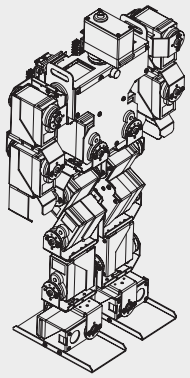
Hardware Manual

KHR-1



KONDO
KONDO KAGAKU CO., LTD.

Safety Information

This product is an assemble kit. Almost responsibility of use is belonging to user.Please use the kit recognizing this point.

Precautions are classified into Warning and Caution according to their bearing on safety.

Read the Warning, Cuation and Note thoroughly before attempting to assemble the kit.

Descriptions of Warning, Caution and Note

Danger	Danger: Applied when there s a danger of the user death or severe injury or when there is a severe damage of property if the approved procedure is not observed.
Warning	Warning: Applied when there is a danger of the user death or being injured or when there is a damage of both the user being ijured and the equipment being damaged if the approved procedure is not observed.
Caution	Caution: Applied when there is user being injury or there is equipment being damaged.

Following figure calls attention as each description.

	Prohibit: Applied to prohibit action
	Compulsory: Applied to compulsory action

⚠ Danger

Assemble the kit in enough space and in healty condition.

Prohibited When there is a danger of death or severe injury by accident.

⚠ Warning

Keep away from small children

Prohibited Alminum frames has sharp edge.

Unplug NiCd battery in the abnormal case.

The battery is broken, Any liquid is leaked. Flame, smoke, smell or heat up abnormally.

It may occur fire or shock.
Please call or send e-mail to our customer service.

Never break battery charger and cables.

Never scratch, remodeling, or melt the cable. Never use under stressed condition.

Prohibited It may occur fire or shock.
Repair of cables can be supported by custoer service.

Remove battery charger from plug not in use.

To avoid short circuit.
Keep plug clean.

Never disassemble remodeling servo motors and boards.

Prohibited

Probihit disassemble and remodeling besides of instructions in this manual.
Wrong remodeling and disassemble may occur fire or shock.
Call customer service for repair.

Never use in wet environment

Prohibited

The kit consists of precision instruments.It may be in trouble.
It may occur fire, short circuit or shock.
Call customer service if the kit is moistened with water and so on.

Pay attention to robot performance and safety.

Safety of the robot performance is not guaranteed because of assemble kit. Different perfromance may occur by misoperation. It may occur user being ijured on finger or being broken bone.

Pay attention to short circuit of parts.

RCB-1 are made short circuit easily because of no protection. Mis-plug and short circuit may fire NiCd battery or cables.

⚠ Caution

The kit is designed for domestic use in Japan.

Prohibited

Depending on country or region, it requires procedure to use obeying to law.
Out of service for abroad.

Handle connector of battery charger and cables with care.

If the line is pulled, the breaking of a wire and short circuit may occur fire or shock.

Never use the robot unstable place.

Prohibited

The robot may fall down on unbalance. User may be injured by hit the robot.

Ni-Cd

NiCd battery can be recycle. Please confirm waste of NiCd battery to your community.Thank you for your cooperation

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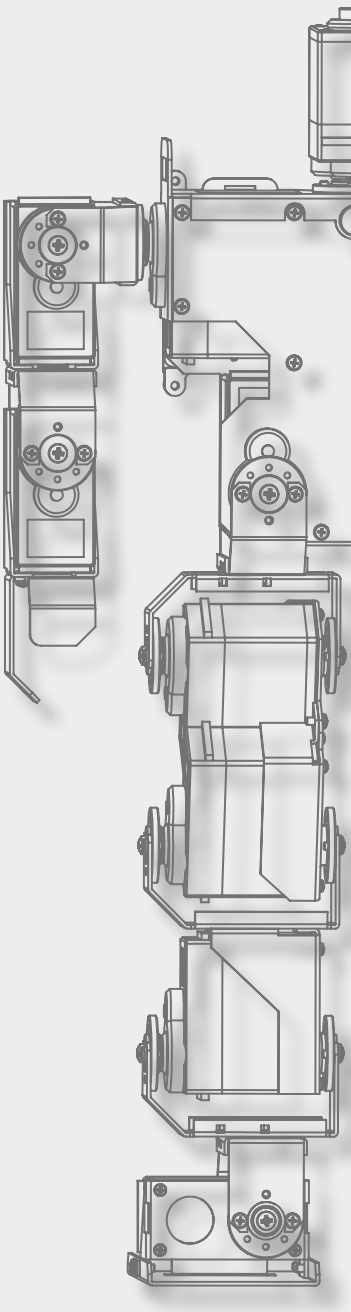

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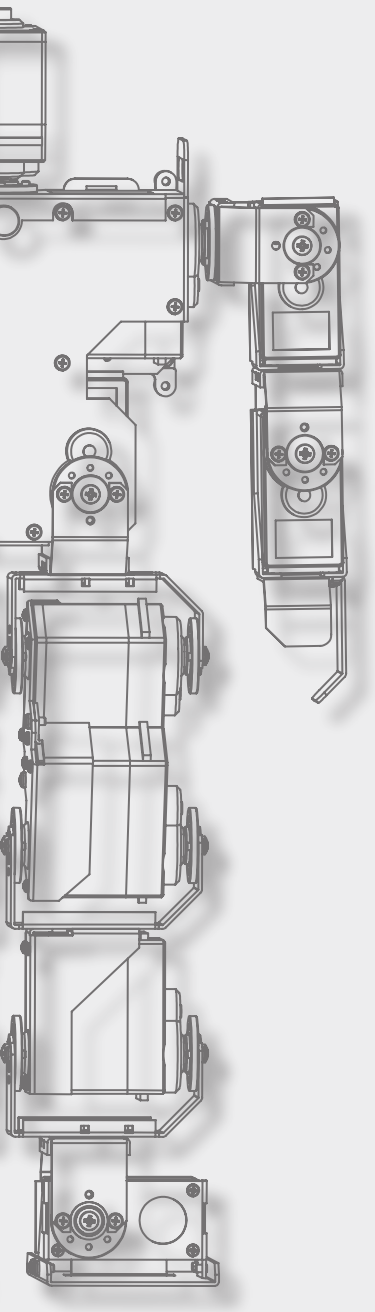

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goto PartsList

Introduction

Thank you for buying our product.
This is reasonable humanoid robot kit for bipedal locomotion.
Please read carefully to make robot for safety.
We recommend to copy this manual harddisks on your PC or to print out to refer, if you need.

Before use

1 **This product is assemble kit. It is no guarantee of performance of robot. Depending on accuracy of assemble, it is hardly possible to answer to question of robot performance.**

2 **This product is made to enjoy humanoid robot for various age.**
However, some of parts are hard to assemble for children because this is not a toy.
Please help them to assemble or understanding robot and robot performance.

3 **Knowledge to use PC and Windows is a precondition to read this manual. It has a software to set up and to make performance on PC with RS232C port. The software requres Windows 2000 or latest version. (It is impossible to answer about question of your PC and Windows.)**

Tools

Please prepare PC and tools to assemble a robot which are shown in following list.

PC

OS: MicroSoft Windows2000 or XP

RS-232C Port(※)

CD-ROM Drive (for installation software and manual)

Printer (If user want to print out these manuals.)

※ USB/RS232C adapter can be used if your PC doesn't have RS-232C port. Depending on combination of PC, OS and USB, there is a case not to work software on the PC. Please refer to software manual for details. (Information to attach USB/RS232C adapter to your PC is out of our support service.)

Tools

Plus driver: This product has 1.7mm, 2mm and 2.6mm screws.

Nippers or Cutter: To remove unnecessesary projection.

Tweezers: It is useful to pick up a small screw.

About Manual

This product has three manuals.

1.Kit guidance

Paper manual (1 sheet) about description of kit and introduction of manual in PDF file.

2. Hardware manual

This manual. It is in PDF.
This is description to assemble robot hardware.

3. Software manual

Software manual is PDF in CD-ROM.
This describes software to set up and to make performance of robot.

Abstract

This manual describes procedure to assemble robot hardware.

1. Romove servo case screws
2. Attach bracket to servo motor
3. Assemble body
4. Assemble arms and legs parts
5. Attach servo hone to servo motor
6. Attach arms to body
7. Attach legs to body
8. Attach boards to body
9. Setting up
10. Organizing cables
11. Attach board cover to body

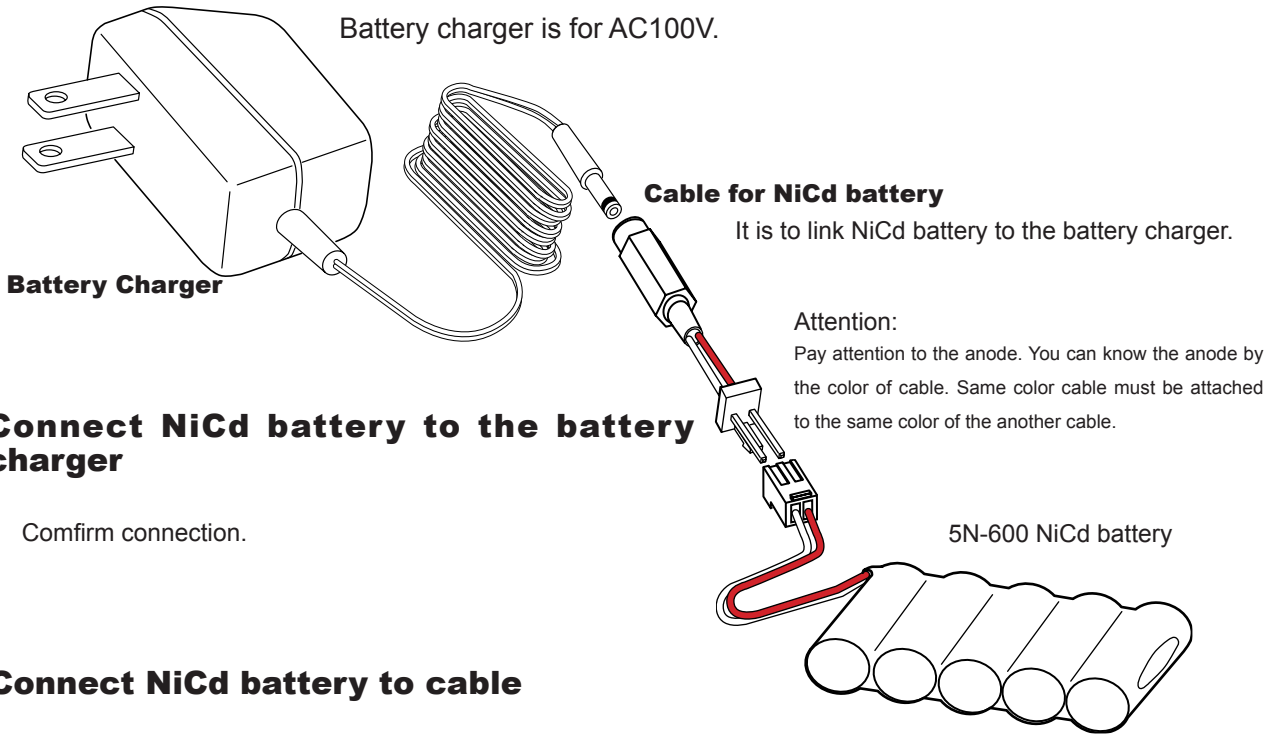
This product can be made by screwed up each parts. Howerver, procedure 5-9 uses boards to find out servo neutral position. Therefore, NiCd battery is required to work board. Please charge battery before assemble.

Each screw is tightened temporary. All screws are tightened up at the last.
If you tighten up screw at first, the position of rest screw is not in the right place.

How to handle NiCd battery?

This product uses NiCd battery for robot power source.
NiCd battery is rechargeable. Please read carefully this manual to use it safety.

Recharge

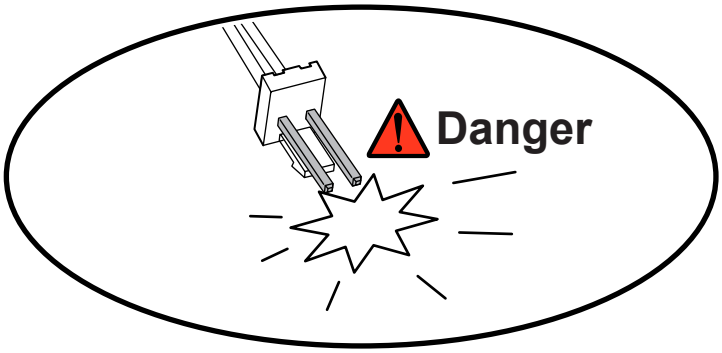


1 Connect NiCd battery to the battery charger

Comfirm connection.

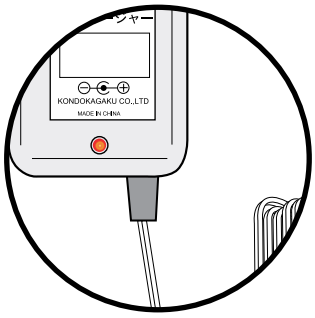
2 Connect NiCd battery to cable

Power indicator LED turns on and start to charge.
Depending on remainder, empty NiCd battery takes 12 hours to be full charge.



3 Insert the battery charger to AC100V

Warning
Both pins of terminal of connector supplies electricity. Never ground orshort circuit. Handle the ends appropriately.



Pay attention to NiCd battery during charge. Stop charging battery if you found abnormal tempreture, sound or smell.

NiCd battery Safety Information

Profhibit

Do not following action because of danger.

Remove connector from cables or boards, replace or remodeling of cables.Do not make a short circuit of NiCd battery.

Causes severe eye injury or injury by short circuit of NiCd battery. Short circuit breaks battery or flames or leaks. Handle the ends such as pins of connector appropriately.

Keep away from other parts during carrying or in strage.

※It may fire or leak from the battery if you keep or bring the battery with connector, cables, and other conductors. For example, coins, key of house or car fired with the battery. Because of short circuit.

You must operate following tasks if it may occur.

A liquid leak has been found. You must wash your hands if the liquid stuck to your skin. In the case of eye, wash your eye carefully. After wash, you must consult a doctor.

The liquid is a toxic substance. It is not only human body but also house and furnitures. In the case of eye injured, the person may lose his/her eyesight in the accident.

You must remove the battery from board or the battery charger if you leave from the battery or not in use.

Do not leave it alone. It can't be handled appropriately for fire or flame.

NiCd battery is a toxic waste. According to the article of your local region, recycle or waste the battery. If you dump garbate unlawfully, it may occur fire or severe accident or environmental pollution.

Charactoristics

NiCd has less electrical resistance comparing with other batteries. Therefore, NiCd battey can supply high electric current. When NiCd battery is repeatedly recharged without fully discharging, it progressively loses its ability to run at full capacity. To avoid the memory effect, we recommend fully discharging a battery before recharging it.

Fittings

KRS-784ICS

KRS-784ICS is the digital FET servo motor. It has been developed to drive joint of robot.
It is the basic robot servo which is inherited know-how of the servo motors for a radio control car and KRS-2346 servo motor.

* Characteristic change and position capture
* It can set parameters from outside using ICS.
* The motor can be fixed from both side of axises.

***Specifications**

Size 41x35x21(mm) excluded projections

Weight 45g

Torque 8.7kg/cm (using 5N600 power cell)

Speed 0.17sec/60degree (using 5N600 power cell)

Reasonable Voltage 6V

RCB-1

RCB-1 has been developed for this robot kit as the robot control board. A board can control 12 servo motors. It can control using all functions of our robot servo motors as KRS-784ICS (included this robot kit) and all red versions.

Specifications

Size: 45x35(mm)

Weight: 12g (1 board)

Possible number of servo motors: 12 (2 boards can be linked to control 24 servo motors.)
Reasonable Voltage: DC6V (Booster circuit keeps voltage if NiCd battery would stop discharging by low voltage.)
Scenario memory of 4 bank: You can replay 1 scenario as 200 motion replay from combination of 40 kinds of motion in maximum 100 poses.
Fully supported Red Version functions: Our robot servo motor "Red Version" can be fully controled such as characteristic change, position capture and power reduction.
Teaching function: You can make performance by teaching function using Red Version.

*You must use software on PC to use all functions.

P a r t s L i s t

Product parts list
Please refer part name to figures of parts in next pages.

P a r t s / I t e m	N u m b e r	bag	amount
Servo motor	KRS-784ICS	-	17
Battery Charger		-	1
NiCd battery	5N600AE	-	1
CD-ROM	CD-ROM (Software and manuals)	-	1
Servo hone	for KRS-784	-	17
Free hone	for KRS-784	-	17
Washer	M3	-	34
RCB-1 main board		-	2
Link cable RED	(attached to both boards)	-	1
RCB-001 PCB base		-	1
Screw for RCB-1	Nickel 2-4 pan screw	***PartsBag G***	8
Screw for PCB base	2-5 chrome pan screw	***PartsBag H***	5
Screw for RCB-002 (Board case)	2.6-6 BH Nickel tapping screw	***PartsBag H***	4
RCB-002 Board case		-	1
HR-001 Top cover		-	1
HR-002 M3-6 thumb screw		-	1
HR-003 body frame F		-	1
HR-004 body frame B		-	1
HR-005 shoulder frame		-	2
HR-006 servo bracket A		-	2
HR-007 body frame L		-	1
HR-008 hand R		-	1
HR-009 hand L		-	1
HR-010 servo bracket B		-	6
HR-011 servo arm		-	14
HR-012 foot R		-	1
HR-013 foot L		-	1
HR-014 Servo bracket C		-	2
HR-015 foot sole		-	2
Screw for hone	2.6-6BH Nickel tapping screw	***PartsBag A***	35
Screw for body	2-4 Nickel pan screw	***PartsBag B***	130
Nyron clip	AB-3N	***PartsBag C***	14
Screw for Nyron crip	2-6 BH black tapping screw	***PartsBag C***	14
Washer for Nyron crip	M2 Nickel	***PartsBag C***	14
Expanding cable(200mm)		***PartsBag D***	2
Expanding cable(100mm)		***PartsBag D***	6
Link Cable (gray)		***PartsBag D***	1
Battery link cable		***PartsBag E***	1
Extend cable for AC adaptor		***PartsBag E***	1
Adaptor for battery charger		***PartsBag E***	1
Interface cable ICS-PC Interface II		***PartsBag F***	1
Nyron band	SKB-80M	-	5
KHR-1 sticker		-	1

Parts List

These parts consists of the product.
Please confirm number of each part.


2-6 BH Black tapping screw


M2 washer


2.6-6 BH Nickel tapping screw

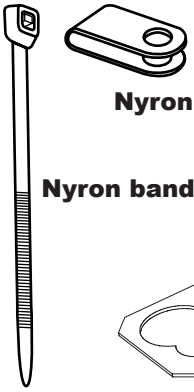

M3 washer


2-4 Nickel pan screw

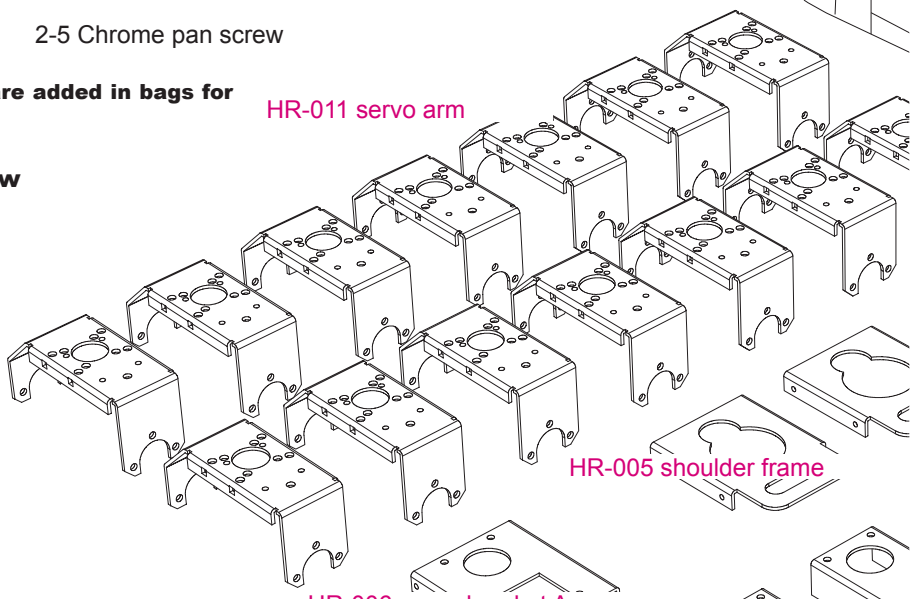

2-5 Chrome pan screw

some of screws are added in bags for spare.

