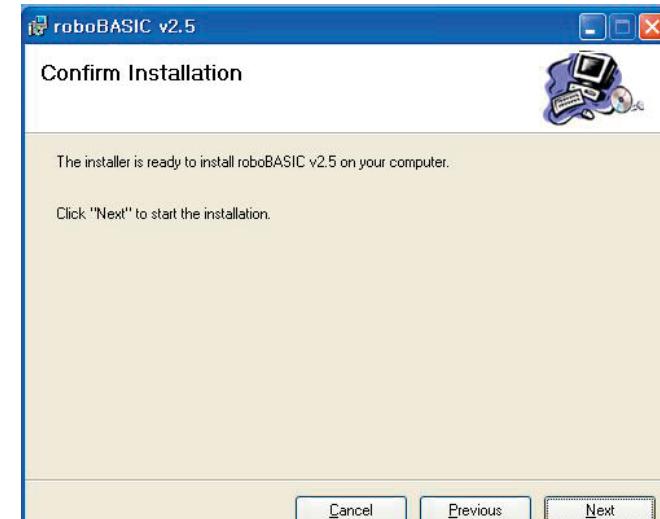
This manual is for the installation and operation of roboBASIC. This version may be different from previous versions and may, along with the manual, be changed without notice in order to improve performance.

RoboBasic is registered software, making it illegal to reproduce, publish, post, transmit or distribute this manual or software without permission.

HITEC Robotics <http://www.hitecrobotics.com>



② Select the installation folder.



(1) About roboBASIC

RoboBASIC is based on the BASIC programming language and specifically developed to communicate with the MR-C family of robot control boards.

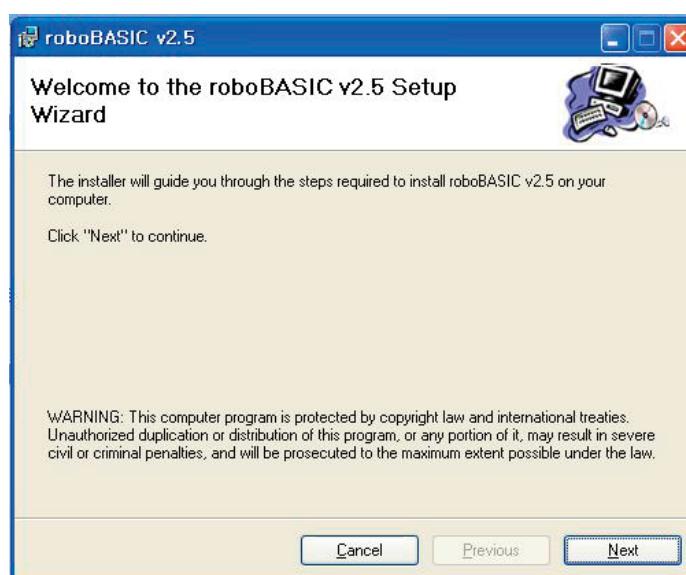
RoboBASIC is an educational language that enhances the BASIC programming language allowing for the operation of robots.

RoboBASIC is compatible with MS Windows 98, ME, 2000, and XP

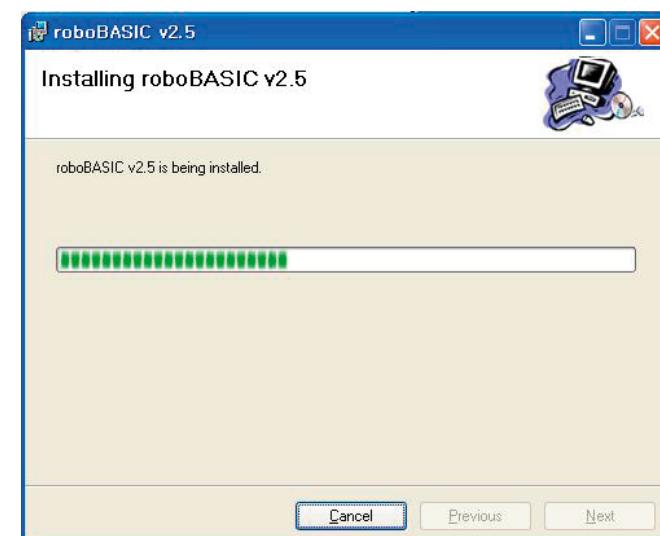
(2) Installation of roboBASIC

- RoboBASIC software can be installed from the diskette or CD included with the RN-1 robot, or downloaded from the HITEC Robotics homepage (<http://www.hitecrobotics.com>)

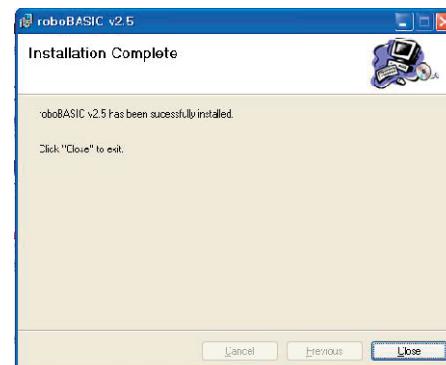
*When Installing ROBOBASIC, ROBOSCRIPT and ROBOREOMCON softwares are installed at the same time.



① Click "SETUP.EXE" to begin the setup wizard.



③ The ROBOBASIC installation begins



④ Installation complete

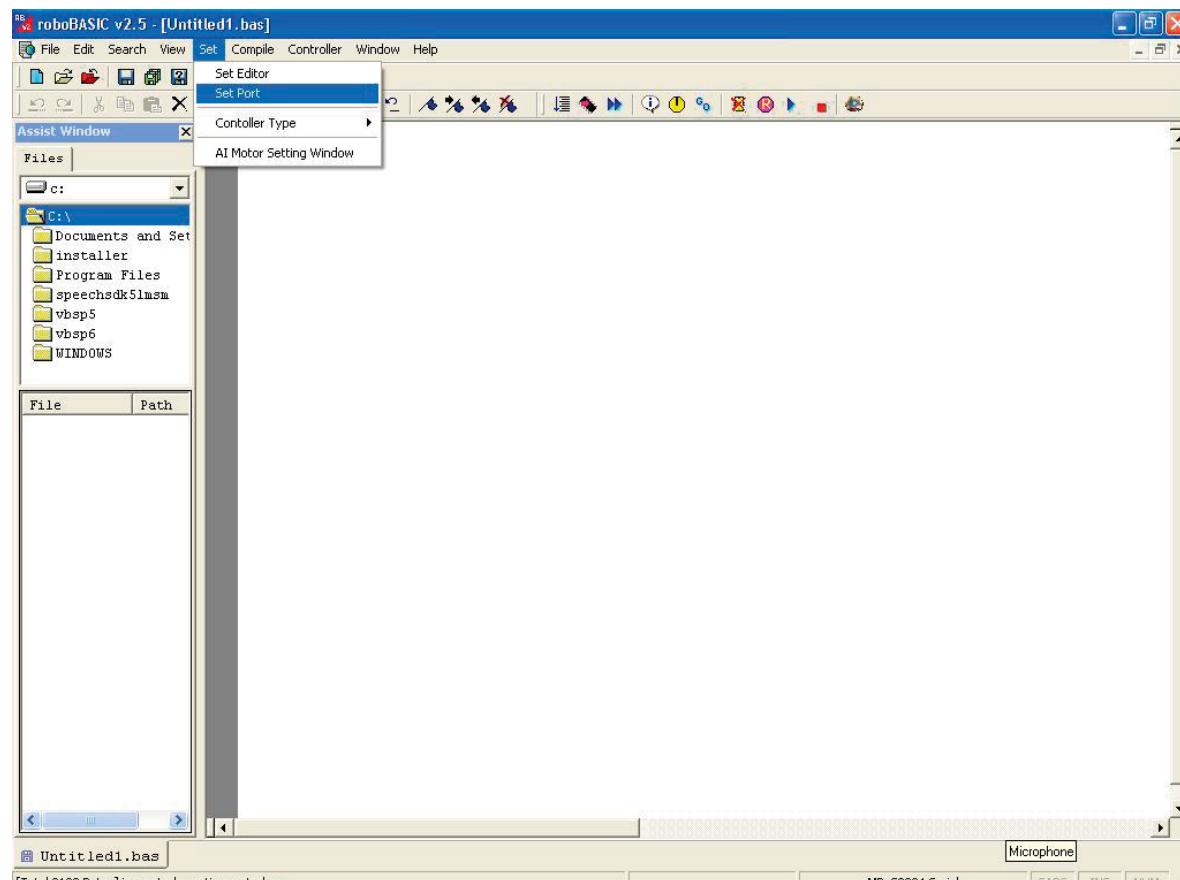
(3) Initial setup of roboBASIC

Connect the download cable and power to the controller and switch the unit on.

Open roboBASIC.

① Select the controller type.

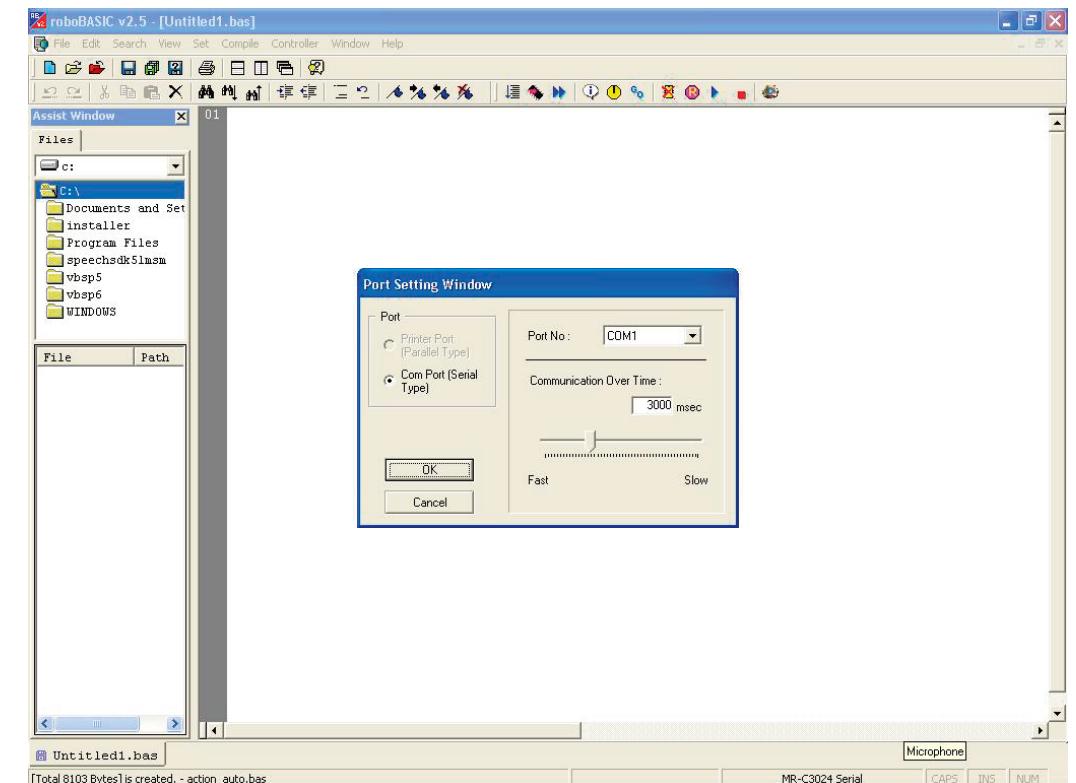
Select the MR-C3000 controller. If you have the MR-C3024, select the MR-C3024 controller.



② Select serial port number. Select the serial port that will be used.

To confirm which serial port to use, open the device manager found in the Windows operating system,

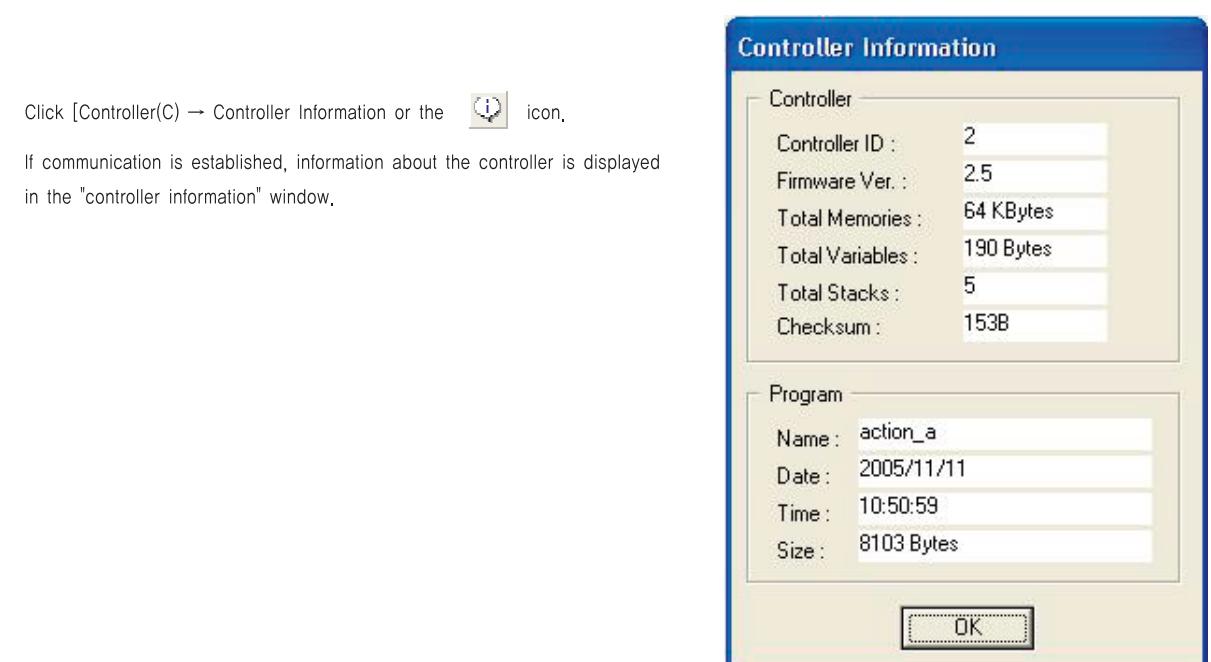
[control panel → system → device manager → port (COM and LPT)]



When using roboBASIC for the first time, an initial setup for the controller and system must be performed.

