

# KHR-2HV

## Assembly instruction manual



# About safety

Please understand beforehand that there are many cases where the customer has to be responsible for the results of using this product because of the character of this product as an assembly kit.

In this manual, in order to prevent any damage to the person who uses this product and other people as well as their property, prohibited actions are stated as follows.

- The level of danger that is caused when indicatory contents are ignored is divided into following indications.

 **Danger** This indication means that there is a critical danger of death or serious injury.

 **Warning** This indication means that there is a possibility of death or serious injury.

 **Caution** This indication means that there is a possibility of injury or damage to the property.

- Prohibited and compulsory actions are explained by following indications. (These are a part of indications.)



This indicates that the action is prohibited.



This indicates that the action is compulsory.



## Danger



**Prohibition**

**The work has to be done in enough space and in healthy condition physically and morally.**

There is a danger of death or serious injury by an unexpected accident.



## Warning



**Prohibition**

**Pay attention to the children so that they will not touch any part of this product.**

There is a possibility of injury because of frame material of aluminum.



**Pull out the connector of the HV battery immediately when something wrong happens.**

The main part was damaged. A foreign object entered into the main part. The smoke has come out. There is a bad smell. The main part has become feverish abnormally.

If you keep using the product in such abnormal conditions, fire or electric shock might be caused.

- When something wrong happens, stop using the product immediately, and please contact our service section.



**Prohibition**

**Do not damage the charger and the cable.**

Do not use them when they are damaged, converted, brought close to a thermal instrument, or are under too much pressure.

If you keep using them when they are damaged, fire or electric shock might be caused.

- Please contact our service section about the repair of the code and the cable.



**When you do not use the charger, pull it out from the electrical outlet.**

When it is not pulled out from the electrical outlet, a little electrical current flows into the charger.

- Clean the electrical outlet regularly so that the dust does not accumulate.



**Prohibition**

**Do not do servo of the finished product, and do not disassemble and convert the baseplate.**

Disassembling and repairing are prohibited unless they are stated in the manual.  
Wrong disassembly and assembly cause breakdown and also fire and electric shock.

- In case of breakdown, please depend on our service section.



**Prohibition**

**Do not soak this product, and do not use it in high humidity or in the circumstance where dew condensation occurs.**

This will cause breakdown as this product is composed of precise electronic parts.  
This also might cause fire because of electric shock and short circuit.

- When you wet the product, please consult to our service section.



**While operating, pay attention to any danger and try to deal with an unexpected accident.**

Please be reminded that the safety is not completely guaranteed about the results of the operation because of the character of this product as an assembly kit. Please be careful as there is a possibility of injury or fracture of fingertips when the movement of the product is totally different from the one that you expected.



**Recognize the possibility that components cause short circuit.**

Please recognize the danger that conductive things can easily cause short circuit as the terminal of the control plate is bare. Short circuit causes ignition of the battery or wiring materials. Also, wrong connection causes the same danger.



## Caution



**When you use this in overseas, there are cases where permission approval is necessary.**

There are cases where legal procedure is necessary depending upon area or the country where you use this.

- Our support does not apply to the use of this product in the countries other than Japan.



**Hold the plug part when the charger and the cables are pulled out.**

If you hold the cord, it might cause electric shock or fire because of the break of the wire and short circuit.



**Prohibition**

**Do not operate this on an unstable place.**

It might collapse because of losing balance, or it might cause injury because of falling.



The HV battery of this product is the nickel hydrogen battery, which can be recycled. Effective utilization of the resources is possible by recycling. Conversely, disassembly and abandonment cause environmental destruction. Please cooperate to effective recycling.

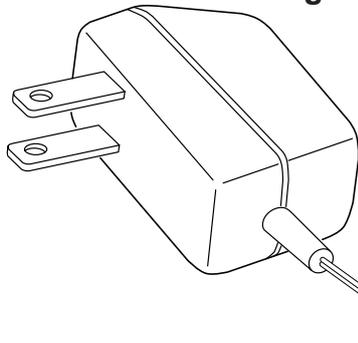
# About the usage of the HV battery

In this kit, the HV battery (the nickel hydrogen electric battery) is used as a power source for operation. Nickel hydrogen is an accumulator which can be charged and reused. But when you use it mistakenly, it might lead to serious accident. Please read this instruction manual carefully before you use it.

## How to charge

### Charger

- The charger is only for AC100V. You use it inserting in the AC electrical outlet at home.



### Charge cord

It is used in order to connect the nickel hydrogen to the charger.



Pay attention to which polarity to connect. Please do not put conversely. You can discern it with the color of the line.

### 9 N-300HV battery

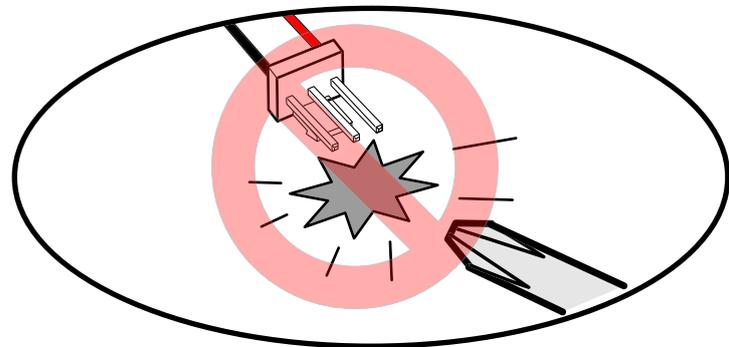
## 1 Connect the charge cord to the charger.

\*Connect it securely so that it will not come out midway.

## 2 Insert the charger into the AC electrical outlet.



\*When it is connected to the charger, electricity comes in the pin ahead the charge cord. Please do not make short circuit with conductive things.

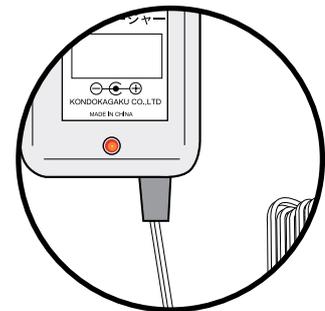


## 3 Connect the HV battery to the connector of the charge cord.

Charging starts when the lamp of the charger lights up.

Charge time differs depending upon the remaining amount of nickel hydrogen. When it is empty, approximately 12 hours is required.

As charging advances, LED (the lamp) becomes dark, but it does not go out completely.



Warning While charging, please pay attention to the state of nickel hydrogen. When there are abnormal heat generation, strange noise and a stench, please remove nickel hydrogen immediately.

# About the usage of the HV battery

## Warnings for the usage

### **Danger**



Please do not do following actions as they are dangerous.

Prohibition

#### **Removing the connector and converting such as exchanging the cords. Do not make short circuit of the battery.**

There are cases where explosion, ignition and the fluid leak occur because of short circuit of the battery, and there is a danger of injury and loss of eyesight. In addition, even when the connector is attached, short circuit can occur in the part of the pin. Attention is always required when it is used.

#### **Do not place the battery with other things when conveying and storing.**

Ignition and the fluid leak can occur because of short circuit which is caused by the damage of the connector, the wire and the wrapping of the nickel hydrogen. Please do not place the battery with other things when conveying and storing. There are examples where the ignition occurred from short circuit because of coins and the keys of a car and a house.

### **Warning**



When the following circumstances occur, take necessary measures.



**When the fluid leak occurs, please wash away the liquid on the hand at once. When it enters into the eye by any chance, after washing away well, please receive the medical examination of the doctor.**

The substance inside the battery is harmful. Influence to the human body occurs, as well as the damage to the furniture and the residence. Enough attention is required because there is a possibility of loss of eyesight when it enters into the eye.



**When you do not use the battery, or leave it for a long time, pull out the connector of the nickel hydrogen from the baseplate or the charger.**

It will be impossible to take necessary measures when unexpected circumstances occur. Please be sure to use it where you can see the battery. Please do not leave the connector inserted for a long time because there is a possibility of fire.

### **Caution**



**Please recycle the nickel hydrogen which is unnecessary, following the method of each community. Illegal abandonment causes environmental pollution. In addition, there is a danger of the accident due to the short circuit and the fluid leak after the abandoning.**

## About the quality of nickel hydrogen

Nickel hydrogen has an advantage that a big electric current can be produced because internal resistance is very low comparing with the dry cell battery. On the other hand, if charging is repeated before it is fully consumed, the memory effect can occur, which makes the life of the battery very short. In order to prevent this memory effect, charge nickel hydrogen after it is fully consumed.

# Preface

Thank you for purchasing robot assembly kit "KHR- 2 HV".

Even though it is a low price, this product is an assembly kit of a two foot walking robot that various operations are possible.

For the assembly, please read carefully this instruction manual and the other instruction manuals that are attached. In addition, we recommend to printout the manuals when necessary.

## Caution

- 1** Please be reminded that we can not necessarily guarantee operations of the assembled product because of the character of this product as an assembly kit. In addition, please recognize the fact that there are times when precise replies are not possible for questions about operations, because they are largely influenced by the method of the assembly.
- 2** This product is constituted in order for people of all ages to enjoy two foot walking robot. But as this is not a toy, there are parts that are difficult to understand or work that can not be done by small children. Therefore, parents or teachers should help them.
- 3** For the assembly and the operation of this product, the personal computer (the Windows2000 or the versions after that is required as well as the USB port) is used. Because of that, in this instruction manual and the other attachment instruction manuals, it is presumed that you have the basic skills of the personal computer. In addition, we can not answer the inquiry regarding personal computer or windows

- Company name, trade name, or the logographic mark that are written in this manual are trade mark or registered trade mark of each company.
- The contents of the manual and the product are subject to change without any notice due to improvement or other reasons.

## Things that have to be prepared

For the assembly and the operation, the following things are necessary other than the kit of this product.

### •Personal computer

Microsoft Windows2000 or XP

At least one USB port\*

CD-ROM drive (for installation of the software and reading the manuals)

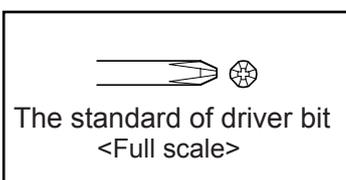
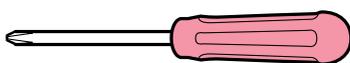
Printer (in case of printing out the manuals)

\*Please use a USB port of the body of a computer. It might not operate properly when the ports that are expanded by the USB hub are used.

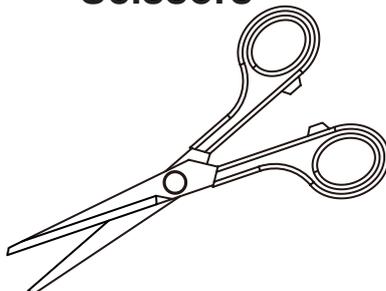
### •Tools

#### Driver of medium size

The one with a thick handle and a magnetic point is convenient.



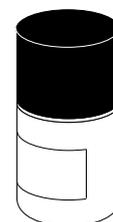
#### Scissors



It is used for cutting the cowl, decal and the sponge. To cut the cowl (made of polycarbonate), strong scissors are suitable.

#### Paint for polycarbonate

It is used to paint the front cowl and the board cover. The paint for model, which is the spray type, is recommended.



#### Other tools that are convenient if you have

- Gimlet
- Pin vise
- Drill

They are convenient for making holes of the board cover

- Cutter
- Nipper
- File

They are convenient for cutting the parts and the board cover.

# About the attached products

## About KRS-788HV

KRS-788HV, which is used to drive the joint in this kit, is a digital FET servo that improved KRS-786ICS. In addition to the know-how which was accumulated with the radio control, by making it a servo applicable to HV, it became a more powerful and energy conservation servo only for a robot than former 6V drives. Functions and specifications are as follows.

- The functions of RedVersion is installed. The use of characteristics change and position capturing is possible.
- By the use of ICS, setting from outside is possible.
- Fixing with the support of both axes is possible as a servo only for robots.
- Applicable to HV. It conserves more energy though the specifications are upgraded compared to former products.

### ■Major specifications

External size -----	41×35×21(mm) *Without projections
Weight -----	47.5g
Torque -----	10.0kg/cm (when nicad 9 cell is used)
Speed -----	0.14sec/60°(when nicad 9 cell is used)
Proper voltage -----	9-12V

## About RCB-3J

### ●Major functions and specifications

\*For the usage, the software for the computer needs to be used.

- Size ----- 45×35(mm)
- Weight ----- 12g
- The number of servo that can be controlled ----- 24
- Proper voltage ----- Direct current 9-12V

# About the after-sales service

Our service section will reply to the questions about this product.

Kondo Kagaku co., LTD. Service Section	Tel: 03-3807-7648 (Direct to Service Section)
4-17-7, Higashi Nippori, Arakawa, Tokyo	9:00-12:00 13:00-17:00
116-0014	excluding Saturdays, Sundays and national holidays

As for the inquiry by the email, we take it by the following email address, but please understand that it might take a while until we reply.

**support@kondo-robot.com**

Notice and updates about the product are shown on our website.

**<http://www.kondo-robot.com>**

# About the instruction manuals

**There are four manuals in total in this product.**

**1, Kit guidance**

The only printed manual.  
It explains the kit and how to view the other manuals.

**2, Assembly instruction manual for KHR-2HV**

This manual. This is provided by a PDF file.  
It explains how to assemble the kit.

**3, Operation manual for RCB-3J**

This is also provided by a PDF file. It explains about the motion making software and control board RCB-3J.

**4, Serial USB adapter**

This is a manual for a serial USB adapter that is used when you connect RCB-3J to a computer.

## The composition of this manual and the outline of the assembly

Charge HV battery before assembly

**1** Removing servo case screw

**2** Installing servo in the bracket

**3** Assembly of shoulder unit

**4** Assembly of leg unit

**5** Assembly of foot unit

**6** Assembly of front frame

**7** Assembly of body unit

**8** Assembly of control unit

**9** Setting the origin, installing servo arm

**10** Assembly of the entire part

**11** Setting home position

**In this kit, most jobs can be done just by tightening screws. But in the contents after the 9th in the figure in the left, it is necessary to do the work, connecting servo to the control baseplate, and verifying the stop position of the initial condition (the origin setting).**

**Therefore, before starting the assembly, please **charge the HV battery**.**

**When tightening plural screws, all the screws have to be temporarily locked and then be tightened. If a screw is tightened hard from the first one, other screws might not fit to the holes.**

# The list of parts

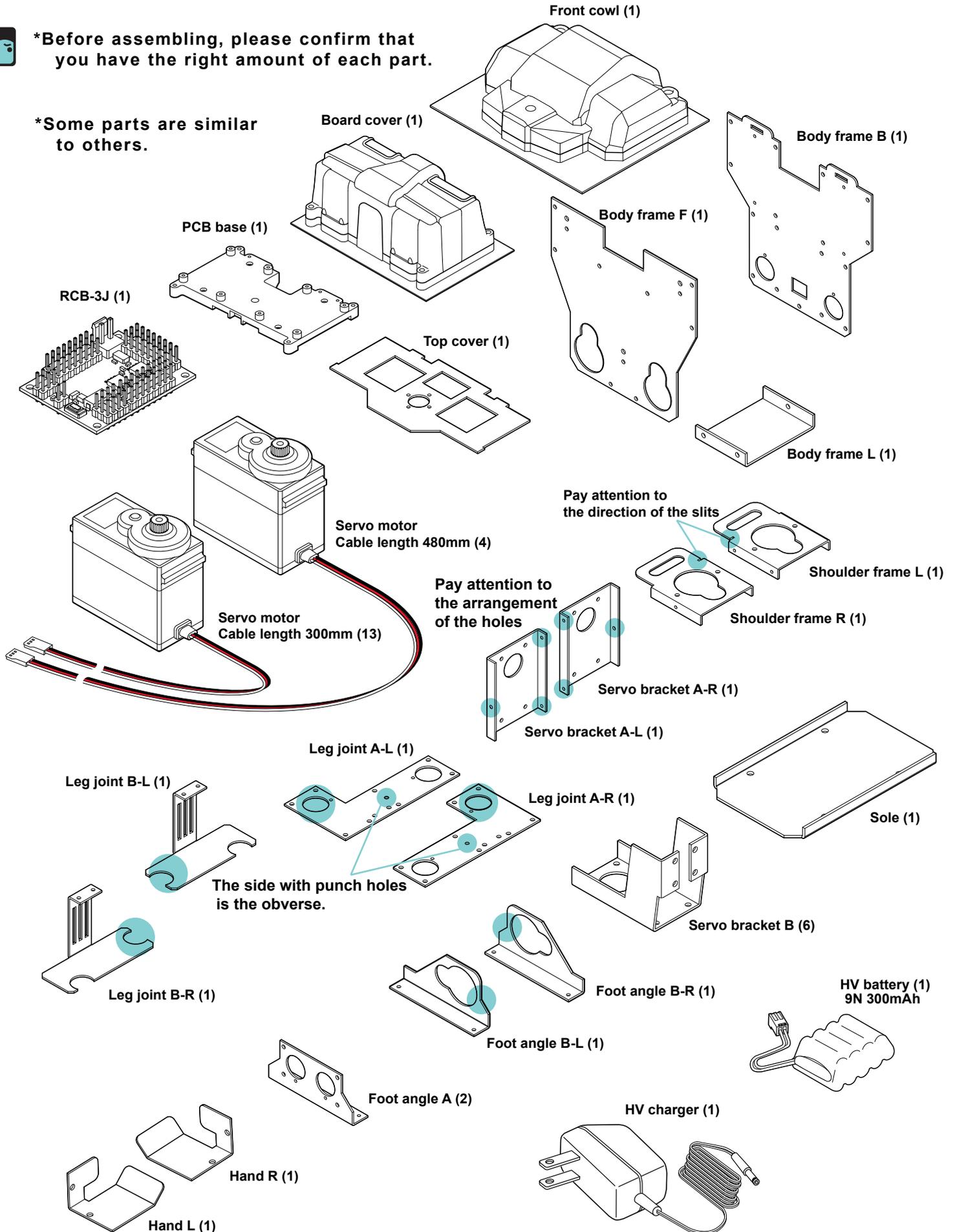
Name	Number	Amount	Notes
Control board	RCB-3J	1	
Servo motor Cable length 300mm	KRS-788HV C300	13	
Servo motor Cable length 480mm	KRS-788HV C480	4	
Top cover	NHR-001	1	
Body frame F	NHR-002	1	
Body frame B	NHR-003	1	
Body frame L	NHR-004	1	
Shoulder frame L	NHR-005	1	
Shoulder frame R	NHR-006	1	
Servo bracket A-L	NHR-007	1	
Servo bracket A-R	NHR-008	1	
Servo bracket B	NHR-009	6	
Hand L	NHR-010	1	
Hand R	NHR-011	1	
Leg joint A-L	NHR-012	1	
Leg joint A-R	NHR-013	1	
Leg joint B-L	NHR-014	1	
Leg joint B-R	NHR-015	1	
Foot angle A	NHR-016	2	
Foot angle B-L	NHR-017	1	
Foot angle B-R	NHR-018	1	
Sole	NHR-019	2	
PCB base		1	
Board cover		1	
Front cowl		1	
Cable guide		12	
Arm supporter 700A		2	
Servo arm 700A upper arm		14	
Servo arm 700A bottom arm		14	
Servo arm 700A base		12	
Body pin		5	for 5 mm
Body post		3	
Low height servo hone		3	
Nylon strap		4	
Screw for flat head hone		30	
2.6-6 tapping screw		15	
M2-4 screw		35	
2.6-8 tapping screw		30	
2-6 plate tapping screw		15	
2.3-6 tapping screw		26	
M2-5 screw		15	
2-4 plate screw		10	
HV power source switch harness		1	
HV battery charge cord		1	
Cable extension		1	100m long
Serial USB adapter		1	
Serial cable extension		1	
HV battery	9N-300mAh	1	
HV charger		1	

# The catalogue of parts



\*Before assembling, please confirm that you have the right amount of each part.

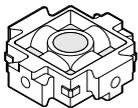
\*Some parts are similar to others.



# The catalogue of parts

**Parts Bag A**

Servo arm 700A base (12)



\*When you use this, be careful of the obverse and the reverse. This figure shows the obverse.