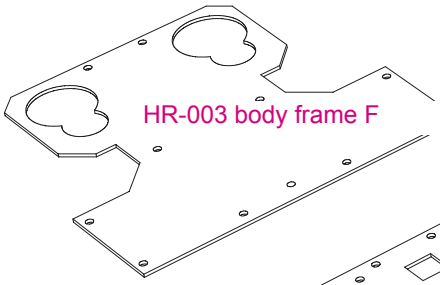

M3-6 thumb screw

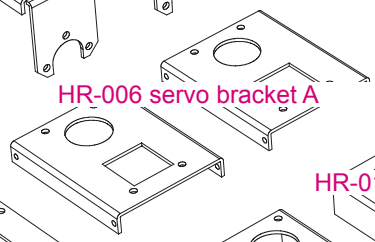

Nyron crip

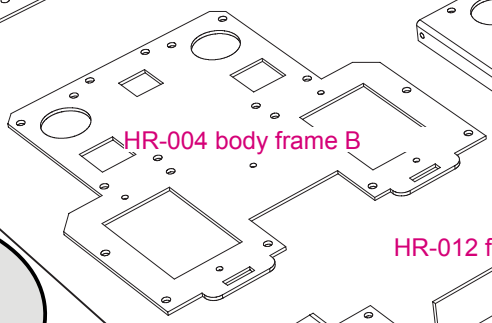
Nyron band

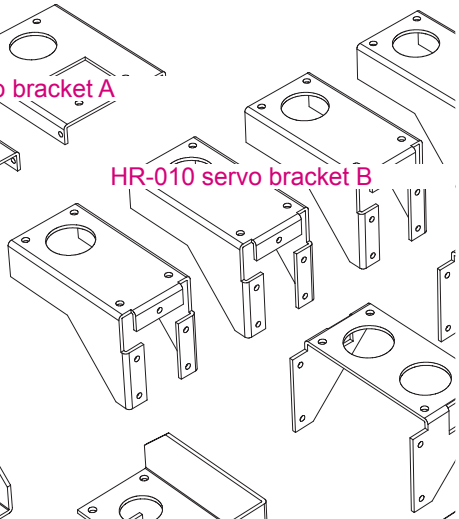

HR-011 servo arm

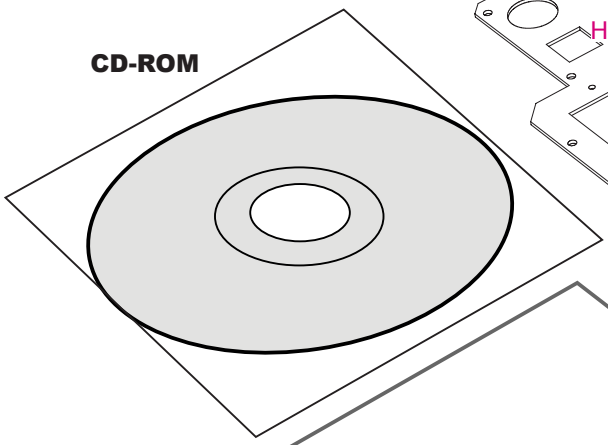
HR-005 shoulder frame

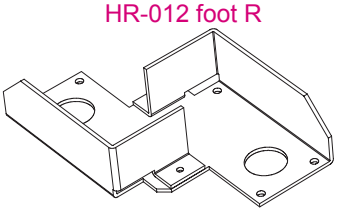

HR-003 body frame F

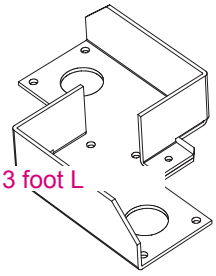

HR-006 servo bracket A

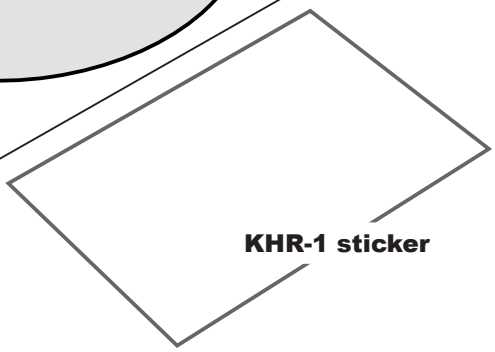

HR-004 body frame B

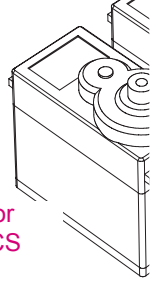

HR-010 servo bracket B


CD-ROM

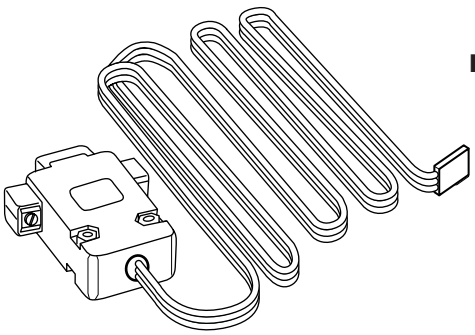

HR-012 foot R


HR-013 foot L


KHR-1 sticker

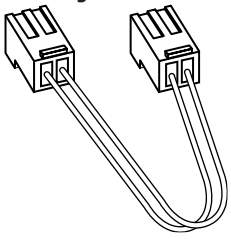

Servo motor
KRS-784ICS

ICS-PC Interface II



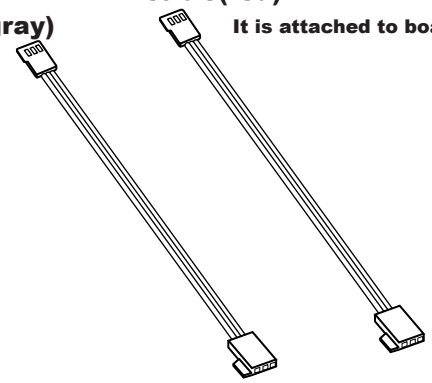
Link cable (gray)

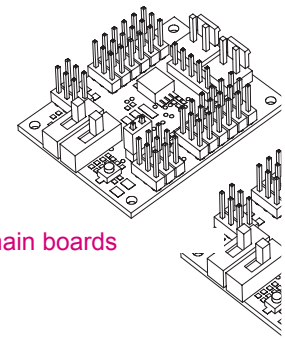
Battery link cable

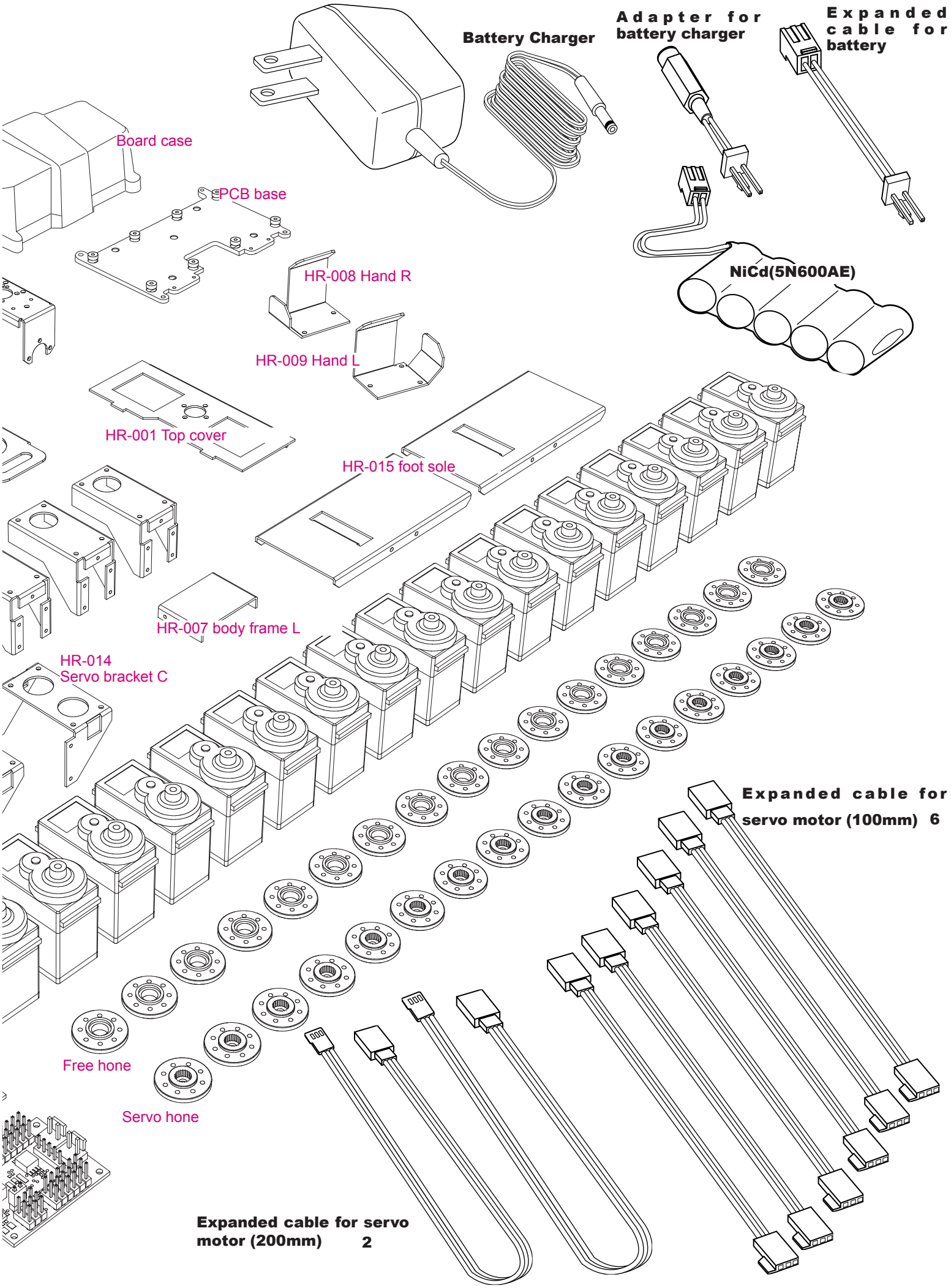


Link cable(red)

It is attached to boards.




RCB-1 main boards

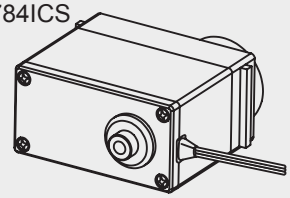

Battery Charger
Adapter for battery charger
Expanded cable for battery
Board case
PCB base
HR-008 Hand R
HR-009 Hand L
NiCd(5N600AE)
HR-001 Top cover
HR-015 foot sole
HR-007 body frame L
HR-014
Servo bracket C
Expanded cable for servo motor (100mm) 6
Free hone
Servo hone
Expanded cable for servo motor (200mm) 2

Install bracket

First of all, servo motors are attached to brackets.

Remove screws from KRS-784ICS

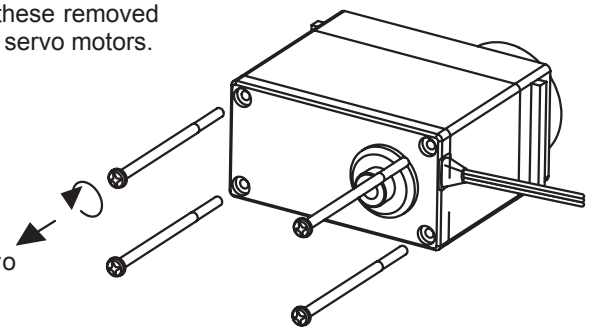
Servo motor
KRS-784ICS
16



Bracket is fixed to a servo motor by these removed screws. Screws are removed from 16 servo motors.

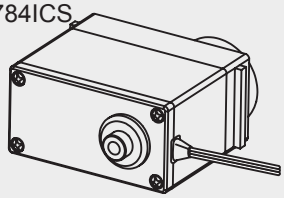
1.7-32 black screw

64 screws are removed from servo motor cases.

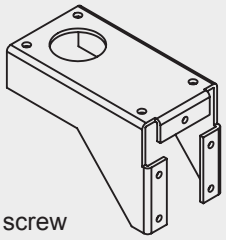


Assemble servo bracket B

Servo motor
KRS-784ICS
6



HR-010 servo bracket B
6

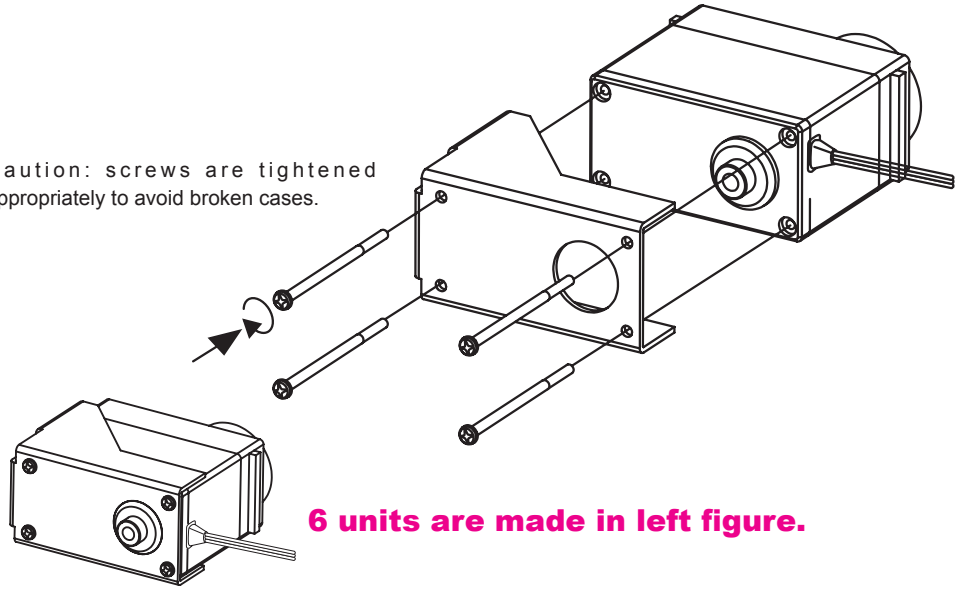


1.7-32 black screw

24

Attach bracket B to KRS-784ICS with removed screws.

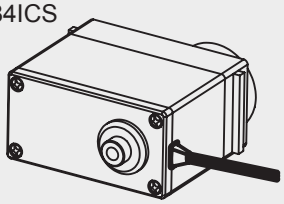
Caution: screws are tightened appropriately to avoid broken cases.



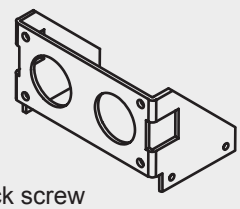
6 units are made in left figure.

Assemble servo bracket C

Servo motor
KRS-784ICS
2



HR-014 servo bracket C
2



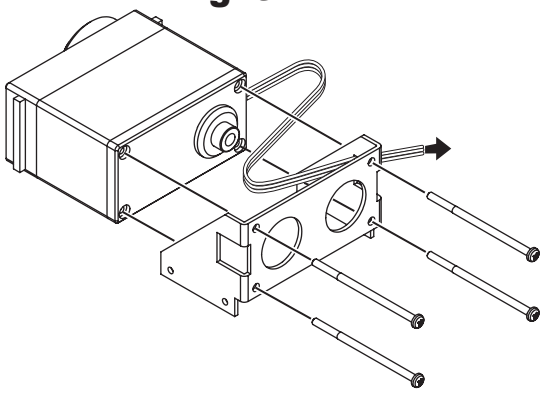
1.7-32 black screw

8

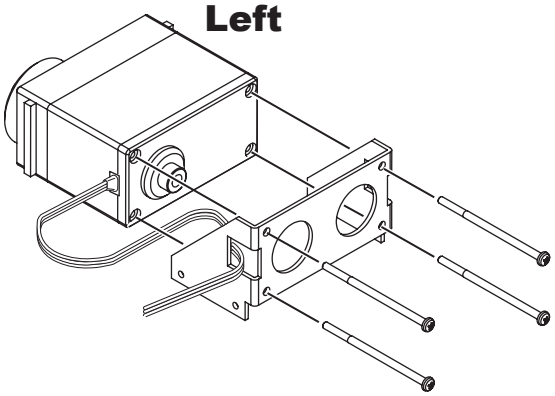
Each different direction servo bracket C is attached to each servo motor.

Cable from the servo motor is passed the bracket through the hole.

Right



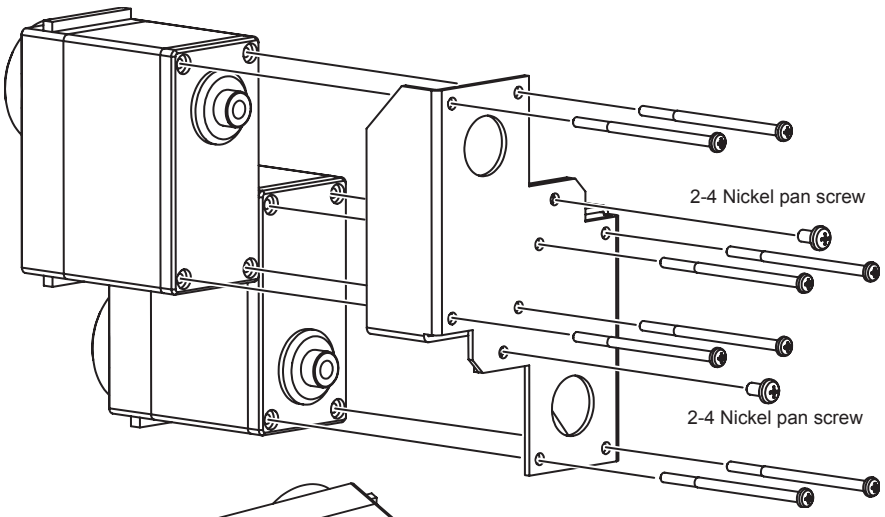
Left

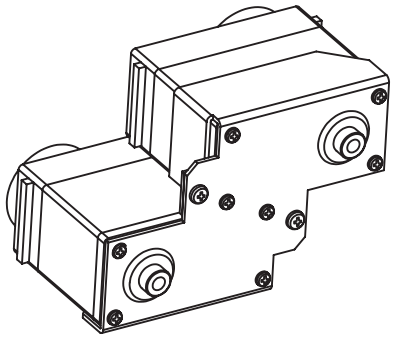


Attach bracket

These two parts are used for thigh.

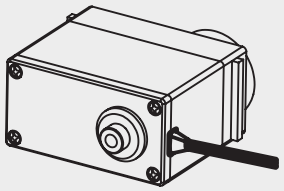
Left thigh bracket



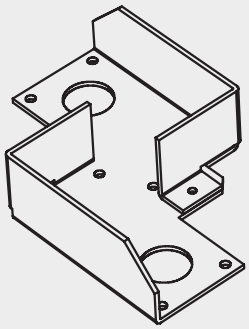


At first, all screws are tightened temporary for plural screws on the part. All screws are tightened up after each screw hole placed with screw.