Once setup is complete, this operation is no longer required unless changes are made to the system.

To confirm that the controller is communicating with the PC, open the controller information window.

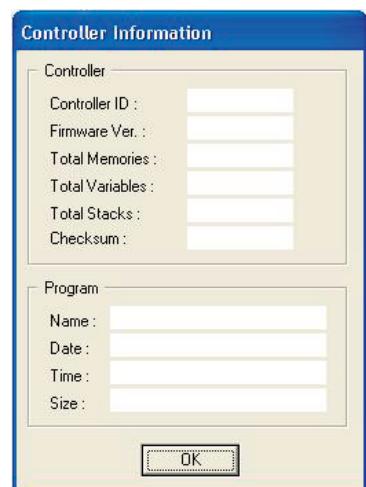


If there is a communications failure, an error message will appear. Click the OK button.

No information is displayed in the "controller information" window at this time.



〈Controller Error Message〉

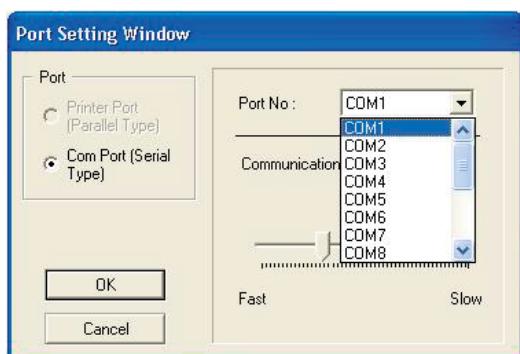


⟨No controller information displayed in the window⟩

Double check that the download cable is securely attached and that there is power to the controller. Begin the setup procedure again.

Click [Set up (T) → Port set up

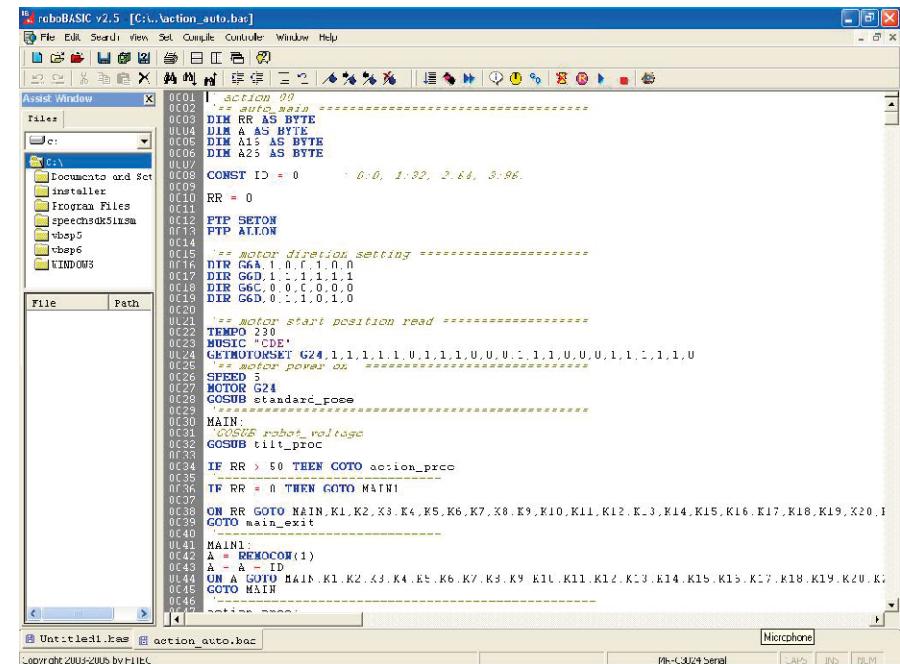
The port can be changed as needed



(4) Programming in RoboBASIC

With installation and setup complete, it is time to begin the programming stage.

Create a new program or open an existing file. All files are saved with the [*.bas] extension.

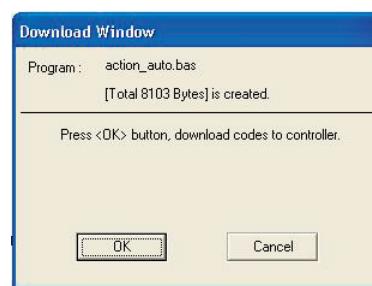


To upload an existing or newly created program into the controller, it must be converted into object code through the compiling process. Only then is it ready to upload into the controller's ROM. The compiling and upload processes can be performed together or separately.

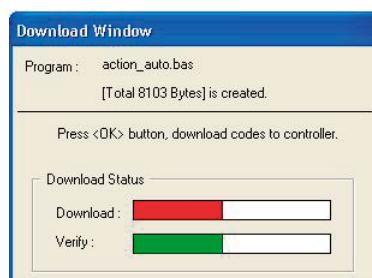
Click the "Make Object Code" icon, (F2) or Make Object Code from the menu. [Compile (O) → Make object code (F2)]



Click the "Download" icon (F6) or select Download from the menu [File (O) → Download (F6)].



Click the "Integrated Execution" icon, (F9) or select Run All from the menu, [File (O) → Run All (F9)]

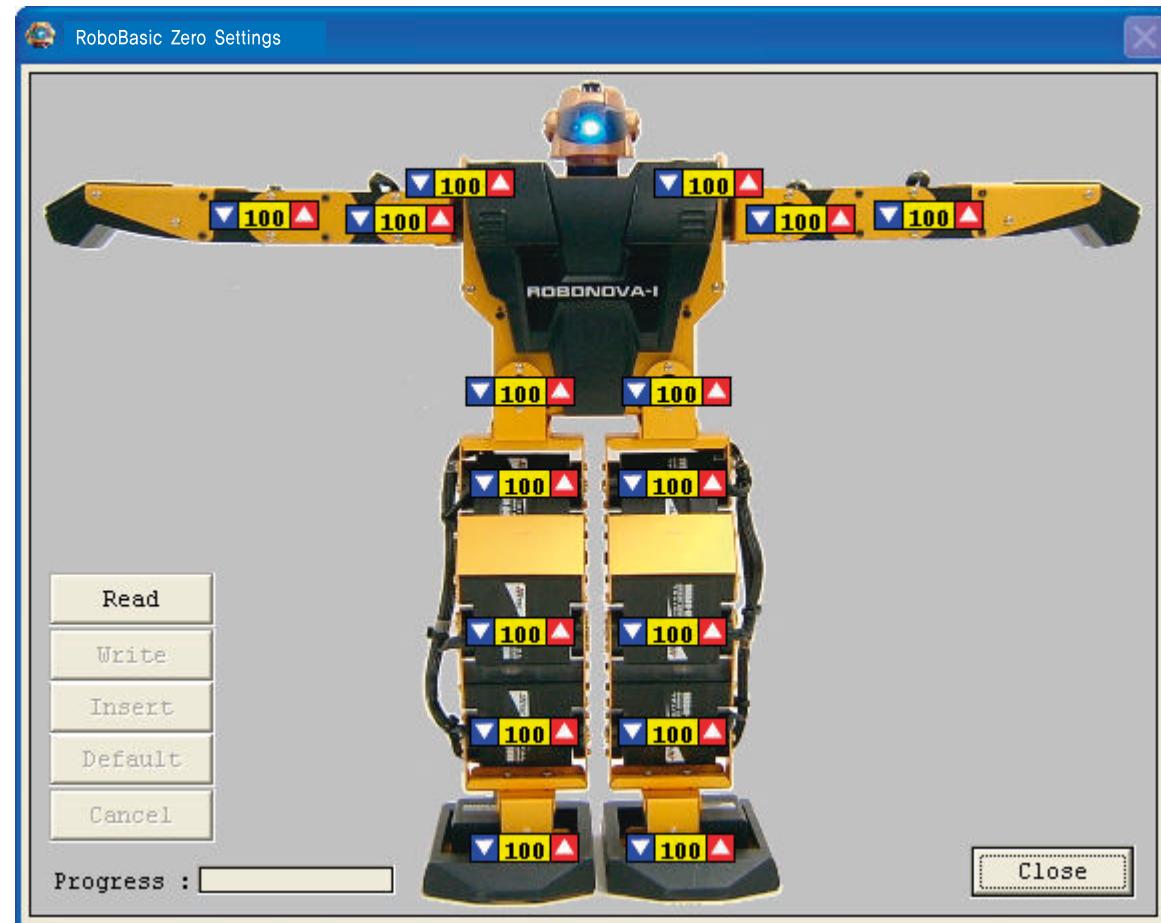


(5) RoboBasic Zero Settings

Even though the robot is assembled correctly, the servos may be slightly off center. A zero setting is required to set the proper servo neutral positions.

The zero settings are controlled through the RoboBasic software.

- To access the zero settings from the Menu in RoboBasic, go to ' Compile ' Set Zero Point,



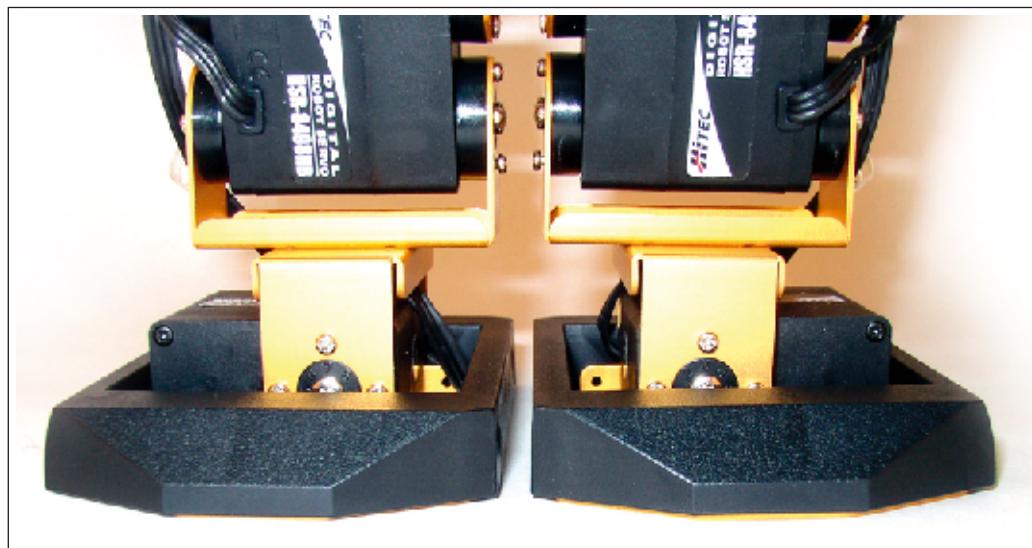
(The zero settings for each servo can be adjusted by using the up or down arrows)

- A small window will open with a picture of the ROBONOV-A. Besides each servo is its default neutral position. (Refer to RN-I photo).

To have the robot move to the same position as the picture, click on the "Read" button.

* (Warning) When clicking the "READ" button, the arms and legs will move to match the position in the above photo. If the robot is being held there is the possibility of injury to the hand. It is suggested that before clicking the "READ" button the robot be set on a flat surface.

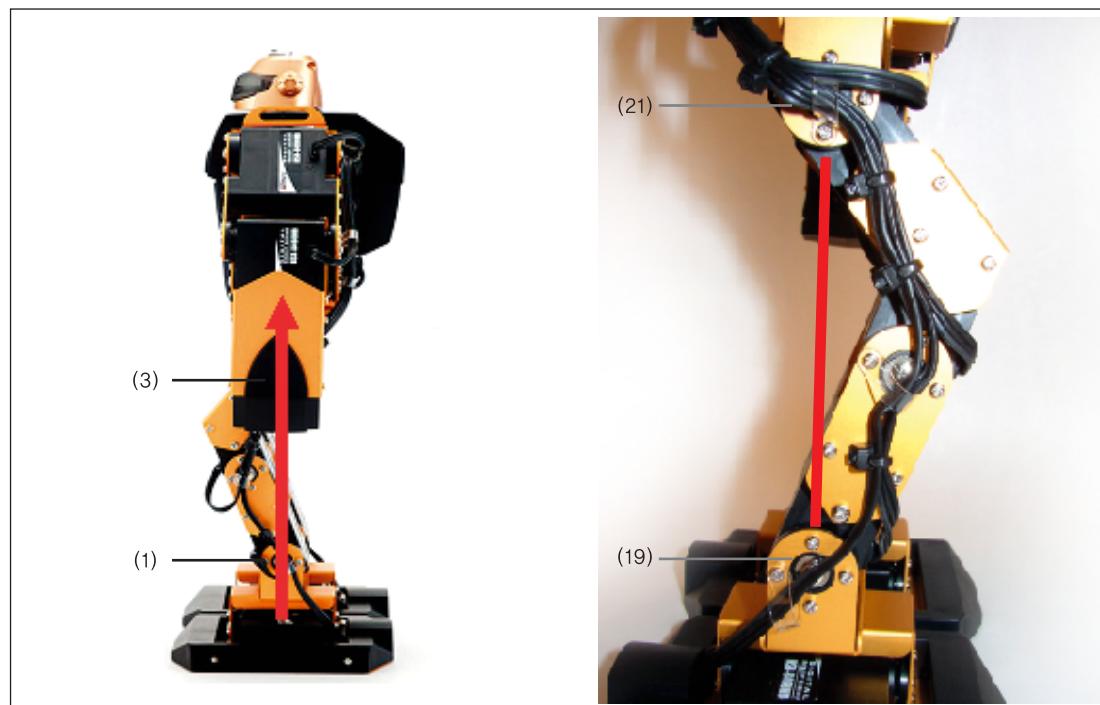
Proper zero positions.