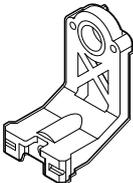
**Parts Bag B**

Servo arm 700A upper arm (14)



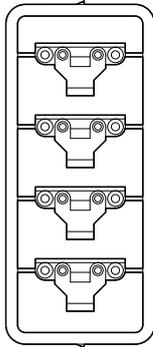
**Parts Bag C**

Servo arm 700A bottom arm (14)



**Parts Bag D**

Cable guide (3)



Arm supporter 700A (2)



**Parts Bag E**

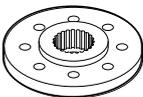
Body post (3)



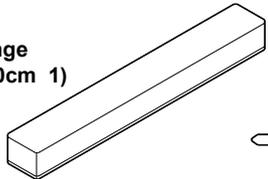
Body pin (5)



Low height servo hone (3)



Sponge (about 10cm 1)

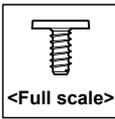


Nylon strap (4)



**Parts Bag F**

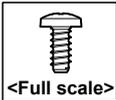
Screw for flat head hone (30)

<Full scale>

**Parts Bag G**

2.6-6 tapping screw (15)

<Full scale>

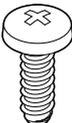
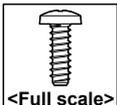
M2-4 screw (35)




<Full scale>

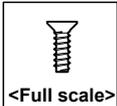
**Parts Bag H**

2.6-8 tapping screw (30)

<Full scale>

2-6 plate tapping screw (15)

<Full scale>

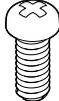
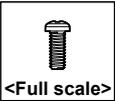
**Parts Bag I**

2.3-6 tapping screw (26)




<Full scale>

M2-5 screw (15)

<Full scale>

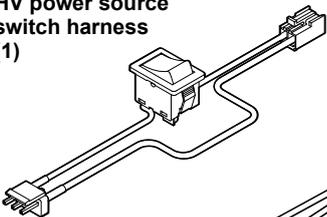
2-4 plate screw (10)



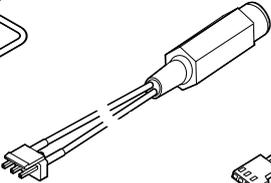

<Full scale>

**Parts Bag J**

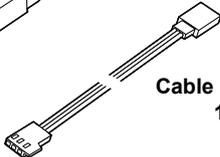
HV power source switch harness (1)



HV battery charge cord (1)

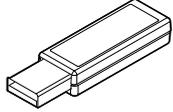


Cable extension 100m long (1)

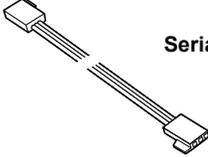


**Parts Bag K**

Serial USB adapter (1)



Serial cable extension 1.5m long (1)



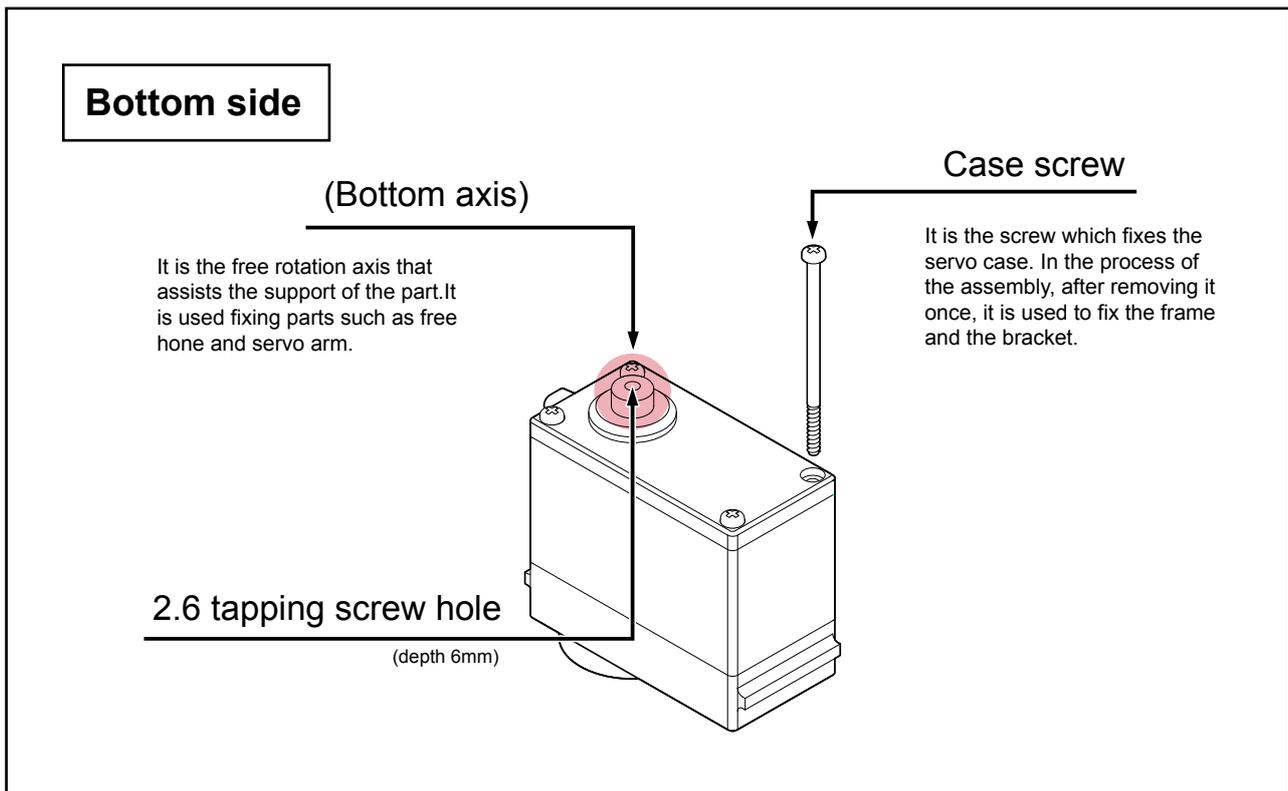
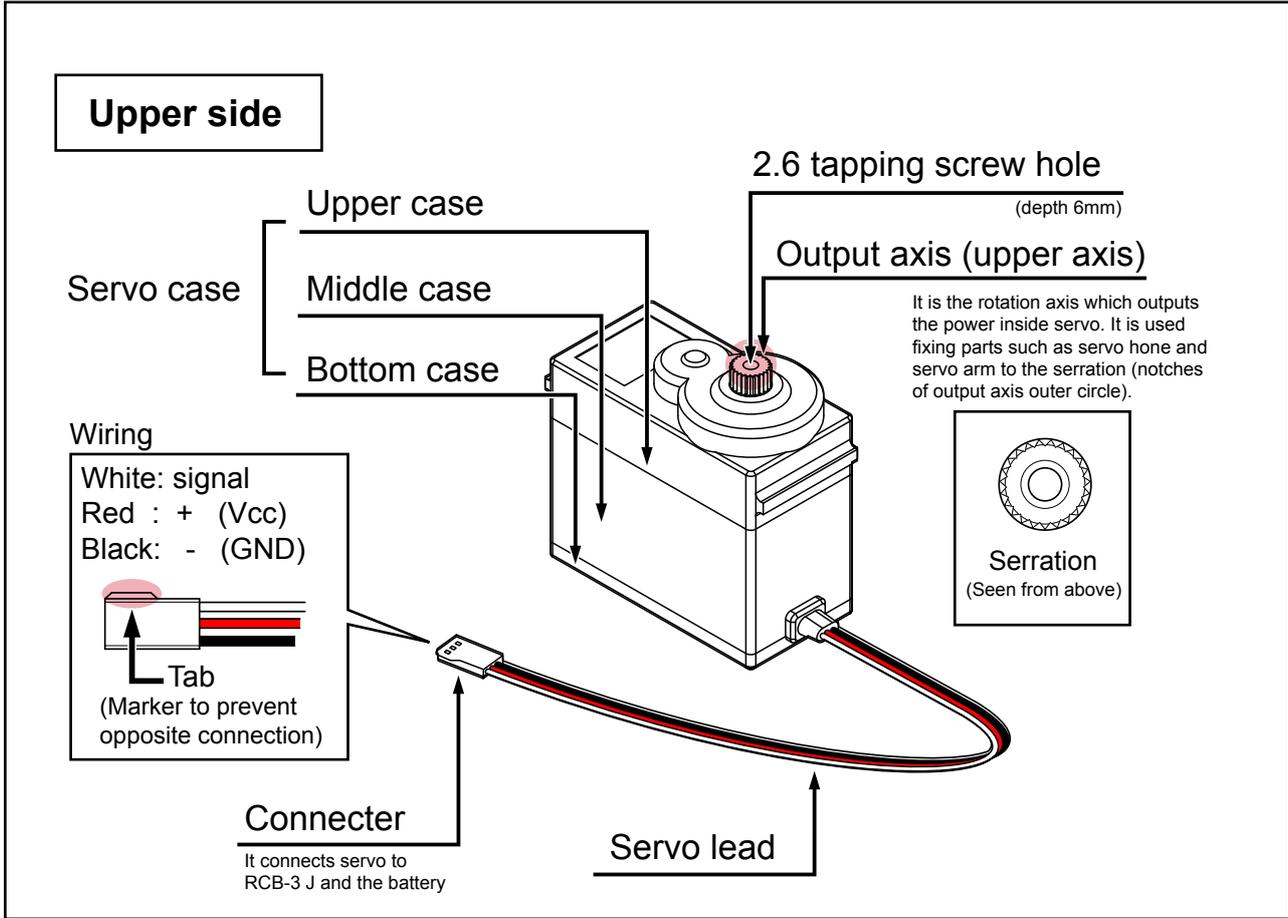
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# Before the assembly

## Names of each part of servo motor (KRS-788HV)



## The types of screws and how to use them



### Screw (coarse meter screw)

#### ■Characteristics of the screws

In this kit, this screw is used for most of the fixings of the aluminum part. ("M" inscribed in the name of the screws means that it is the meter bis of JIS standard.)

It fits only in the screw holes whose screw is cut. (You can see notches of the screw in the side of the hole.) It can be used repeatedly unless it wears or deforms.

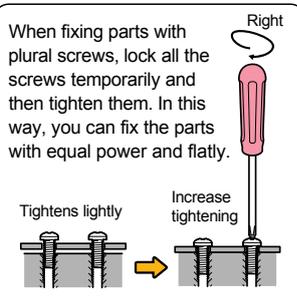
#### ■Attentions when tightening the screws

When tightening, be careful not to break the head of a screw with a driver. (Don't use the driver whose size of the point does not fit. Also, don't tighten it too hard.)

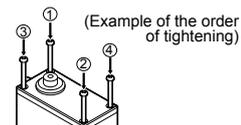
Change the screw with a new one when its head is squashed, as it will not be able to remove with a driver.

When you can't finish tightening a screw, please see if the screw is bent.

If you continue to use a bent screw, a screw hole will deform and it will be impossible to tighten a screw even if you change it with a new one.



In addition, when you fix the parts with more than four screws, tighten a screw in a diagonal line first so that the parts will not be under too much pressure.



#### ■Maintenance

Even if the screws are tightened securely, they loosen naturally from vibration. See regularly if the screws are not loosened.

When screws loosens frequently or fall off with motions, locking material for screws (lock tight or screw lock) is effective.

\*When you use them, please follow a manual of materials.

If you fix screws with instantaneous adhesive, be careful because it might be impossible to take off the screws or the holes might be filled.



### Tapping screw

#### ■Characteristics of the screws

It is used to fix resin parts and a part of aluminum parts. The screw part of tapping screws is a drill and its head is thin, and it fixes the parts cutting a screw in the hole whose diameter is smaller than a screw. (It is called 'tapping' cutting a spiral hole so that a screw fits into the hole.) It can be tightened harder than normal screws, but you need more power to tighten them at first. If the tapping screws are tightened and taken off repeatedly, holes become larger and they loosen.

#### ■Process of tightening screws

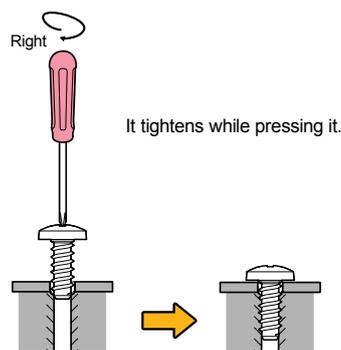
1, Confirmation of screw holes Before tightening tapping screws, see if the position and the shape are as in the manual.

\*If you tighten tapping screws into normal screw holes or the holes of different size, screw holes deform and it will be impossible to tighten the right ones.

#### 2, Tapping

Tighten a tapping screw pushing its head with a driver so that it stands vertical.

\*If resin parts are tightened too hard, the head of a screw deforms.



#### ■Tightening a screw again after taking it off

If a tapping screw is loosened after tightening it, screws are formed in the hole. When tightening it again, do it as follows.

#### 1, Lock a screw vertically

Rotate a screw conversely before tightening it to see if the it is locked vertically.

#### 2, Tighten it without pushing

Do it as normal screws.

\*If you push a screw, the holes will be damaged and it will be impossible to fix a screw.

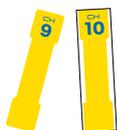
# Before the assembly

## Distinction of servo and channel

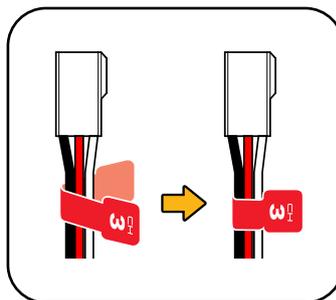
### How to stick decal for servo lead



It is convenient when sticking if you cut them with scissors or cutter beforehand.



Cut decal into your favorite figure seeing the left drawing.



As for the number of channel, see 'Process of assembly' or 'the list of channel'.

### How to stick decal for the body of servo

Stick it on a distinctive part such as the side of servo.

\*Stick decal which has the same number of channel as the one on a connector.

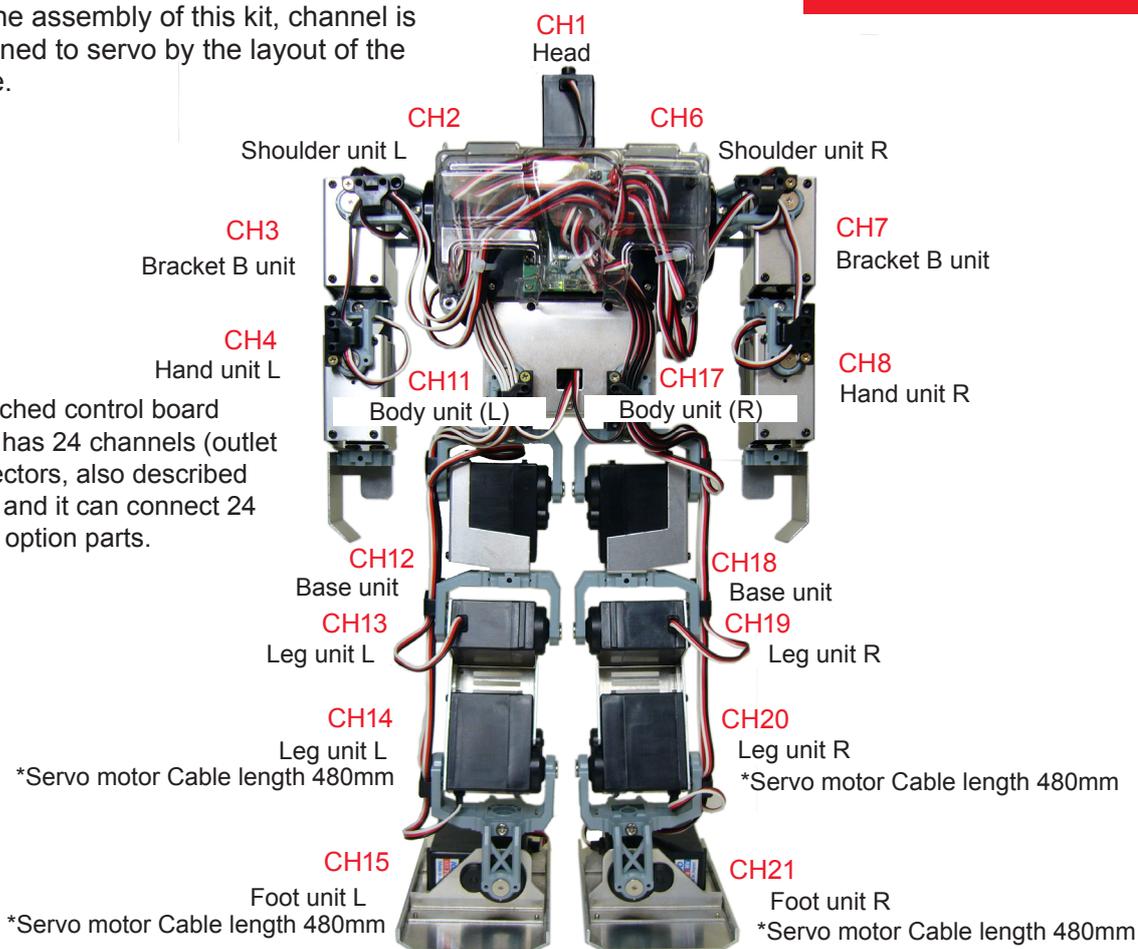


## KHR-2HV the list of channel

For the assembly of this kit, channel is assigned to servo by the layout of the figure.

\*This is the back side

The attached control board RCB-3J has 24 channels (outlet of connectors, also described as 'CH') and it can connect 24 servo or option parts.



CH 5  
CH 9  
CH 10 It doesn't use it in this kit.  
CH 16  
CH 22-24

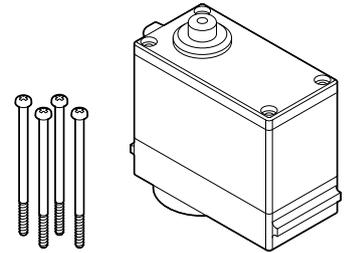
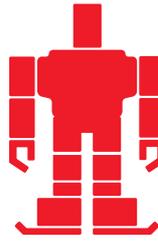
## Removing case screw

The image of a complete one

Preparation of assembly

### Necessary parts

- Servo motor KRS-788HV Cable length 300mm 12
- Servo motor KRS-788HV Cable length 480mm 4



Explanation of the icons



Explaining the points



Knack to do the work well



Caution of breaking



Need to be confirmed

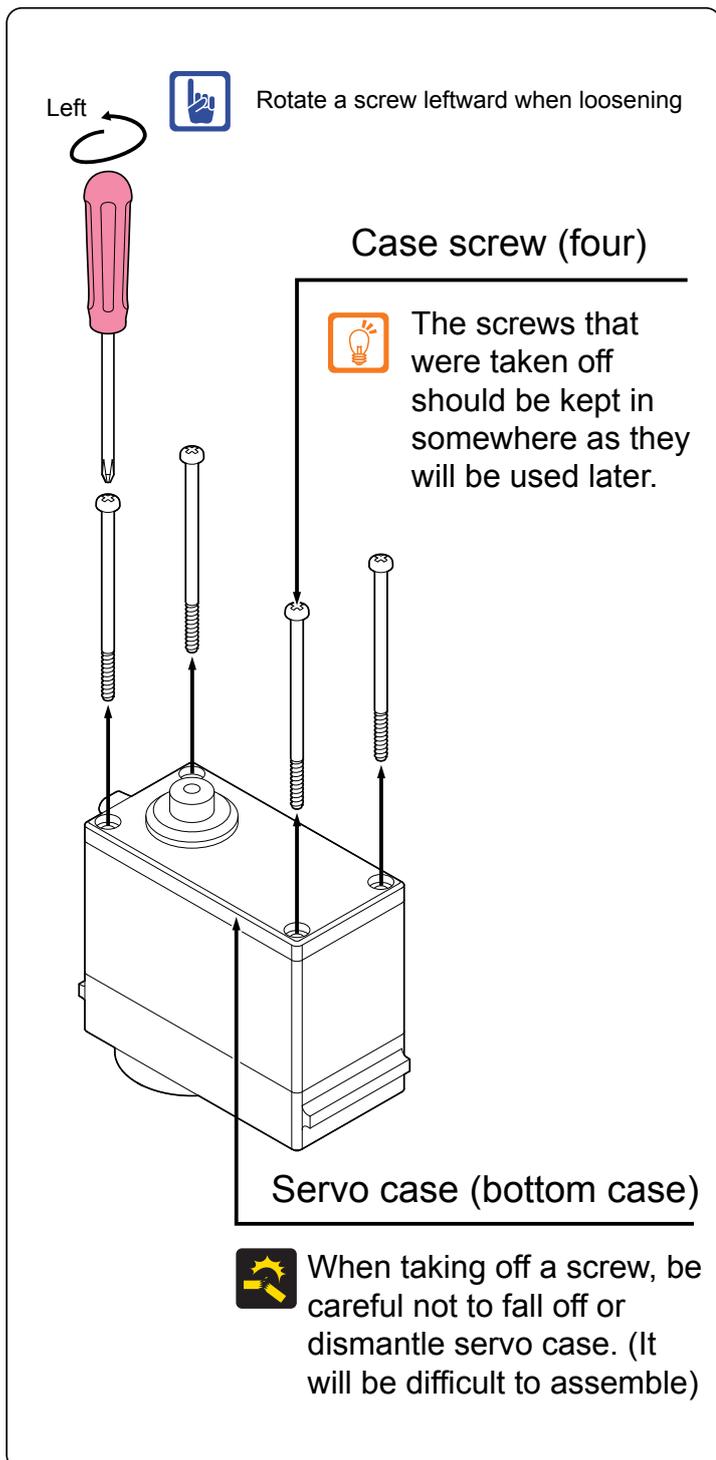
### The process of work

1. Remove case screw which is attached to the bottom case of servo motor.

For one servo motor (servo) four case screws are attached.