Servo motor
KRS-784ICS
2



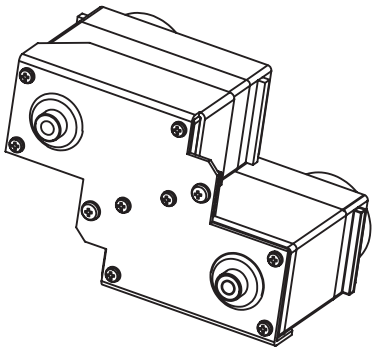
HR-012 Foot R
1

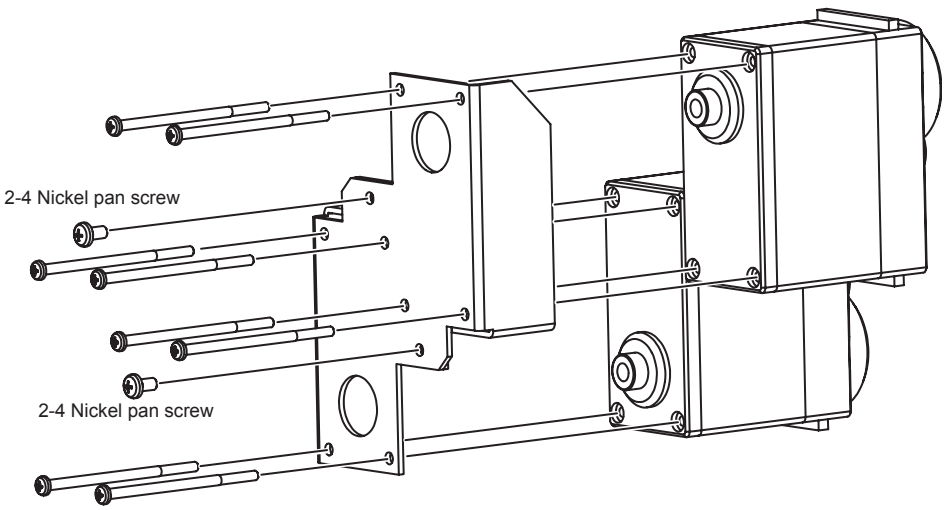


2-4 Nickel pan screw
2

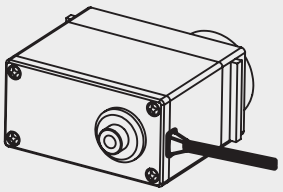
1.7-32 black screw
8

Right thigh bracket

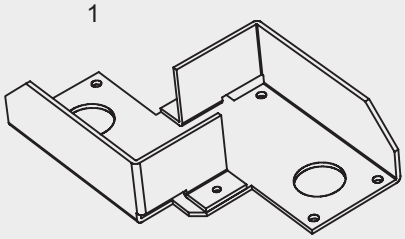




Servo motor
KRS-784ICS
2



HR-013 Foot L
1



2-4 Nickel pan screw
2

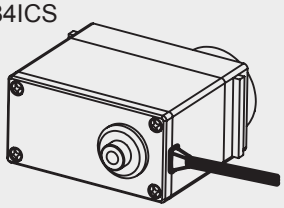
1.7-3 black screw
8

goto PartsList goto Index

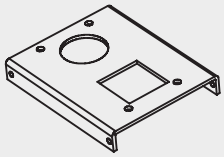
Assemble brackets

Assemble servo bracket A

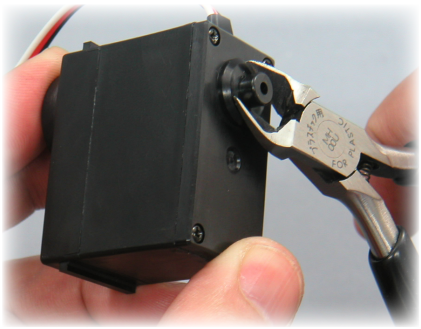
Servo motor
KRS-784ICS
2



HR-006 Servo bracket A
2

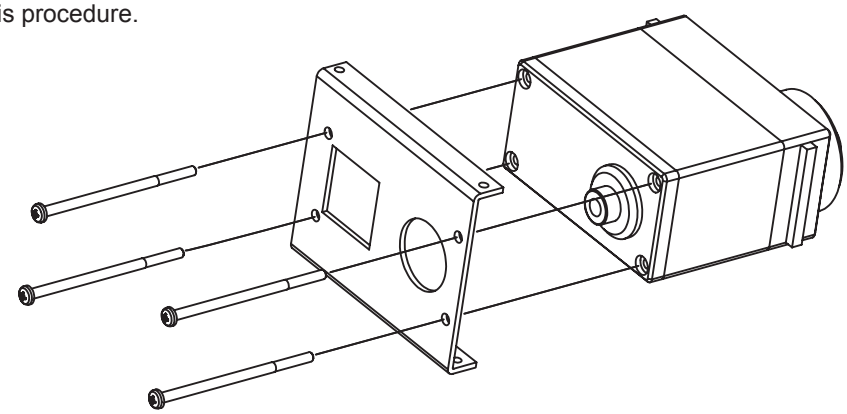


1.7-32 black screw
8



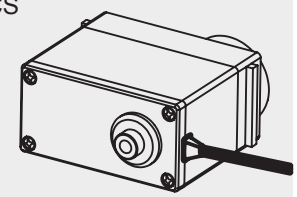
Remove projection of servo case to attach to servo bracket A.If it remains, the robot can't have battery in the body.

Servo bracket A are installed to body. 2 same units are made in this procedure.

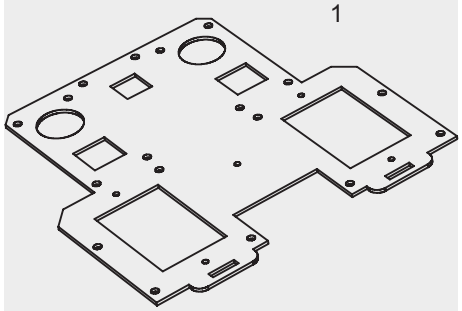


Install servo motor to body frame B

Servo motor
KRS-784ICS
2



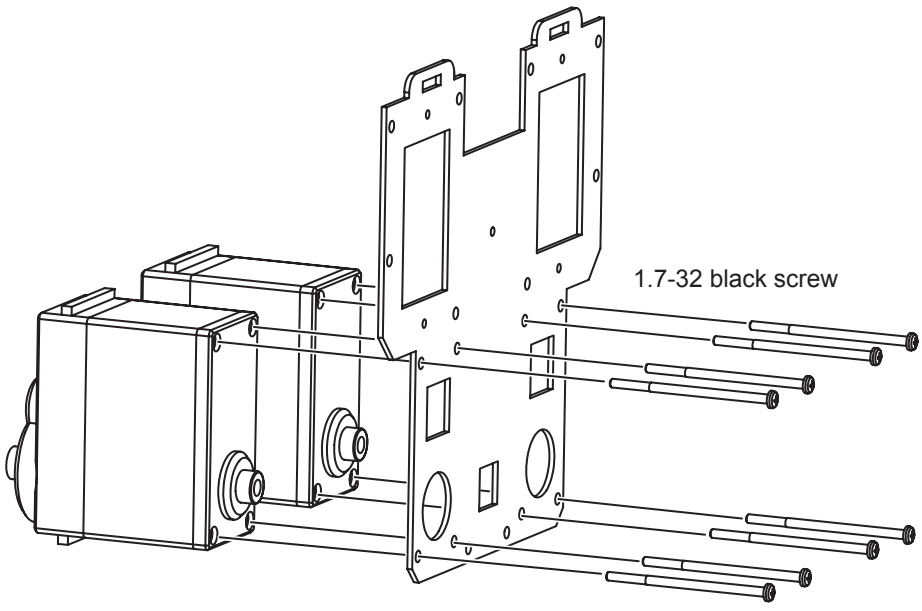
HR-004 body frame B
1



1.7-32 black screw
8

Two servo motors are installed to body frame B.

It is difficult to recognize suface of body frame B. Because of a symmetrical shape.Please select smooth surface for front.

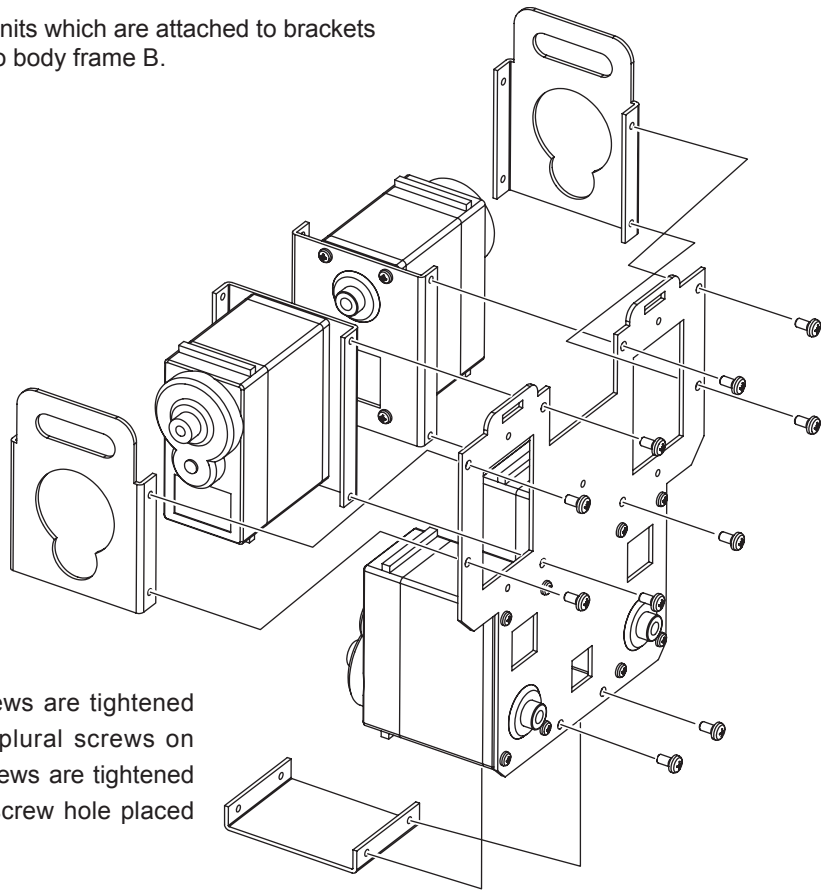


Assemble body

Body (torso) parts.
Body frame and part units are attached each other.

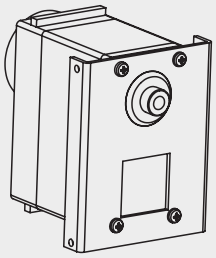
Assemble body frame B

Servo motor units which are attached to brackets are installed to body frame B.

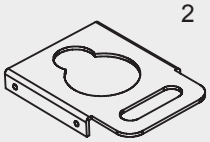


At first, all screws are tightened temporary for plural screws on the part. All screws are tightened up after each screw hole placed with screw.

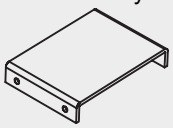
Bracket A unit
2



HR-005 shoulder frame
2



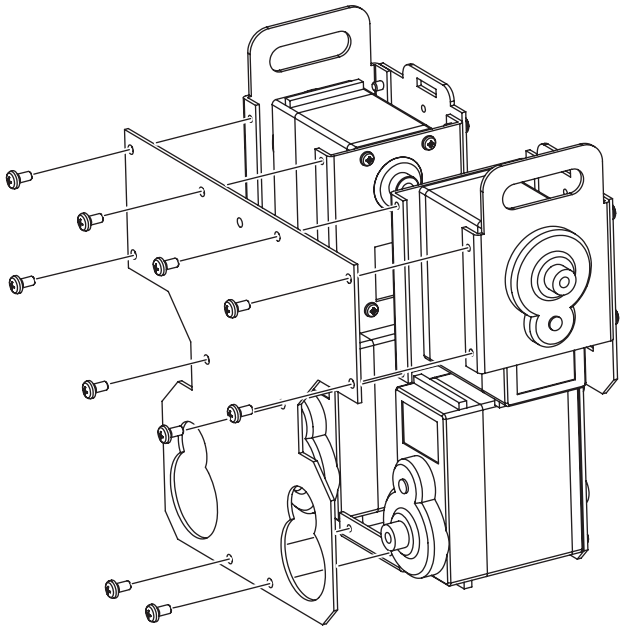
HR-007 body frame L
1



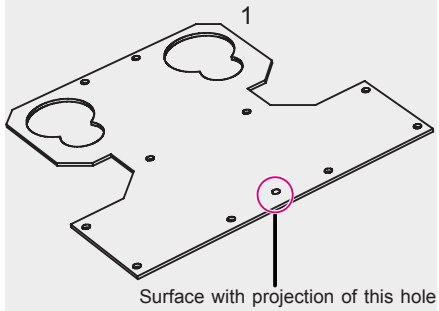
2-4 Nickel pan screw
10

Assemble body frame F

Cover body frame B unit with body frame F.



HR-003 body frame F
1



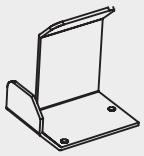
Surface with projection of this hole is reverse side of body frame F.

2-4 Nickel pan screw
10

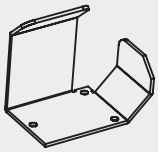
Assemble Arms and Legs

Install hand parts

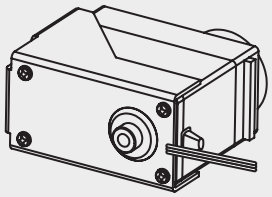
HR-008 hand L
1



HR-008 hand R
1



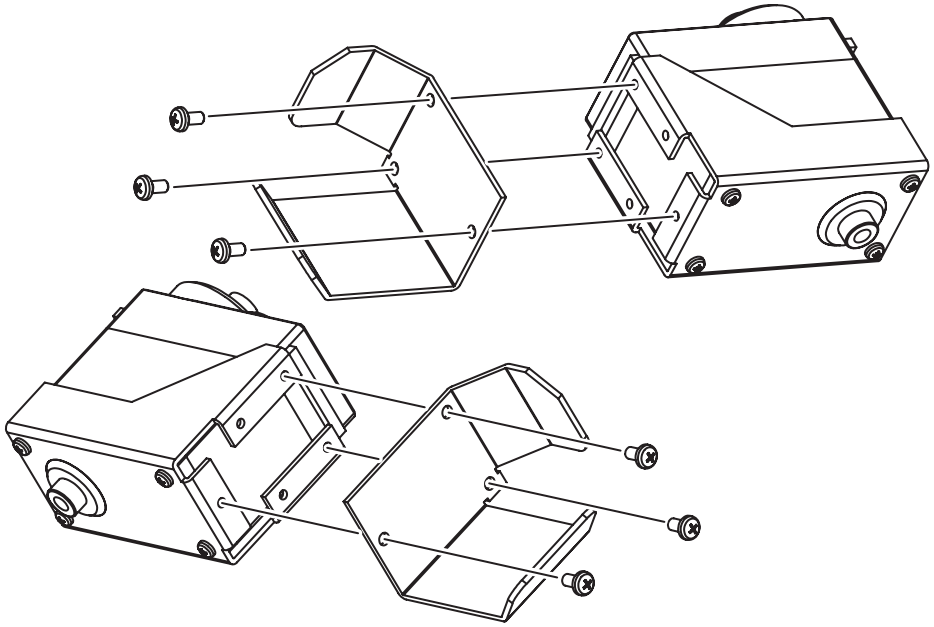
Servo bracket unit B
2



2-4 Nickel pan screw

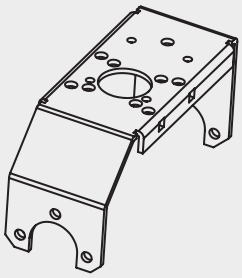
6

Hand parts are installed to KRS-784ICS and servo bracket B unit.
These parts are left and right hand.

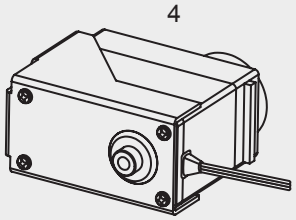


Assemble servo arms

HR-011 Servo arm
4



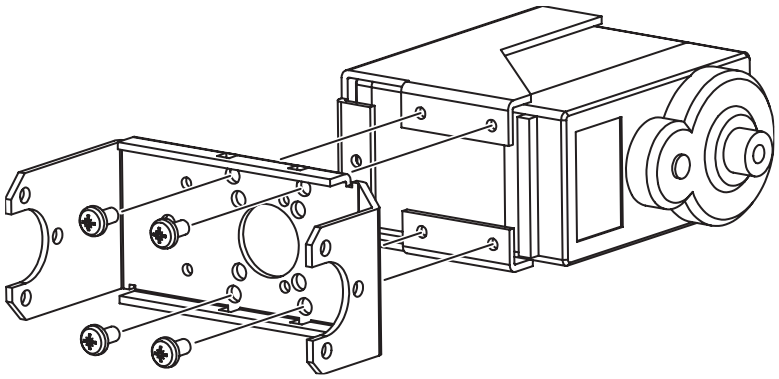
Servo bracket unit B
4



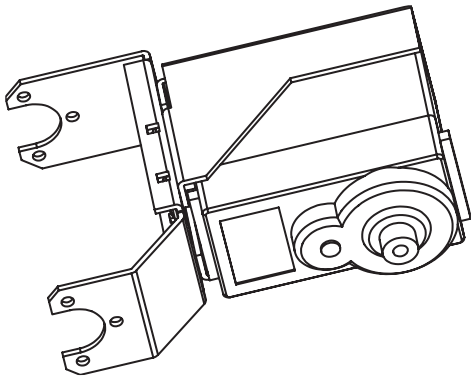
2-4 nickel pan screw

16

Servo arm is attached to KRS-784ICS and servo bracket B unit.
Four same units are made for arms and legs.



Pay attention to right direction of servo arm and servo bracket unit.

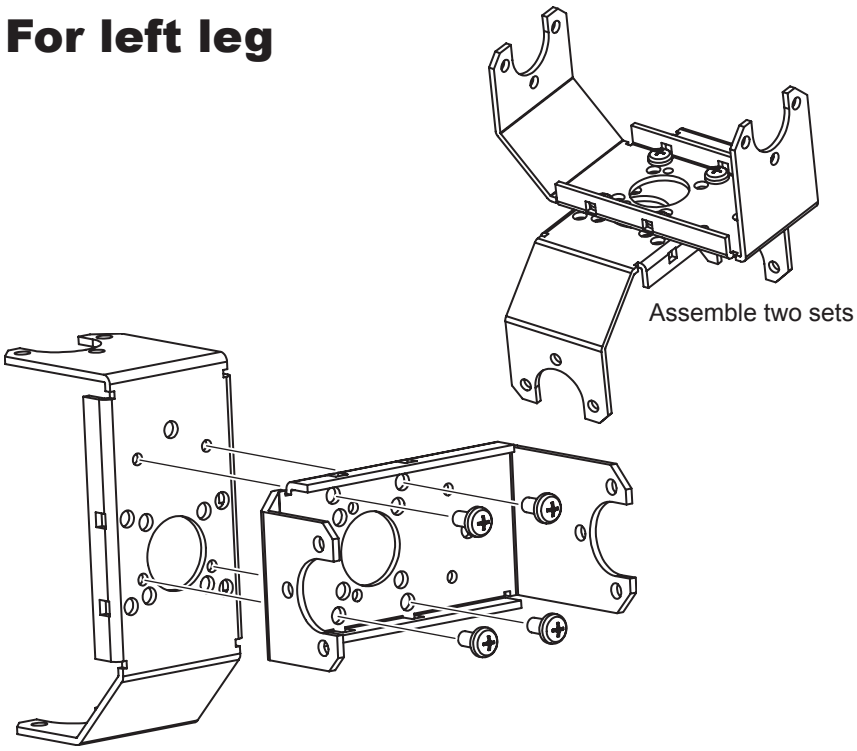


Assemble cross servo arms

Assemble servo arms

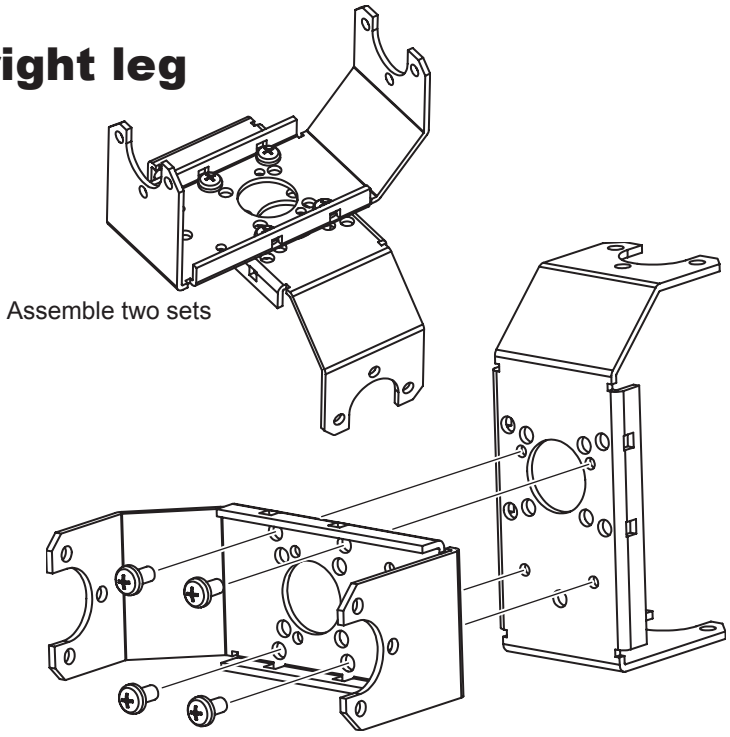
Two different direction units are assembled here. Two sets of two kinds of parts are made here.