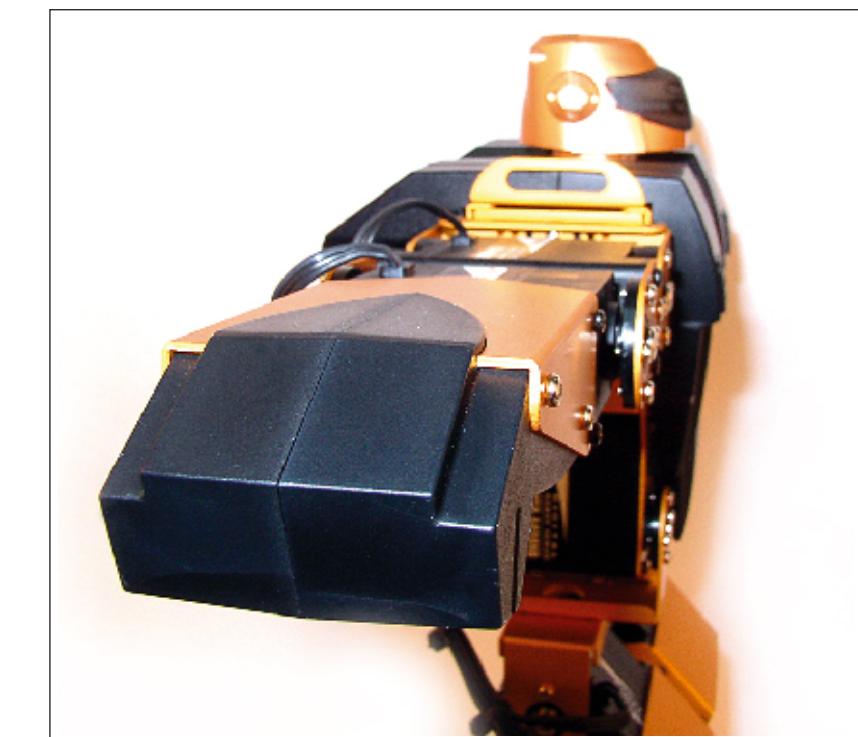
The two feet must be flat on the surface.



The gap between the right and left legs is approximately 8mm.



Servos No.1 and No.3 of the left leg (No.19 and No.21 of the right leg) are in a straight line.



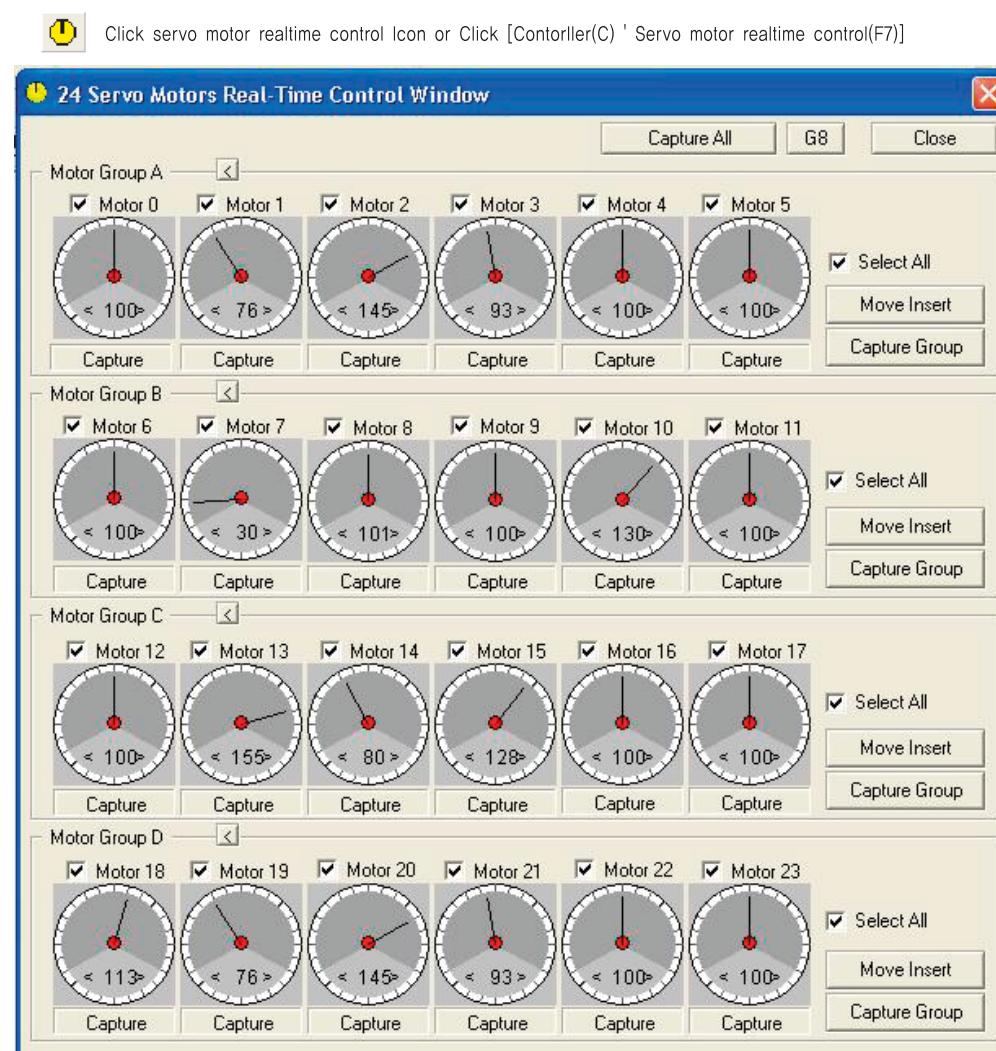
The arms are in a flat horizontal position as the photo above.

- The zero settings can be adjusted by using the up or down arrows.
- To save the settings in RoboBasic, click on the "Write" button. This will insert the new settings into the program.
- To upload the zero settings to the robot immediately, click on the "Insert" button.
- This inserts the new zero settings into the MR-C3024 controller bypassing the normal RoboBasic software upload.
- To view the new settings, cycle the power on the robot.

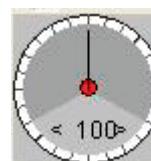
(6) Servo motor realtime control

With servo motor realtime control, you can control motion of robot quick and easy.

Connect MR-C3024 with PC and run ROBOBASIC program.



Motor 0 Servo motor to control

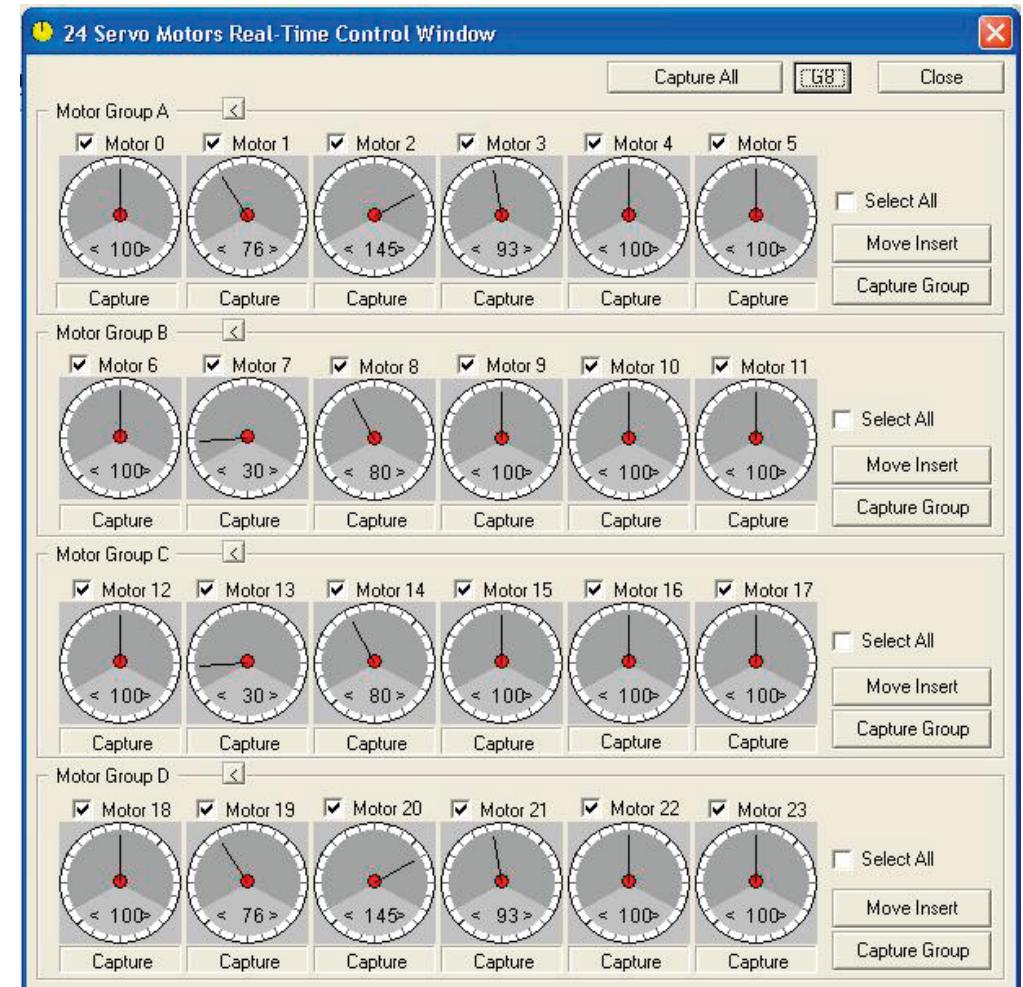


The position of servo motor, range is 10~190

Open and close servo motor group

GB

24 of dial window and appoint 6 units on the group of servo motor.



Move Insert

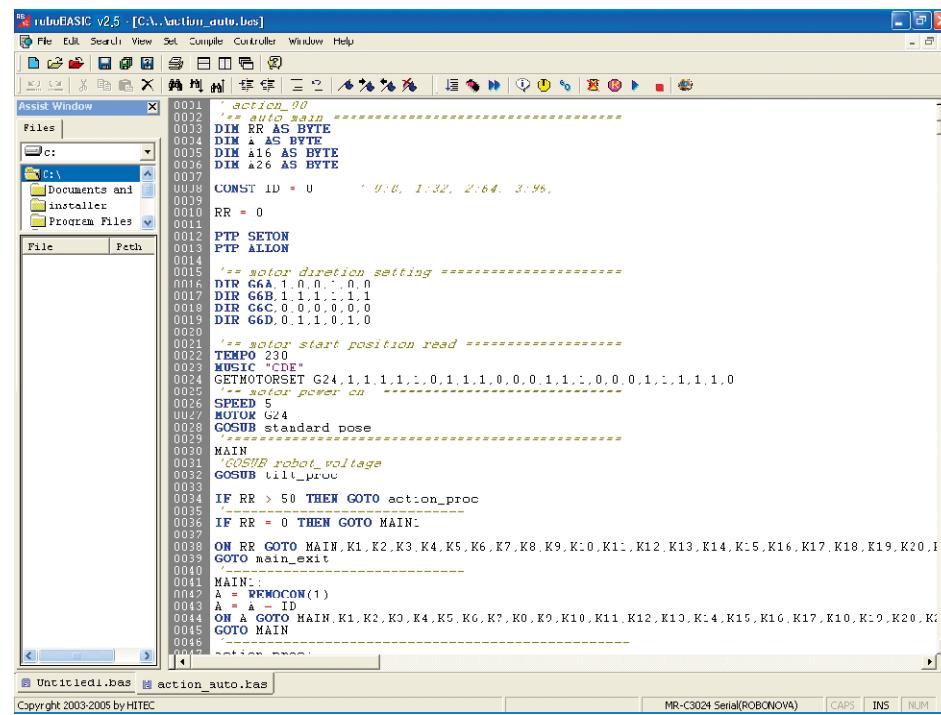
Insert command "MOVE" in the program window.
ex) MOVE G8A, 100, 100, 100, 100, 100, 100, 100

Capture Group

Close servo motors realtime control

(7) RoboBasic ROBONOVA-I servo motor control

1) Servo Motor Real Time Control.



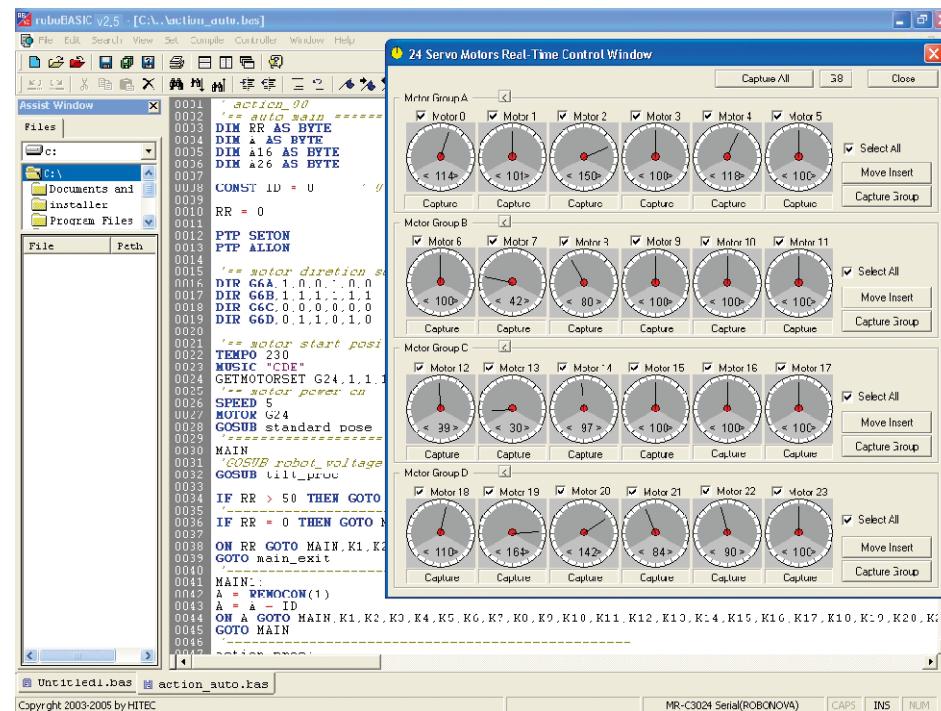
```

0011 *# auto main *****
0012 DIM RR AS BYTE
0013 DIM A15 AS BYTE
0014 DIM A16 AS BYTE
0015 CONST ID = U
0016 RR = 0
0017 PTP SETON
0018 PTP ALION
0019 /*= servo direction setting =====*/
0020 DIR GAA 1.0.0.1.0.0
0021 DIR G6A 1.1.1.1.1.1
0022 DIR G6C 0.0.0.0.0.0
0023 DIR GGD 0.1.1.0.1.0
0024 /*= servo start position read =====*/
0025 TEMPO 230
0026 MUSIC "CDE"
0027 GETMOTORSET G24,1.1.1.1.1.0,1.1.1.0,0.0.1.1.1.0,0.0.1.1.1.1.0
0028 SPEED 5
0029 MOTOK G24
0030 GOSUB standard_pose
0031 MAIN
0032 GOSUB robot_voltage
0033 GOSUB tilt_muuc
0034 IF RR > 50 THEN GOTO action_proc
0035 IF RR = 0 THEN GOTO MAIN
0036 ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0037 GOTO main_exit
0038 ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0039 GOTO MAIN
0040
0041 MAIN:
0042 A = PFMOCN(1)
0043 A = A ID
0044 ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0045 GOTO MAIN
0046
0047 action_proc:

```

Connect the ROBONOVA to the PC through a Serial Interface Cable and turn on the switch,

Within the program move the cursor to the line where the "MOVE" commands will be inserted.)



```

0011 *# auto main *****
0012 DIM RR AS BYTE
0013 DIM A15 AS BYTE
0014 DIM A16 AS BYTE
0015 CONST ID = U
0016 RR = 0
0017 PTP SETON
0018 PTP ALION
0019 /*= servo direction setting =====*/
0020 DIR GAA 1.0.0.1.0.0
0021 DIR G6A 1.1.1.1.1.1
0022 DIR G6C 0.0.0.0.0.0
0023 DIR GGD 0.1.1.0.1.0
0024 /*= servo start position read =====*/
0025 TEMPO 230
0026 MUSIC "CDE"
0027 GETMOTORSET G24,1.1.1.1.1.0,1.1.1.0,0.0.1.1.1.0,0.0.1.1.1.1.0
0028 SPEED 5
0029 MOTOK G24
0030 GOSUB standard_pose
0031 MAIN
0032 GOSUB robot_voltage
0033 GOSUB tilt_muuc
0034 IF RR > 50 THEN GOTO action_proc
0035 IF RR = 0 THEN GOTO MAIN
0036 ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0037 GOTO main_exit
0038 ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0039 GOTO MAIN
0040
0041 MAIN:
0042 A = PFMOCN(1)
0043 A = A ID
0044 ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K
0045 GOTO MAIN
0046
0047 action_proc:

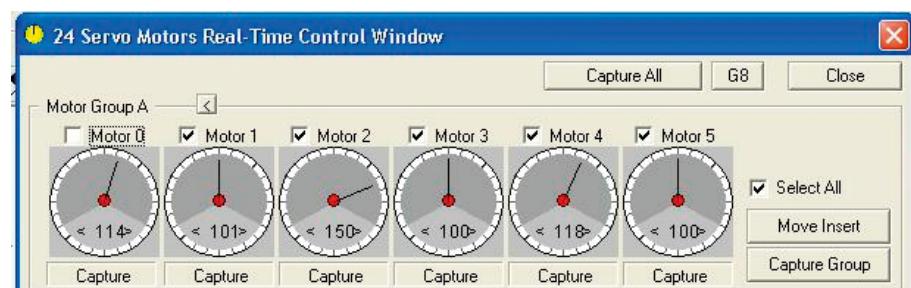
```

(Click Menu ' controller ' Servo motor real-time control. The servo control window will open.)

- There are two ways to use the servo motor real time control, One method is moving the servos by hand,

The other method is by clicking the arrows to the sides of the numerals to either increase or decrease the value,

① Hand adjustment method

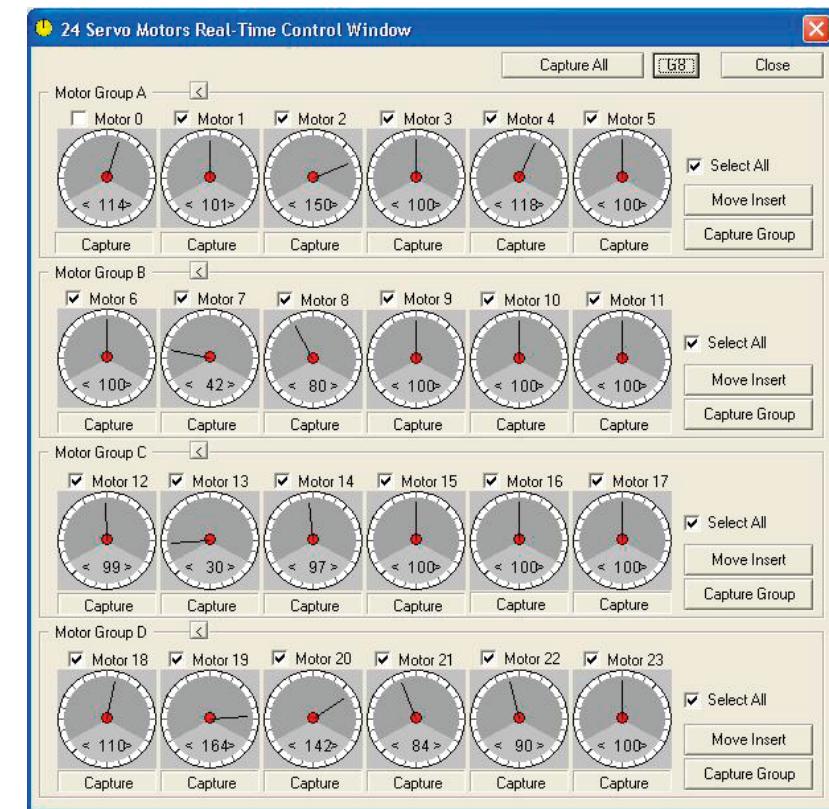


- Uncheck the #0 servo in group A. This servo will now move freely,

- Move the servo to the desired position. To save this position, hold the servo in place and click in the empty checkbox,

-To insert this position into the RoboBasic program, click the "MOVE INSERT" button. If any checkbox is empty, the position will not be inserted into the program, only a blank space,

② Mouse adjustment method



- Make sure the checkbox is checked and then either move the gauge for the desired servo or the arrows to the left and right,

As the adjustments are changed, the specific servo will move. Once it is at the desired position, click the "MOVE INSERT" button to insert the value into RoboBasic.

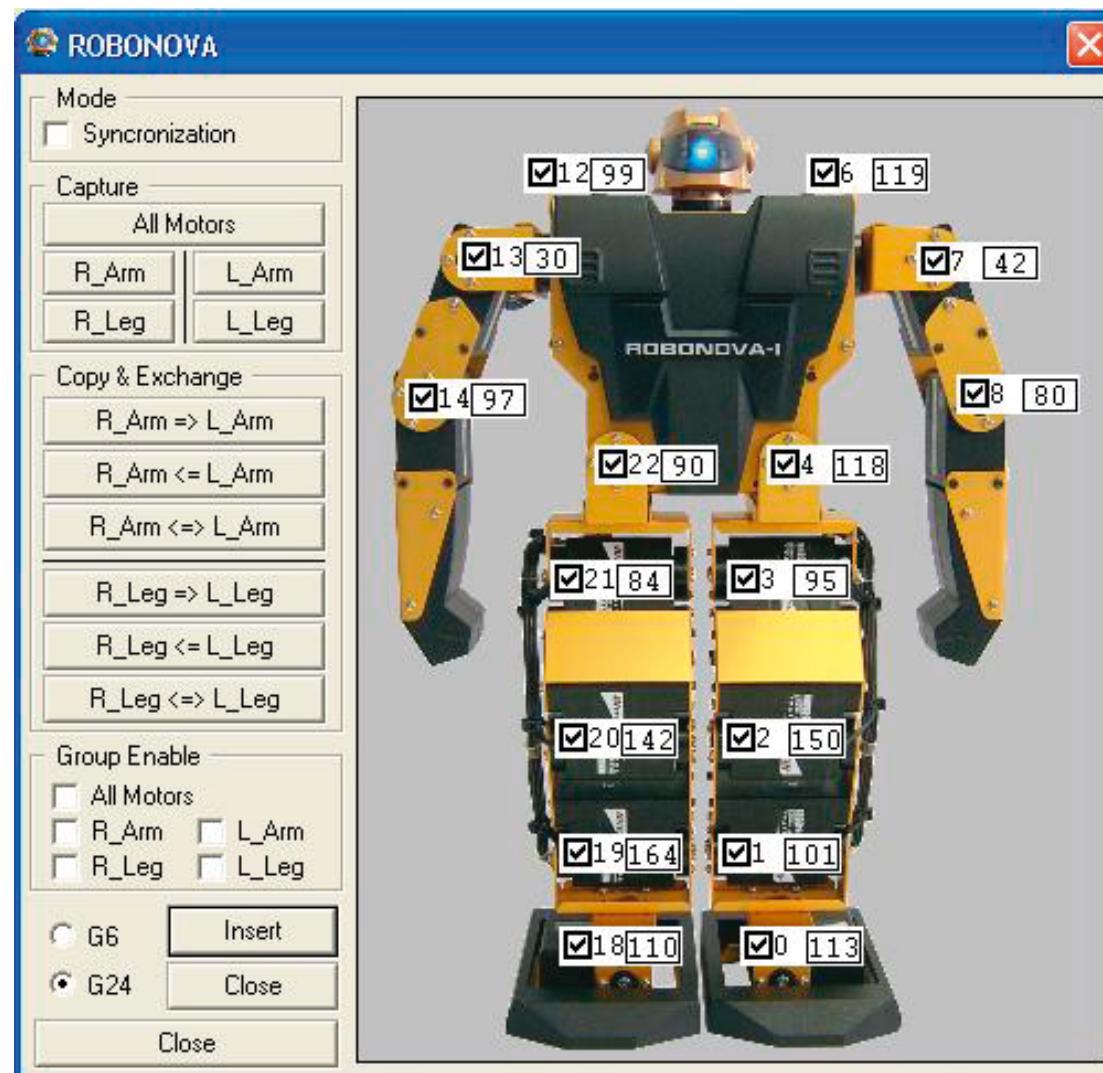
To place a checkmark in all the boxes of a group, click the "Select All" button,

To uncheck all the boxes of a group, click the "Select All" button

2) ROBONOVA-I servo motor control

- Servos can also be controlled via the ROBONOVA-I motor control.

Menu ' controller ' RoboNova motor control



- Servo motor control box: check box/servo number/ number value (angle of servo)

Each servo can be controlled by clicking the servo motor control box.

(8) Direct line control

- This is used to run just one line in the program.

The screenshot shows the RoboBASIC v2.5 software interface. At the top, the menu bar is visible with 'File', 'Edit', 'Search', 'View', 'Set', 'Compile', 'Controller', 'Window', and 'Help'. The 'Controller' menu is open, showing options like 'Servo Motor Real Time Control F7', 'ROBONOVA Motor Control Ctrl+F7', 'Direct Line Control F5', 'Clear Memory F4', 'Controller Run Mode', 'Controller Stop Mode', and 'Controller Reset Mode'. Below the menu, there is a code editor window containing two versions of a BASIC program. The top version is for 'RoboNova Motor Control' and the bottom version is for 'action_auto.bas'. Both versions include comments for servo direction settings, power on, and standard pose. The code uses commands like PTP SETON, PTP ALLOH, TEMP0, MUSIC, GETMOTORSET, MOTOR, GOSUB, IF, THEN, GOTO, and CONST. The bottom code also includes a REMOCON section.

```

Controller Information
Servo Motor Real Time Control F7
ROBONOVA Motor Control Ctrl+F7
Direct Line Control F5
Clear Memory F4
Controller Run Mode
Controller Stop Mode
Controller Reset Mode
2: 64, 3: 96.

0002 PTP SETON
0003 PTP ALLOH
0014 '** acter direction setting *****
0015 DIR G5A.1.0.0.1.0.0
0016 DIR G5B.1.1.1.1.1.1
0017 DIR G5C.0.0.0.0.0.0
0018 DIR G5D.0.1.1.0.1.0
0019 DIR G6A.1.0.0.1.0.0
0020
0021 'motor start position read -----
0022 TEMP0 230
0023 MUSIC "CDE"
0024 GETMOTORSET G24.1.1.1.1.0.1.1.0.0.1.1.1.0.0.1.1.1.1.0
0025 '** acter power on *****
0026 SPEED 5
0027 MOTOR G24
0028 GOSUB standard_pose
0029
0030 MAIN:
0031 'GOSUB robot voltage
0032 GOSUB tilt_prc
0033
0034 IF RR > 50 THEN GOTO action_proc
0035
0036 IF RR = 0 THEN GOTO MAIN1
0037
0038 ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21
0039 GOTO main_exit
0040
0041 MAIN1:
0042 A = REMOCON(1)
0043 A = A - ID
0044 ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21
0045 GOTO MAIN
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1437
1
```

2. Operation of roboScript v2.5

Registered trademark

Windows is a registered trademark of the Microsoft Corporation

Notice

This manual and the RoboScript software may be changed without notice to improve performance of the product. RoboScript is registered software, making it illegal to reproduce, publish, post, transmit or distribute this manual or software without permission.

Hitec Robotics <http://www.hitecrobotics.com>

(1) About RoboScript

RoboScript is a scripting environment developed to simplify the modification and programming of RoboBASIC,

RoboScript is compatible with MS Windows 98, ME, 2000 and XP

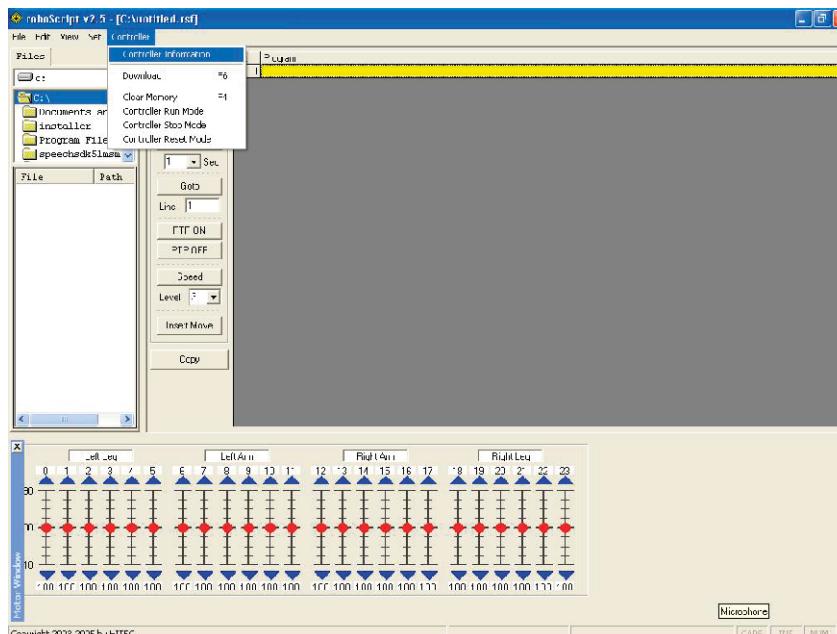
(2) Initial setup of roboScript

Connect the download cable and power to the controller then switch the unit on. Open RoboScript. The initial setup window will appear.