Remove all case screws that are attached to 16 servo in total (length of servo lead = 300mm: 12, 480mm: 4).

2. See the number of servo and case screws (64 in total) and keep them in a stable place or in a box)



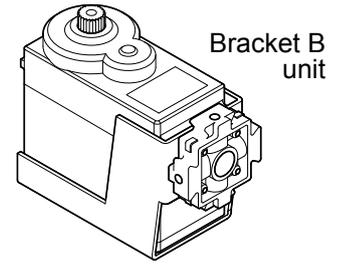
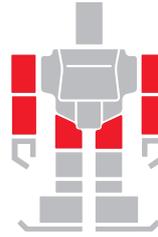
## Assembly of bracket B unit

The image of a complete one

### Necessary parts

- Servo motor KRS-788HV  
Cable length 300mm 6
- Servo bracket B 6
- Servo arm 700A base 6
- 2.3-6 tapping screw 24
- Case screw 24

Arm - Upper arm - Thigh



Explanation of the icons



Explaining the points



Knack to do the work well

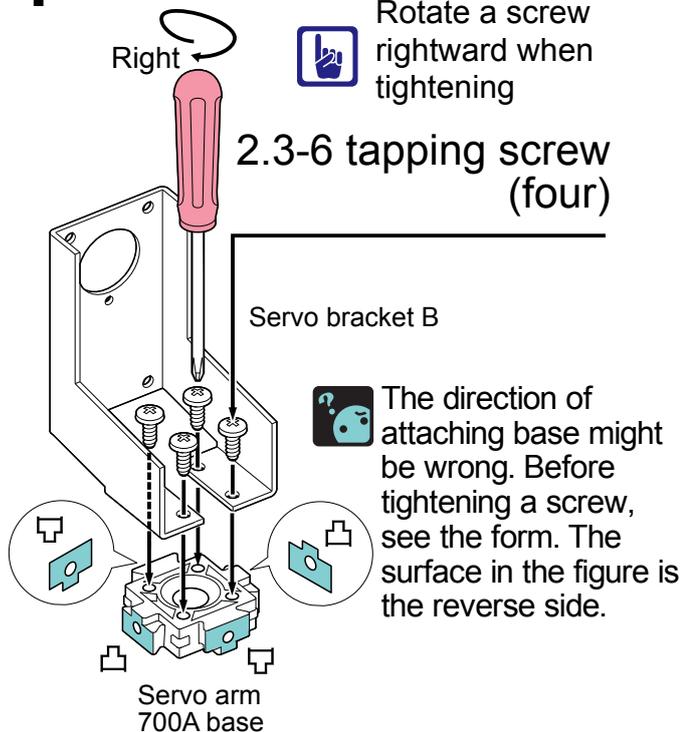


Caution of breaking



Need to be confirmed

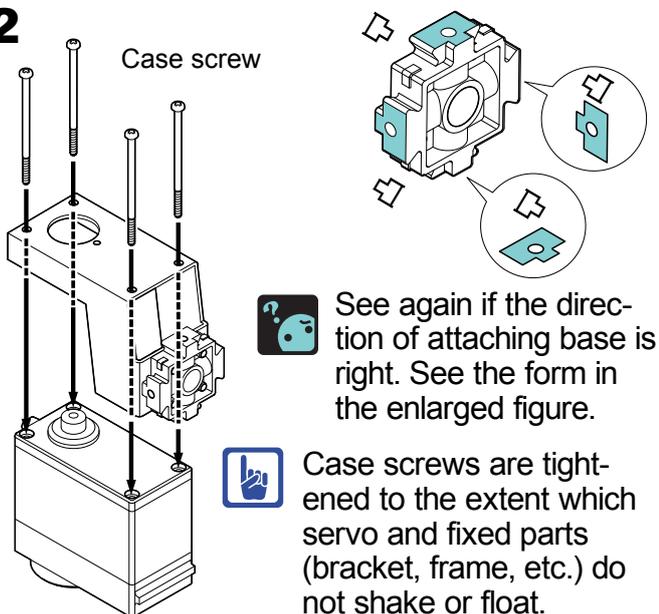
1



### The process of work

1. Attach base of servo arm 700A (servo) to servo bracket B (bracket B) with 2.3-6 tapping screws.

2



2. Attach bracket B to servo with case screws.



**Be careful not to tighten case screws too hard. They can deform and physical resistance will be produced in output axis. This causes servo to be feverish or to ignite.**



**Case screws are tightened as soft as possible to the extent which servo and fixed parts (bracket, frame, etc.) do not shake or float.**

**\*Assemble 6 same units in total**

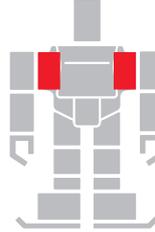
## Assembly of shoulder unit

The image of a complete one

### Necessary parts

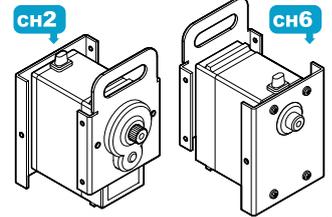
- Servo motor KRS-788HV  
Cable length 300mm 2
- Shoulder frame L 1
- Shoulder frame R 1
- Servo bracket A-L 1
- Servo bracket A-R 1
- Case screw 8

### Shoulder joint



Shoulder unit L

Shoulder unit R



Explanation of the icons



Explaining the points



Knack to do the work well



Caution of breaking

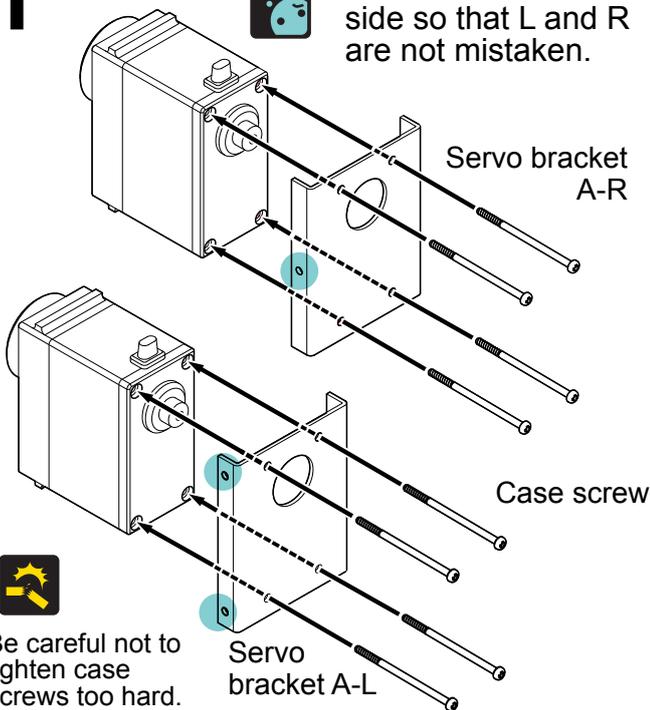


Need to be confirmed

# 1



See the holes of the side so that L and R are not mistaken.



Be careful not to tighten case screws too hard.

### The process of work

1. Assemble unit L and unit R attaching shoulder L and shoulder R to servo with case screws (four for each)

2. Attach servo bracket A-L and servo bracket A-R to unit L and unit R.

Screws are not used in this part, so holes are designed a little tight.

Be careful not to bend bracket.

3. Cut decal for servo lead and stick it on servo lead.

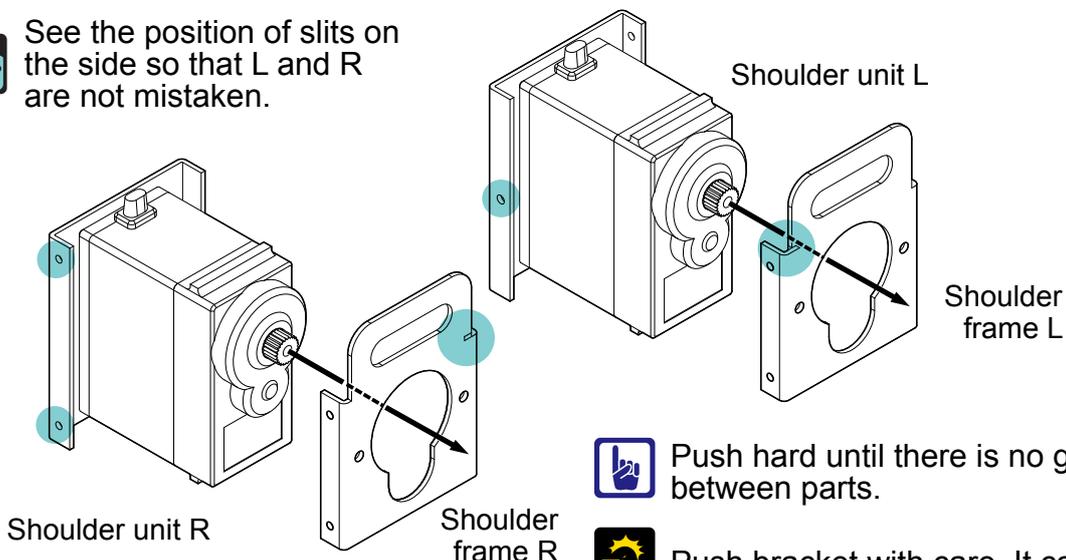
CH 2 : Shoulder unit L

CH 6 : Shoulder unit R

# 2



See the position of slits on the side so that L and R are not mistaken.



Push hard until there is no gap between parts.



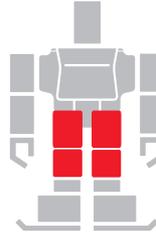
Push bracket with care. It can deform.

## Assembly of leg unit

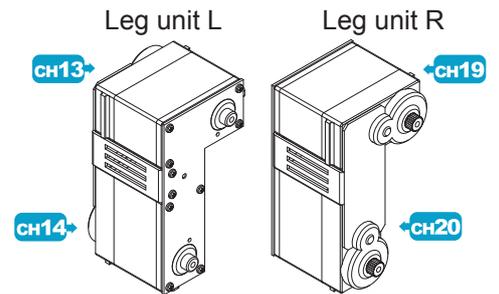
### Necessary parts

• Servo motor KRS-788HV Cable length 300mm	2	• M2-4 screw	4
• Servo motor KRS-788HV Cable length 480mm	2	• Case screw	16
• Leg joint A-L	1		
• Leg joint A-R	1		
• Leg joint B-L	1		
• Leg joint B-R	1		

### Thigh - Knee



### The image of a complete one



### Explanation of the icons



### Explaining the points



### Knack to do the work well

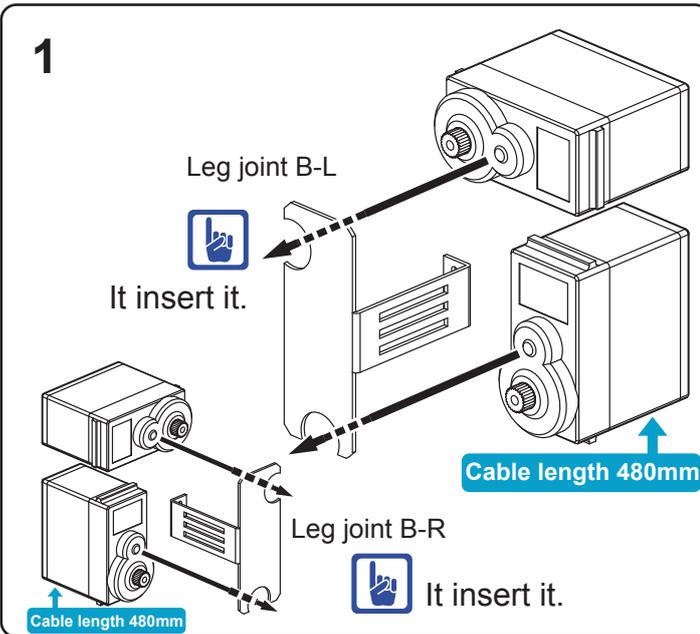


### Caution of breaking



### Need to be confirmed

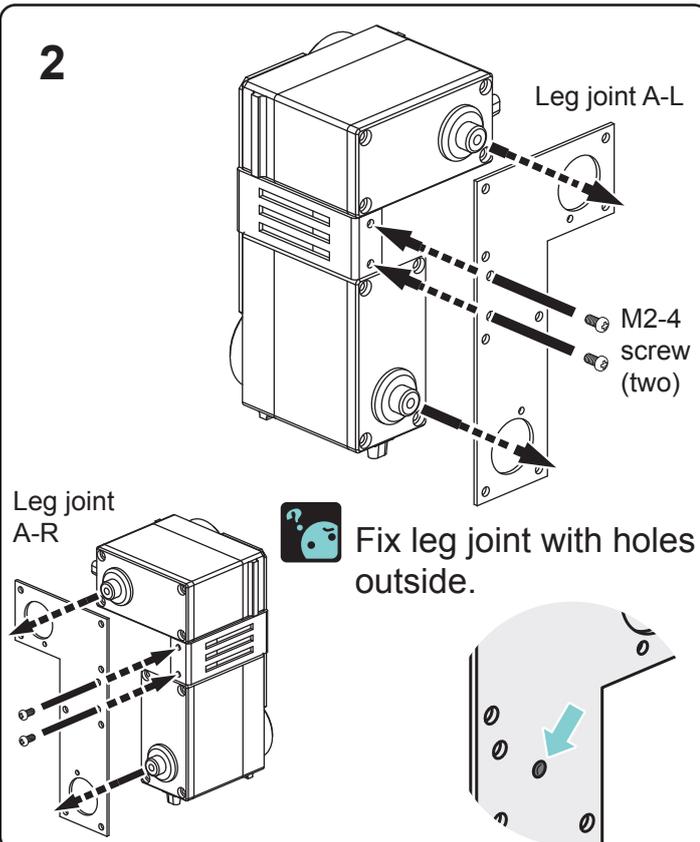
1



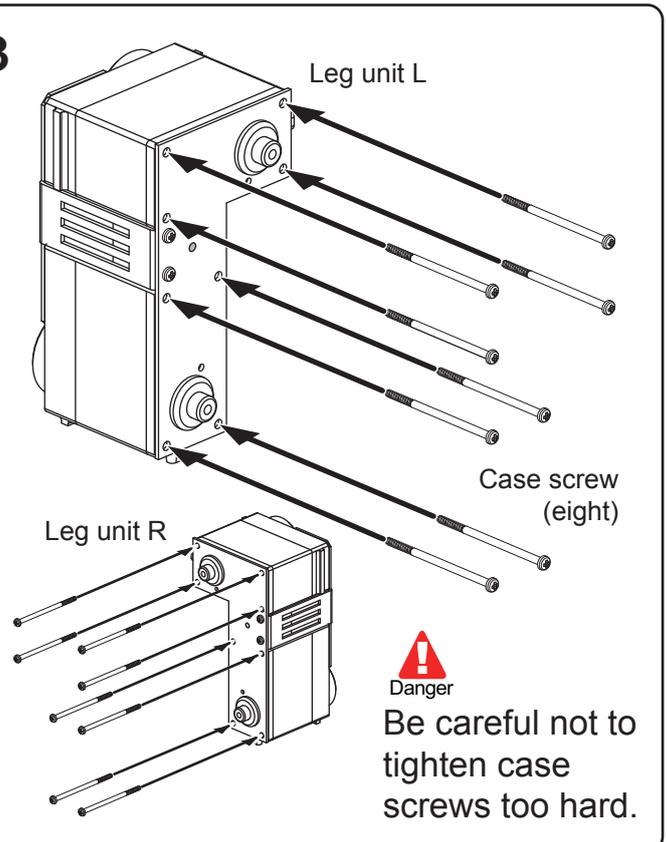
### The process of work

1. Insert leg joint B-L and leg joint B-R into servo
2. Attach leg joint A-L and leg joint A-R with M2-4 screws (2 for each)
3. Attach leg joint A-L and leg joint A-R to servo with servo case screws (8 for each).
4. Cut decal for servo lead and stick it on servo lead.  
CH13 : Leg unit L (upper part)  
CH14 : Leg unit L (lower part)  
CH19 : Leg unit R (upper part)  
CH20 : Leg unit R (lower part)

2



3



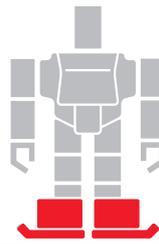
## Assembly of foot unit

The image of a complete one

### Necessary parts

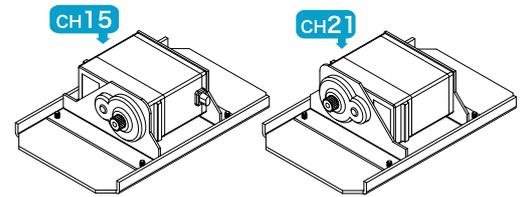
- Servo motor KRS-788HV  
Cable length 480mm 2
- Sole 2
- Foot angle A 2
- Foot angle B-L 1
- Foot angle B-R 1
- M2-4 plate screw 8
- Case screw 8

Ankle - Sole



Foot unit L

Foot unit R



Explanation of the icons



Explaining the points



Knack to do the work well

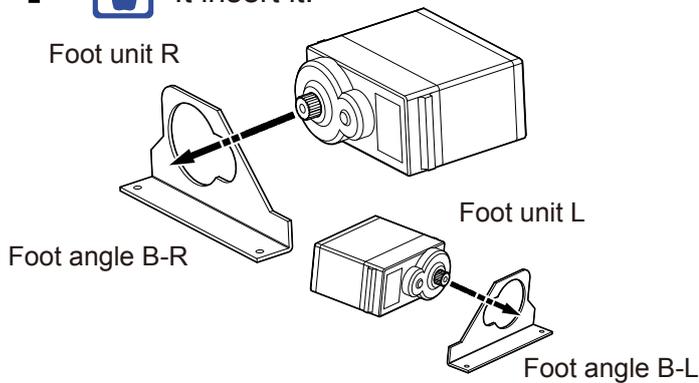


Caution of breaking



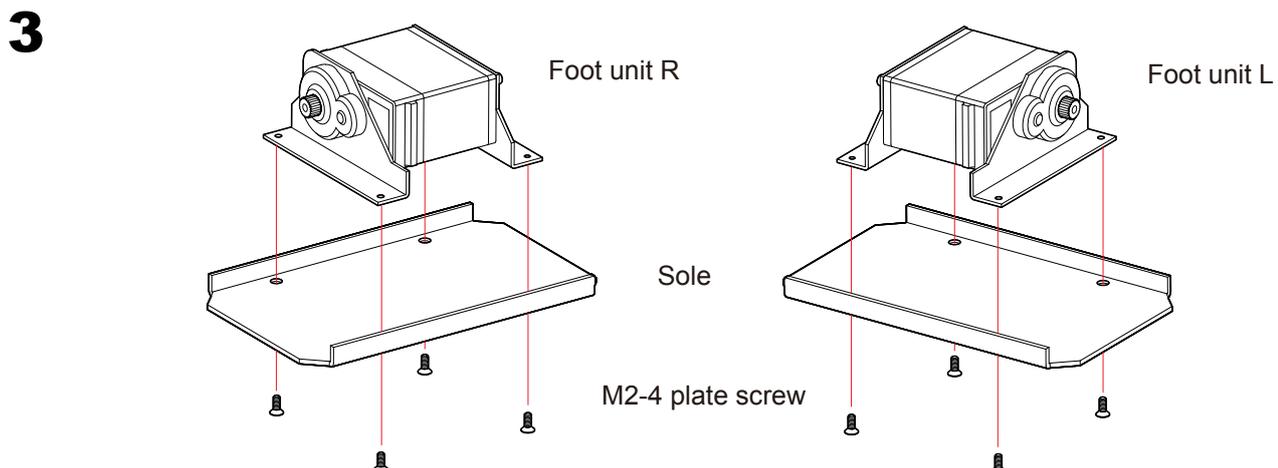
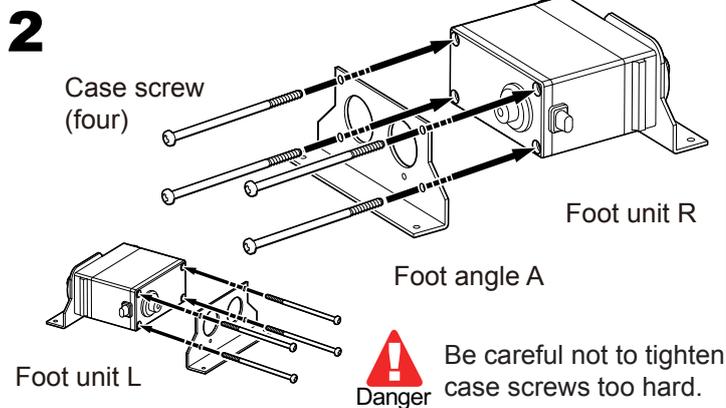
Need to be confirmed