For left leg



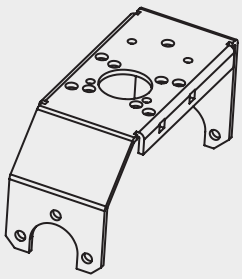
Pay attention: watch screw hole to attach two servo arms.
Wrong assembled parts effect to locomotion.

For right leg



HR-011 servo arm

8



2-4 Nickel pan screw

16

At first, all screws are tightened temporary for plural screws on the part. All screws are tightened up after each screw hole placed with screw.

Get servo axis position

How to attach servo hone to axis?

Servo motor axis and other parts are fixed by a servo hone. Servo motor rotates limited degree (about 180 degree.) It is important to make robot performance that it is found out better axis position on the servo case. Control board RCB-1 output neutral position signal at initial setting. Using this function, we can found neutral axis position easily.

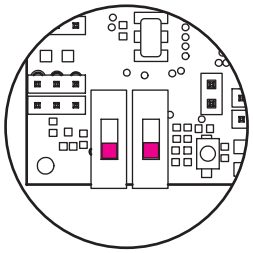
If RCB-1 is used once, it is set up another position settings. In this case, please initialize RCB-1 using PC software. If RCB-1 output different output, it is difficult to make performance with the robot.

How to set axis position?

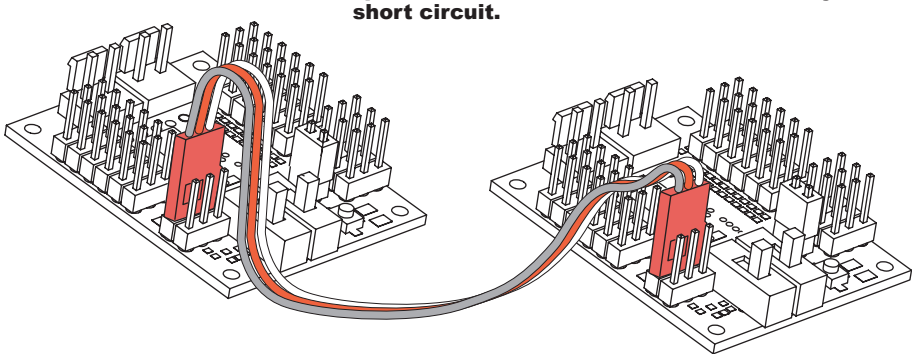
Servo hone must be attached after servo axis setting on neutral position. And also, the same procedure is required to fix servo hone and servo arm.

Procedure of board and servo motor connection is described here.
In this step, it is not required that board is on the robot. servo motors, NiCd battery and RCB-1 are prepared.

***put RCB-1 on an insulator such as vinyl to avoid short circuit.**



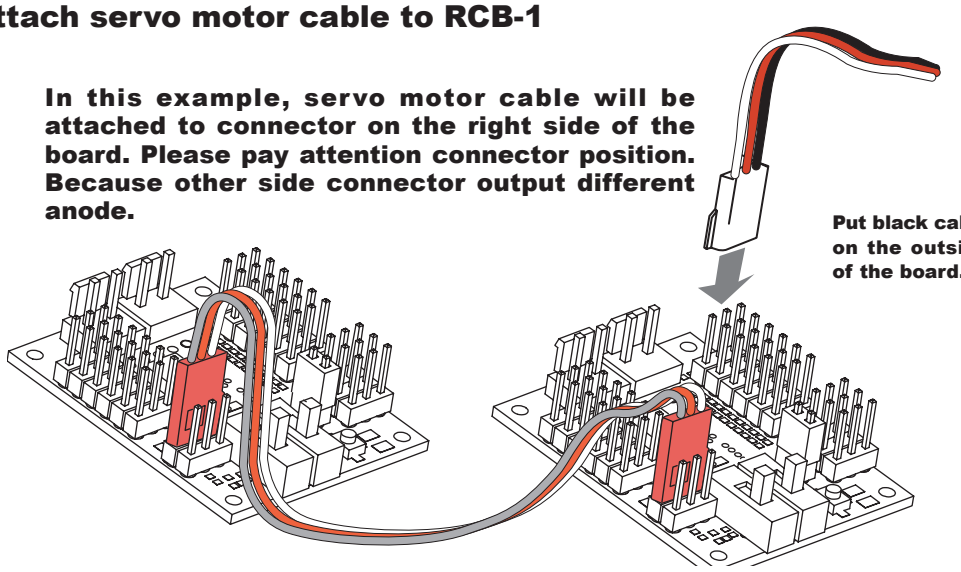
All swiches on two boards must be set to turn off (down direction)



Don't remove link cable. This cable is attached to two board from shipment.

1 Attach servo motor cable to RCB-1

In this example, servo motor cable will be attached to connector on the right side of the board. Please pay attention connector position. Because other side connector output different anode.

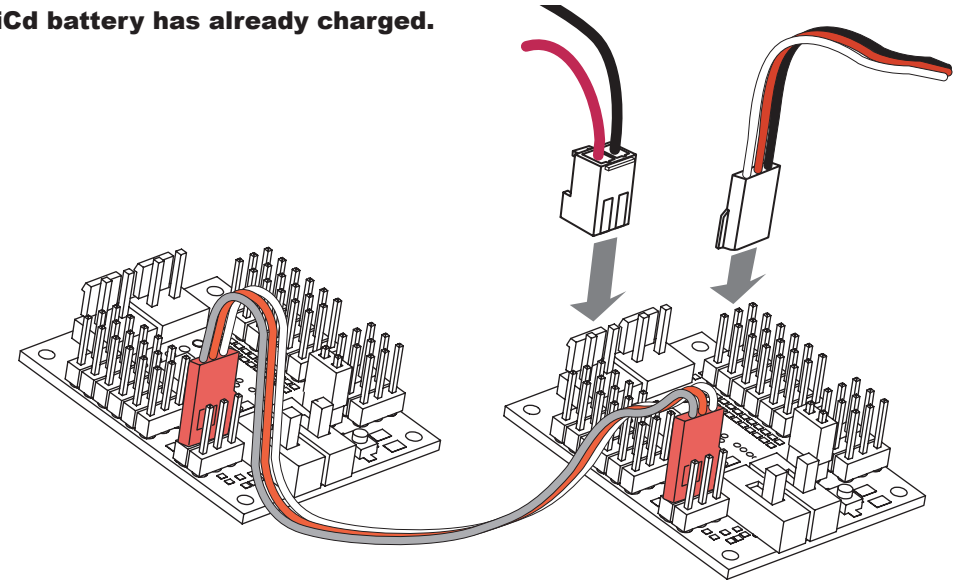


Put black cable on the outside of the board.

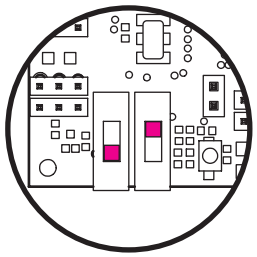
How to find neutral position?

2 Plug NiCd battery to RCB-1

NiCd battery has already charged.



Switch position "POWER ON"



3 Turn on switch on RCB-1 which is plugged NiCd battery.

Servo axis rotates to neutral position. (Initialized position)

4 Put servo hone to axis to find place to horizontal/vertical degree such as left figure.

Servo axis and servo hone have gear. Rotation of servo hone can be shown better place to up to gear. If best position can not be found, servo hone can be put to better position.

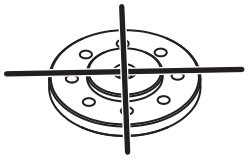
All (17) servo axises must be attached servo hone. After servo hone attached to axis, fix both of them using 2.6-6 tapping screw with M3 washer.

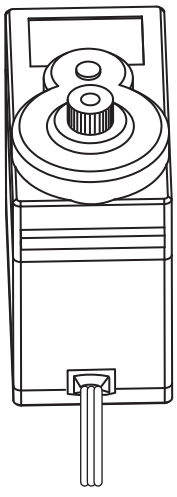
The play in the gear and servo hone is least. If the better place is found, servo hone must be put to gear strongly.

* Tapping screw tightened up servo hone and axis. However, servo axis may break if screw tightened up too much.

2.6-6 tapping screw

M3 washer



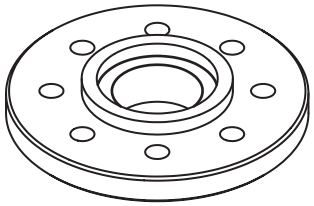


5 Free hone attached to other side of the servo motor.

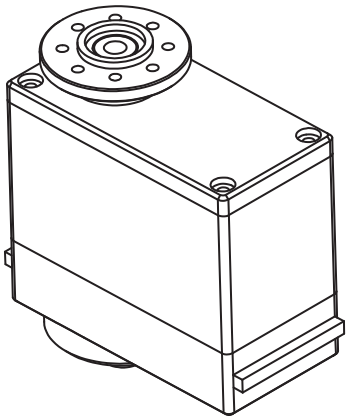
14 servo motors requires to put free hone. Pay attention to surface of free hone. There is direction.

2.6-6 tapping screw

M3 washer

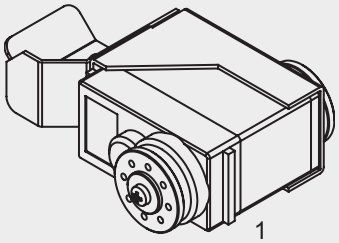


Top surface of free hone has step in the center hole. Free hone is also fixed with 2.6-6 tapping screw with M3 washer.



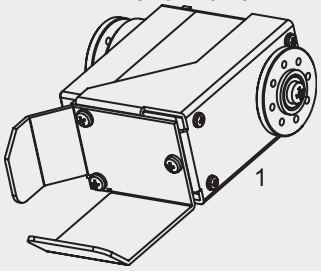
Assemble Arms

Hand L unit



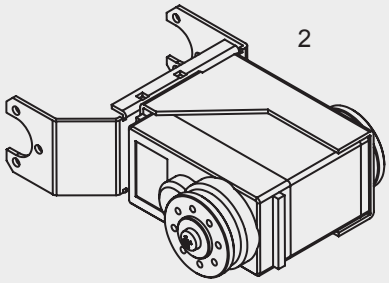
1

Hand R unit



1

Bracket B+servo arm unit
(already assembled)

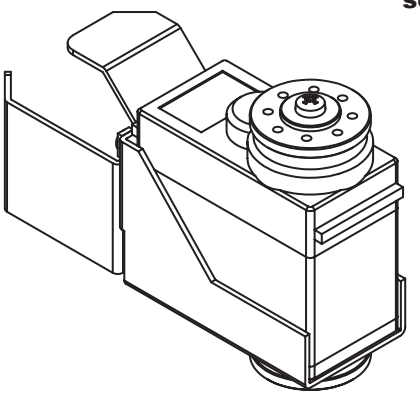


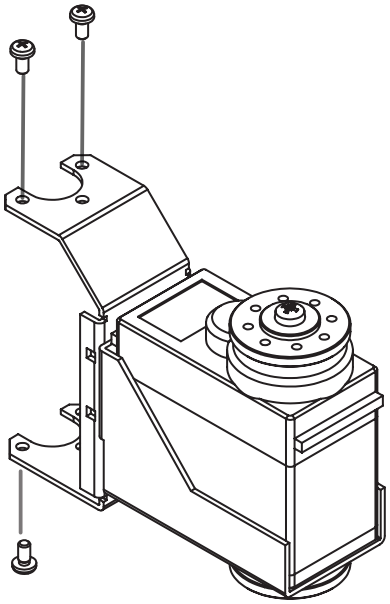
2

2-4 Nickel pan screw

6

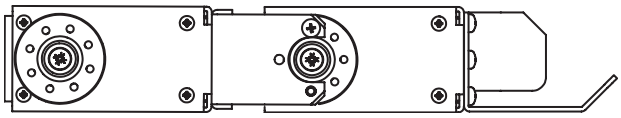
2-4 screw are used to fix servo hone.

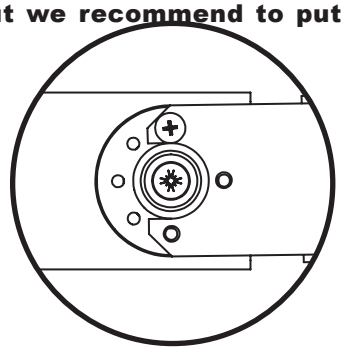




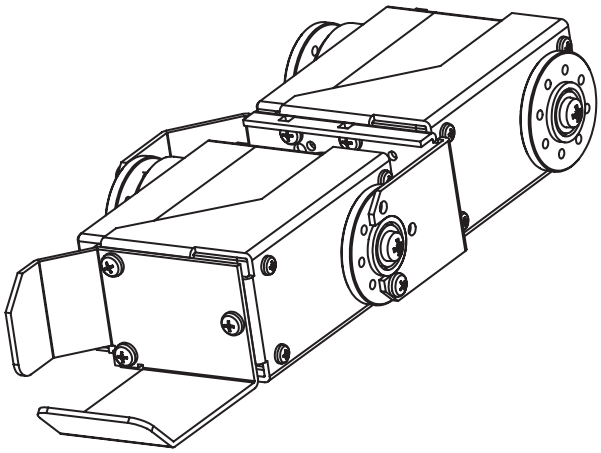
Already assembled hand units and servo arms are installed in this procedure.In this procedure, servo axis must be to set up neutral position using RCB-1 board. Attached arm setting correct neutral position shows a streight arm following figure.

1 screw is used to fix frew hone. Another screw hole is used to fix with nyron crip to organize lines.(but we recommend to put screw temporary.)



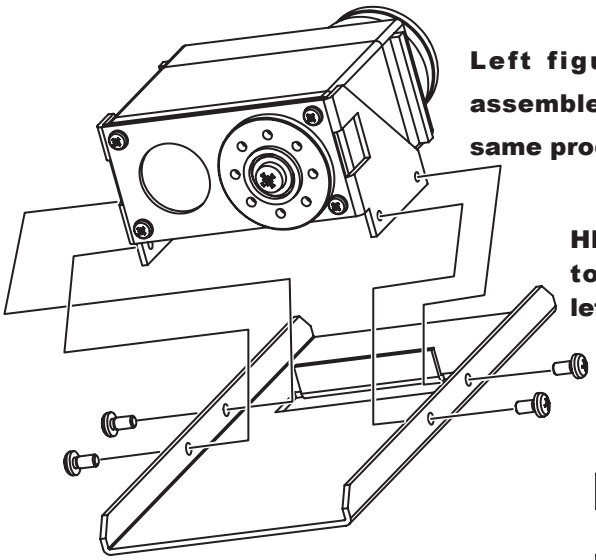


Assemble right arm as same as left hand.



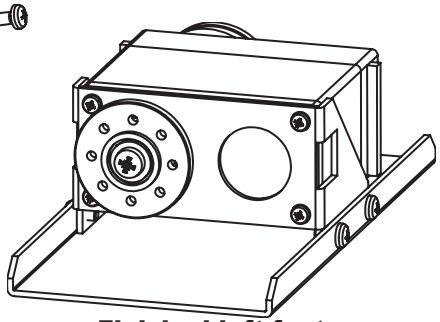
Assemble leg and foot parts

Assemble soles



Left figure shows right sole assemble procedure. Left is the same procedure, but symmetory.

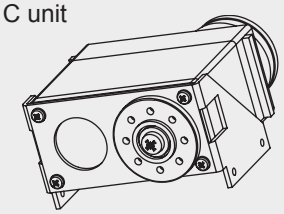
HR-015 foot sole is attached to servo bracket C unit for left or right foot.



Finished left foot.

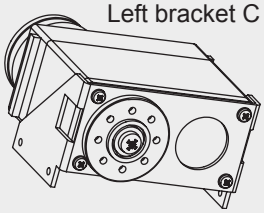
Right bracket C unit

1



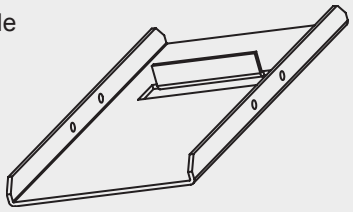
Left bracket C unit

1



foot sole

2

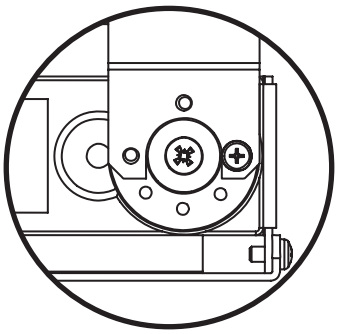


2-4 Nickel pan screw

8

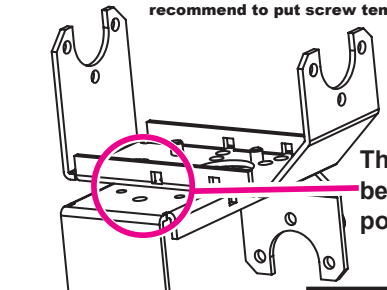
Attach cross arm to left and right foot

Cross arm parts are attached to foot units.RCB-1 is used to get neutral position of servo axis in this procedure.



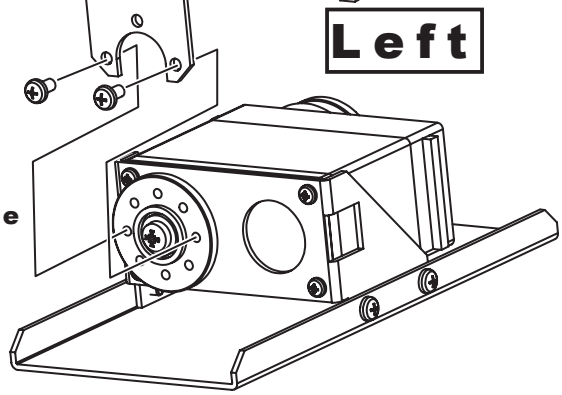
This is the position to fix servo hone and cross arm. (From view point of servo hone)

1 screw is used to fix servo hone. Another screw hole is used to fix with nyron crip to organize lines.(but we recommend to put screw temporary.)