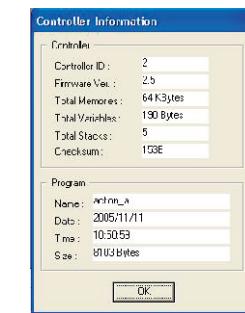
To confirm whether RoboScript is installed properly, check the controller information.

Click [Controller(C) → Controller Information]

or  icon.



If communication is established, the information about the controller is displayed in the "controller information" window.

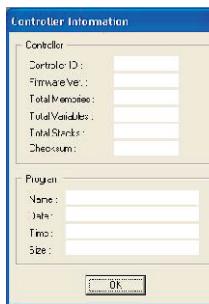


(The information about the controller is displayed)

If there is a communications failure, an error message will appear. Click the OK button.
No information will be displayed in the "controller information" window at this time.

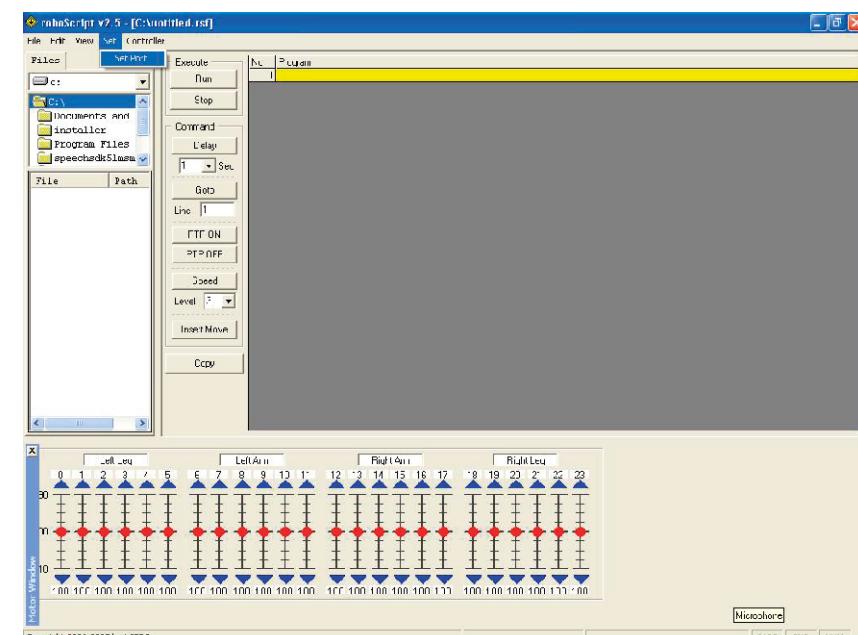


(Controller error message)

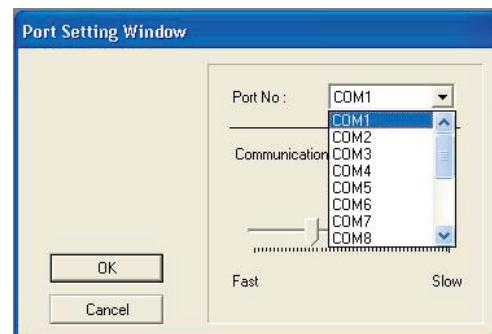


(There is no information about controller in window)

Double check that the download cable is securely attached and that there is power to the controller. Begin the setup procedure again.
Click [Setup (T) → Port setup]



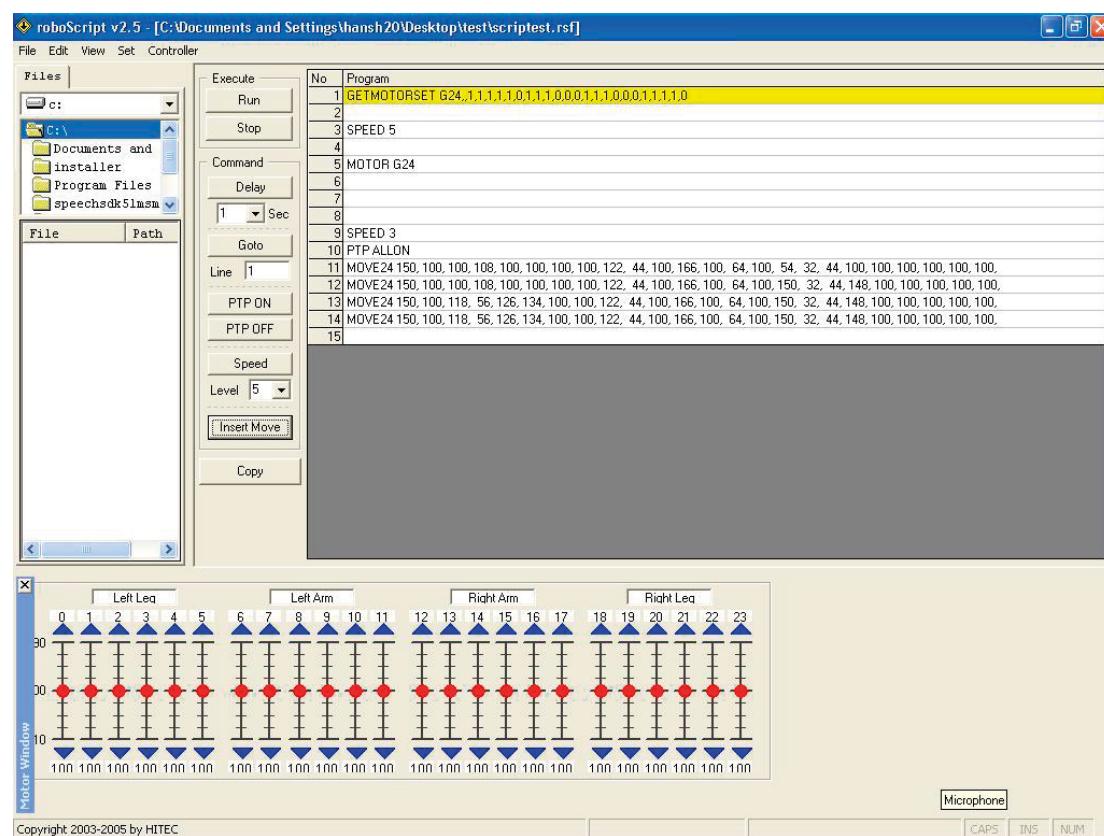
The port can be changed as needed,



(3) Programming RoboScript

With installation and setup complete, it is time to begin the programming stage,

Create a new program or open an existing file. All files will be saved with the [*.rsf] extension,

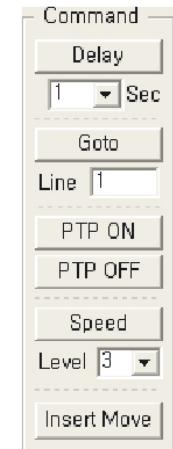


In RoboScript, it is possible to test the motion of the robot without uploading a program into the controller,

If required it can be modified and pasted back into Robobasic.



Run/Stop the created or modified program,



Delay – Set a delay time between 0,5sec to 30sec,

Goto – Insert a goto line command into the program,

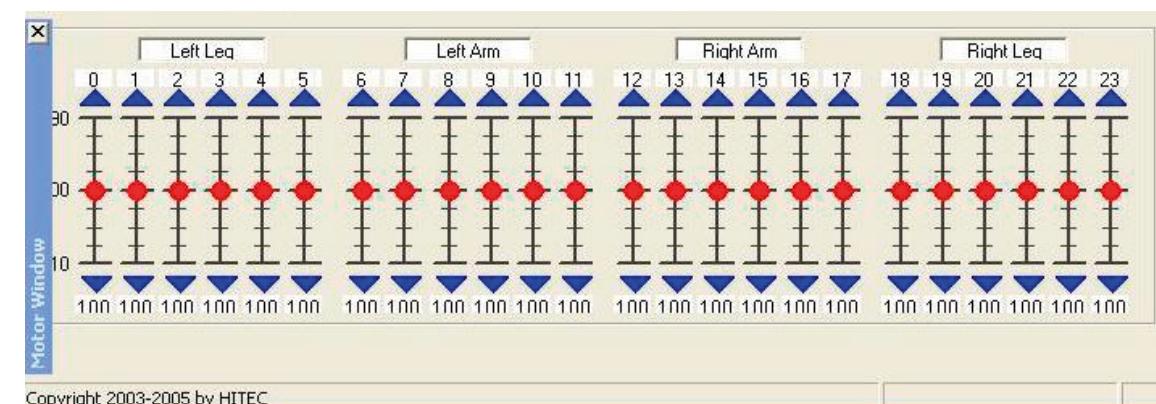
PTP – Turn the PTP function on or off,

Speed – Set the speed of the servo from 1 to 15,

Insert Move – Insert a "Move" command into the program,

Copy

Copy – Copy the program you created with the "copy" key in order to paste into Robobasic with [Ctrl+v] or [Paste]



Servo control window – Each servo can be controlled in real time by dragging the corresponding slider,
After finalizing the position of the servo, insert it into the program with the "Insert Move" key.

(3) Operation of RoboRemocon V2.5

Registered trademark

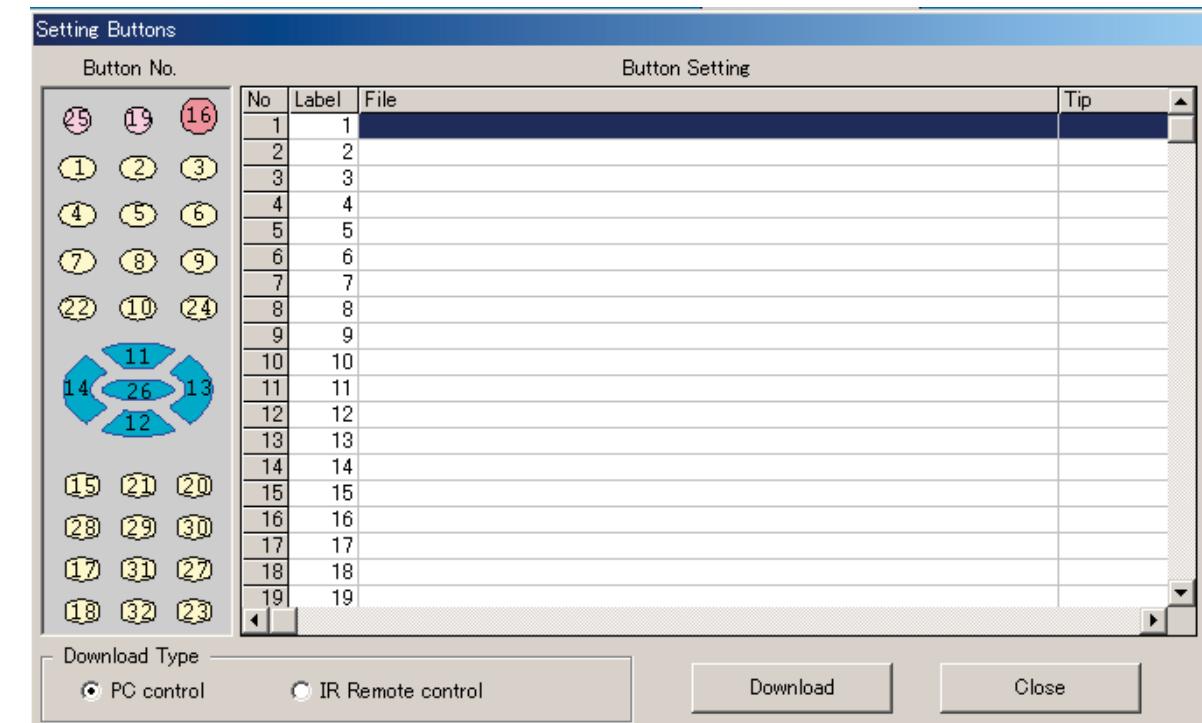
Windows is a registered trademark of the Microsoft Corporation

Notice

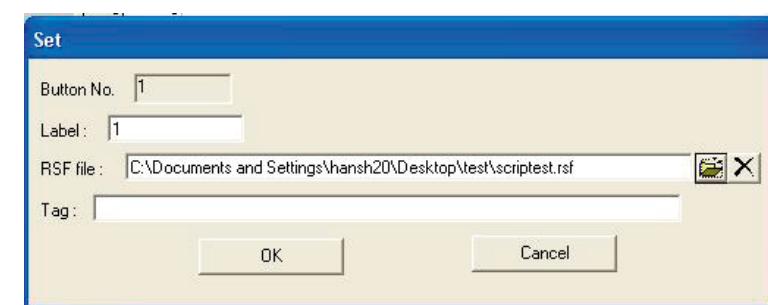
RoboRemocon is registered software, making it illegal to reproduce, publish, post, transmit or distribute this manual or software without permission.
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(1) About RoboRemocon

RoboRemocon allows wireless operation of the robot. To operate RoboRemocon, a previously created RoboScript program is required.
The handheld remote is not required to understand the concepts of the RoboRemocon software.
RoboRemocon is compatible with MS Window 98, ME, 2000 and XP



Click each button number twice in the remocon and set the function.