**1**  It insert it.



The process of work

1. Insert servo into foot angle B-L and foot angle B-R
2. Attach foot angle A with case screws (4 for each).
3. Attach sole to foot unit L and foot unit R.  
(Sole can be attached to both L and R)
4. Cut decal for servo lead and stick it on servo lead.  
CH15 : Foot unit L  
CH21 : Foot unit R



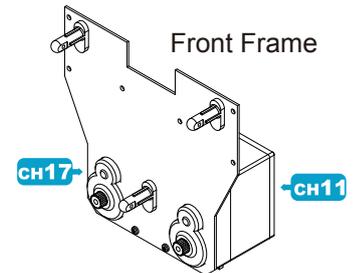
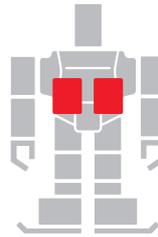
## Assembly of front frame

The image of a complete one

### Necessary parts

- Servo motor KRS-788HV  
Cable length 300mm 2
- Body frame F 1
- Body frame L 1
- Body post 3
- M2-4 screw 2
- 2.6-6 tapping screw 3

Hip joint



Explanation of the icons



Explaining the points



Knack to do the work well

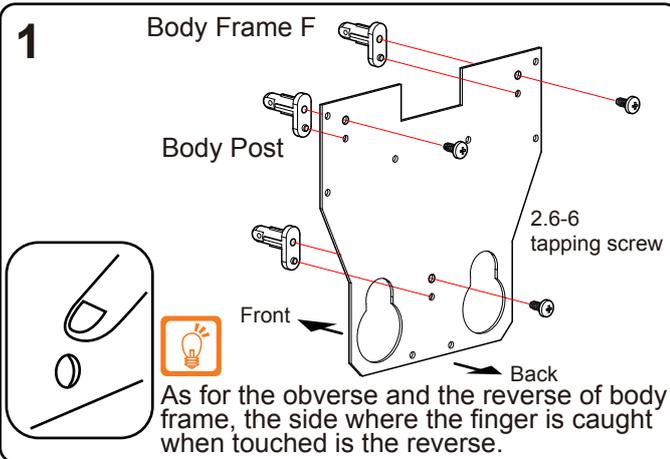


Caution of breaking



Need to be confirmed

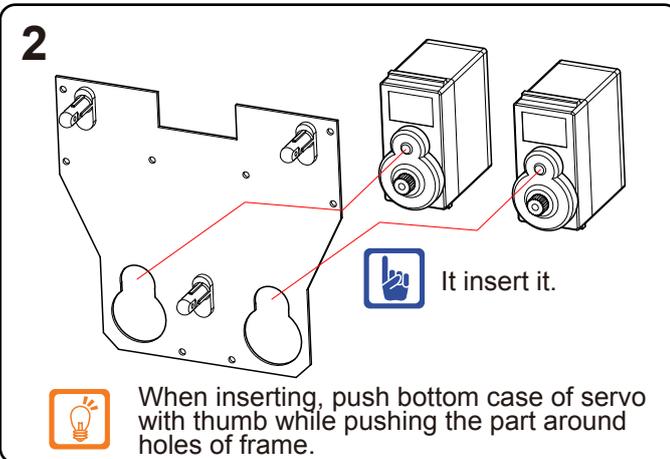
1



1. Fix body post to body frame F with 2.6-6 tapping screws.

### The process of work

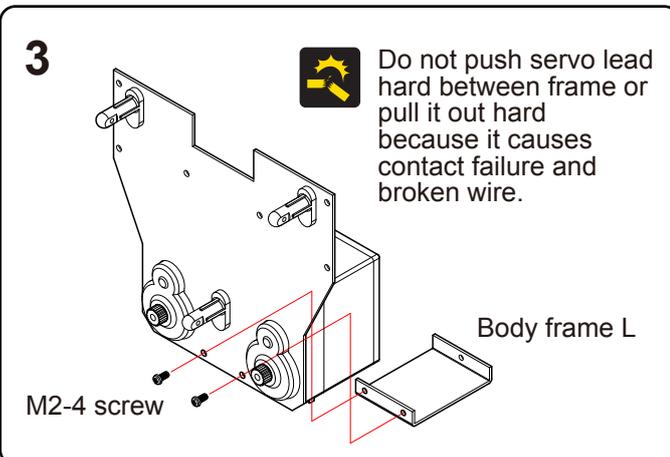
2



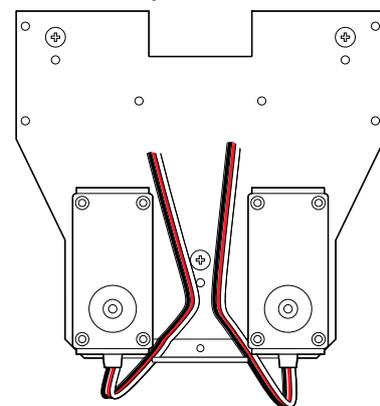
2. Insert servo into body frame F.

3. Attach body frame L to body frame F with M2-4 screws. Pay attention to the position of servo lead.

3



How to put servo lead



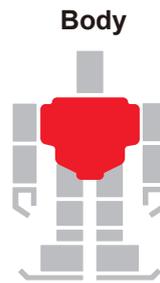
See if servo lead is put as in the figure. If it's put in the wrong direction, wiring will be difficult.

## Assembly of body unit

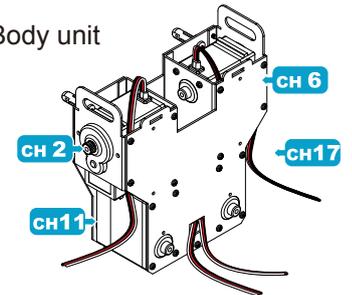
The image of a complete one

### Necessary parts

- Shoulder unit L (assembled) 1
- Shoulder unit R (assembled) 1
- Front unit (assembled) 1
- Body frame B 1
- M2-4 screw 15
- Case screw 8



Body unit



Explanation of the icons



Explaining the points



Knack to do the work well

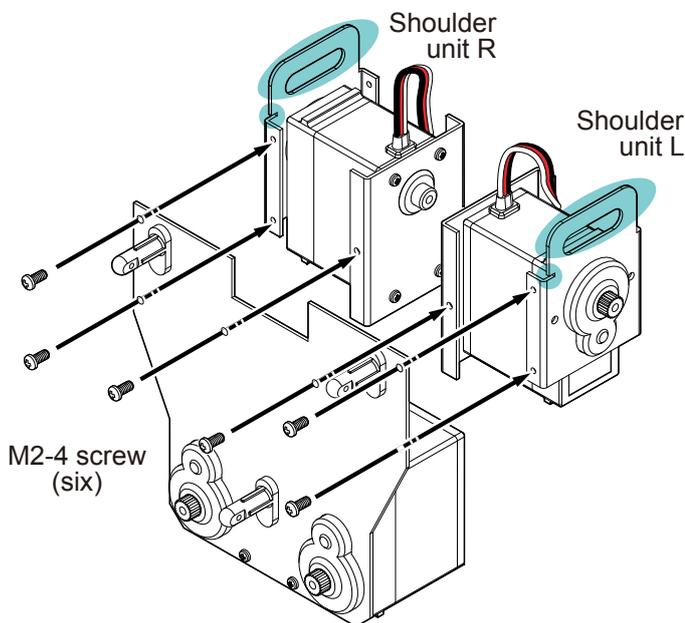


Caution of breaking



Need to be confirmed

- 1**  When attaching shoulder frame, attach L and R with shoulder frame outside.



### The process of work

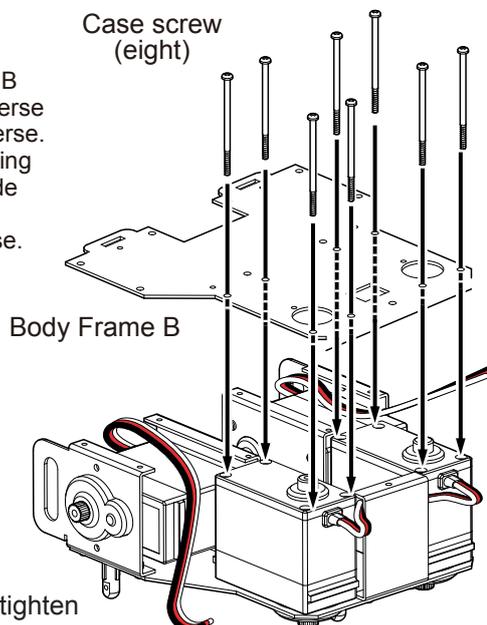
1. Attach shoulder unit L and shoulder unit R to front unit with M2-4 screws (3 for each).
2. Fix body frame B and servo of front unit with case screws.
3. Attach body frame B and servo bracket A-L and servo bracket A-R of shoulder unit with M2-4 screws.
4. Cut decal for servo lead and stick it on servo lead.  
 CH2 : Shoulder unit (L)  
 CH6 : Shoulder unit (R)  
 CH11 : Front Frame (L)  
 CH17 : Front Frame (R)

**2**



Body frame B had the obverse and the reverse. When touching screw holes, the side where the finger is caught is the reverse. Attach it with the obverse side up.

Case screw (eight)

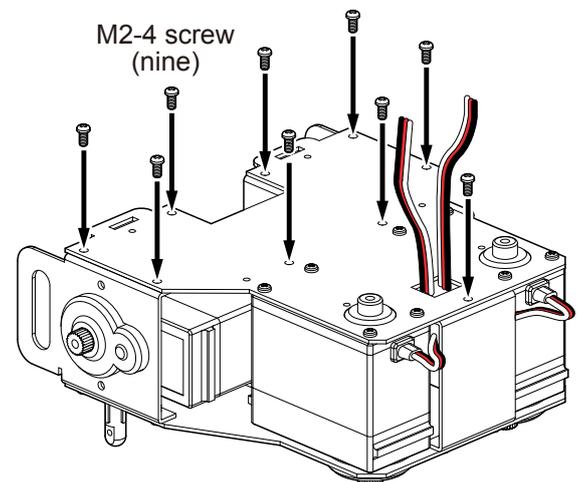


**Danger**  
Be careful not to tighten case screws too hard.

**3**



Servo lead of CH11 and CH17 has to be put through so that it come out from the holes of body frame B to the back.



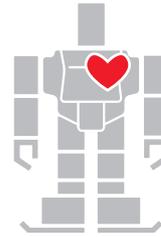
## Assembly of control unit

The image of a complete one

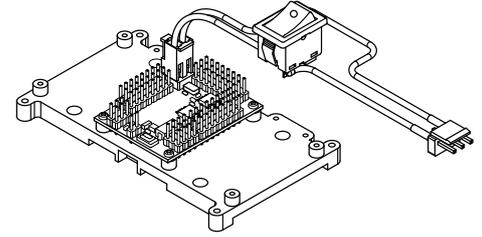
### Necessary parts

- RCB-3J 1
- PCB base 1
- M2-4 screw 4
- HV power source switch harness 1

Control part



Control unit



Explanation of the icons



Explaining the points



Knack to do the work well



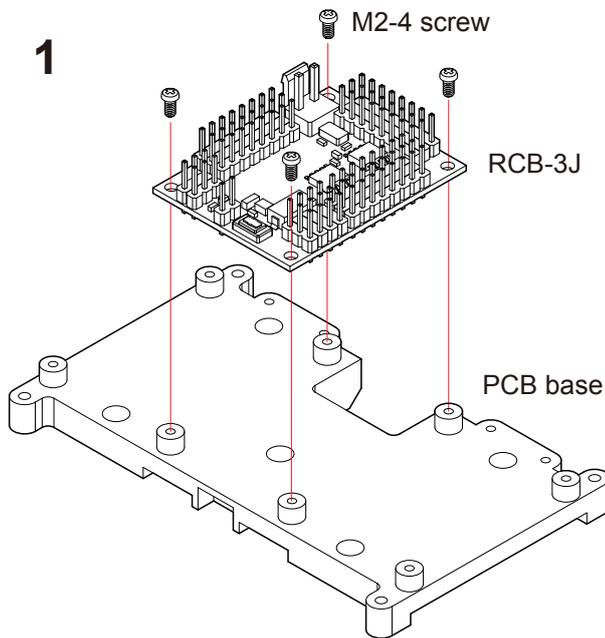
Caution of breaking



Need to be confirmed

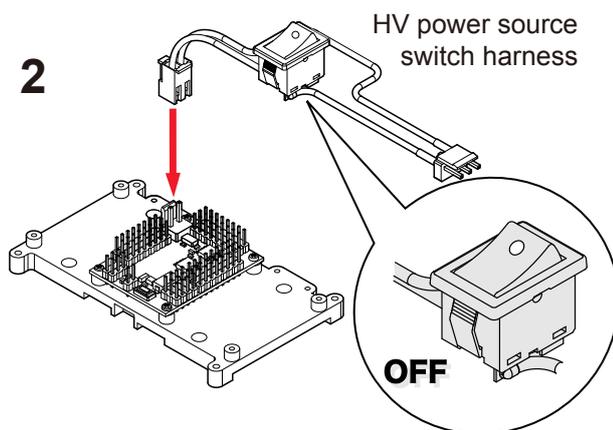
### The process of work

1



1. Attach RCB-3J to PCB base with M2-4 screws.
2. Insert the power source switch harness in the power source terminal of RCB-3J.

2



Danger

Keep the power switch in power source switch harness off unless it is indicated. (See the enlarged figure.) If it's kept on, the robot might move suddenly and fall off or break down when connected to outlet. It also might cause serious injury with finger scissors.



The connector is designed so that it can not be inserted conversely. If you try to insert it in the wrong way, it will damage the connector.

### ■ Is the control board the heart of a robot?

In case of the person's mechanism to move the body, the brain orders first by thinking that "I will move the body", and the nerve transmits the order to the muscle, which moves each joint of arms and feet by muscles around them. Blood flows to the brain and the muscle, and circulating organs such as the heart work so that the energy to exercise (oxygen, nutrition etc.) are always carried.

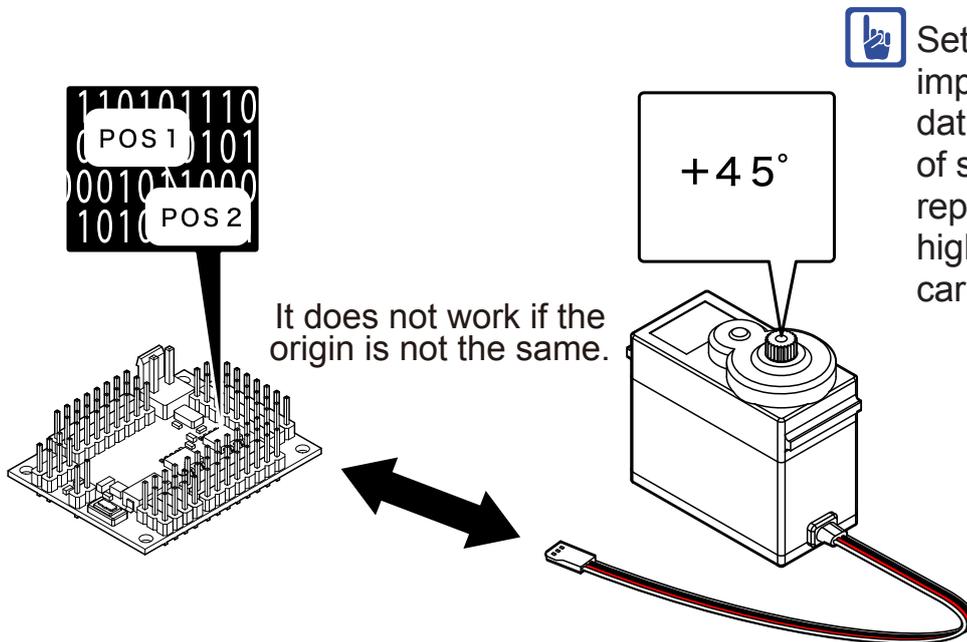
The body of the person continues to move in this way, but how about the robot?

In KHR-2HV, the control board (RCB-3J) plays a role as a heart and the signal conductor in the wiring as the nerve, and they control servo which plays a role as a joint. This motion is carried out following the program which is written in the memory in the control board.

The motor inside the servo case and the gear play a role as the muscle. Therefore, if the assembly or the condition of these parts are bad, the joint of the robot does not move well and it leads to unstable motions.

In addition, for the robot which does not have the circulatory organ, the electricity instead of blood is the source of the energy that operates the control board and moves the joint. The control board also functions as the repeater of the electricity to each servo.

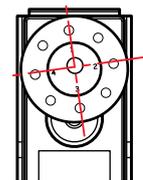
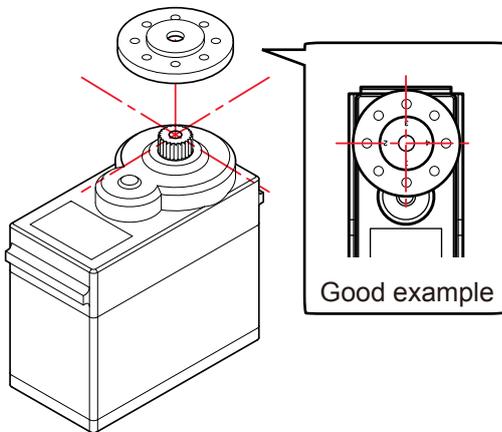
## Setting parts to servo output axis, Cautions



Setting the origin is the important work that decides the datum point of the turning angle of servo. By doing this securely, reproducibility can become high when sample motions are carried out.

### Attaching servo hone

There are notches which are called the serration in the output axis of servo. When installing servo hone, by shifting the position where you install, the appropriate position can be chosen.

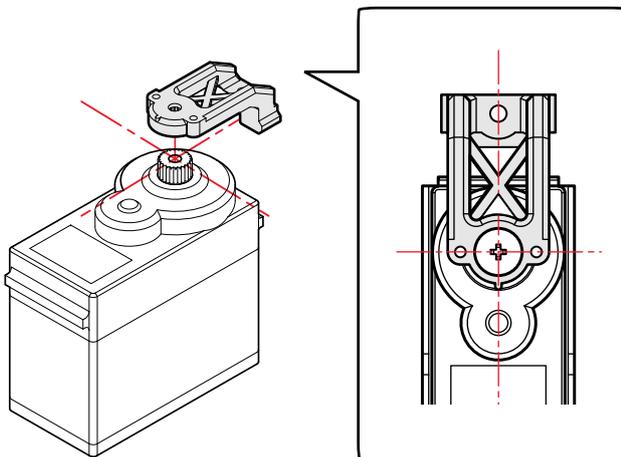


### Attaching servo arm

In case of the servo arm, as the direction is fixed, attach it shifting rightward or leftward slightly when it does not exactly match the figure.

For example, when setting the origin in both shoulders, as there are more gaps in the origin of servo of both shoulders, they become unstable.

Choose the appropriate position when assembling.



## Setting the origin of servo

The servo-motor KRS-788HV can turn for approximately 180 degrees at the maximum. Therefore, like joints of humans, it does not turn limitlessly. The robot has to be assembled so that it can make the best motions considering its restriction.

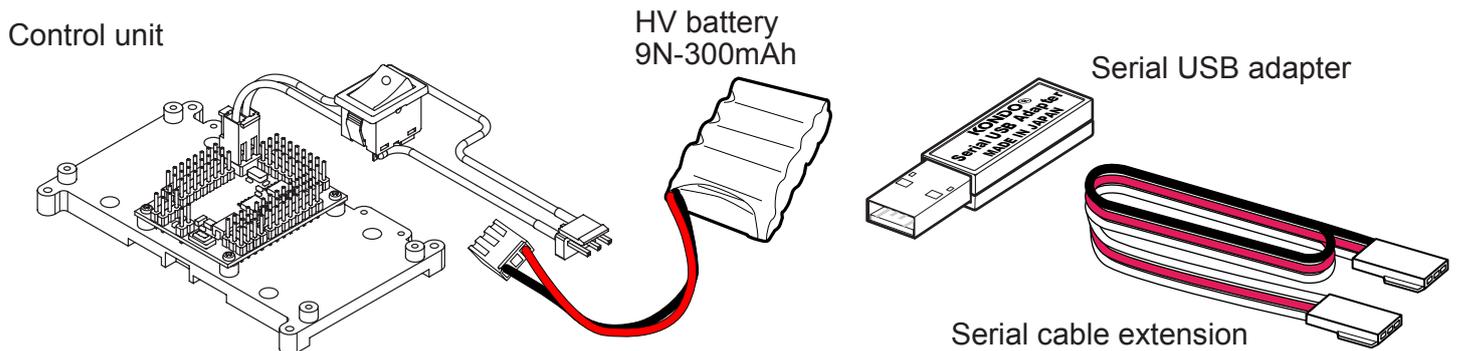
Setting the origin of servo is important in this respect.

If the origin is not correct, it might not operate properly when doing sample motions. Therefore, understand the method and do it correctly.

Setting the origin has to be done when the servo arm is installed to each servo. The following is the process of setting the origin.