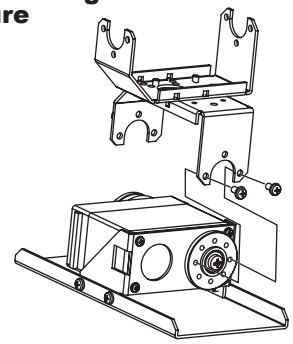


Three holes can be seen (correct position)

Left

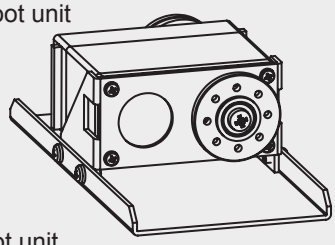


Assemble right foot as same procedure

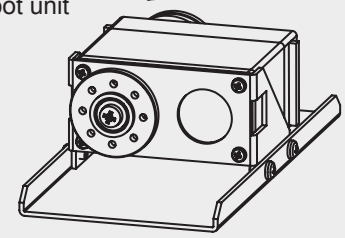


Pay attention to cross arm direction. Free hone is set in front of this figure.

Right foot unit



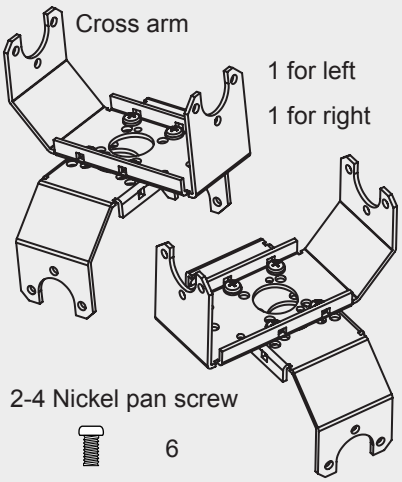
Left foot unit



Cross arm

1 for left

1 for right



2-4 Nickel pan screw

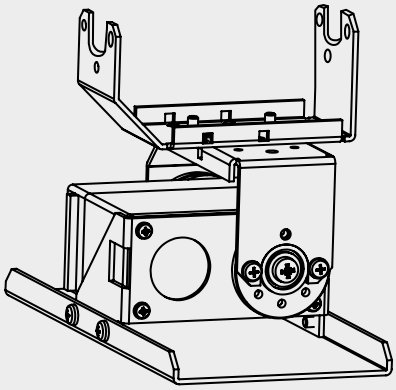
6

Assemble Knee and Foot

Assemble Knee and Foot

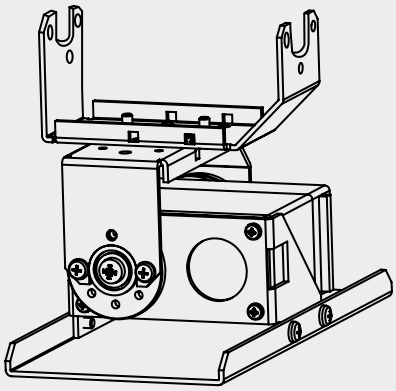
Right foot unit

1



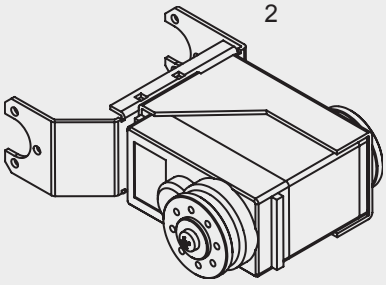
Left foot unit

1



Bracket B + Servo arm
(already assembled)

2

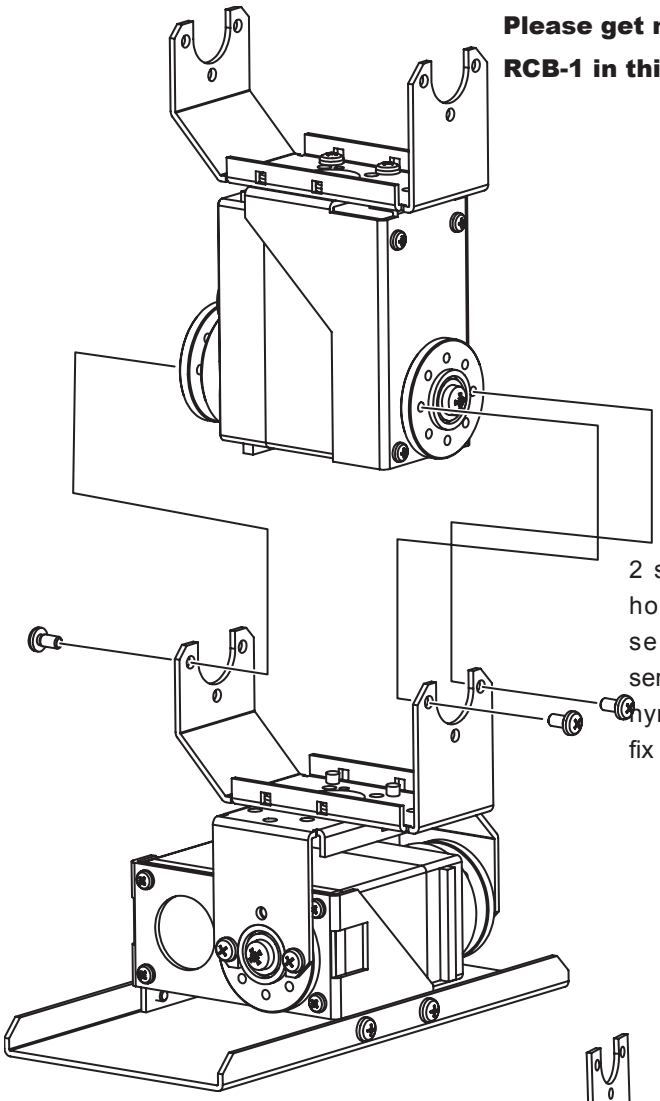


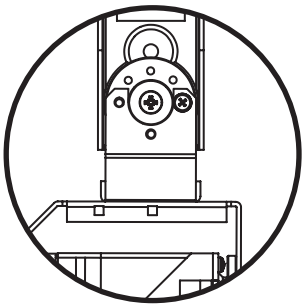
2-4 Nickel pan screw

6

These parts are used for knee and foot.

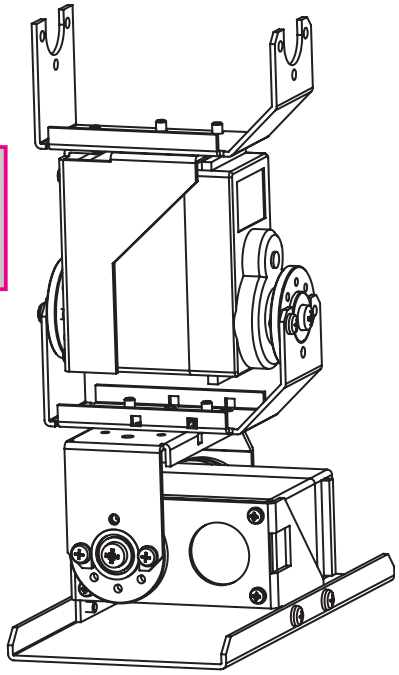
Please get neutral position using RCB-1 in this procedure.



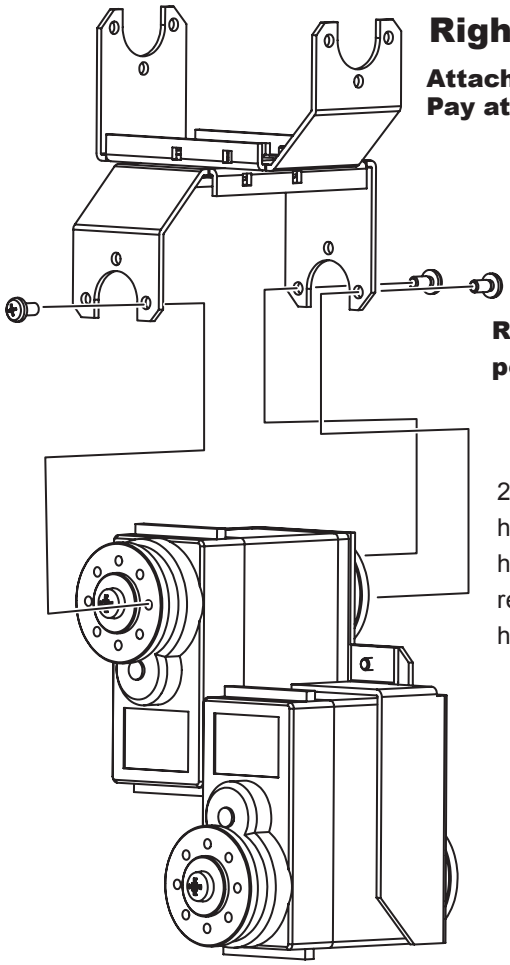


2 screws are used to fix free hone. A screw is used to fix servo hone. Other holes of servo hone are used to fix with nyron crip.(We recommend to fix them temporary.)

Pay attention to direction to attach servo hone and free hone.



Attach cross arm to thigh



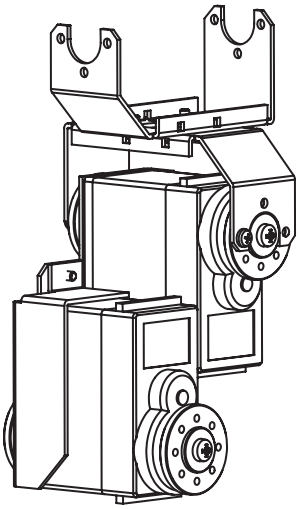
Right

Attach cross arm to thigh unit.
Pay attention to direction of cross arm.

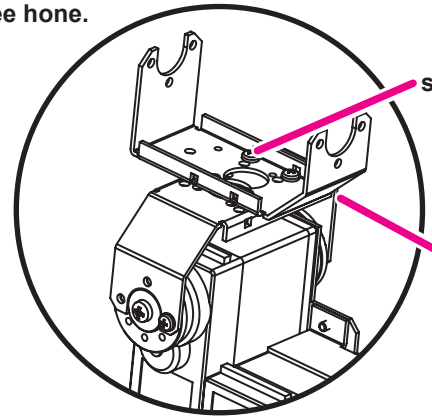
RCB-1 is used to get neutral position of servo axis.

2 screws are used for free hone. Servo hone is fixed with 1 screw but other holes used for screw with nyron crip. We recommend to put two screws on servo hone temporary.

Left



Correct direction of cross arm shows screw cap on the cross arm such as following figure.Perpendicular side is for free hone.



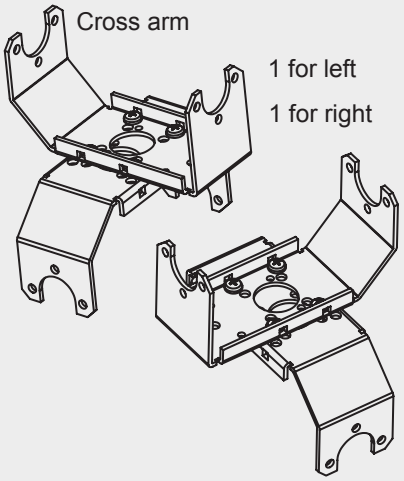
screw cap
This is the correct position.

Parpendicular side is for free hone.

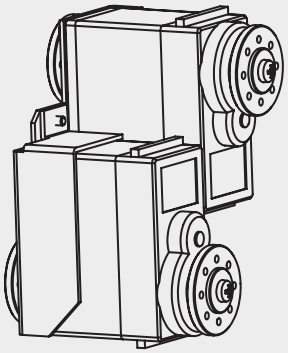
Cross arm

1 for left

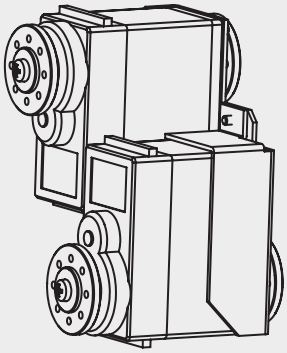
1 for right



Left thigh unit



Right thigh unit



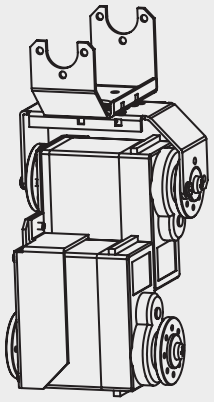
2-4 Nickel pan screw

6

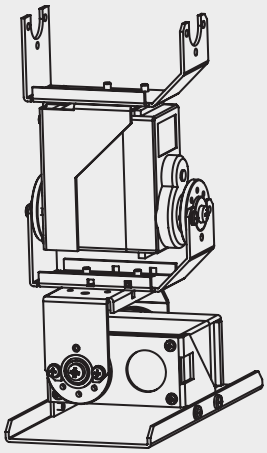
Assemble leg

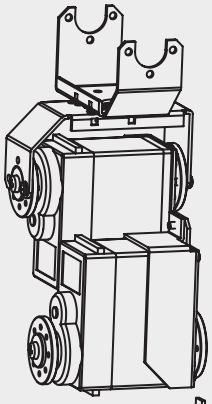
F i n i s h e d l e g

Left thigh

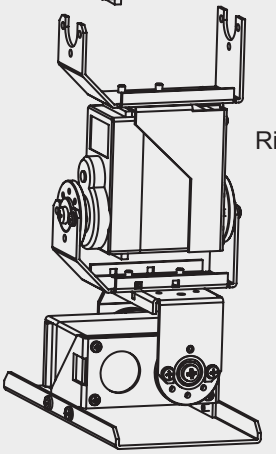


Left knee





Right thigh



Right knee

2-4 Nickel pan screw

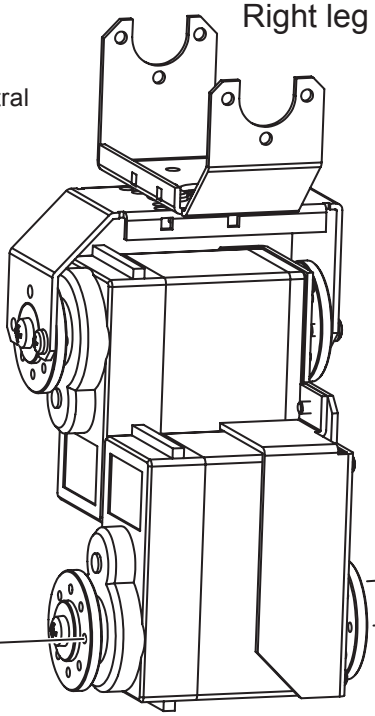
6

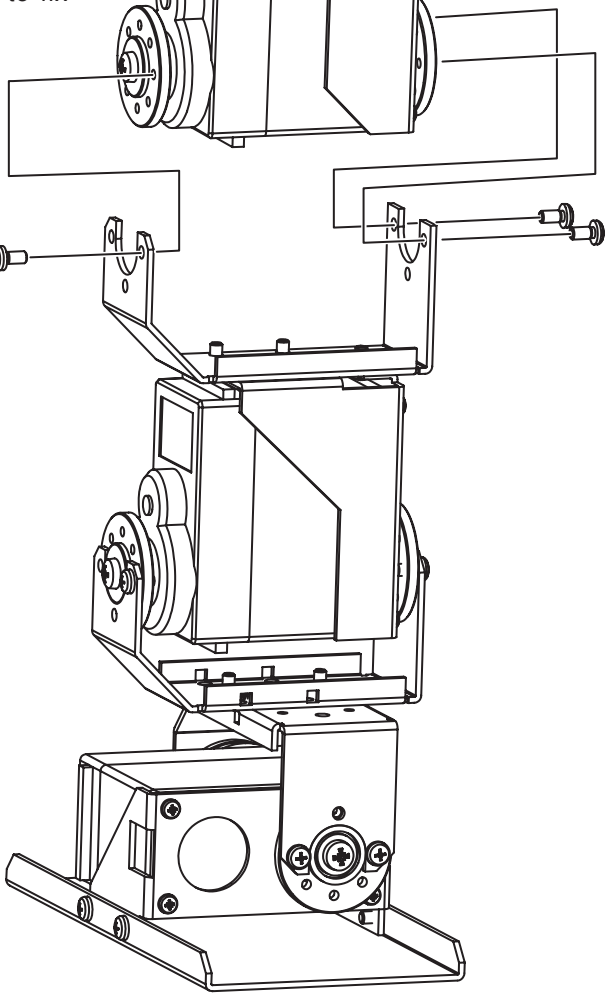
Thighs and knees are jointed.

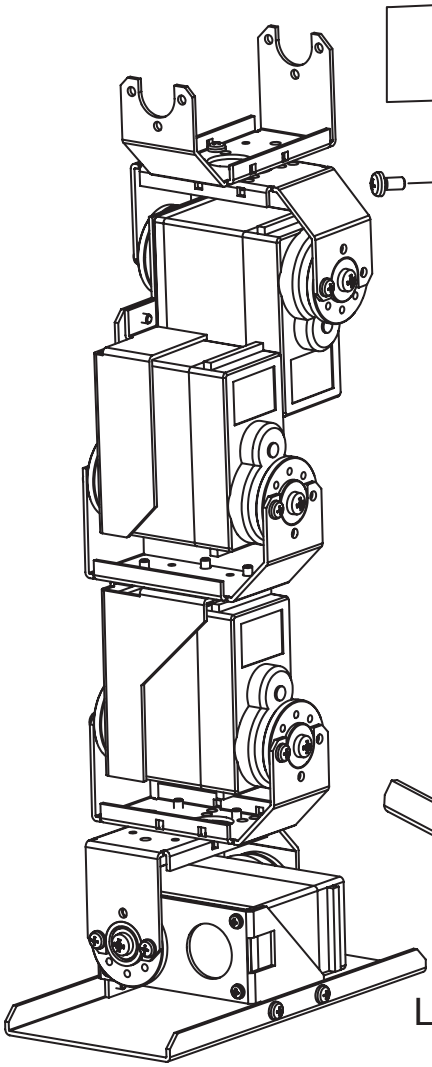
Using RCB-1, servo axis must be neutral position to fix servo hone.

2 screws are used to fix free hone. A screw is used to fix servo hone. Other holes of servo hone are used to fix with nyron crip.(But we recommend to fix them temporary.)

Right leg





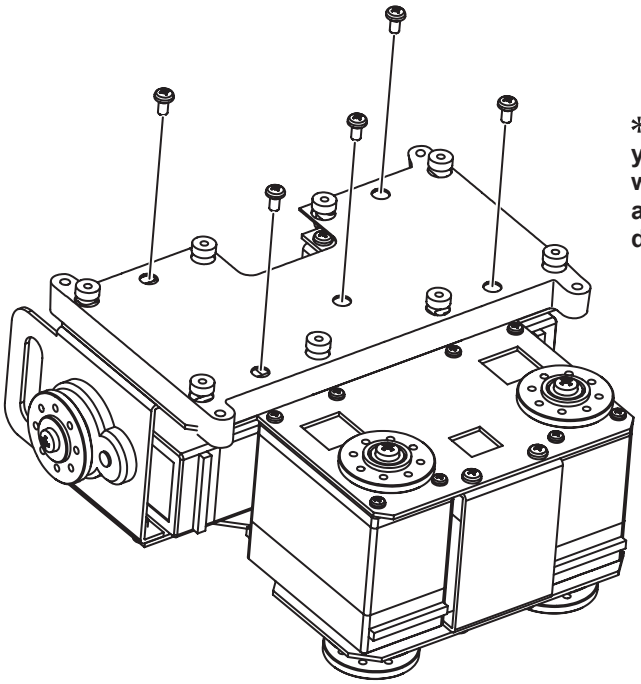


Left leg

Fix boards on the robot

Attach PCB base

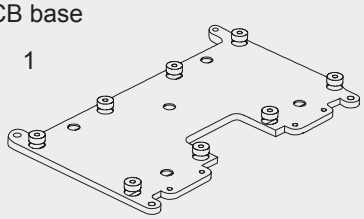
2-5 chrome pan screw is used to fix this part. Pay attention to screw.