This picture is an example of setting the #0 button. Set the label, RoboScript file and tag of #0 button



In Download Type menu, Click "PC Control" if you want to choose ROBOREMOCON of PC program,

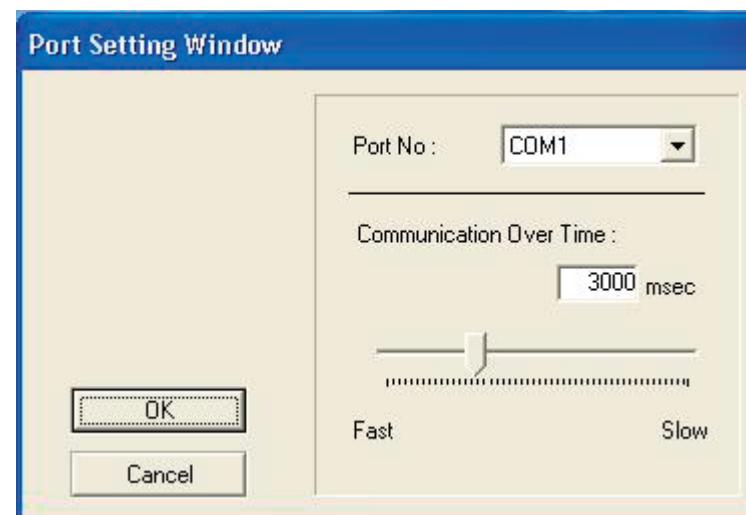


Click "IR Remote control" if you want to choose Handheld IR Remocon,

Download Download program to the controller.
Exit Close program

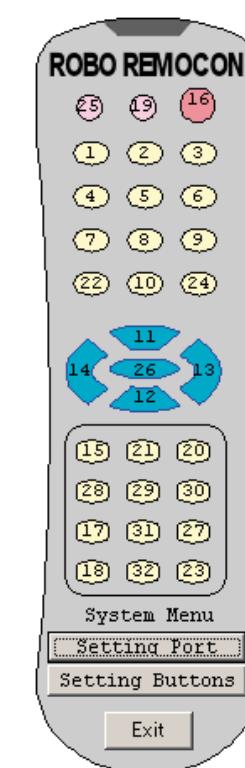
(2) Programming and Operation of RoboRemocon

To confirm whether RoboRemocon has been setup properly, check the controller information



Setup the communication port

Click **Setting Buttons** the button icon,



Click **Setting Port** the port icon,

(3) How to use RoboRemocon in RoboBasic

- Open the file "Overall Template Program.bas".

```

0001 ' action_00
0002 '== auto_main =====
0003 DIM RR AS BYTE
0004 DIM A AS BYTE
0005 DIM A16 AS BYTE
0006 DIM A26 AS BYTE
0007
0008 CONST ID = 0      ' 0:0, 1:32, 2:64, 3:96,
0009
0010 RR = 0
0011
0012 PTP SETON
0013 PTP ALION
0014
0015 '== motor direction setting =====
0016 DIR G6A,1,0,0,1,0,0
0017 DIR G6B,1,1,1,1,1,1
0018 DIR G6C,0,0,0,0,0,0
0019 DIR G6D,0,1,1,0,1,0
0020
0021 '== motor start position read =====
0022 TEMPO 230
0023 MUSIC "CDE"
0024 GETMOTORSET G24,1,1,1,1,1,0,1,1,1,0,0,0,0,1,1,1,0,0,0,0,1,1,1,1,1,1,0
0025
0026 '== motor power on =====
0027 SPEED 5
0028 MOTOR G24
0029 GOSUB standard_pose
0030
0031 MAIN:
0032   'GOSUB robot_voltage
0033   GOSUB tilt_proc
0034   IF RR > 50 THEN GOTO action_proc
0035   '
0036   IF RR = 0 THEN GOTO MAIN1
0037
0038   ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15
0039   GOTO main_exit
0040
0041 MAIN1:
0042   A = REMOCON(1)
0043   A = A - ID
0044   ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15.

```

DIM RR AS BYTE // The declaration RR is used as a ROBOREMOCON variable.

RR =0 // Initialize RR as 0

MAIN:

```

IF RR> 50 THEN GOTO action_proc
IF RR=0 THEN GOTO MAIN1          //Jump to MAIN1 since RR = 0

MAIN1:
A = REMOCON(1)
A = A - ID
ON A GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8.....,
GOTO MAIN

```

Since the variable RR is initialized as 0, the HITEC REMOCON can be used.
When a signal from RoboRemocon is perceived, the value of RR will change sending the program to the sub-routine MAIN.

```

MAIN:
'GOSUB robot_voltage
GOSUB tilt_proc

IF RR > 50 THEN GOTO action_proc
IF RR = 0 THEN GOTO MAIN1

ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12
GOTO main_exit
'
```

Execute each value (K1,K2...) with ON RR GOTO.

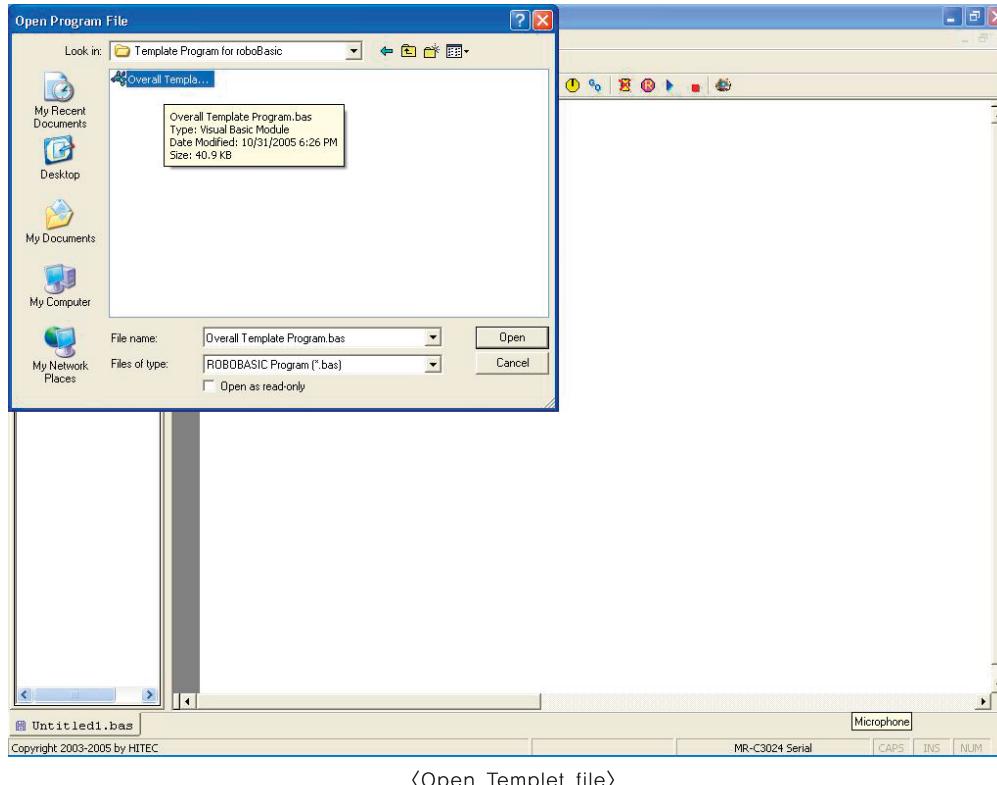
(Refer to the Table in IR REMOCON operation)

VI. Application of Program

1. Installation and Operation of the Template Program

(1) Installation of the Template Program

Open the "Overall Template Program.bas" file in the "Template Program for roboBASIC" folder of the CD.



(2) Ways to change the Template Program

The program is divided into 3 parts:

1) Basic Program settings

```

0002 '== auto_main =====
0003 GOTO AUTO
0004 FILL 255,10000
0005
0006
0007 DIM RR AS BYTE
0008 DIM A AS BYTE
0009 DIM A16 AS BYTE
0010 DIM A26 AS BYTE
0011
0012 CONST ID = 0      ' 0:0, 1:32, 2:64, 3:96.
0013 RR = 0
0014
0015 PTP SETON
0016 PTP ALLOAN
0017
0018
0019 '== motor direction setting =====
0020 DIR G6A,1,0,0,1,0,0
0021 DIR G6B,1,1,1,1,1,1
0022 DIR G6C,0,0,0,0,0,0
0023 DIR G6D,0,1,1,0,1,0
0024
0025 '== motor start position read =====
0026 TEMPO 230
0027 MUSIC "CDE"
0028 GETMOTORSET G24,1,1,1,1,0,1,1,1,0,0,0,1,1,1,1,1,1,0
0029 '== motor power on =====
0030 SPEED 5
0031 MOTOR G24
0032 GOSUB standard_pose
0033
0034 MAIN:
0035 'GOSUB robot_voltage
0036 'GOSUB tilt_proc
0037
0038 IF RR > 50 THEN GOTO action_proc
0039
0040 IF RR = 0 THEN GOTO MAIN1
0041
0042 ON RR GOTO MAIN1,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21,K22,K23,K24,K25,K26,K27,K28,K29,K30,K31,K32
0043 GOTO main_exit
0044

```

GOTO AUTO

FILL 255,10000 ' Store the Template program in address 10000 of the MR-C3024 controller's memory

Ex)

```
GETMOTORSET G24,1,1,1,1,0,1,1,1,0,0,0,1,1,1,0,0,0,1,1,1,1,0
SPEED 5
MOTOR G24
```

```
ACTION 1
DELAY 1000
ACTION 2
```

DIM RR AS BYTE 'The first variable declared in the RoboBasic program is used with RoboRemocon.

CONST ID =0 'The HITEC IR REMOCON (w/ ID function) can handle 4 remocons and 4 ROBONOVA's at the same time without interference.

' EX: CONST ID =1 (ID No.1)

IF RR > 50 AND RR < 83 THEN GOTO action_proc

'When the input value is between "50 and 83" due to being controlled by RoboRemocon, jump to "action_proc"

For other commands used within the Template, refer to the Template command list.

```

2) MAIN
MAIN:
'GOSUB robot_voltage
GOSUB tilt_proc

IF RR > 50 THEN GOTO action_proc
IF RR = 0 THEN GOTO MAIN1

ON RR GOTO MAIN1,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21,:GOTO main_exit

MAIN1:
A = REMOCON(1)
A = A - ID
ON A GOTO MAIN1,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21,K22,K23,K24,K25,K26,K27,K28,K29,K30,K31,K32
GOTO MAIN

action_proc:
A = RR - 50
ON A GOTO MAIN1,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21,K22,K23,K24,K25,K26,K27,K28,K29,K30,K31,K32
RETURN

```

MAIN is a very important function of the ROBONOVA-I software.

The command 'GOSUB robot_voltage' is annotated in the first line of the sub-routine MAIN.

This command is for low voltage warning.

(Refer to section VI.program application'2. ROBOBASIC programming application '(7) Low Voltage Warning setup)

To use this command delete the ')' symbol and the low voltage warning (6,25v) function will be activated

GOSUB robot_tilt 'When the robot falls down, this command will make it stand up (tilt sensor is required).

IF RR = 0 THEN GOTO MAIN1 'When RR does not receive any signal, jump to MAIN1.

MAIN1:

```

A = REMOCON(1)
A = A - ID
ON A GOTO MAIN,
K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K14,K15,K16,K17,K18,K19,K20,K21,K22,K23,K24,K25,K26,K27,K28,K29,K30,K31,K32
GOTO MAIN
```

'MAIN1: is the sub-routine allowing the HITEC REMOCON to control the robot.

'The values from the remocon are saved into variable A. But the ID value is different. The statement, A=A-ID allows the motion applicable to each remocon key.

3) Motion function and remocon key

```

0064 =====
0065 k1:
0066   GOSUB bow_pose
0067   GOSUB standard_pose
0068   GOTO main_exit
0069 k2:
0070   GOSUB hans_up
0071   DELAY 500
0072   GOSUB standard_pose
0073   GOTO main_exit
0074 k3:
0075   GOSUB sit_down_pose
0076   DELAY 1000
0077   GOSUB standard_pose
0078   GOTO main_exit
0079 k4:
0080   GOSUB sit_hans_up
0081   DELAY 1000
0082   GOSUB standard_pose
0083   GOTO main_exit
0084 k5:
0085   GOSUB foot_up
0086   GOSUB standard_pose
0087   GOTO main_exit
0088 k6:
0089   GOSUB body_move
0090   GOSUB standard_pose
0091   GOTO main_exit
0092 k7:
0093   GOSUB wing_move
0094   GOSUB standard_pose
0095   GOTO main_exit
0096 k8:
0097   GOSUB right_shoot
0098   GOSUB standard_pose
0099   DELAY 500
0100  GOSUB left_shoot
0101  GOSUB standard_pose

```

4) Individual motion

```

0234      RETURN
0235 =====
0236 sit_down_pose16:
0237   IF A16 = 0 THEN GOTO standard_pose16
0238   A16 = 0
0239   SPEED 10
0240   MOVE G6A, 100, 151, 23, 140, 101, 100
0241   MOVE G6D, 100, 151, 23, 140, 101, 100
0242   MOVE G6B, 100, 30, 80, 100, 100, 100
0243   MOVE G6C, 100, 30, 80, 100, 100, 100
0244   WAIT
0245 === motor power off ===
0246   MOTOROFF G24
0247   TEMPO 230
0248   MUSIC "FEDC"
0249   RETURN
0250 =====
0251 standard_pose16:
0252   TEMPO 230
0253   MUSIC "CDE"
0254   GETMOTORSET G24,1,1,1,1,1,0,1,1,1,0,0,0,1,1,1,0,0,0,1,1,1,1,1,0
0255 === motor power on ===
0256   MOTOR G24
0257   A16 = 1
0258 =====
0259   SPEED 10
0260   GOSUB standard_pose
0261   RETURN
0262 =====
0263 =====
0264 bow_pose:
0265   MOVE G6A, 100, 58, 135, 160, 100, 100
0266   MOVE G6D, 100, 58, 135, 160, 100, 100
0267   MOVE G6B, 100, 30, 80, : , : , :
0268   MOVE G6C, 100, 30, 80, : , : , :
0269   WAIT
0270   DELAY 1000
0271   RETURN

```

To assign an individual operation to a key on the remocon, create the operation and insert it into the key sub-routine for the chosen remocon key.

Ex: Create an individual operation and assign it to a key. The following routine will make the LED blink.

```

LED_TOGGLE:
  OUT 52,1
  DELAY 1000
  OUT 52,0
  DELAY 1000

```

When the routine is finished, link it to a key on the remocon.