### 1 Things to prepare

Control board RCB-3J is used which was attached to PCB base.  
Connect the board using USB serial adapter on a personal computer.  
Also, install the motion making software 'HeartToHeart3J' to the computer.



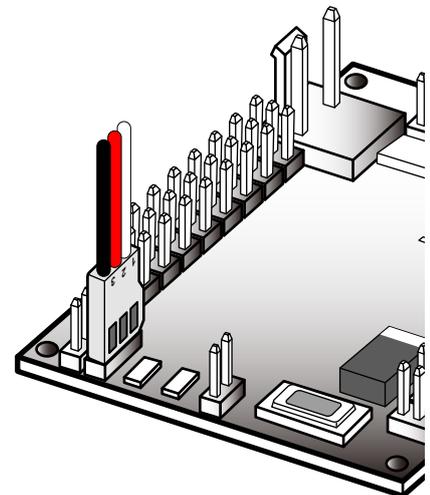
See RCB-3J instruction manual for RCB-3J, the software and USB serial adapter.  
Prepare the computer which has Microsoft Windows 2000 or XP.

### 2 Connection

Connect serial USB adapter to the USB port on the computer.

\*Complete the setup following the manual of serial USB adapter.

- Connect the cable of serial USB adapter to high speed serial terminal of RCB-3J.
- Connect the power source harness to RCB-3J and connect the HV battery which is charged beforehand.
- If you turn on the power source harness, the green LED on the base plate starts to light up.

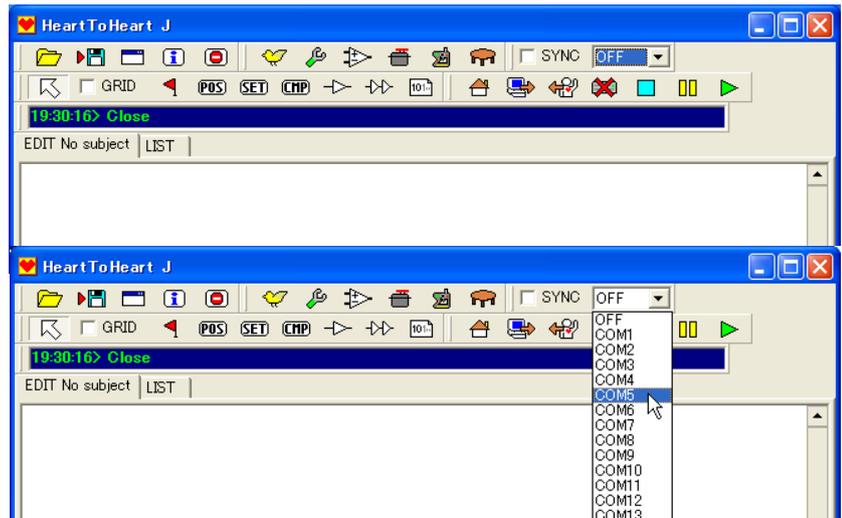


## 3 Starting the software

If you start the motion making software 'HeartToHeart3J', the window on the right will appear.

First, select the number of the communication port (COM).

- \*For the numbers of COM, see the manual of serial USB adapter.
- \*On the right window, COM8 is selected as an example.

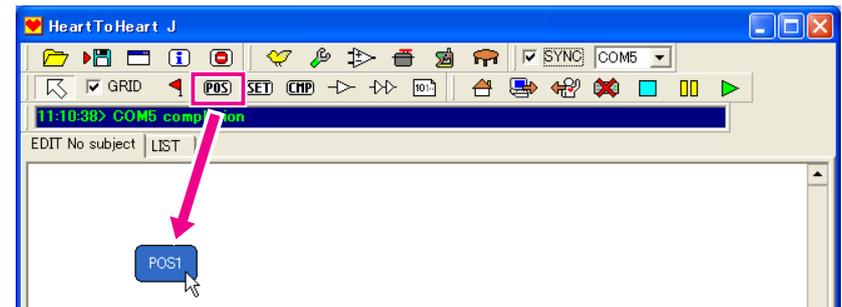


Check SYNC on the window.



Put one position on the data sheet.

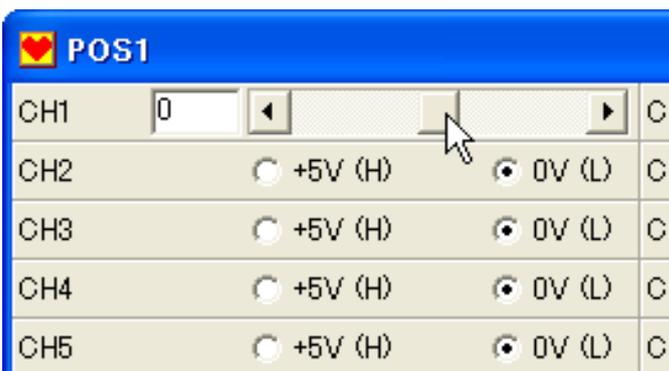
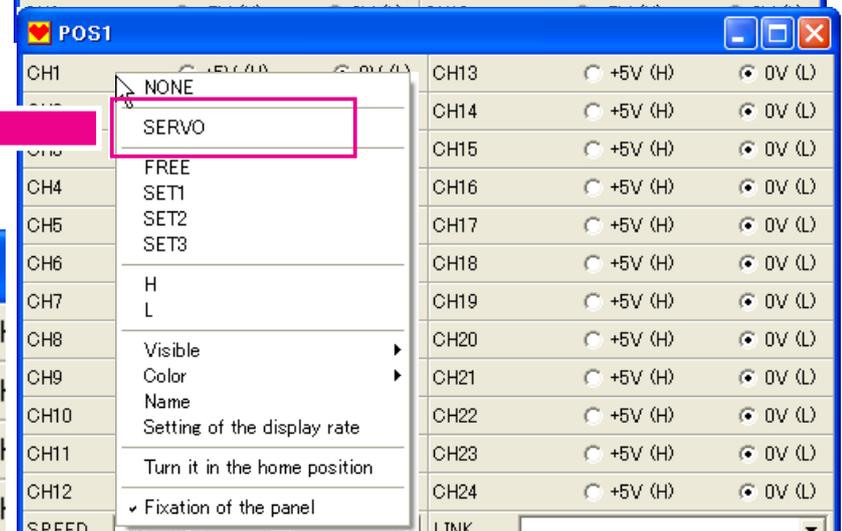
Click position tool and then click data sheet.



Double click the position that was put on the data sheet, and open the position window.



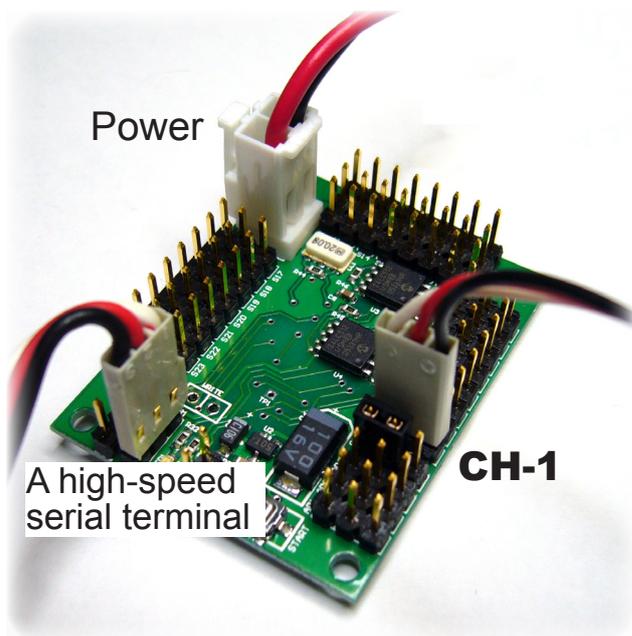
Right click CH1 and open the menu. Select SERVO.



The process continues to the next page

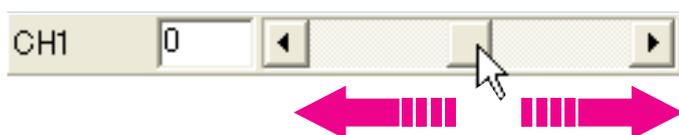
# Setting

## 4 Connect servo and see if it operates.



Connect servo whose origin you set to CH1.

Move the slide bar of CH1 on the position window of the software and see if servo operates. Move it widely and you can see easily.



## 5 Set the origin.

Move the slide bar on the position of the origin of each servo. For most of servo, position 0 is selected, but it differs for some. Install servo arm or servo hone and remove servo lead from RCB-3J.



If you already used the RCB-3J, it might not be able to assemble correctly even if you choose the same number. If you set the origin again after assembling, pay attention to the setting of the software. (Also see the manual of RCB-3J)

### The position of the origin according to channel

CH1	0
CH2	0
CH3	0
CH4	0
CH6	0
CH7	0

CH8	0
CH11	0
CH12	0
CH13	-90
CH14	0
CH15	0

CH17	0
CH18	0
CH19	90
CH20	0
CH21	0



Numbers of each setting is not an angle. It's the number that you set on the position window of the software. If you have changed the display magnification, the numbers will be different.

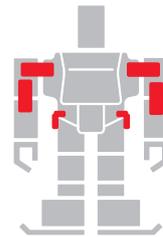
## Installing servo arm

### - arm and thigh-

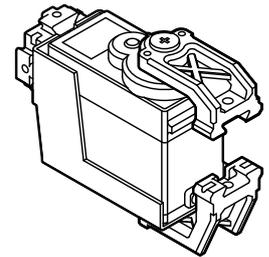
The image of a complete one

#### Necessary parts

- Bracket B unit (assembled) 6
- Servo arm 700A upper arm 6
- Servo arm 700A bottom arm 6
- Screw for flat head hone 12



Connection of servo



Explanation of the icons



Explaining the points



Knack to do the work well

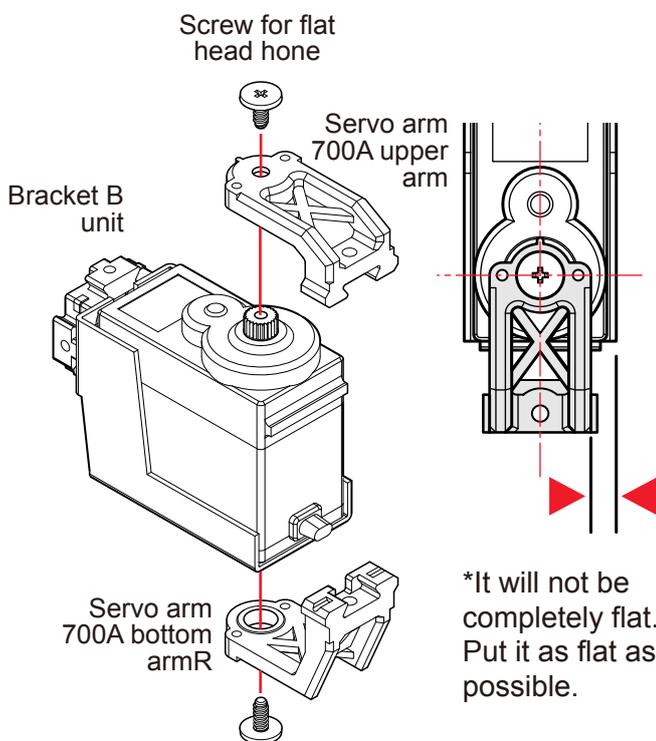


Caution of breaking



Need to be confirmed

2



#### The process of work

1. Set the origin of servo. (See 'Setting the origin of servo')

Select '0' on the slide bar of CH1 and connect servo to RCB-3J.

2. Insert servo arm 700 A upper arm into bracket B unit and remove the connector of servo from RCB-3J. Put the servo arm on the position as close as the unit on the figure. Attach upper arm and bottom arm by flat head screws.

3. See the movable range of servo.

(1)Origin

Adjust servo arm to the position as in the figure by hand.

(2)Limit of the movable range on the left

Turn servo arm leftward slowly and it will stop as in the figure.

(3)Limit of the movable range on the right

Turn servo arm rightward slowly and it will stop as in the figure.



Do not put too much pressure on servo. It will break.

3

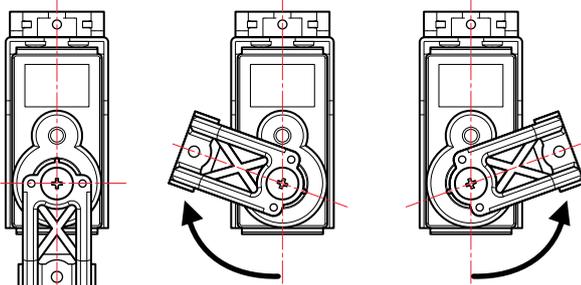


Remove servo lead from RCB-3J. If you move upper arm with servo lead on ( you can hear the sound), it will cause breakdown.

(1)

(2)

(3)



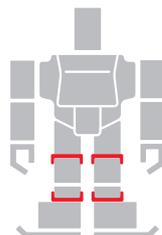
This process is done for 6 servo in total.

## Installing servo arm - shin and knee -

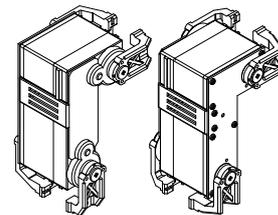
The image of a complete one

### Necessary parts

- Leg unit (assembled) 1
- Control unit 1
- Servo arm 700A upper arm 4
- Servo arm 700A bottom arm 4
- Screw for flat head hone 8



Connection of servo



Explanation of the icons



Explaining the points



Knack to do the work well



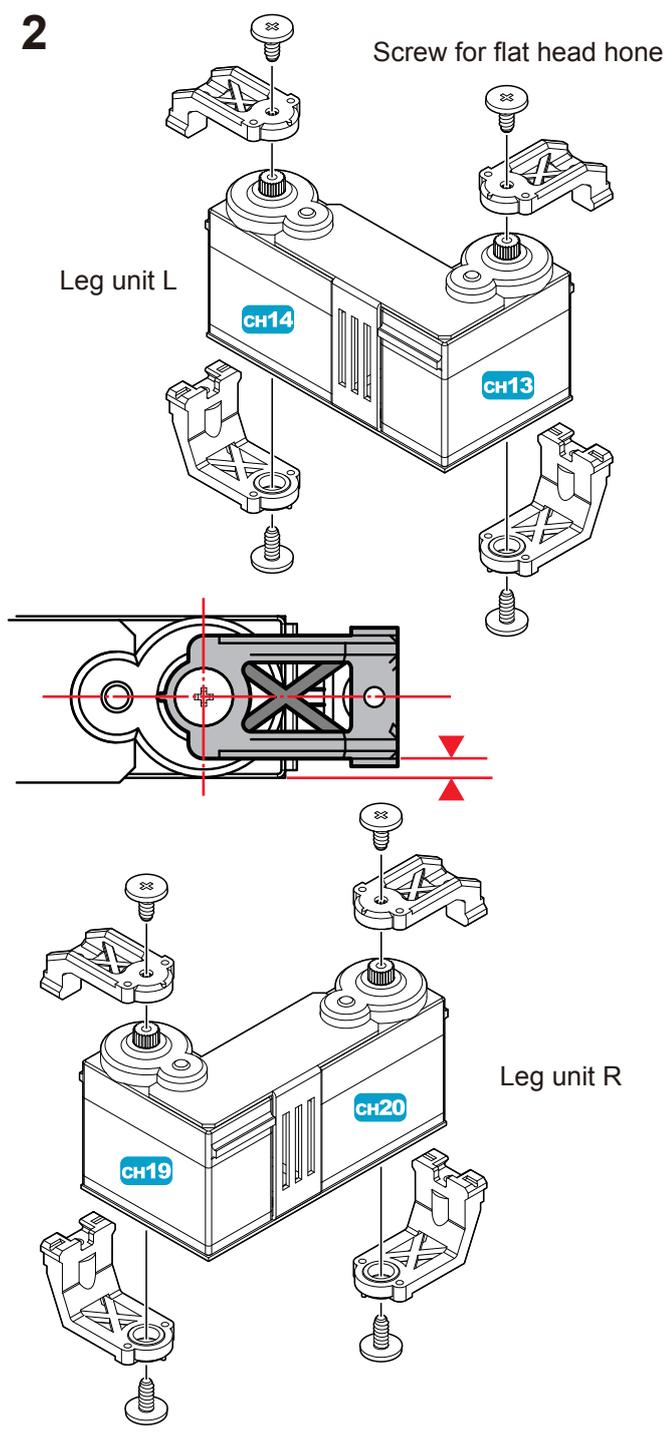
Caution of breaking



Need to be confirmed

### The process of work

2



1. Set the origin of servo. (See '[Setting the origin of servo](#)') Select the numbers on the slide bar of CH1 as in the figure and connect servo to RCB-3J.

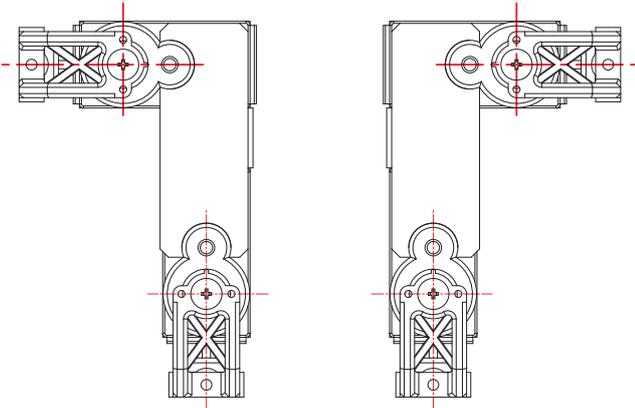
CH13: -90	CH14: 0
CH19: 90	CH20: 0

2. Insert upper arm into leg unit and remove the connector of servo from RCB-3J. Put the servo arm on the position as close as the unit on the figure. Attach upper arm and bottom arm by flat head screws.

After installing servo arm, see the movable range of each servo. If there is a mistake in the setting of the origin or installing servo arm, servo will not move as supposed.

### 3

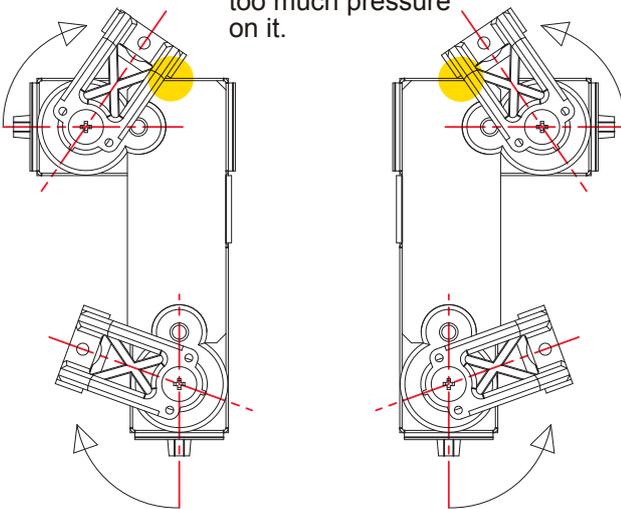
(1)



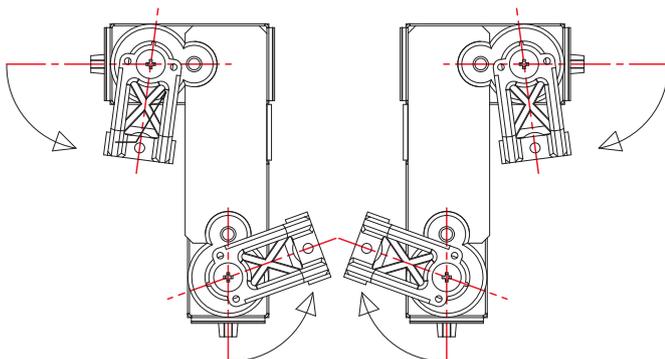
(2)



When it touches the frame, it will stop. Do not put too much pressure on it.



(3)



3. See the movable range of servo.

(1)Origin

Adjust servo arm to the position as in the figure by hand.

(2)Limit of the movable range on the left

Turn servo arm leftward slowly and it will stop as in the figure.

(3)Limit of the movable range on the right

Turn servo arm rightward slowly and it will stop as in the figure.



Remove servo lead from RCB-3J. If you move upper arm with servo lead on (you can hear the sound), it will cause breakdown.



If you turn the servo over the movable range, gears inside the servo might break down. So turn servo arm carefully.