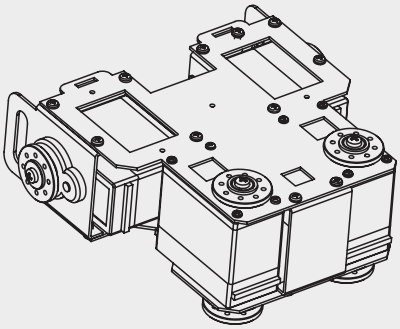
*** 2-5 chrome pan screw is yellowish screw. 2-4 screw which is used for other assemble is silver. They are different length and color.**

RCB base

1



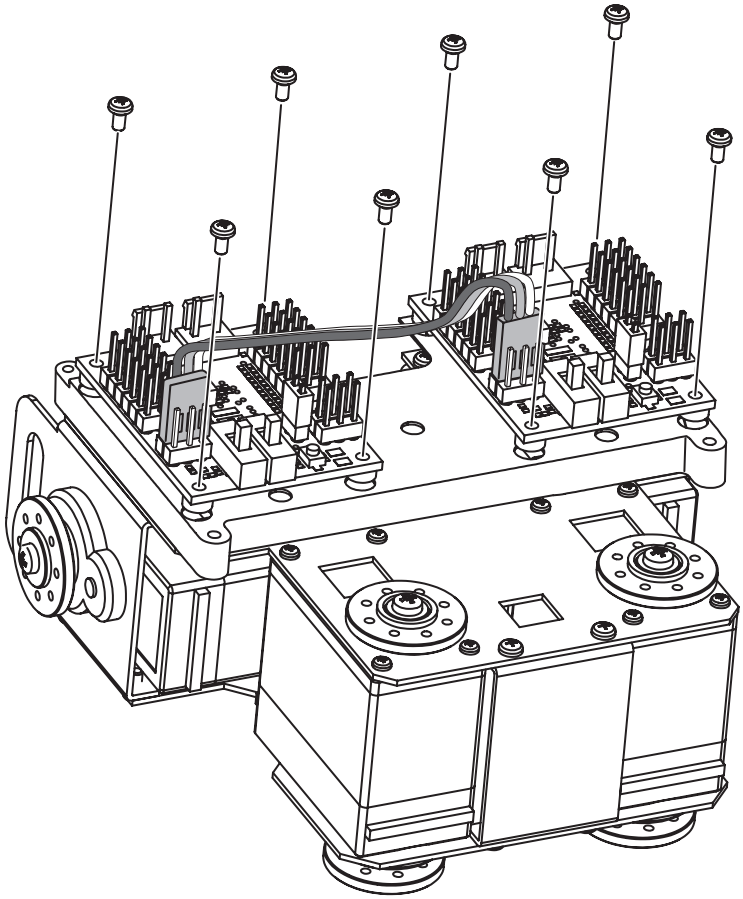
Body (torso)



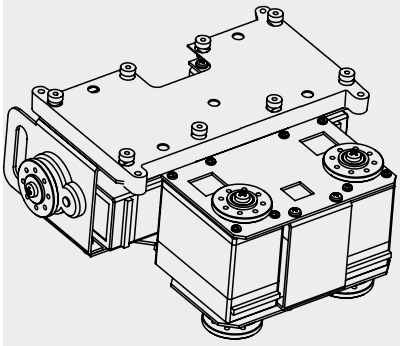
2-5 chrome pan screw

5

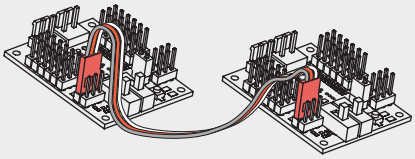
Attach boards on the PCB base



Body with PCB base



RCB-1 (two for 1 set)

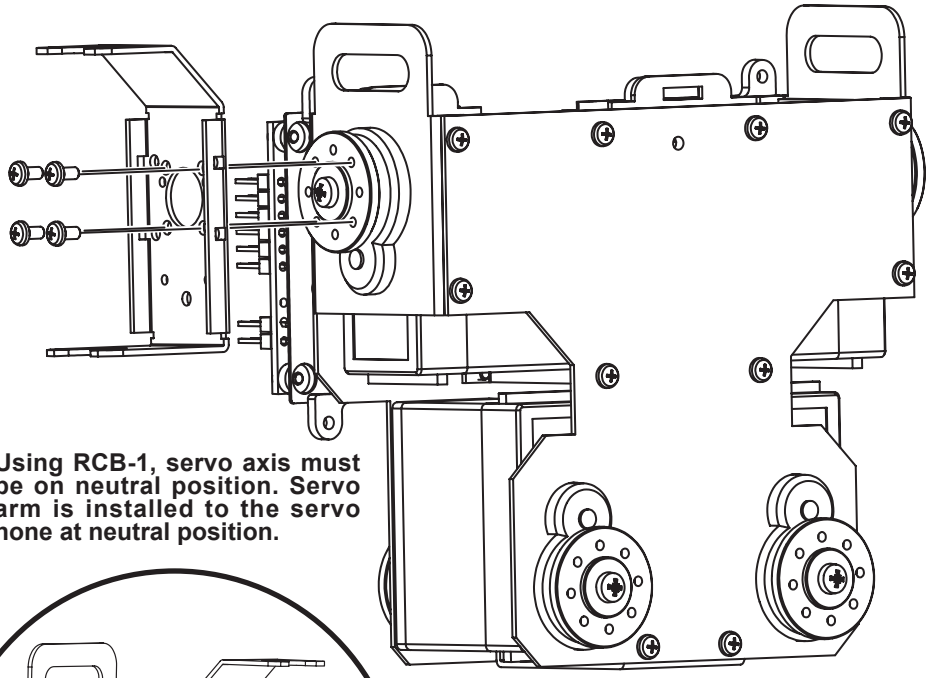


2-4 Nickel pan screw

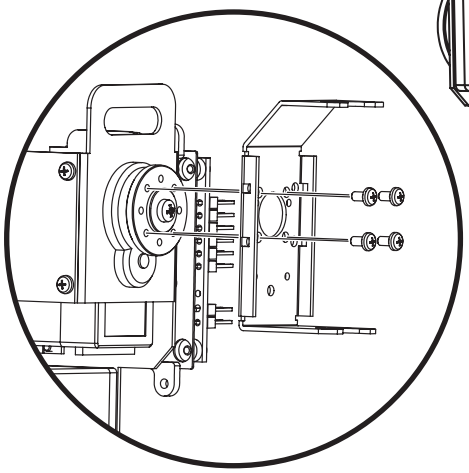
8

Prepare to finish

Attach shoulder servo arms

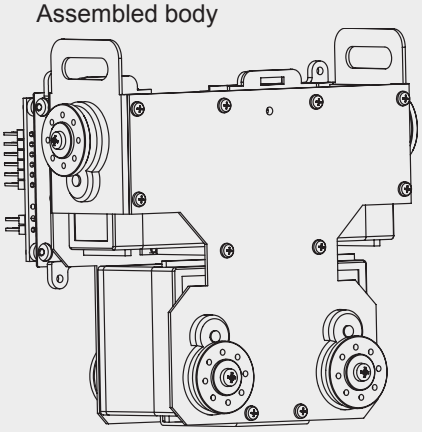


Using RCB-1, servo axis must be on neutral position. Servo arm is installed to the servo hone at neutral position.



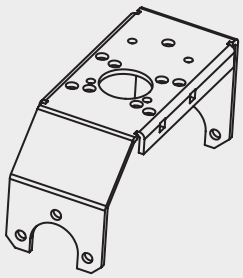
Make left side as same procedure.

Assembled body



HR-011 servo arm

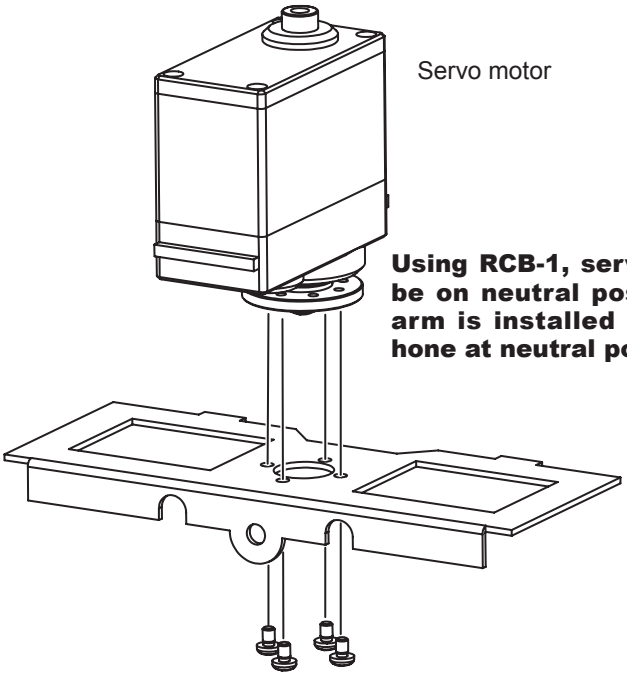
2



2-4 Nickel pan screw

8

Attach servo motor for head



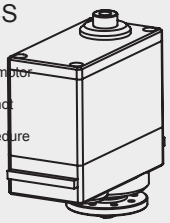
Servo motor

Using RCB-1, servo axis must be on neutral position. Servo arm is installed to the servo hone at neutral position.

Servo motor
KRS-784ICS

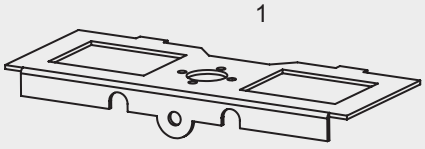
1

This is the last servo motor which screws are not removed at first procedure



HR-001 top cover

1



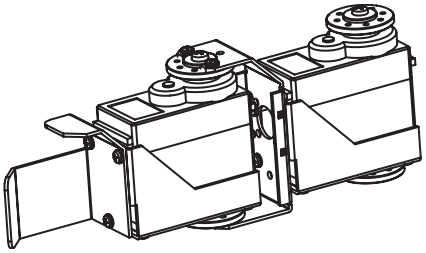
2-4 Nickel pan screw

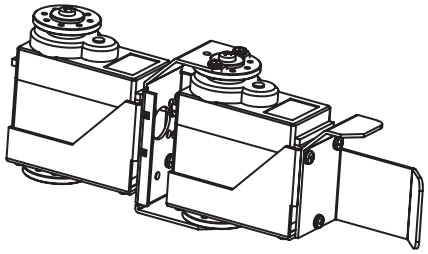
4

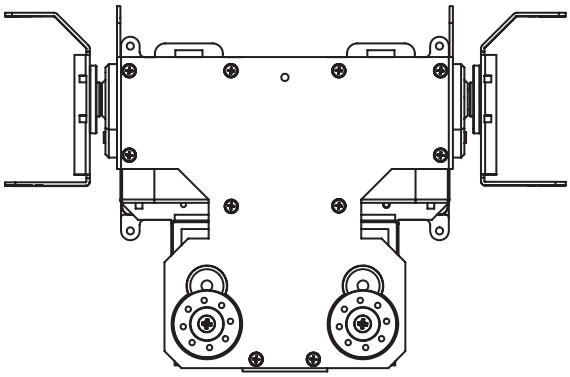
Prepare to finish

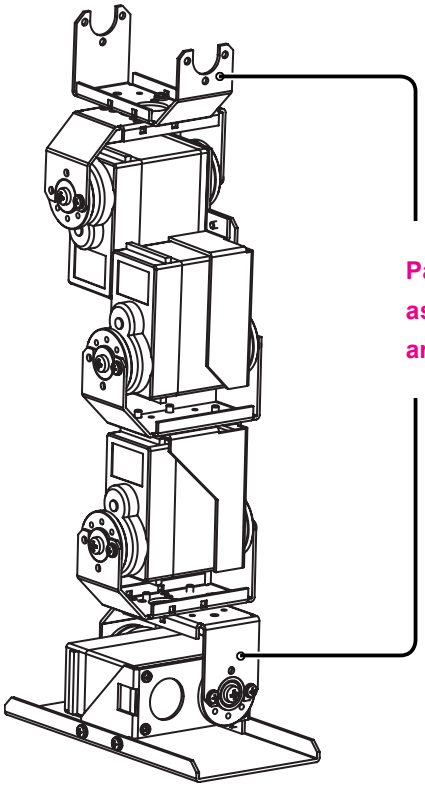
Confirm assembled parts

**Before finish, confirm direction and posture of all parts which are assembled.
Especially, posture and direction of legs and arms are important to make locomotion.**

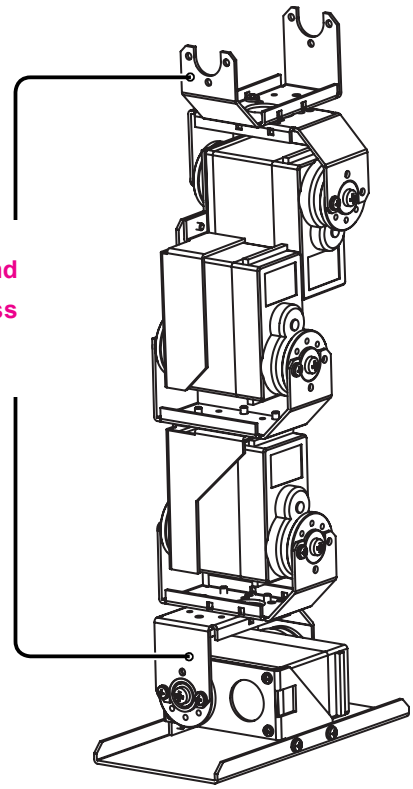








Pay attention to direction and assembled position of cross arms and servo arms.

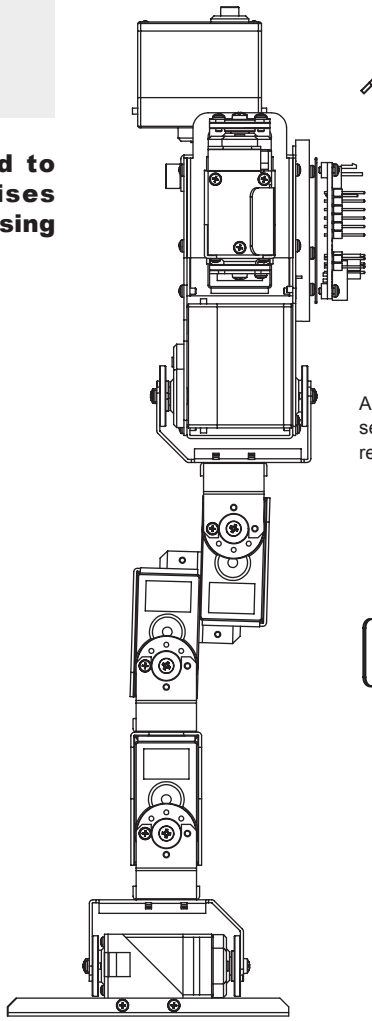


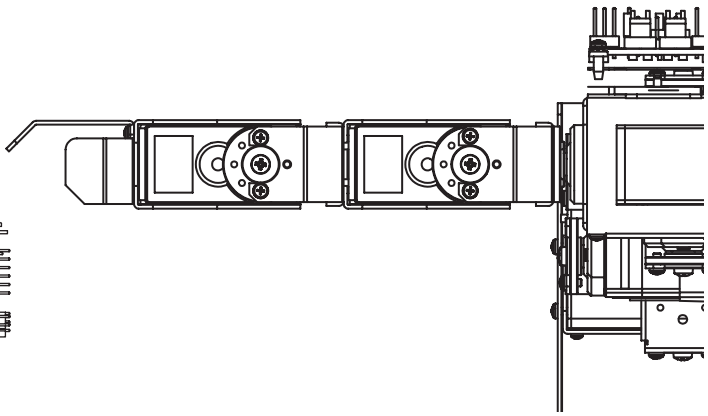
Finish

2-4 Nickel pan screw

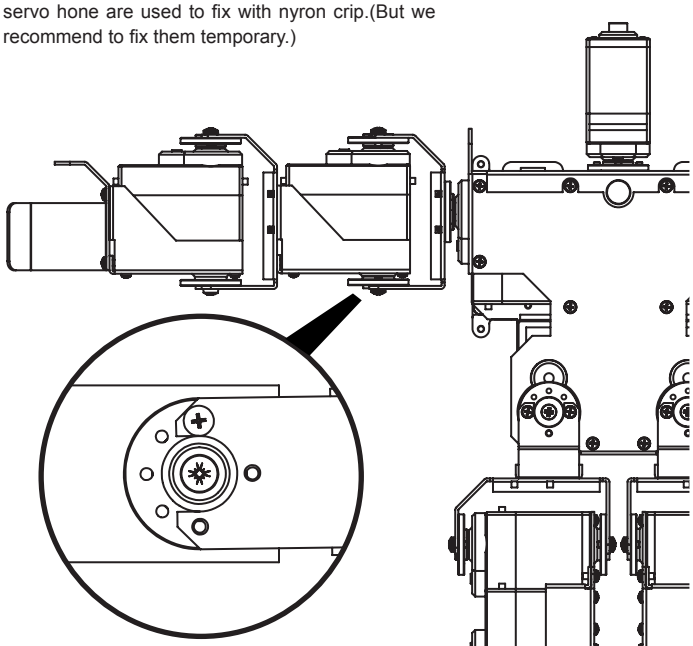
12

Arms and legs are installed to assembled torso.Servo axises are set up neutral position using RCB-1.



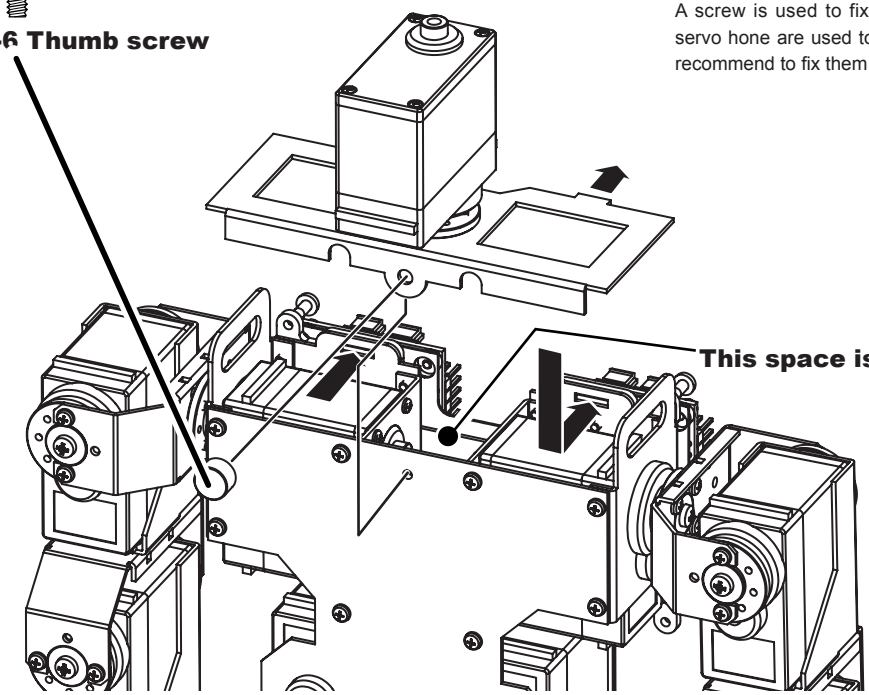


A screw is used to fix free hone. Other holes of servo hone are used to fix with nyron crip.(But we recommend to fix them temporary.)



A screw is used to fix free hone. Other holes of servo hone are used to fix with nyron crip.(But we recommend to fix them temporary.)

M3-6 Thumb screw



This space is for NiCd battery.