Delete the current contents in sub-routine k18 in "action_auto.bas". Insert the following commands,

K18:

```

GOSUB LED_TOGGLE
GOTO main_exit

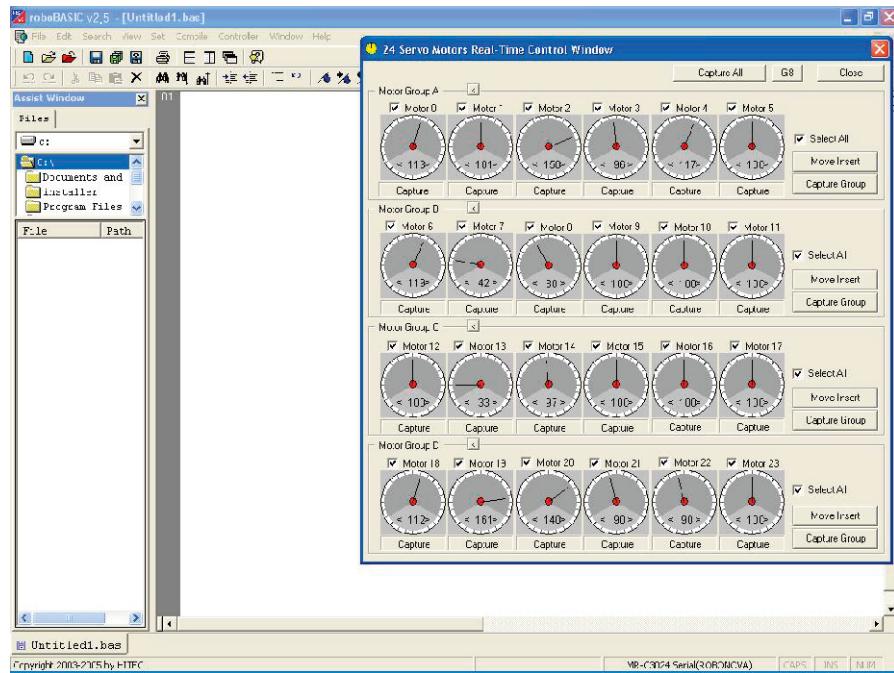
```

Click the "Run All" (integrated execution) button to upload to the controller.

Push the 'E' button on the remocon and the light will start blinking.

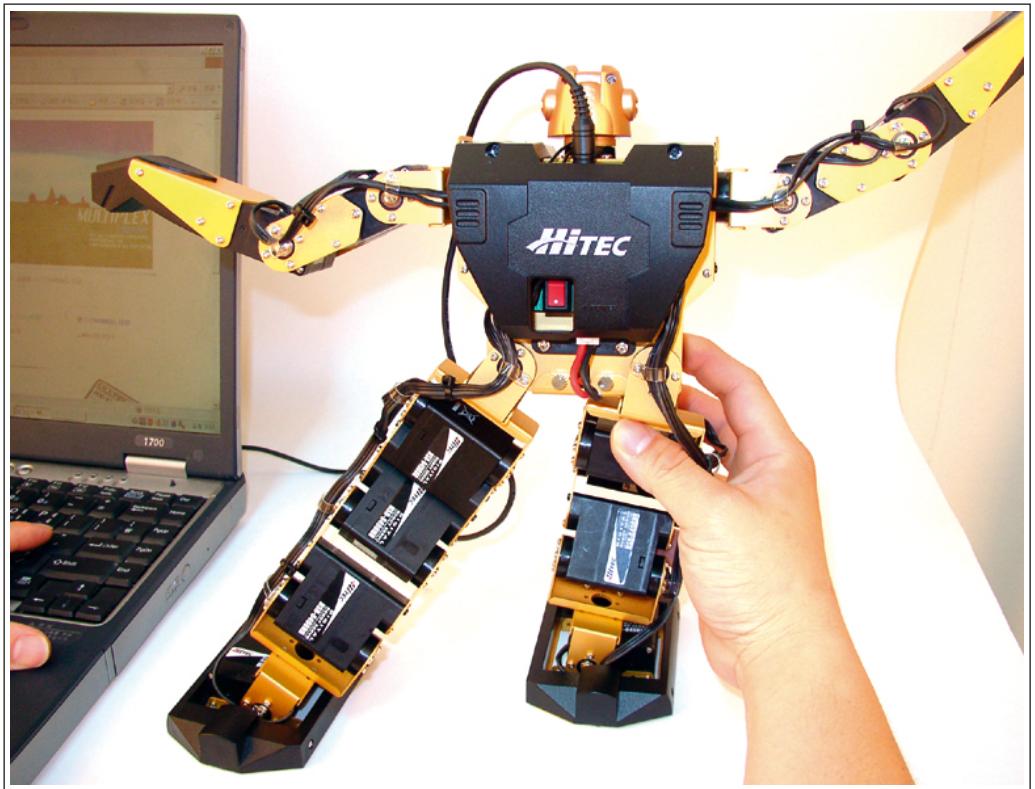
2. Programming Applications

(1) Motion capture and its embodiment

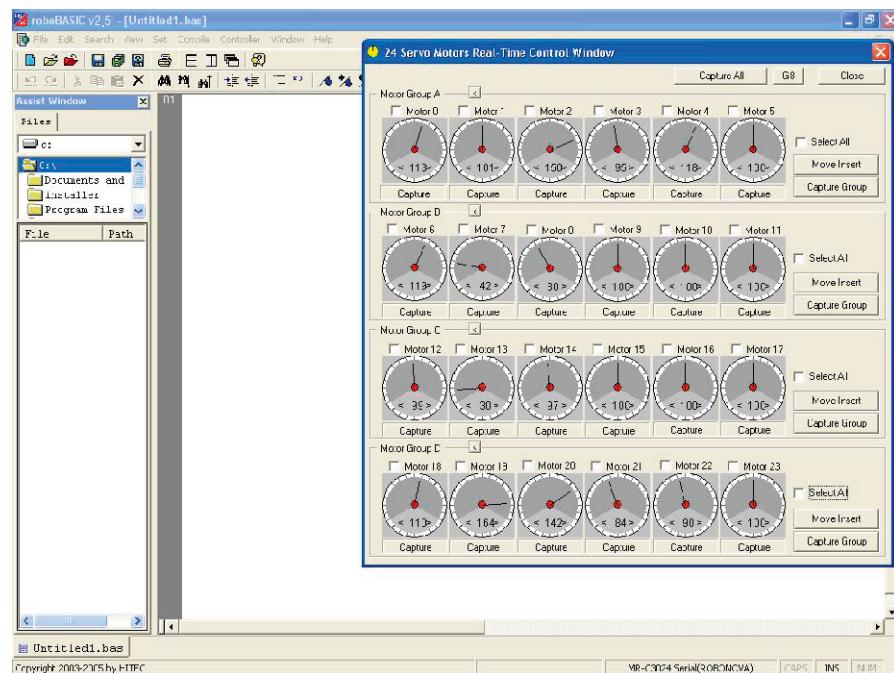


<This picture is an example of the angle controls for each motor group >

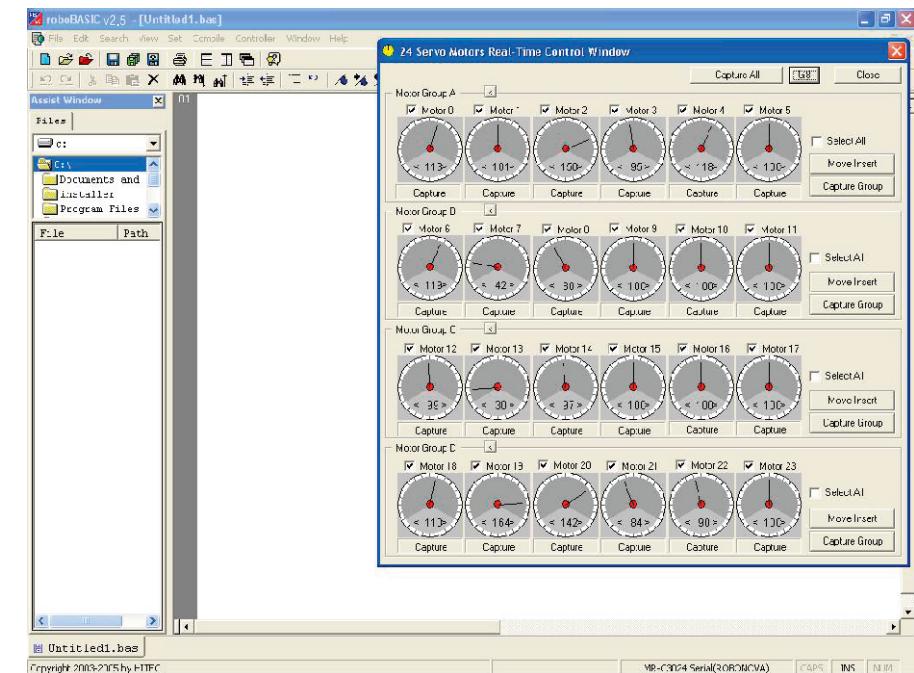
- Turn the robot on after connecting it to the serial cable and a PC.
- Menu ' Compile ' Servo motor real time control
- The current angle values of the servos are displayed .

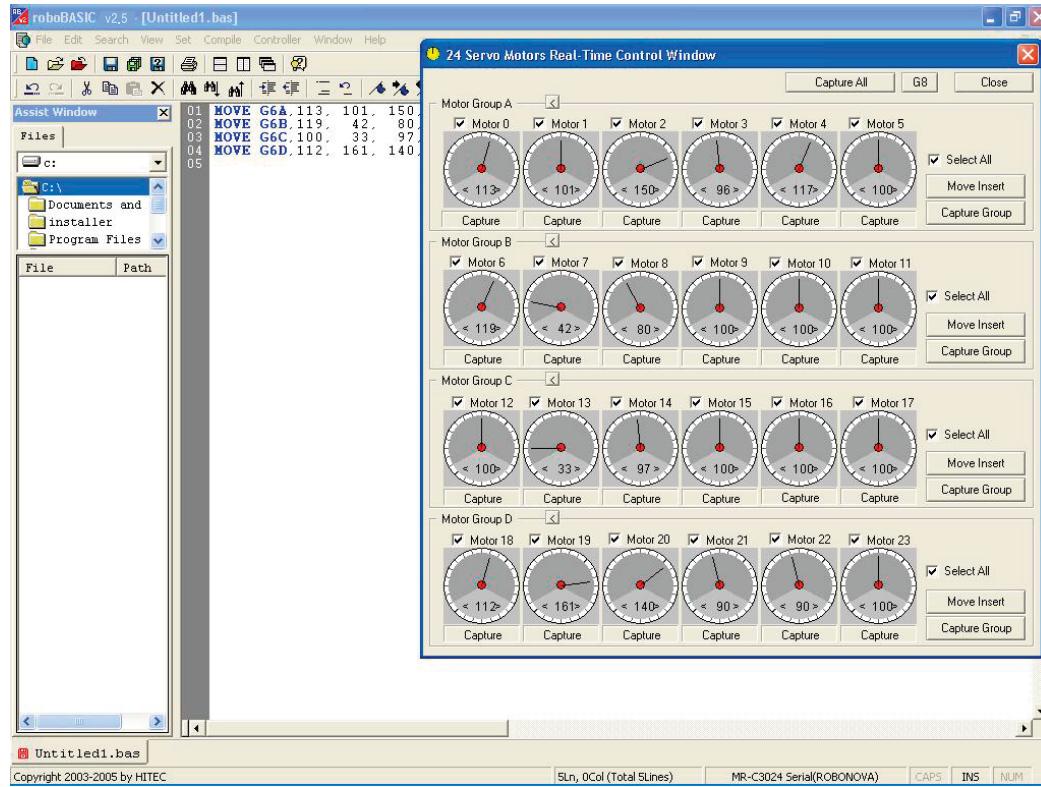


< At this time the servos move freely. Move them to the desired position and then place a check in the checkbox. The new position will be set and the servos will no longer move freely. >



<To create a motion, uncheck the checkbox of the servo or servos involved in the motion.
To uncheck all the servos in a motor group, click the "Select All" button. >

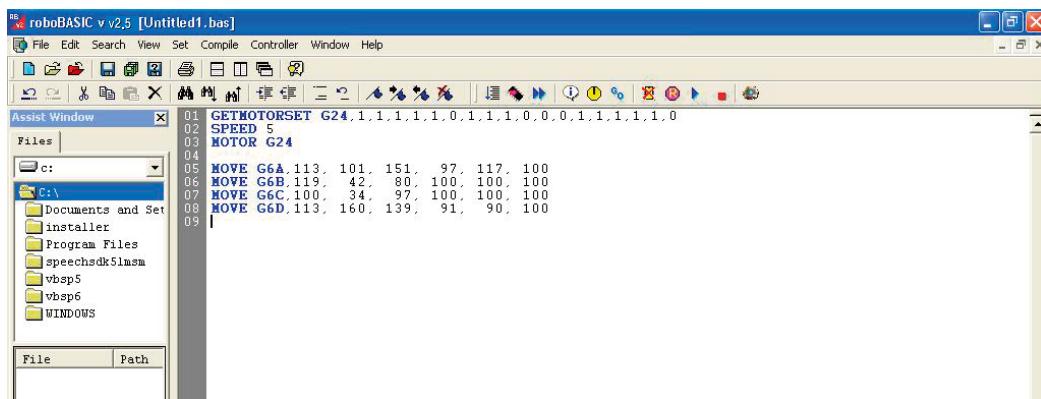




⟨Click the "motion insert" button to insert the motion into RoboBasic.⟩

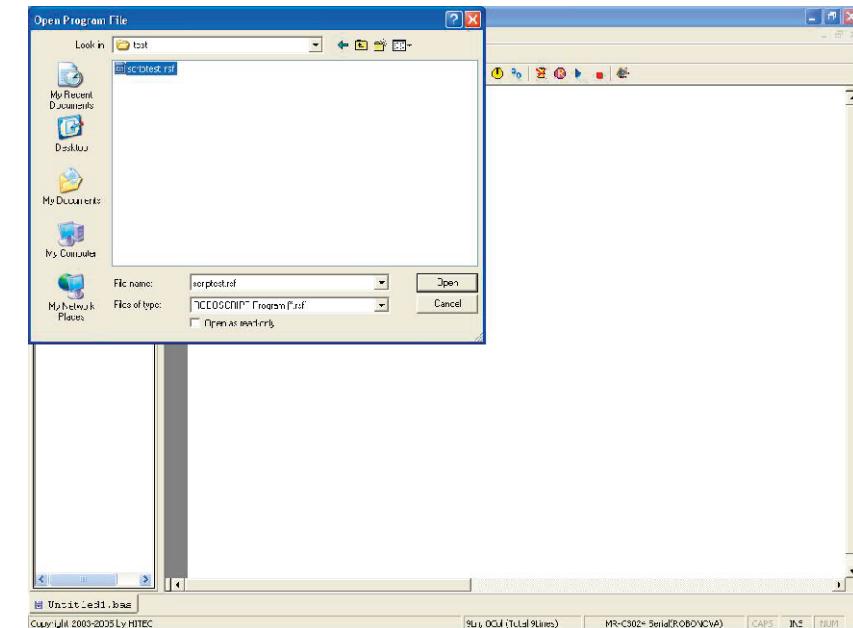
To execute the created movement, the following command must be inserted before it. This command can be copied from the template program and pasted or manually typed by the user.