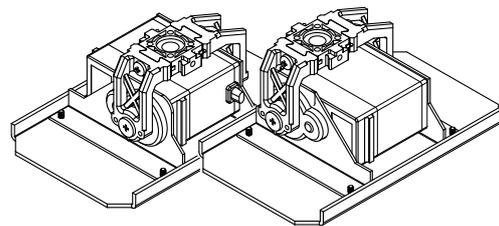
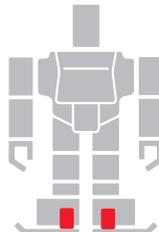
## Installing servo arm - ankle -

The image of a complete one

### Necessary parts

●Foot unit L (assembled)	1	●Screw for flat head	4
●Foot unit R (assembled)	1	hone	
●Servo arm 700A upper arm	2	●2.6-8 tapping screw	4
●Servo arm 700A bottom arm	2	●Control unit	1
●Servo arm 700A base	2	(assembled)	

### Installing servo arm



Explanation of the icons



Explaining the points



Knack to do the work well



Caution of breaking

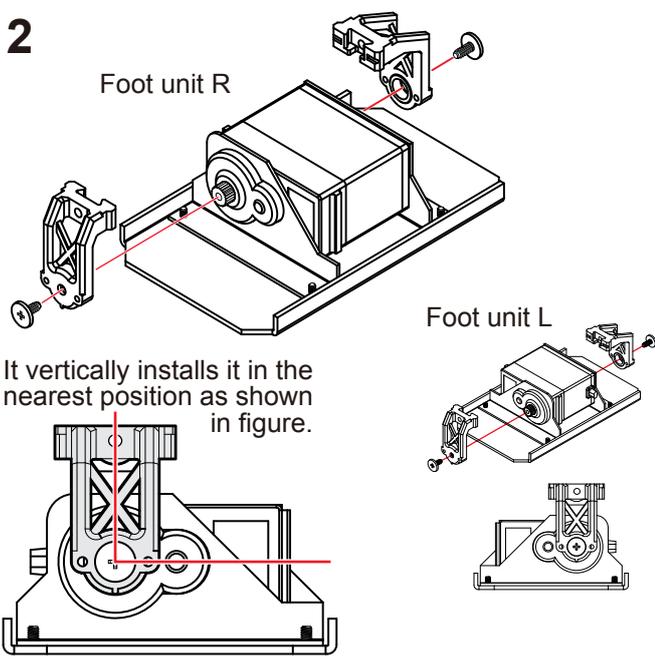


Need to be confirmed

### The process of work

2

Foot unit R



Foot unit L

1. Set the origin of servo. (See 'Setting the origin of servo')

Select '0' on the slide bar of CH1 and connect servo to RCB-3J.

2. Insert upper arm into flat unit and remove the connector of servo from RCB-3J. Put the servo arm on the position as close as the unit on the figure. Attach upper arm and bottom arm by flat head screws.

3. See the movable range of servo.

(1)Origin

Adjust servo arm to the position as in the figure by hand.

(2)Limit of the movable range on the left

Turn servo arm leftward slowly and it will stop as in the figure.

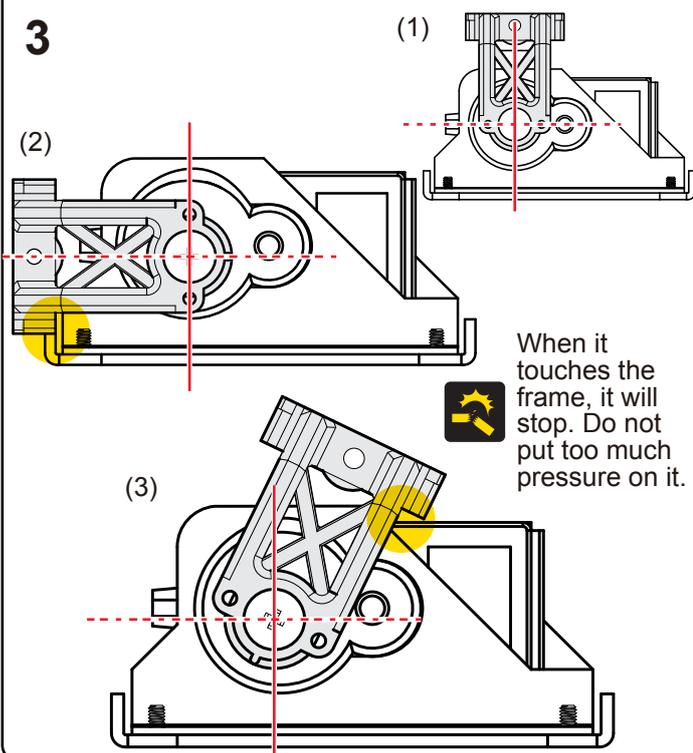
(3)Limit of the movable range on the right

Turn servo arm rightward slowly and it will stop as in the figure.

3

(1)

(2)



When it touches the frame, it will stop. Do not put too much pressure on it.

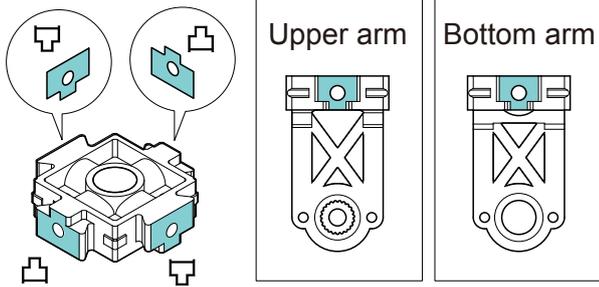


Remove servo lead from RCB-3J. If you move upper arm with servo lead on (you can hear the sound), it will cause breakdown.



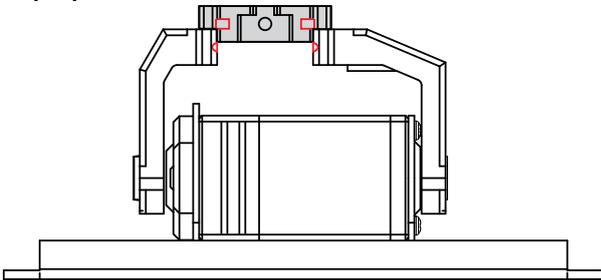
If you turn the servo over the movable range, gears inside the servo might break down. So turn servo arm carefully.

3 (1)

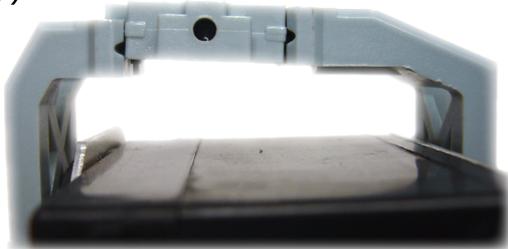


Pay attention to the obverse and reverse side of the base. Insert it with the obverse upside.

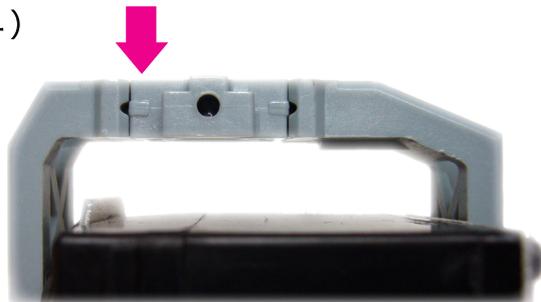
(2)



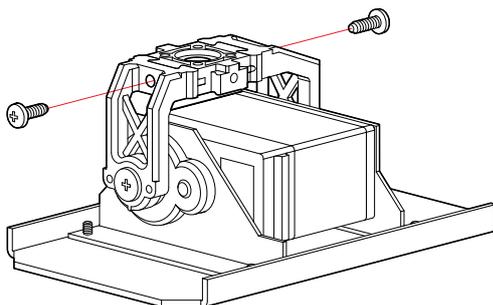
(3)



(4)



4

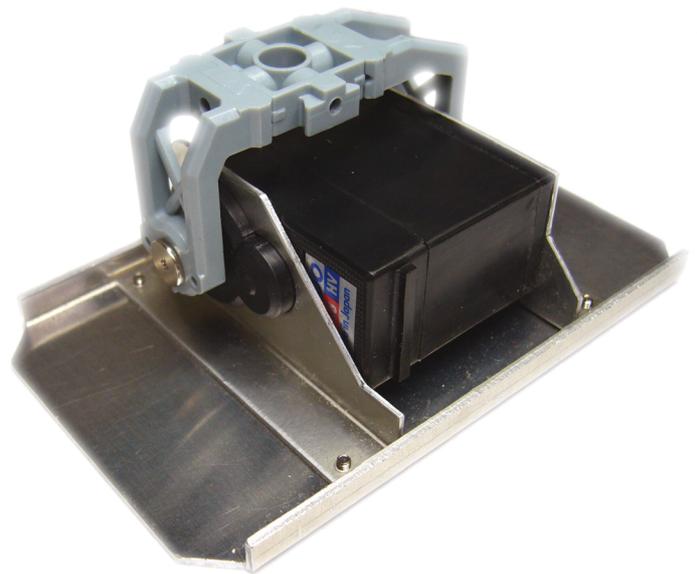


3. Attach servo arm 700A base between upper arm and bottom arm.

- (1) See the shape of arm base. The position of convexity is important.
- (2) Adjust arm base on the joints of upper arm and bottom arm. Push arm base into the joints and insert it to 1/3.
- (3) Insert arm base into the joint of bottom arm until you hear the sound.
- (4) Insert arm base into the joint of upper arm until you hear the sound.



If you warm the base of upper arm and bottom arm by dryer, it will be easier to assemble.



4. Attach the joints of upper arm, bottom arm and arm base by 2.6-8 tapping screws. (1 for each)



The inset is very tight. Be careful not to harm your fingers or nails when inserting servo arm. Also, when removing it, the parts of servo base might blow. Pay attention also to your surroundings.

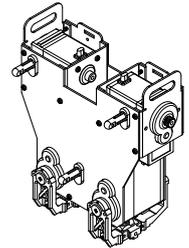
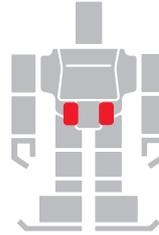
## Installing servo arm - body -

The image of a complete one

### Necessary parts

- Body unit (assembled) 1
- Servo arm 700A upper arm 2
- Servo arm 700A bottom arm 2
- Servo arm 700A base 2
- Screw for flat head hone 4
- 2.6-8 tapping screw 8

### Installing servo arm



Explanation of the icons



Explaining the points



Knack to do the work well

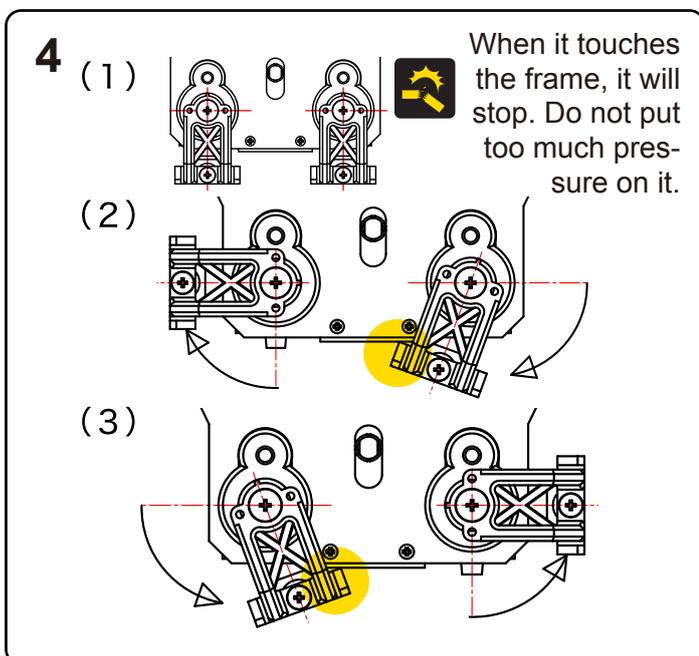
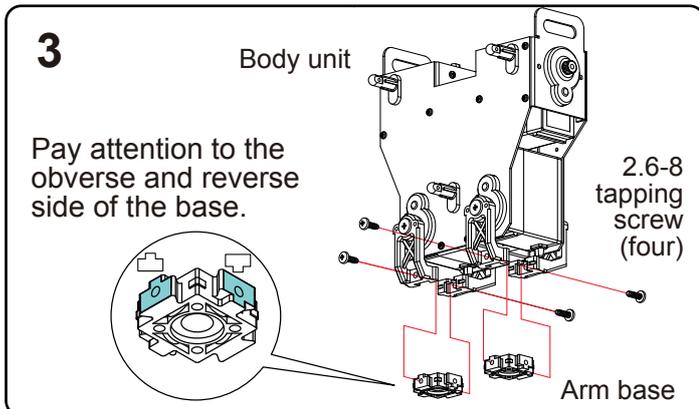
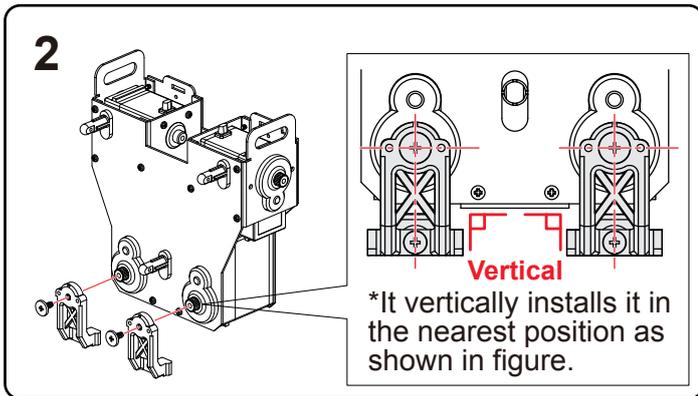


Caution of breaking



Need to be confirmed

### The process of work



1. Set the origin of servo. (See 'Setting the origin of servo')

Set the neutral number and connect servo to RCB-3J.

Attach upper arm.

2. Remove the connector of servo from RCB-3J. Attach upper arm and bottom arm to body unit by hone attaching screws.

3. Insert arm base and attach it by 2.6-8 tapping screws.

4. See the movable range of servo.

(1) Origin

Adjust servo arm to the position as in the figure by hand.

(2) Limit of the movable range on the left

Turn servo arm leftward slowly and it will stop as in the figure.

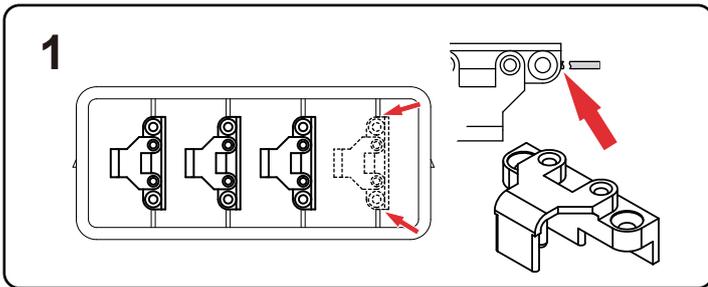
(3) Limit of the movable range on the right

Turn servo arm rightward slowly and it will stop as in the figure.

Remove servo lead from RCB-3J. If you move upper arm with servo lead on (you can hear the sound), it will cause breakdown.

There is the limitation of the movable range of servo arm. Turn it carefully.

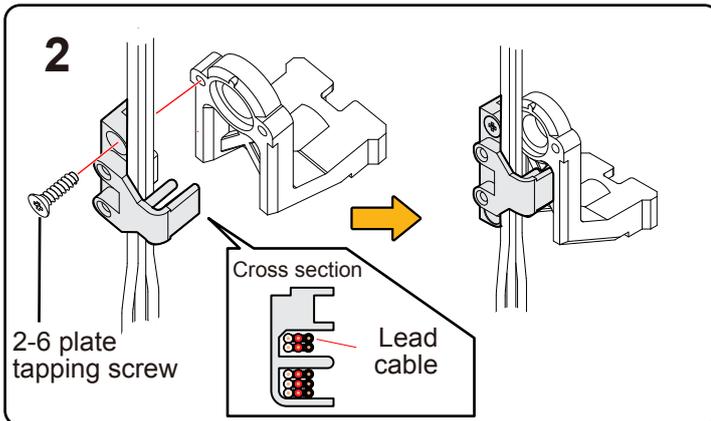
## How to install cable guide



1. Cut off cable guide



You can cut it off by hand, but if you use a nipper and sand paper, it will be better.



2. Attach cable guide to servo arm. For the position, see the picture.

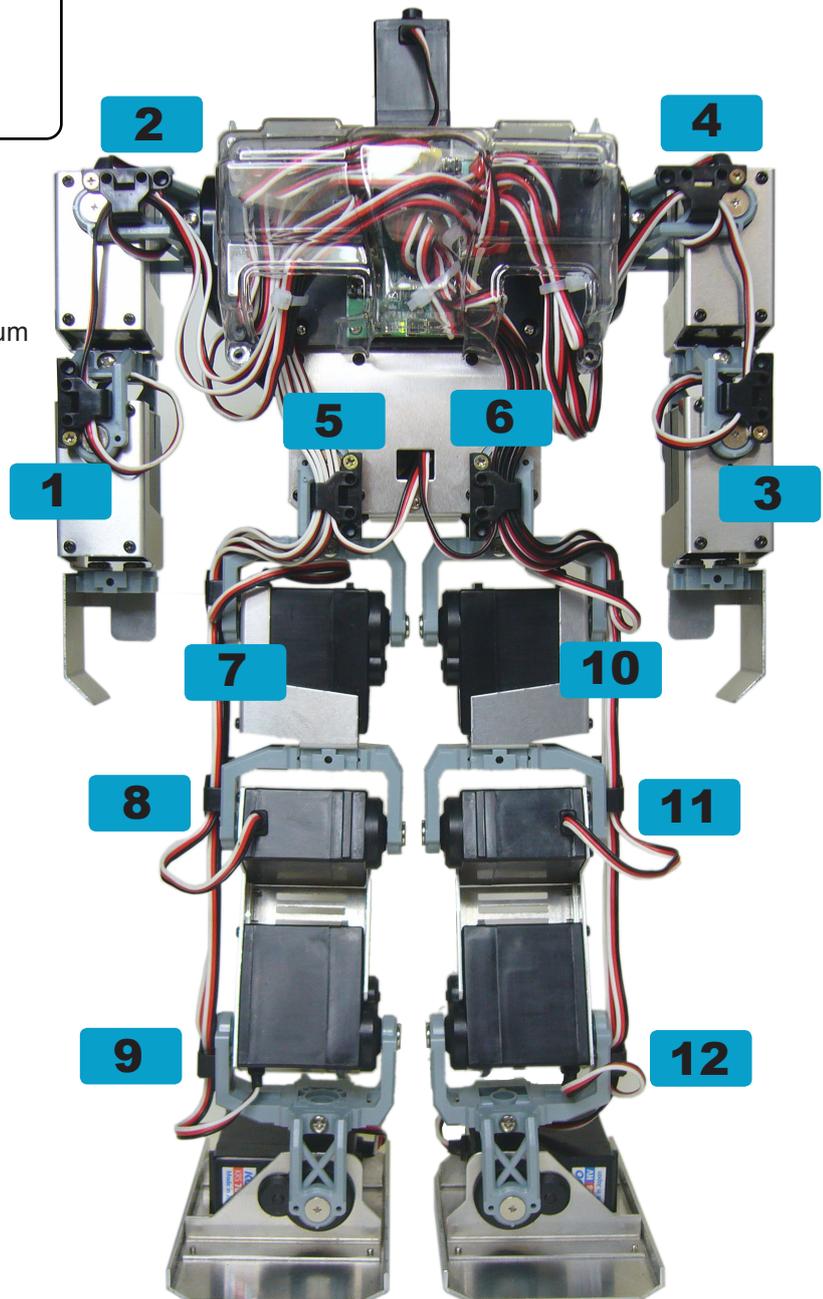
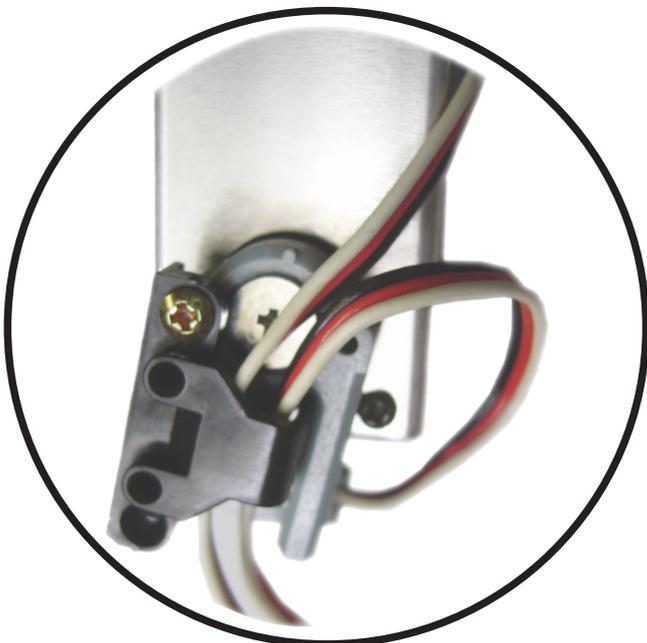


\*You can collect 5 cables at the maximum

Attach 4 cables on the arms (1, 2, 3, 4) after assembling arms.

Attach 6 cables on the feet (7, 8, 9, 10, 11, 12) after assembling feet.

Attach 2 cables on the body (5, 6) when assembling all the parts.