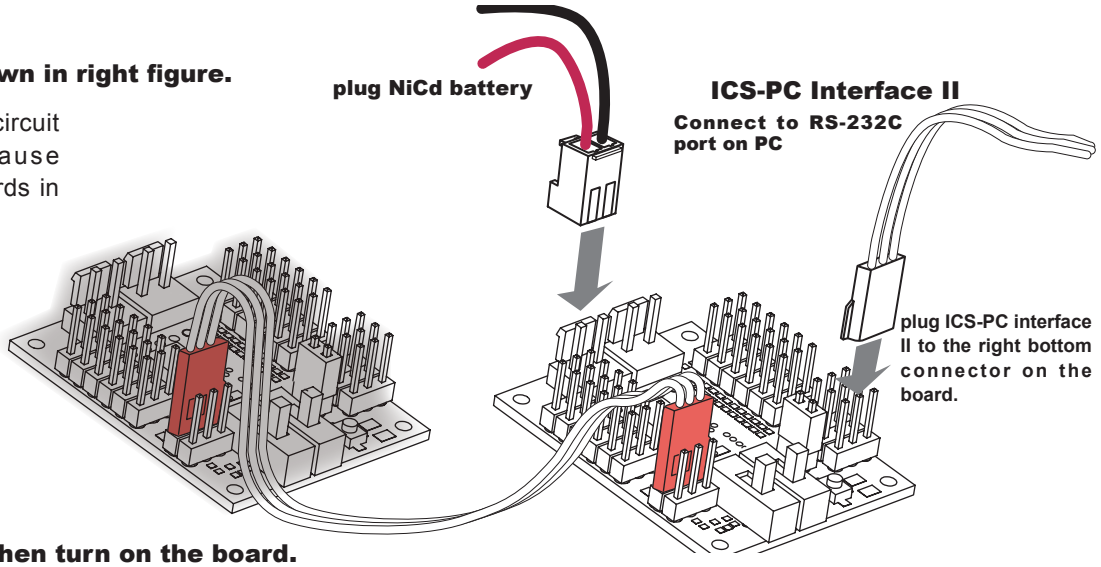
Setting of RCB-1 (ID) ID means identifier of board.

ID setting to RCB-1

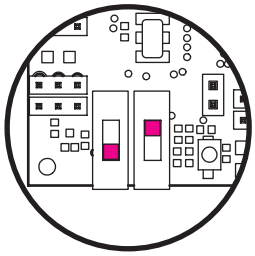
Two RCB-1 are used for this kit. Therefore, different ID is required to distinguish each board. At shipment, both of them are set ID 0. One of boards must be set ID 1.

Cables are plugged shown in right figure.

※Pay attention to short circuit with the boards. Because power is supplied to boards in this procedure.

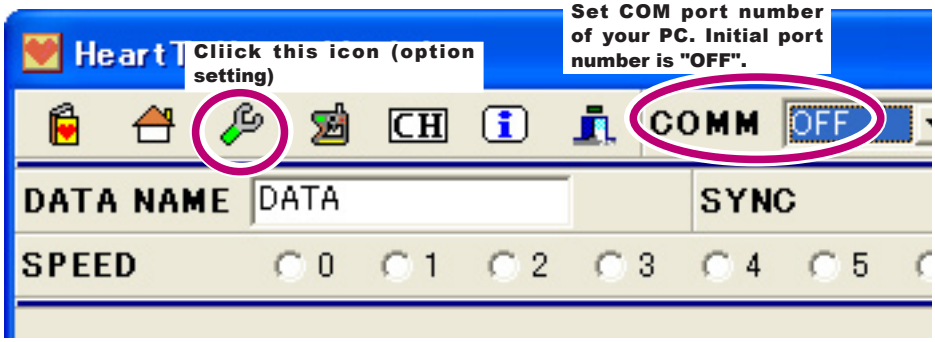


Start software on PC. Then turn on the board.

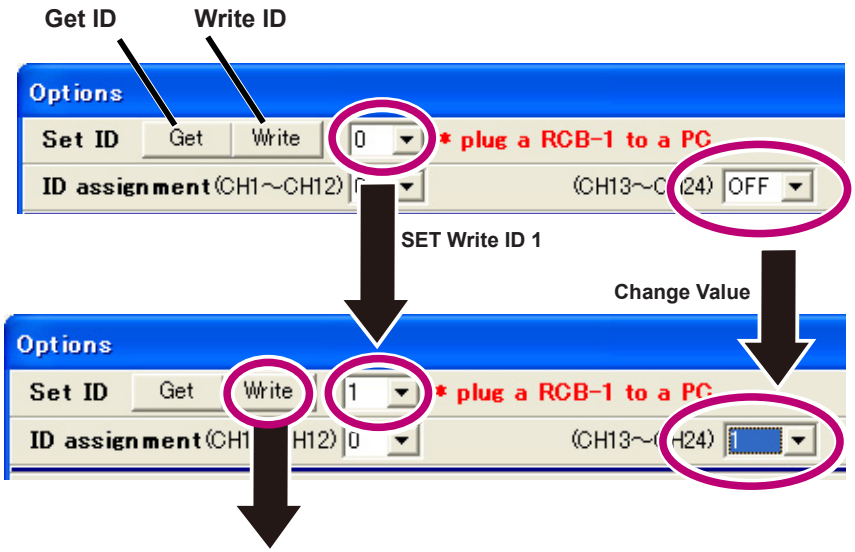


"Power ON" position of switches

Set ID on software.



※Target board is the ICS-PC interface II cable plugged board. Because two RCB-1 are linked with only red cable.
In the software, it describes that "PC and RCB-1 must be connected 1 on 1 to set ID." This description is for the boards on the robot linked with other cables.



At last, ID setting is sent to RCB-1 when this button is pushed.(write button)

After setting, close software and remove NiCd battery from board.

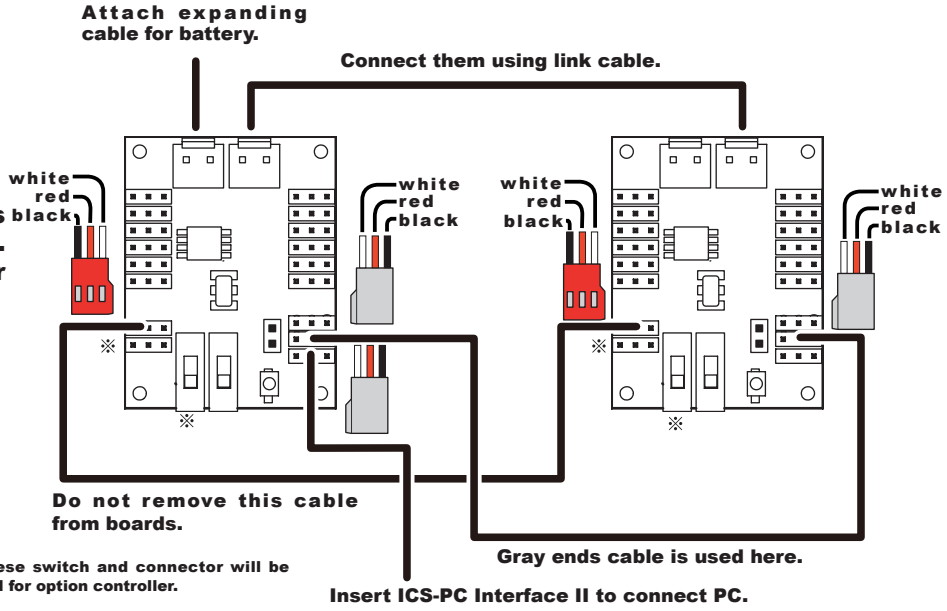
Lines for servo motor

Connection of RCB-1

Never make wrong insert connector position and direction.

Warining:
It may occur to fire or to break boards if you mistake to install cables. Please confirm carefully before power on.

Pay attention:
The direction of three lines to installto the board, black line must be put on the outside of the board. Left and right side would be a symmetrical arrangement.

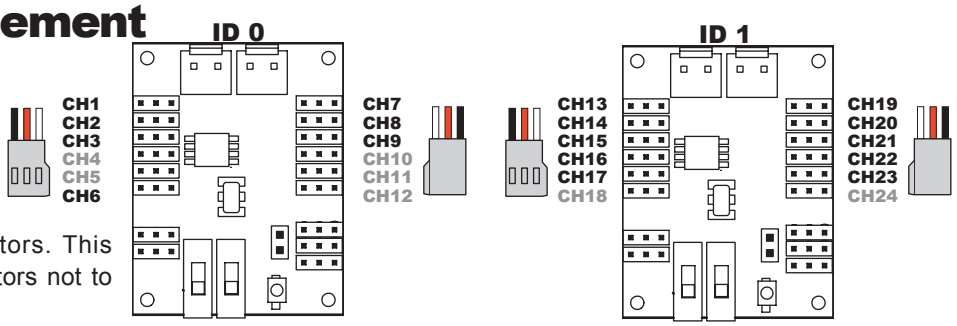


※These switch and connector will be used for option controller.

Servo cable arrangement

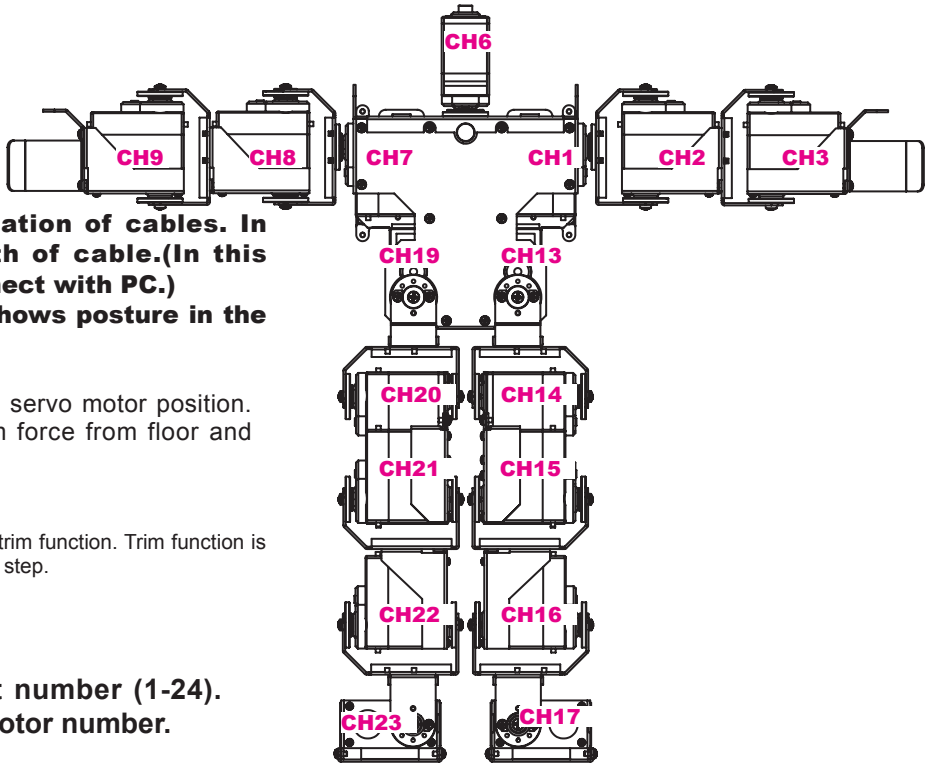
CH means channel.

RCB-1 can control upto 12 servo motors. This product uses 17 servo motors. Connectors not to use are shown by gray.



Length of servo motor cable is the same. Extended cable are used for far servo motors. CH3,9,15,21 use 10cm extended cable, CH17,23 use 20cm extended cable.

Pay attention:
CH number and robot servo motor number must be refered using following figure.



Please switch turn on after confirmation of cables. In this step, pay attention short length of cable.(In this confirmation, it is not required to connect with PC.)
It is right initial posture if the robot shows posture in the previous page.

Please handle robot in air to confirm all servo motor position. Because robot joints must be free from force from floor and weight of itself.

※You can adjust little gap of degree of axis using trim function. Trim function is described later. But large gap must be fixed in this step.

Hint!
This product includes sticker to put number (1-24). They are useful to display the servo motor number.

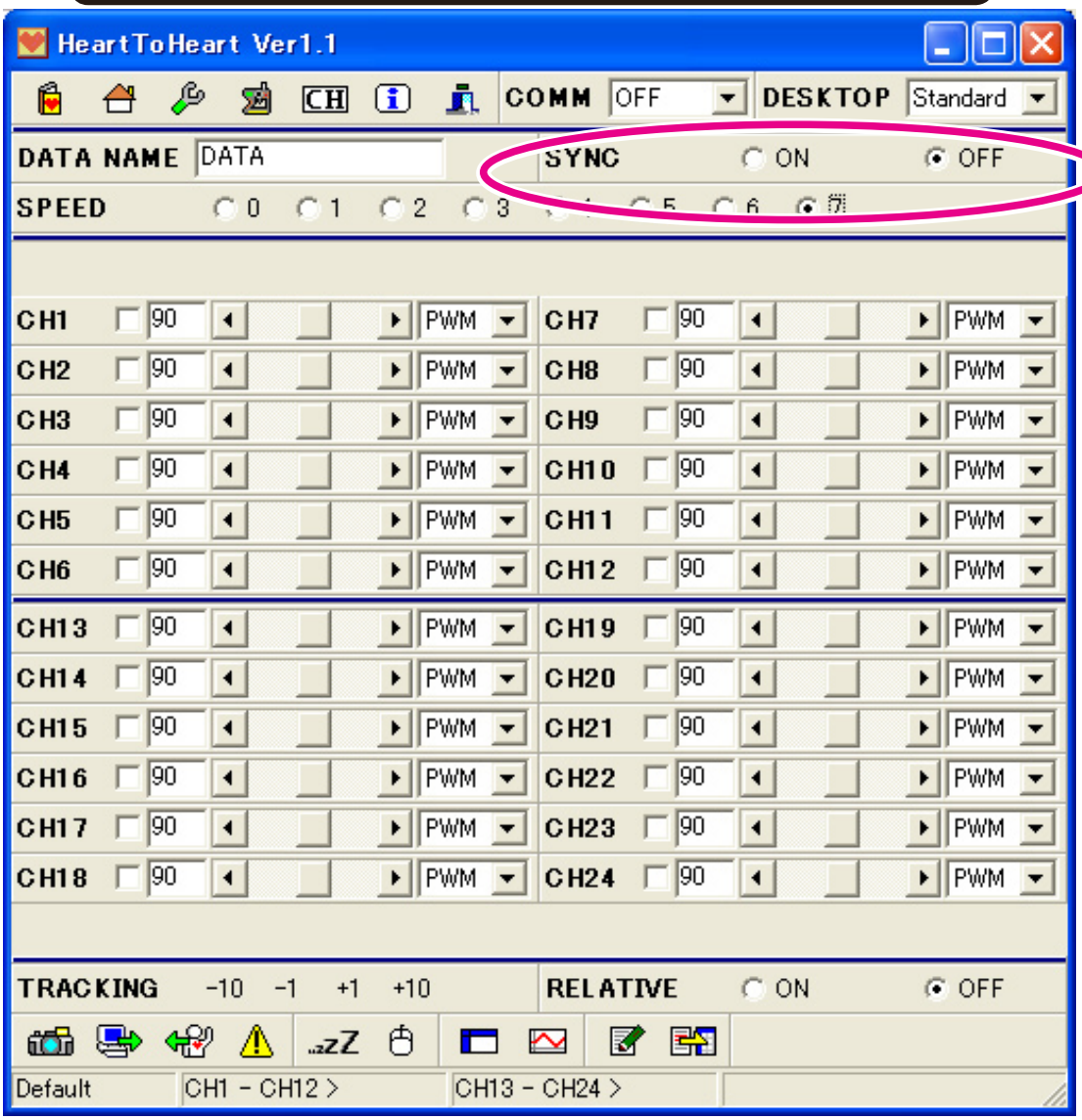
Confirmation of RCB-1

RCB-1 and channel of servo motor can be confirmed using software on PC.

1. **Plug ICS-PC interface II to RCB-1 and PC. Start software.**
2. **Turn on the board and Set "SYNC" to ON in the software.**
3. **Confirm channel and servo motor position using slider of channel on the software. The slider controls the same channel number of servo motor appropriately if the setting is completed.**

Warning:

Servo motor can be controlled by slider directly. It may harm or injury if big value is applied to servo motor. Because the robot moves rapidly.



Confirm channel of servo motor and position.

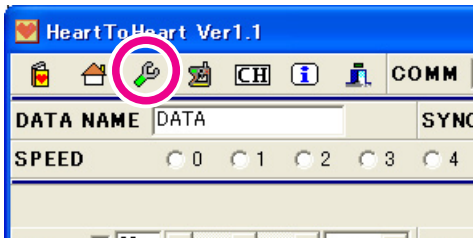
Trim function

What is trim function?

Servo motor axis is fixed by a servo hone using RCB-1 function to get neutral position. In this step, little gap of degree may occur. Espcially, it causes large gap by difference degree of servo motors on the groin. Therefore, RCB-1 and software on PC can adjest little gap. This function is called "trim".

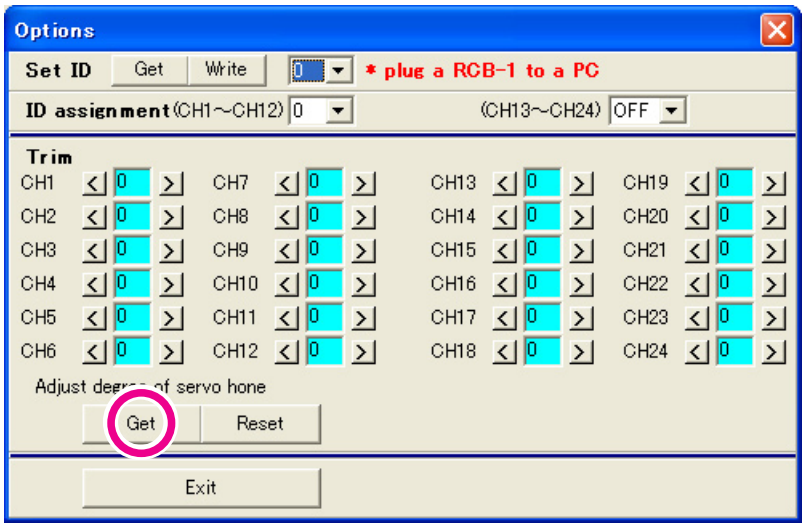
Operation of trim

Start software and connect to RCB-1. Then RCB-1 are turned on.



1 **Open "Ootion setting"**

Click this icon to open "Option setting"



2 **Click "get" button to get trim value from RCB-1 if they are set before. Each value can be controlled to each servo motor aixs on the channel.**

* "get" operation must be operated at once.

* Trim value must be less value (within from -10 to 10.)
If greater value must be input here, you must take the robot apart and assemble again.

* "Initialize" button set all channels to be initialized value "0".

3 **After adjustment, close option setting window.**

All trim values are sent to RCB-1 at window closing.

Problem of trim

At first glance,trim function seems to be useful. However, it has effect to limit degree of rotation of servo motor axis if large value was set.

Refer to left figure. The range of servo motor axis rotates 180 degree.The range shows each 90 degree from center position. Trim value is minus from this degree which is adjusted. Therefore, maximum degree is limited if bigger value is set to trim.

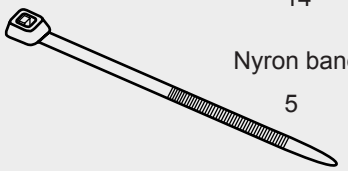
Organize cables(1)

Each cable of servo motor sometimes hold servo motor performance. We recommend to organize cables with nyron crip or nyron band.