GETMOTORSET G24,1,1,1,1,1,0,1,1,1,0,0,0,1,1,1,0,0,0,1,1,1,1,1,0
SPEED 5
MOTOR G24



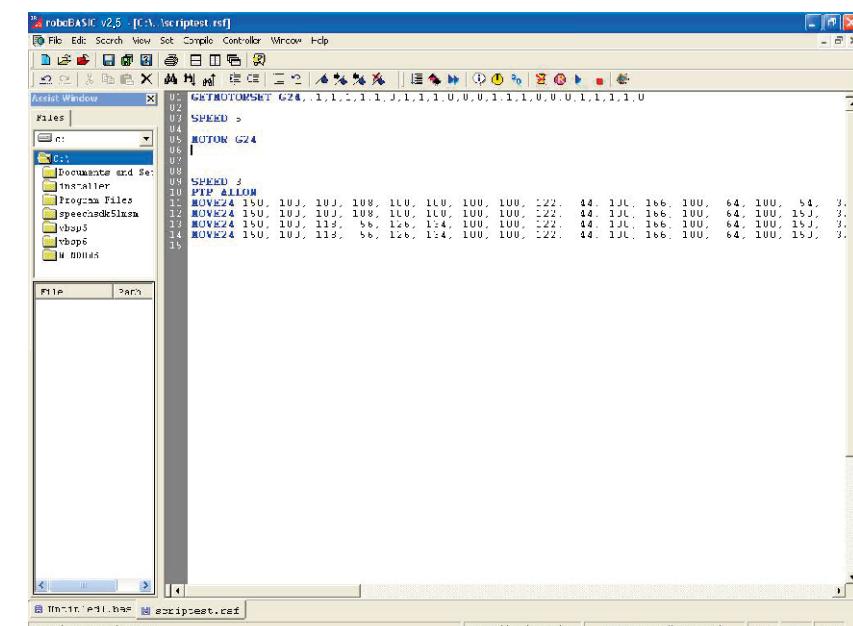
When finished, click the "Run All" (integrated execution) button and motion will be uploaded to the controller. The robot will now perform the created motion.

(2) How to IMPORT A ROBOSCRIPT FILE



<Open *.rsf file>

- Open a RoboScript file (*.rsf) in RoboBasic.



⟨ Inserted commands in the RoboBasic program ⟩

Add the following commands before the imported RoboScript commands.

GETMOTORSET G24,1,1,1,1,1,0,1,1,1,0,0,0,0,1,1,1,0,0,0,0,1,1,1,1,1,0
SPEED 5
MOTOR G24

Click the "Run All" (integrated execution) button to upload to the controller.

(3) AD Conversion
The AD command is explained again in "Chapter 11, RoboBasic analog signal process command explanation" which is in the CD manual

AD()

Analogue signal from the AD Port is converted into a Digital signal.

Sentence structure

AD ([AD Port])

Explanation of command

There are eight AD Ports, numbered from zero to seven, in the MR-C3000 series controllers (Digital In-Out Ports 32 to 39), that convert an analogue signal from external sensors or devices into a digital signal. Constants and byte variables are used for [AD Port].

Example of command

In the following example, a value is outputted to a LCD module after receiving an analogue signal from AD port No. 1.

```

MAIN:
    DIM a AS BYTE
    LCDINIT
    CLS
    CSOFF
    a = AD (1)
    LOCATE 5,0
    PRINT FORMAT(a,DEC,2)
    GOTO MAIN

```

Declare byte variable "a".
Use of LCD module is initialized.
All data on LCD screen is cleared.
The cursor disappears.
A label named MAIN is declared.
The value inputted in AD Port #1 is saved as variable "a".
The cursor is located at 5,0 on the LCD
The inputted value, a, is outputted to the LCD module as two digits using the decimal system.
Go to MAIN.

(4) Gyro settings

- Gyros can connect to AD ports 0,1,2,3,4,5,6,7.
- When a GWS-PG03 (GWS) gyros is used, a maximum of 4 gyros are allowed at one time.
- When a KRG-1 (Kondo) gyro is used, normal mode must be selected from the two modes (Robot Mode/default value, Normal Mode). For detailed information, inquire of the gyro manufacturer.

The Gyro function is explained again in "Chapter 11, RoboBasic analog signal process command explanation" which is in the CD manual

GYRODIR

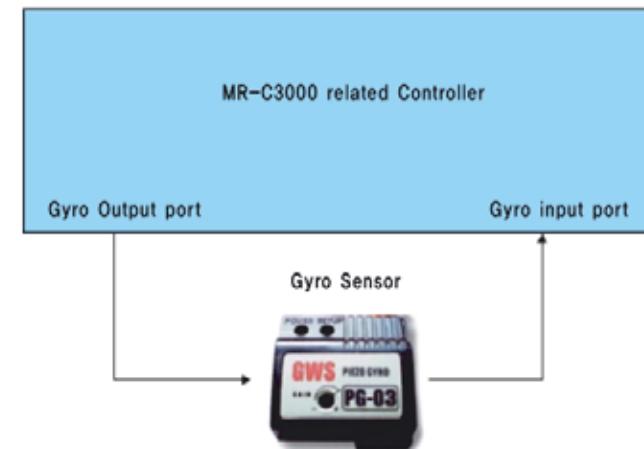
Sets direction of servos when supported by a Gyro.

Sentence structure

GYRODIR [Group], [Motor Direction] ...

Explanation of command

This process controls the direction of a servo group when a gyro is connected to an AD port of the MR-C3000 series controllers. The number of gyros that can be used is four. Refer to the following chart.



AD Port Number (Digital In and Out Port Number) of MR-C3000 series controller.	Gyro Port
Port #0 (Port #32)	Gyro #1 channel output Port
Port #1 (Port #33)	Gyro #2 channel output Port
Port #2 (Port #34)	Gyro #3 channel output Port
Port #3 (Port #35)	Gyro #4 channel output Port
Port #4 (Port #36)	Gyro #1 channel input Port
Port #5 (Port #37)	Gyro #2 channel input Port
Port #6 (Port #38)	Gyro #3 channel input Port
Port #7 (Port #39)	Gyro #4 channel input Port

Since a gyro is reversible, the specific direction should be determined from the present value of the servo. [Motor Direction] is either a "0" or "1". A value of 1 will increase the servo position and a 0 will decrease it.

Example of command

GYRODIR G6A, 1, 1, 0, 0, 1, 0

GYROSET

Determines which gyro will control a particular servo group.

Sentence structure

GYROSET [Group], [Motor N Gyro] ...

Explanation of command

Gyroset determines which servo in a servo group [Group] is controlled by a specific gyro.
[Motor N Gyro] is the specific gyro port being used for each servo in the group. Refer to the example below.

Example of command

GYROSET G6B, 1, 1, 2, 2, 0, 0
 #6 servo receives Gyro sensor #1 and processes it.
 #7 servo receives Gyro sensor #1 and processes it.
 #8 servo receives Gyro sensor #2 and processes it.
 #9 servo receives Gyro sensor #2 and processes it.
 #10 and #11 servos do not use Gyro sensor.

GYROSENSE

Sets servo sensitivity to a Gyro.

Sentence structure

GYROSENSE [Group], [Motor N Gyro Sensitivity] ...

Explanation of command

Four gyros can be connected to the MR-C3000 series controller.
GYROSENSE sets a single servo's sensitivity to a gyro.
[Motor N Gyro Sensitivity] uses numerals from 0 to 255 or constants to control sensitivity of each servo in a group.
A setting of "0" will not change servo sensitivity. As the value increases so does the servos response to the gyro.

Example of command

GYROSENSE G6A, 100, 100, 255, 255, 50, 50
 #0 and #1 servo set to 100 of Gyro sensitivity.
 #2 and #3 servo set to maximum (255) of Gyro sensitivity.
 #4 and #5 servo set to 50 of Gyro sensitivity.

- 1) How to connect GWS, KRG-1 gyros
- * Gyro port #1: AD0, AD4
- * Gyro port #2: AD1, AD5
- * Gyro port #3: AD2, AD6
- * Gyro port #4: AD3, AD7

Ex:

#1, #2, #3 servo motor in group A and #1, #2, #3 servo motor in group D are using #1 gyro

#1, #2, #3 servo motor in group A and #1, #2, #3 servo motor in group D are using 0 gyro direction

#1, #2, #3 servo motor in group A and #1, #2, #3 servo motor in group D are using gyro sensitivity 250,200,250

⟨Code for a GWS gyro⟩

```
GYROSET G6A,0,1,1,1,0,0
GYROSET G6D,0,1,1,1,0,0
```

```
GYRODIR G6A,0,0,0,0,0,0
GYRODIR G6D,0,0,0,0,0,0
```

```
GYROSENSE G6A, 0, 250, 200,250, 0, 0
GYROSENSE G6D, 0, 250, 200,250, 0, 0
```

⟨ Code for a KRG-1 gyro ⟩

```
' KRG-1
(normal version : If any questions, ask manufacturer)
' Write 1
(module number of KRG-1) ahead of gyro channel number.
(Module number of GWS gyro is 0 but 0 can be omitted)
' Write gyro channel number after module number

' "10" means not using a gyro.
' Using #1 channel gyro "11"
' Using #2 channel gyro "12"
' Using #3 channel gyro "13"
' Using #4 channel gyro "14"
```

```
GYROSET G8A,11,10,10,10,10,10,10,10,10
GYROSET G8B,10,10,10,10,10,10,10,10,10
GYROSET G8C,10,10,10,10,10,10,10,10,10
GYROSET G8D,10,10,10,10,10,10,10,10,10
'.....
GYROSENSE G8A,255,1,1,1,1,1,1,1,1
GYROSENSE G8B,1,1,1,1,1,1,1,1,1
GYROSENSE G8C,1,1,1,1,1,1,1,1,1
GYROSENSE G8D,1,1,1,1,1,1,1,1,1
```

```
GYRODIR G8A,1,1,1,1,1,1,1,1,1
GYRODIR G8B,1,1,1,1,1,1,1,1,1
GYRODIR G8C,1,1,1,1,1,1,1,1,1
GYRODIR G8D,1,1,1,1,1,1,1,1,1
```

(5) How to use I2C
 This is a form of communication interface.
 This can be used when there are 2 ports available
 to receive and transmit a signal.

```
CONST scl =22
CONST sda =23
```

```
dim A as byte
```

```
'=====
I2C_SAMPLE:
=====
```

```
a = IN(sda)
```

```
s1: OUT scl,0
```

```
OUT scl,1
```

```
'=====
s3: OUT sda,0
```

```
OUT scl,0
```

```
OUT scl,1
```

```
'=====
OUT sda,1
```

```
OUT scl,0
```

```
OUT scl,1
```

```
OUT sda,0
```

```
OUT scl,0
```

```
OUT scl,1
```

```
OUT sda,1
```

```
OUT scl,0
```

```
OUT scl,1
```

```
'=====
CODE = 0
```

```
FOR I = 0 TO 7
```

```
OUT SCL,0
```

```
OUT SCL,1
```

```
A = IN(SDA)
```

```
A = A<<1
```

```
CODE = CODE OR A
```

```
NEXT I
```

```
'=====
RETURN
```

```
'=====
```

(6) Pulse of HMI Protocol

HMI (Hitec Multi-protocol Interface) is a newly created interface for the HITEC programmable robot servos.
(For more detailed programming of the servos, an optional settings kit is required.)

*The following information can be of use to high-end users as it concerns the pulse data.
This pulse data is required for location (angle) feedback between HITEC robot servos and a PC.

The servos will execute a specified movement when four kinds of pulses are inputted from an outside source.

- 1) 50usec pulse width / Location (angle) value feedback
- 2) 100usec pulse width / Use servo parameter 1 value (default)
- 3) 150usec pulse width / Use servo parameter 2 value
- 4) 200usec pulse width / Use servo parameter 3 value

Note: To use the location (angle) feedback with an external circuit, the control signal terminal must have bidirectional functions. To read the feedback value, a pull-up process must be performed in the signal line.

Control signal 50usec



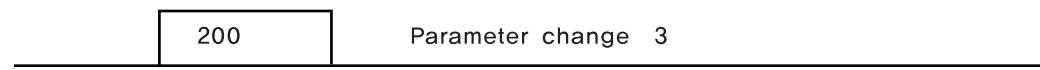
Control signal 100usec



Control signal 150usec



Control signal 200usec



Note: The feedback function has a 10% error rate since this function is used in conjunction with the PWM control.

(7) LOW-VOLTAGE WARNING setup

When the battery voltage of ROBONOVА-I drops to a certain point, the LED of ROBONOVА-I installed in head will blink to alert the user that battery recharging is needed immediately.

The default low voltage value is 5,8V. This can be changed via the programming.

```
0029 '=====
0030 MAIN:
0031 'GOSUB robot_voltage
0032 GOSUB tilt_proc
0033
0034 IF RR > 50 THEN GOTO action_proc
0035 '
0036 IF RR = 0 THEN GOTO MAIN1
0037
0038 ON RR GOTO MAIN,K1,K2,K3,K4,K5,K6,K7,K8,K9,K10,K11,K12,K13,K
0039 GOTO main_exit
0040 '
```

Delete annotation command ('') from 'GOSUB robot_voltage found in the MAIN sub-routine

Ex: Change 'GOSUB robot_voltage to GOSUB robot_voltage

```
'=====
robot_voltage:           [ 10 x Value / 256 = Voltage]
DIM v AS BYTE
A = AD(6)
IF A < 148 THEN          ' 5.8v
FOR v = 0 TO 2
OUT 52,1
DELAY 200
OUT 52,0
DELAY 200
NEXT v
RETURN
```

Move to the robot_voltage sub-routine.

To change the low_voltage value, insert the following command;

IF A < [value] THEN
(In this example, value = voltage*256/10)

Ex: If the new low voltage value is 6,0v, the [value] will be 153,6 ($6.0 *256/10 = 153.6$). Since RoboBasic cannot calculate decimal points, 153 is used.

IF A< 153 THEN
 $6.0 *256/10 = 153.6 = 153 \rightarrow$ IF A< 153 THEN

3. Low voltage schematic