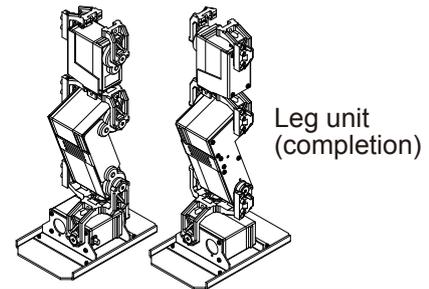
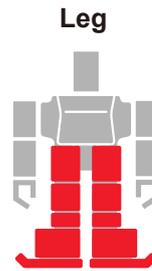


## Assembly of leg

The image of a complete one

### Necessary parts

- Bracket unit (assembled) CH12 1
- Bracket unit (assembled) CH18 1
- Leg unit L (assembled) 1
- Leg unit R (assembled) 1
- Foot unit L (assembled) 1
- Foot unit R (assembled) 1
- 2.6-8 tapping screw 8



Explanation of the icons



Explaining the points



Knack to do the work well



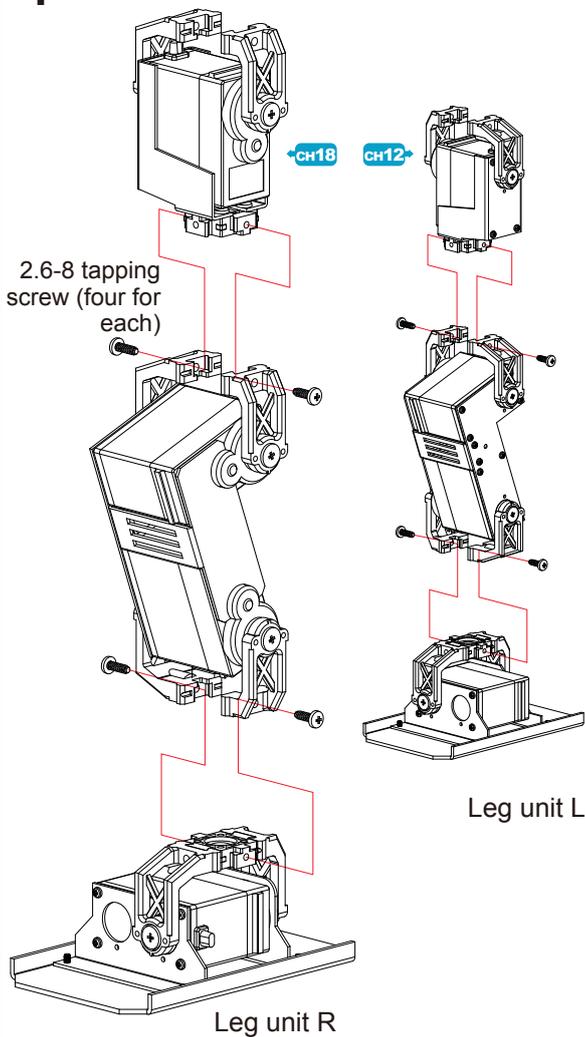
Caution of breaking



Need to be confirmed

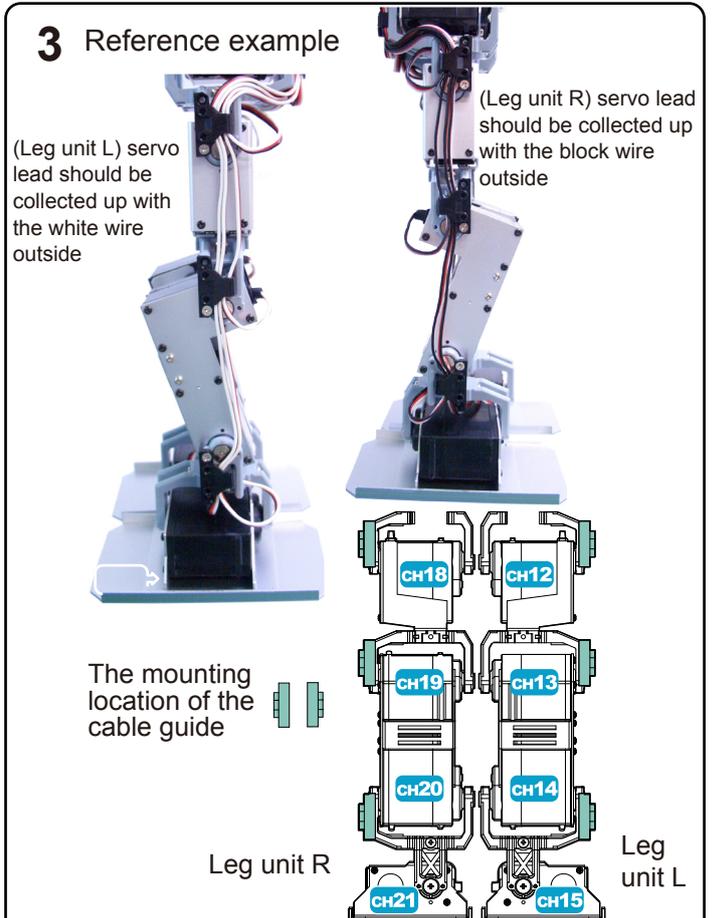
The process of work

1



1. Insert arm base of bracket unit into servo arm of leg unit and attach by 2.6-8 tapping screws ( 2 for each).
2. Pull out servo lead of servo of ankles (CH15, CH21) to the outside of feet. Put decal on each servo lead.
3. Collect cables by cable guide. Be careful that the tension does not become too high.

3 Reference example



2



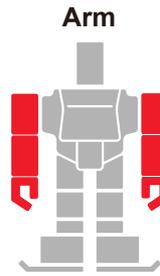
CH15, CH21 servo leads (arrows) should be put out through the under side of the servo arm.

## Assembly of arm

The image of a complete one

### Necessary parts

- Bracket B unit (assembled) 4
- Hand L 1
- Hand R 1
- 2.6-6 tapping screw 4
- 2.6-8 tapping screw 4



Explanation of the icons



Explaining the points



Knack to do the work well

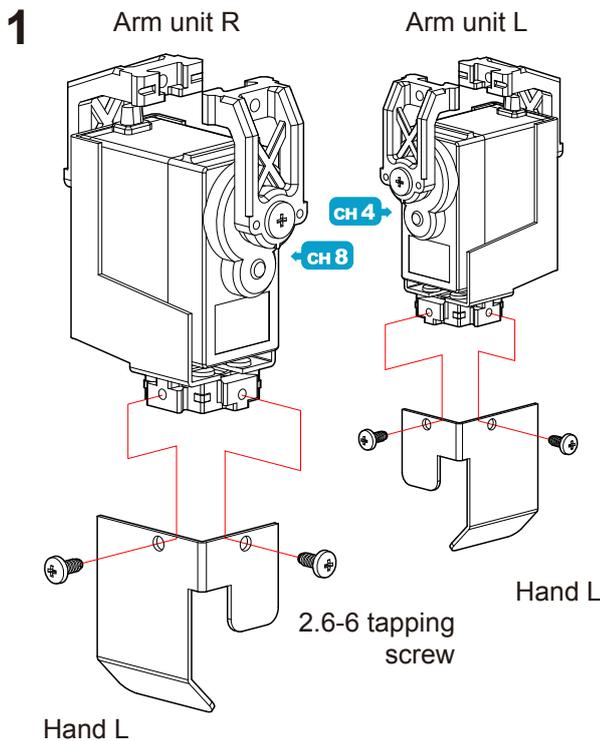


Caution of breaking

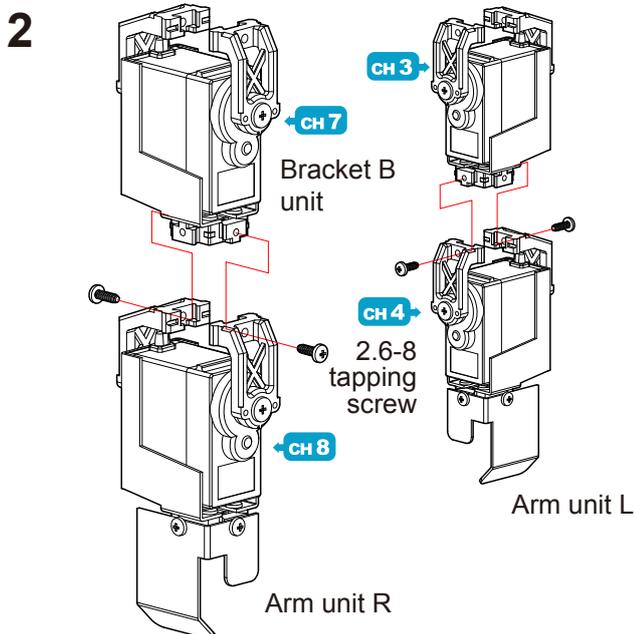


Need to be confirmed

### The process of work

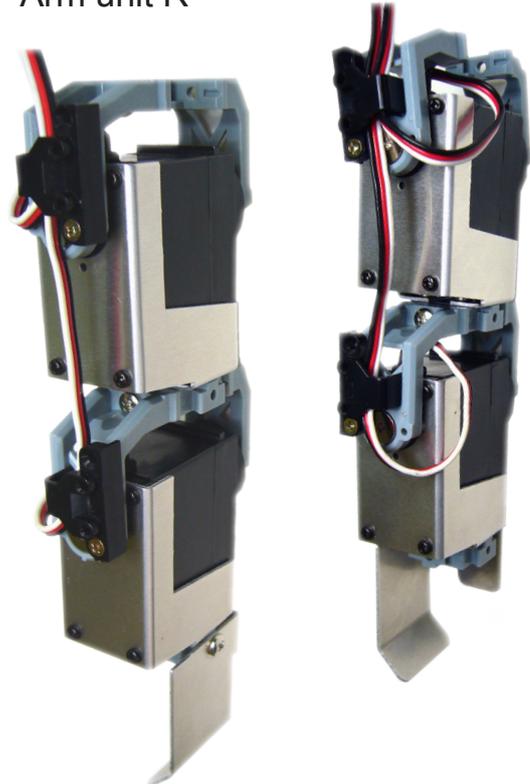


1. Attach bracket B unit to hand L, R by 2.6-6 tapping screws (two).
2. Insert arm unit into arm base of bracket B unit and fix it by 2.6-8 tapping screws. Put decal on each servo lead.
3. Attach cable guide seeing the picture below. Fix servo leads on cable guide. In this case, be careful that the servo leads do not block the movable range of each servo.



Arm unit R

Arm unit L

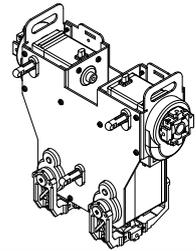
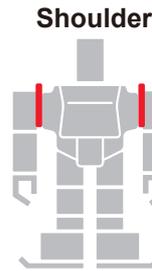


## Attaching servo hone

The image of a complete one

### Necessary parts

●Body unit (assembled)	1
●Low height servo hone	2
●Servo arm 700A base	2
●Arm supporter 700A	2
●M2-5 screw	8
●2.6-6 tapping screw	2



Explanation of the icons



Explaining the points



Knack to do the work well

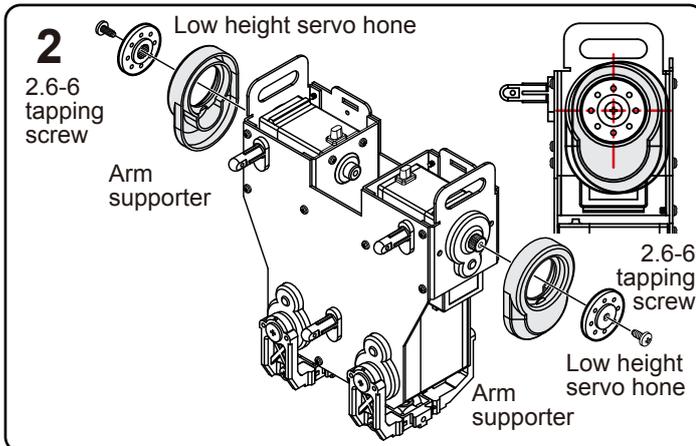


Caution of breaking



Need to be confirmed

### The process of work



1. Set the origin of servo. (See '[Setting the origin of servo](#)')

Select '0' on the slide bar of CH1 and connect servo to RCB-3J.

2. Insert arm supporter and low height servo hone into the body unit and remove the connector of servo from RCB-3J. Put the servo arm on the position as close as the unit on the figure. Fix low height servo hone by 2.6-6 servo tapping screws. (1 for each)

3. Attach arm base to servo hone by M2-5 screws (4 for each). Put the base with obverse outside.

4. See the movable range of servo.

(1)Origin

Adjust servo arm to the position as in the figure by hand.

(2)Limit of the movable range on the left

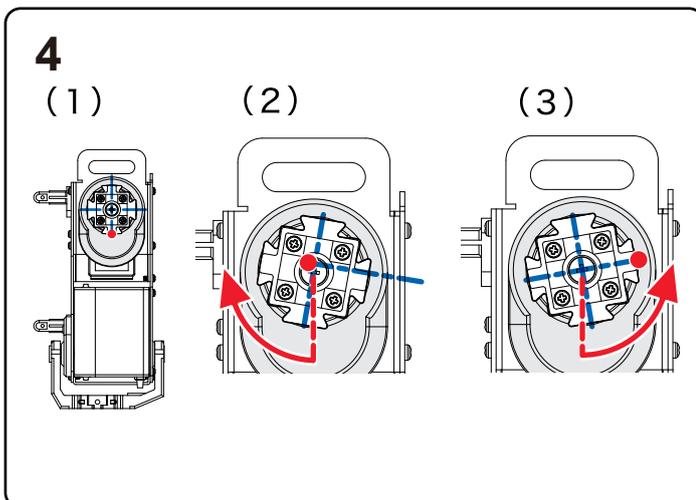
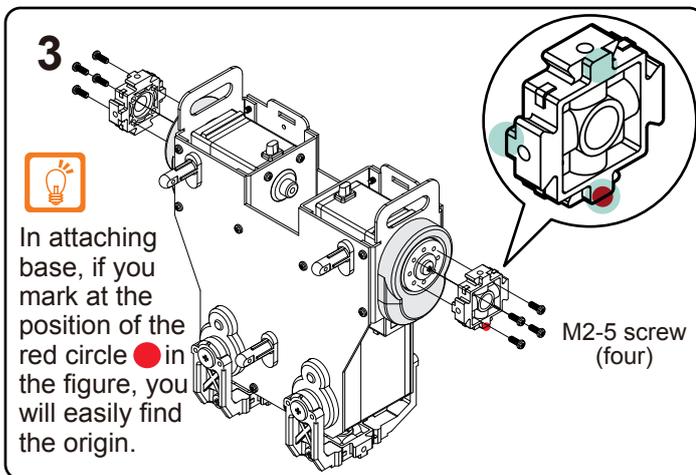
Turn servo arm leftward slowly and it will stop as in the figure.

(3)Limit of the movable range on the right

Turn servo arm rightward slowly and it will stop as in the figure.

 Remove servo lead from RCB-3J. If you move upper arm with servo lead on (you can hear the sound), it will cause breakdown.

 There is the limitation of the movable range of servo arm. Turn it carefully.

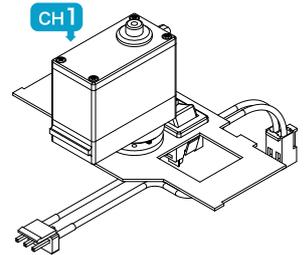
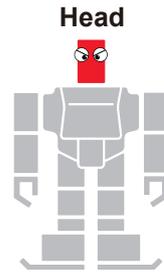


## Assembly of head

The image of a complete one

### Necessary parts

- Servo motor KRS-788HV 1  
Cable length 300mm
- Top cover 1
- Control unit 1
- Low height servo hone 1
- Screw for flat head hone 1
- M2-4 screw 4



Explanation of the icons



Explaining the points



Knack to do the work well

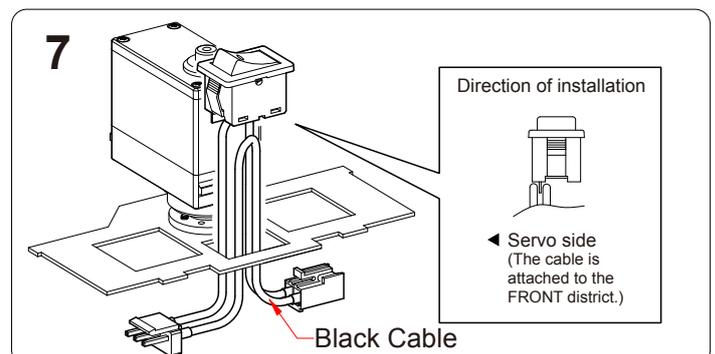
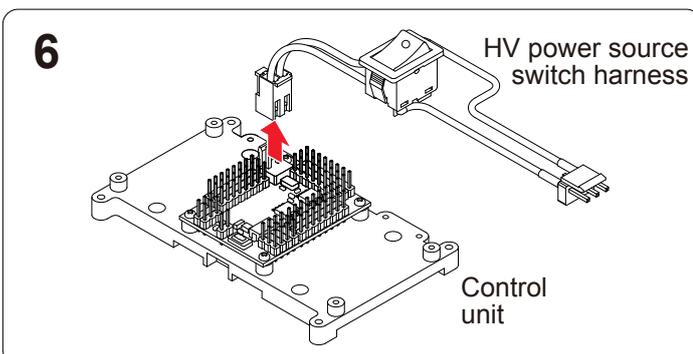
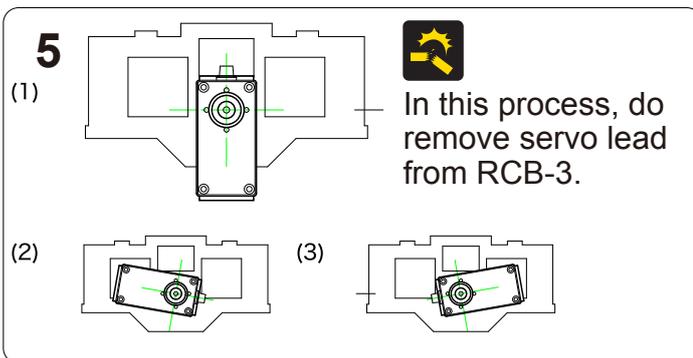
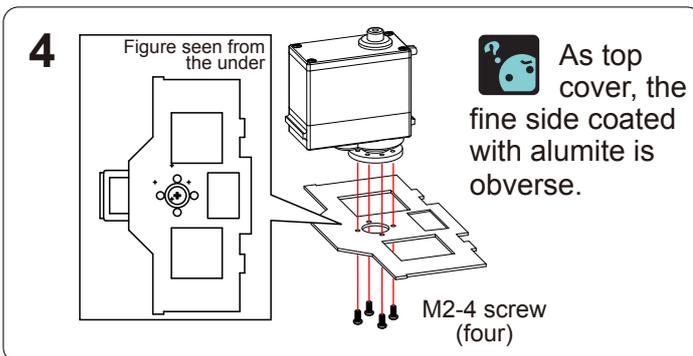
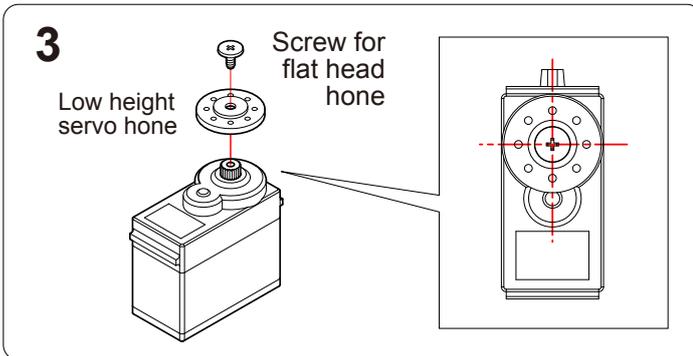


Caution of breaking



Need to be confirmed

### The process of work

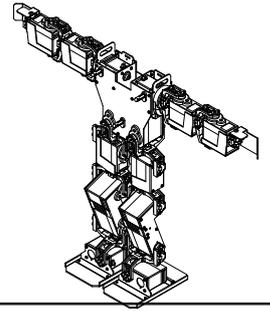
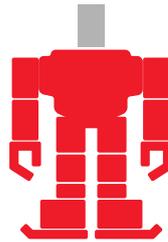


1. Cut decal of the number of CH for servo lead of CH1.
2. Set the origin of servo. Select '0' on the slide bar of CH1 and connect servo to RCB-3J.
3. Attach low height hone to servo with case screws by flat head screws. See the figure for the angle.
4. Attach low height hone and top cover by M2-5 screws.
5. See the movable range of servo.
  - (1)Origin  
Adjust servo to the position as in the figure by hand.
  - (2)Limit of the movable range on the left  
Turn servo leftward slowly and it will stop as in the figure.
  - (3)Limit of the movable range on the right  
Turn servo rightward slowly and it will stop as in the figure.
6. Remove power source harness (outlet switch) from control unit.
7. Push the outlet switch into top cover.