2-6 BH black tapping
14

M2 washer
14

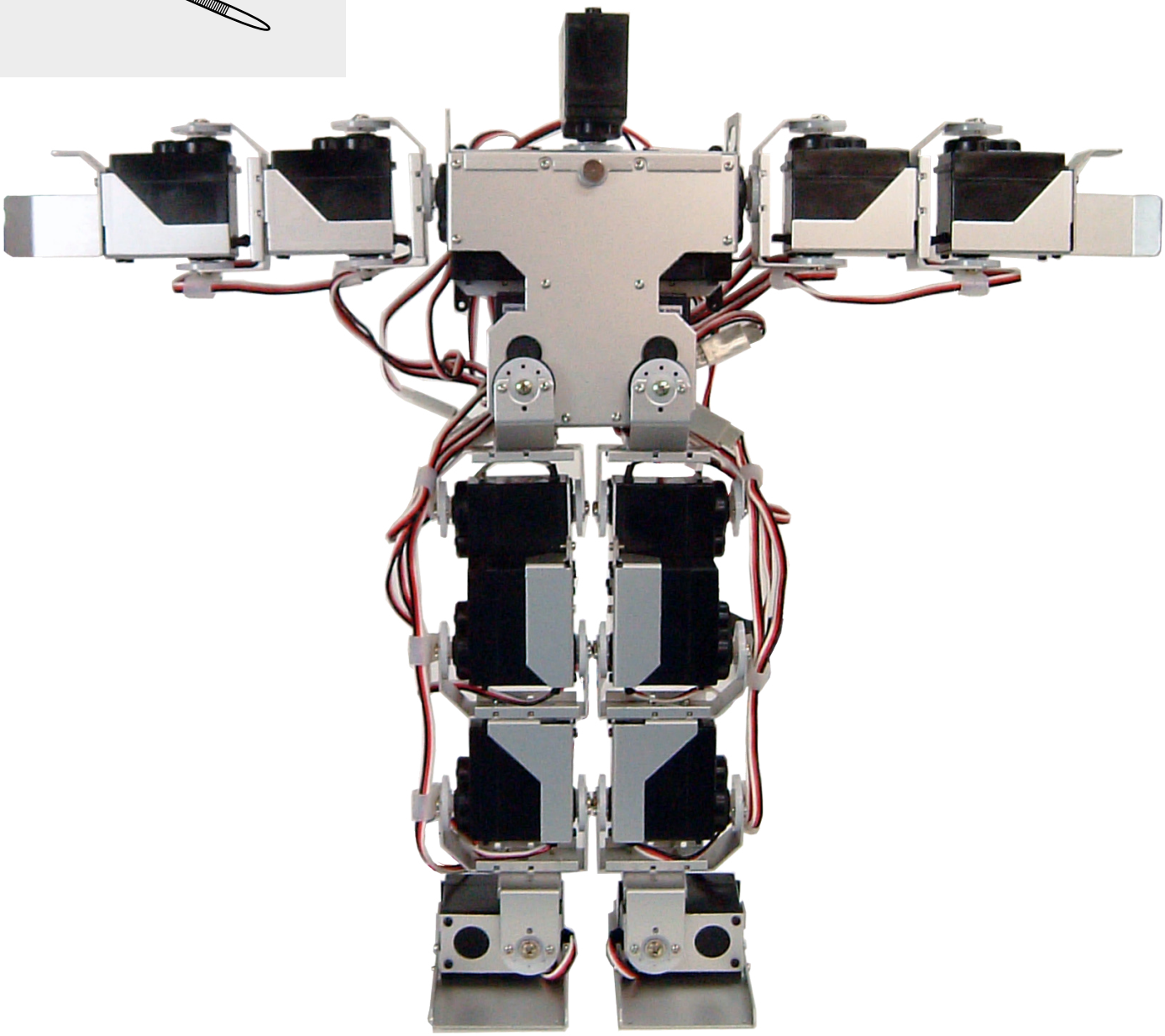
Nyron crip
14



Nyron band
5

Hint

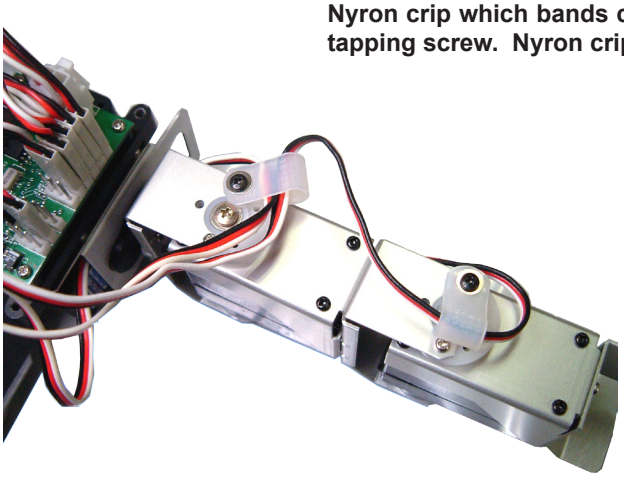
Appropriate length of cable should be remained if robot sits or stretches.

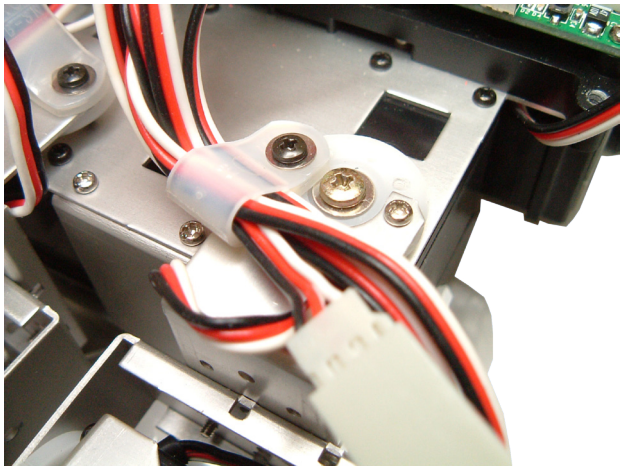


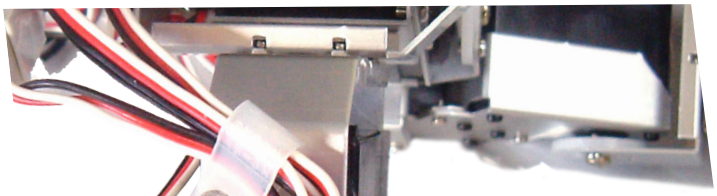
Organize cables(2)

This is the example of organizing cables.

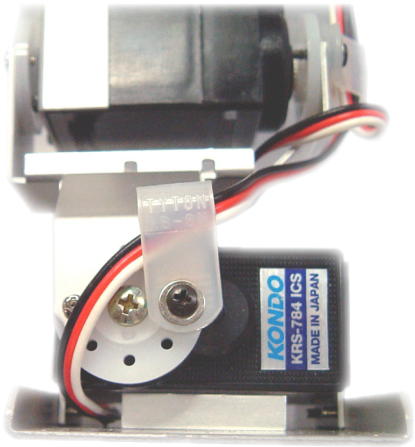
Nyron crip which bands cables is fixed to servo hone or free hone with M2 washer and 2-6 tapping screw. Nyron crip can be attached anywhere if you want.

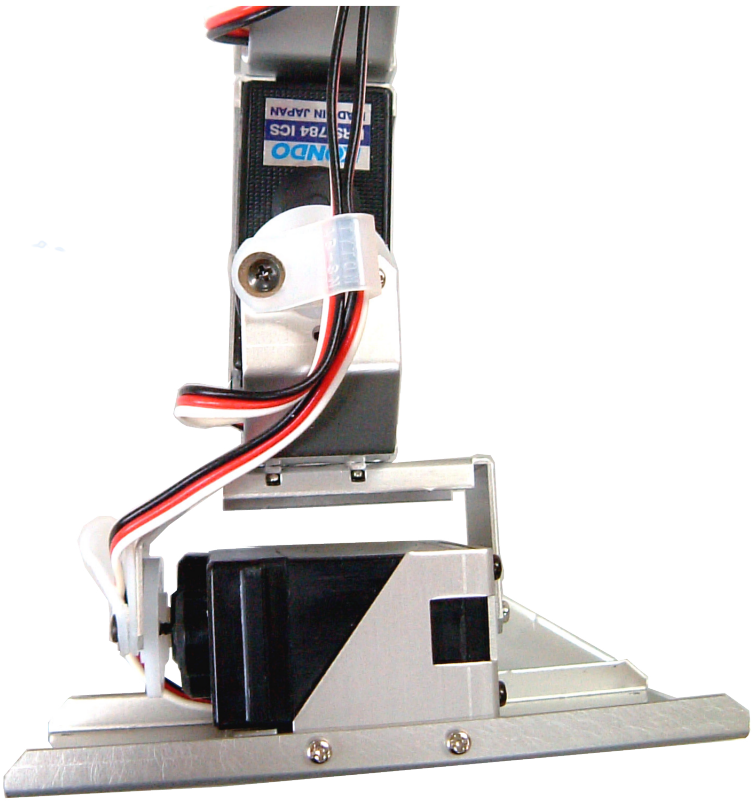






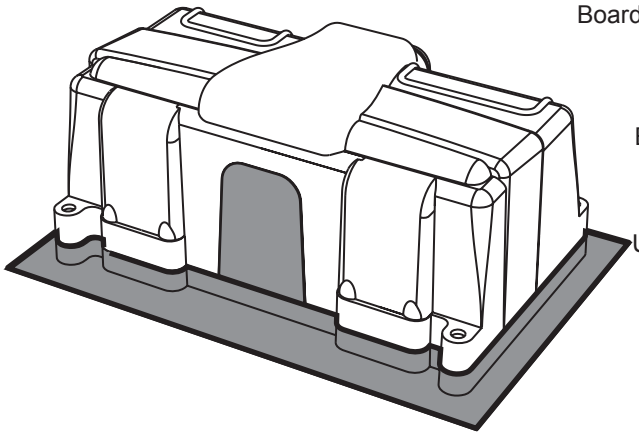
The product include sticker. "Number" sticker is useful to know servo motor number to put each joint. Other sticker can be put anywhere on the robot.





Assemble of case

Cutting of board case

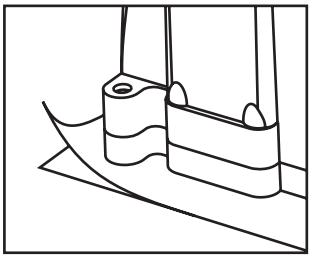


Board case covers boards and cables.

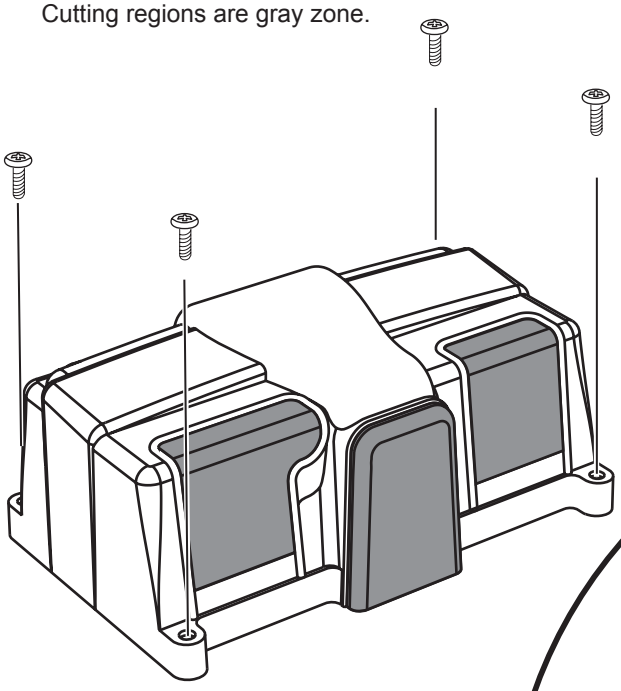
Board case requires cut to put to the robot for cable holes.

Using cutter or scissors to remove these regions.

Cutting regions are gray zone.

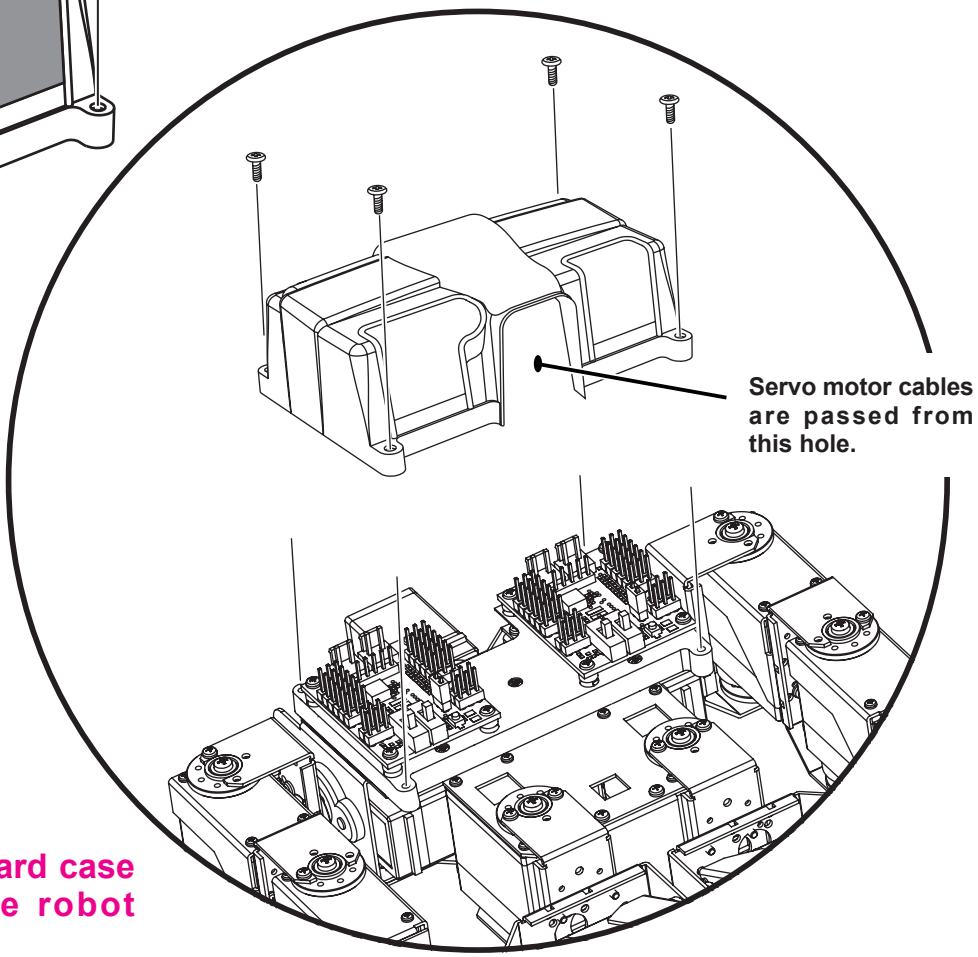


* remove sheet to protect scratch from the board case.



2.6-6 BH tapping screws are used to attach the board case to the robot with four holes. Holes can be opened by a drill.

Attach board case



Servo motor cables are passed from this hole.

Warning:
To avoid short circuit, the board case must be attached when the robot works.

Home position setting

In this step, robot can stand alone if power is supplied.
However, the robot is just standing.
At first, we set basement posture to the robot called "home position."

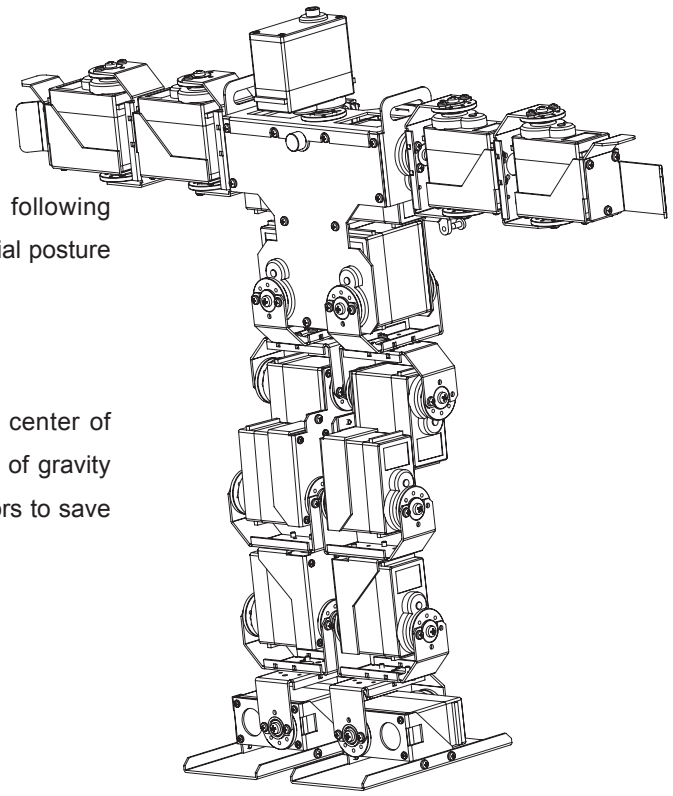
What is home position?

Home position is the basement posture. The posture is standing position. This posture is the fundamental form for stable performance. It is very important to set home position correctly.
It is important that the center of gravity must be put correct place. If the center of gravity is on left or right side, servo motor keeps position using larger torque. The electricity of battery is being waste.

How to set up home position?

RCB-1 has function to keep home position. Home position can be set up using software on PC.

Please refer details to software manual.

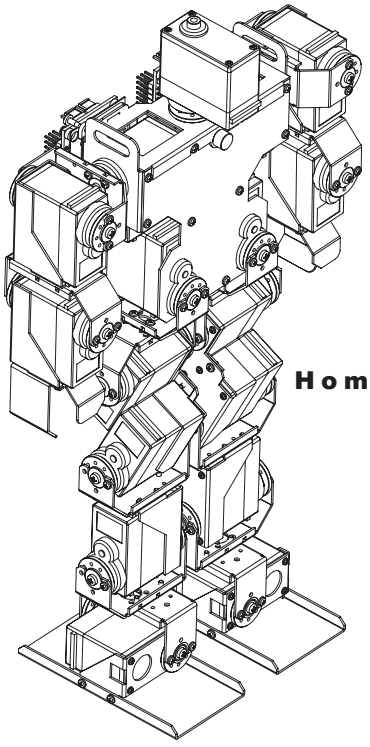


Initial posture

Initial posutre is shown in right figure. On the other hand, following posture shows home position setting. Difference between initial posture and home position are

1. position of shoulders,
2. position of thighs

(other servo axis must be adjusted.) At initial posture, the center of gravity is put on back side.But home position set the center of gravity to be center of body. It realizes minimum load for servo motors to save electricity.



Home position

FAQ

Q Servo motors make noise if power is supplied.

It is normal performance. In the case of robot, each servo motor works to keep position even if the robot is just standing.

Q How long the robot works with NiCd battery?

Depending on charge level of NiCd battery and performance, full charge battery can work the robot 20-30 minutes. Of cause, various performance need much electricity.

Q Servo motor doesn't work but RCB-1 LED turned on.

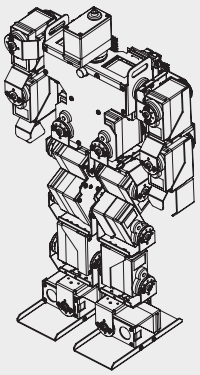
It shows less NiCd battery
RCB-1 can work in less electricity because it has a booster on the board. RCB-1 can work at less electricity if the servo motor can't work.

Q Can other battery use for the robot?

Servo motor KRS-784ICS and RCB-1 requires DC 6V. The dry cell battery can't supply enough electricity to servo motor. The robot performance requires to use the NiCd battery in precondition.

Q Can the robot perform with DC power source?

If the power source can supply DC 6V, it can perform on seveal A. But pay attention to followings:
●Servo motor heat up if the robot works for long time. We recommend to work the robot within 30 mins. Stop servo motors which is heat up the robot even if the time is less than 30 mins.
●Blance of the robot is different from "including NiCd battery". Motion data sometimes requires to adjust weight and blance of NiCd battery.



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