## Assembly of unit

### Necessary parts

- Body unit (assembled) 1
- Arm unit L (assembled) 1
- Arm unit R (assembled) 1
- Leg L (assembled) 1
- Leg R (assembled) 1
- 2.6-8 tapping screw 8



Explanation of the icons



Explaining the points



Knack to do the work well



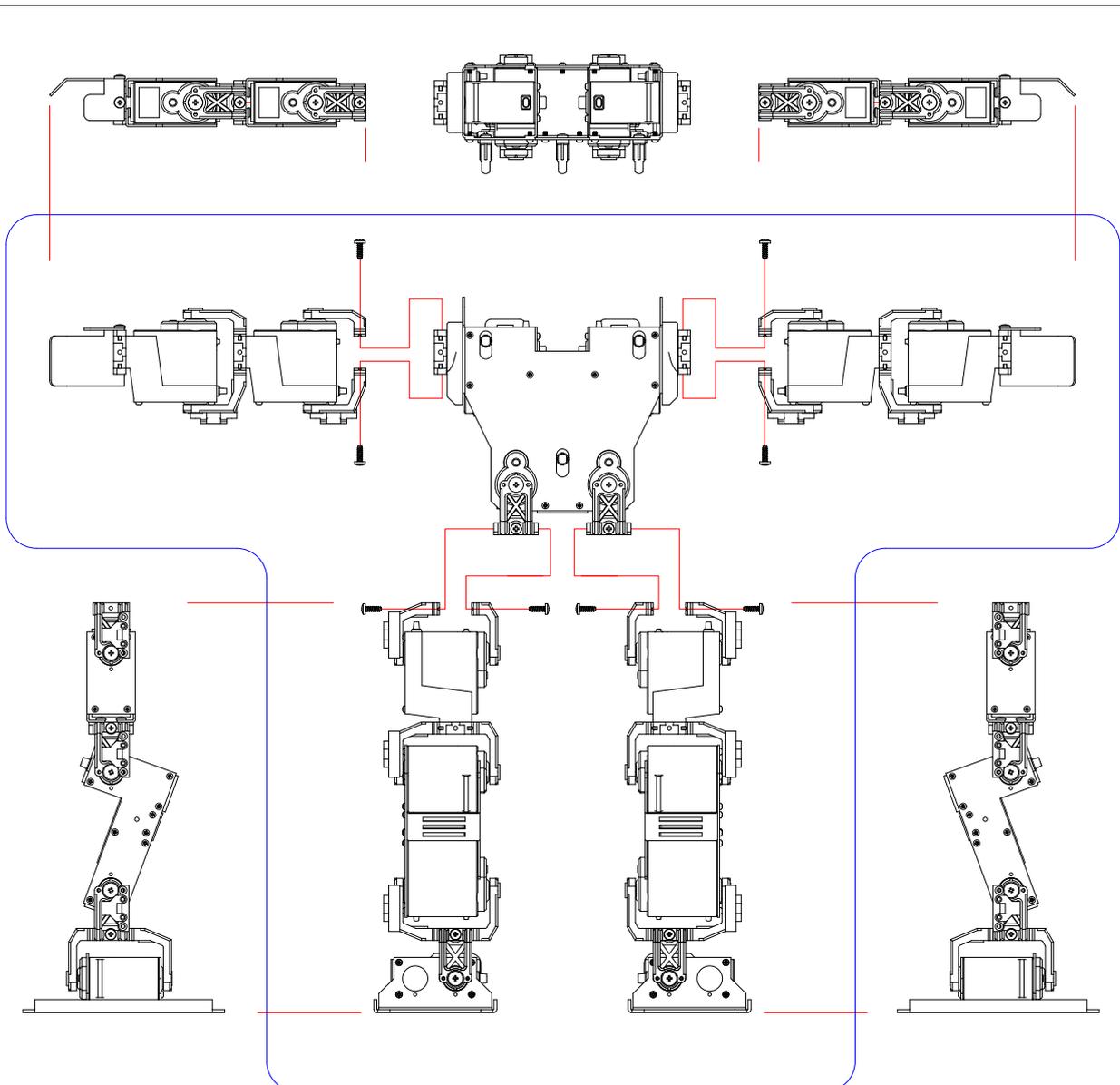
Caution of breaking



Need to be confirmed

### The process of work

1. Attach each part by 2.6-8 tapping screws as in the figure. (2 for each)

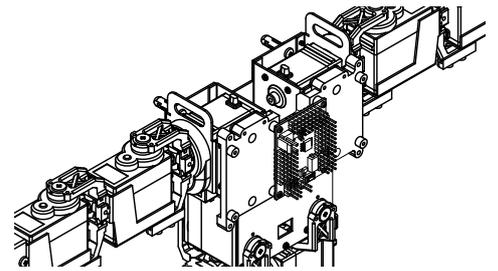
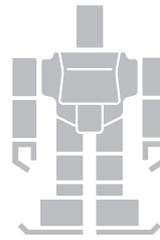


## Attaching control unit

The image of a complete one

### Necessary parts

- Body (assembled) 1
- Control unit (assembled) 1
- M2-5 screw 4



Explanation of the icons



Explaining the points



Knack to do the work well



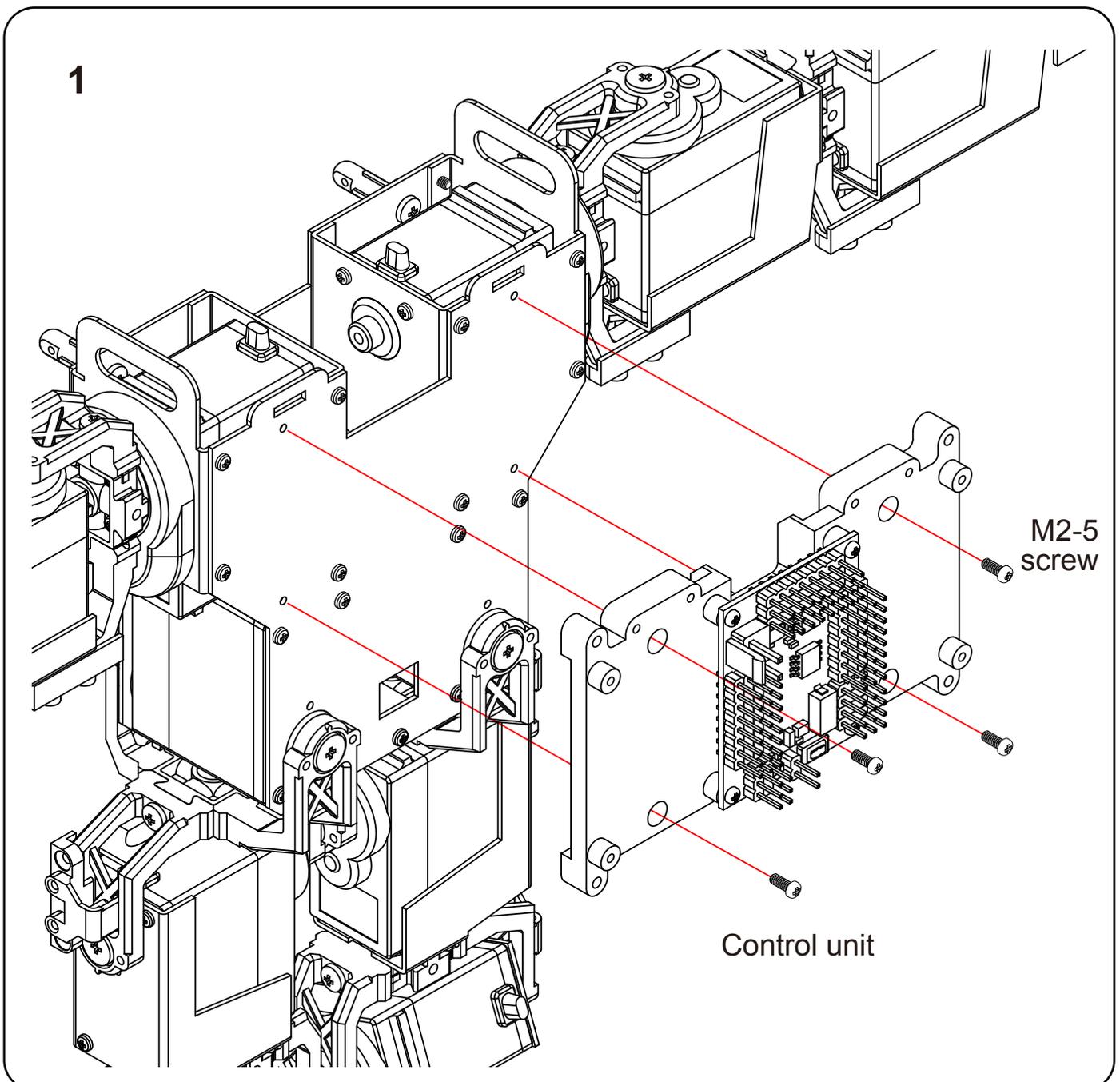
Caution of breaking



Need to be confirmed

### The process of work

1. Attach control unit by M2-5 screws as in the figure.

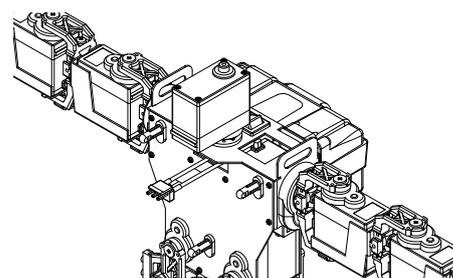
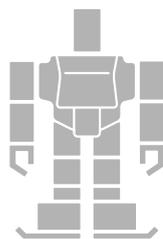


## Attaching head unit

The image of a complete one

### Necessary parts

- Head unit 1
- Body (assembled) 1



Explanation of the icons



Explaining the points



Knack to do the work well



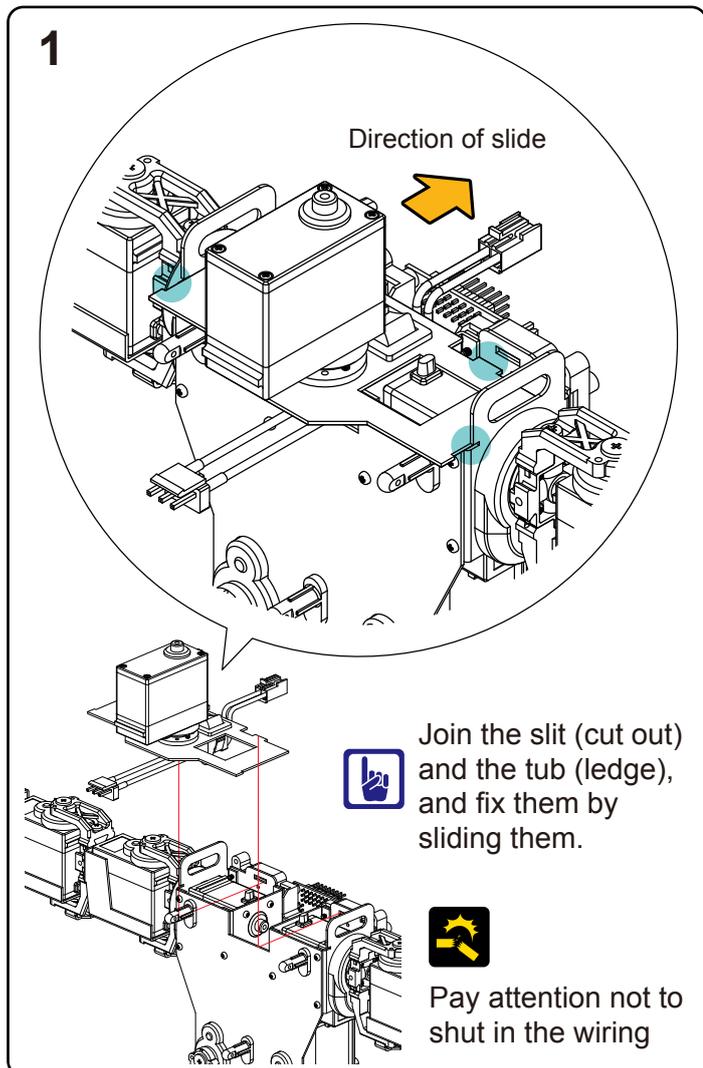
Caution of breaking



Need to be confirmed

### The process of work

1



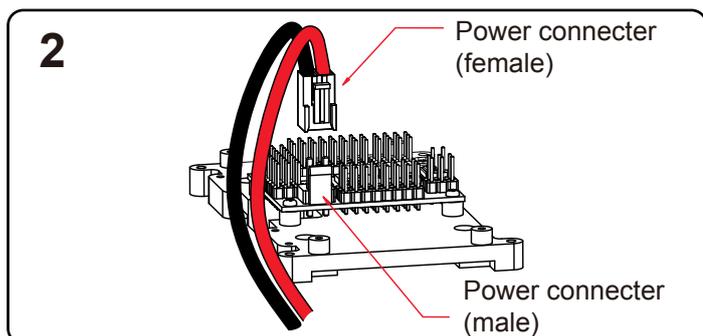
1. Attach head as in the figure.
2. Insert the connector of the outlet switch into RCB-3J.

\* Head unit is not fixed by screws.  
It will be fixed by front cowl.



See the figure for how to put the connector of the outlet harness.

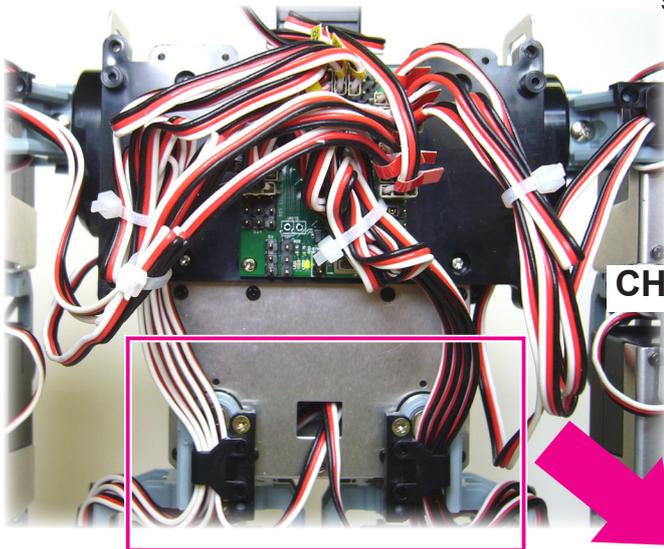
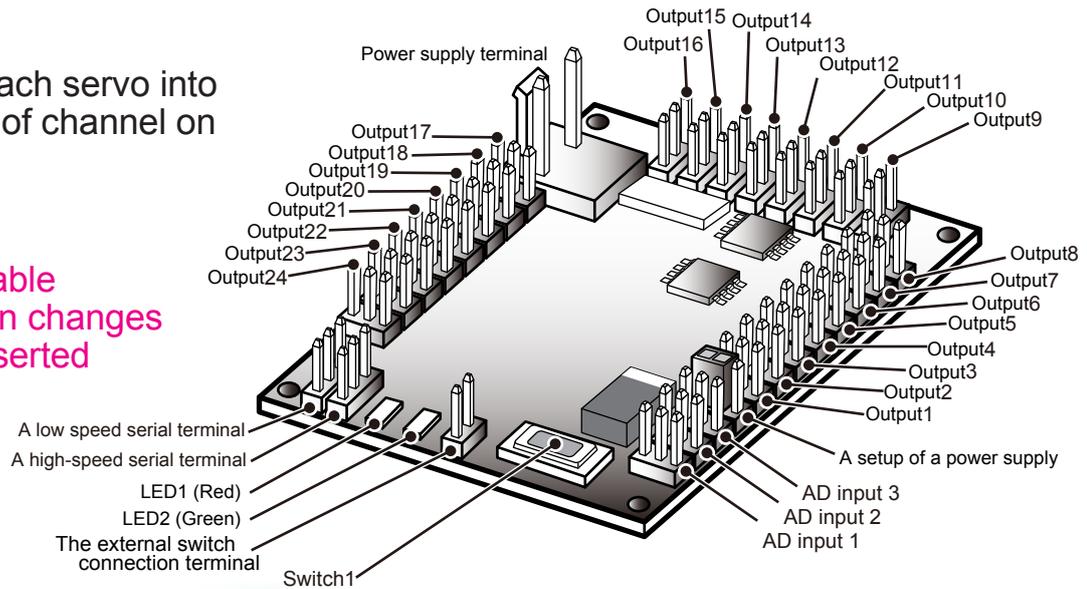
2



## Wiring to control board

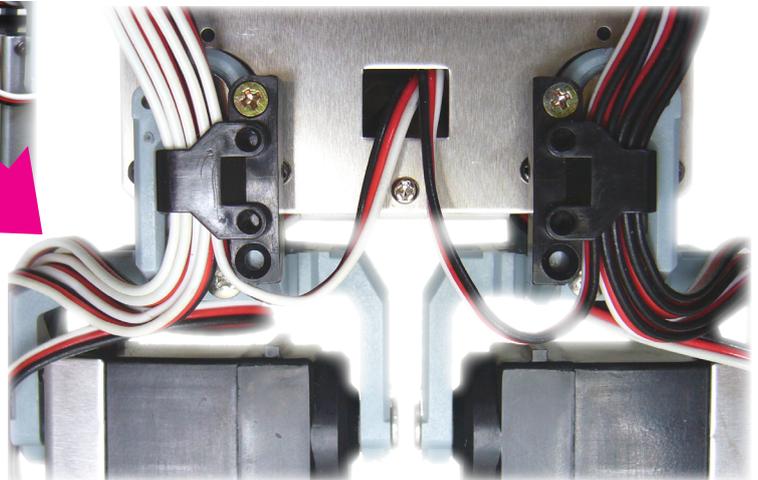
Insert the connector of each servo into RCB-3. See the number of channel on decal.

 Insert it with black cable outside. The direction changes depending on the inserted position.



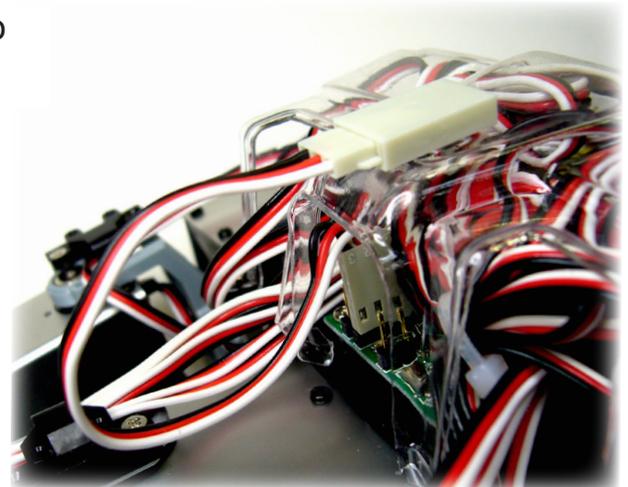
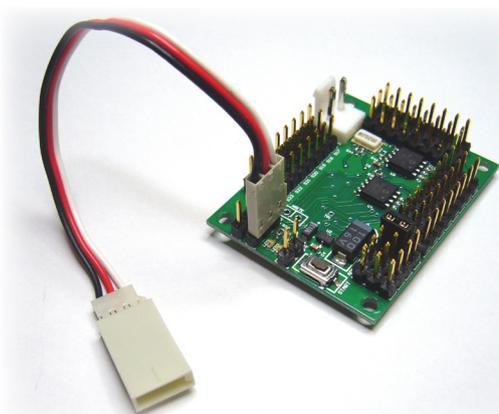
See the picture in the left for how to collect cables for cable guide of the bottom part of the body.

CH14 CH12 CH18 CH20  
CH15 CH13 CH11 CH17 CH19 CH21



After inserting each servo lead into RCB-3J, collect cables by nylon strap as in the picture above.

As the left below picture, attach cable extension to high speed serial terminal.



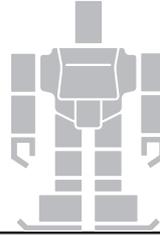
## Processing front cowl and board cover

### Necessary parts

- Front cowl 1
- Board cover 1

Paint for polycarbonate  
Detergent or alcohol  
Scissors, Cutters, Sand papers

Cowl and Cover



Explanation of the icons



Explaining the points



Knack to do the work well

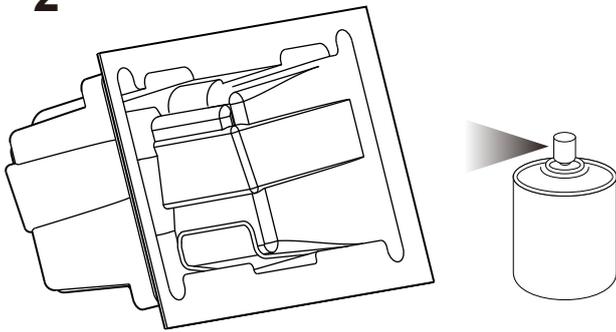


Caution of breaking



Need to be confirmed

2



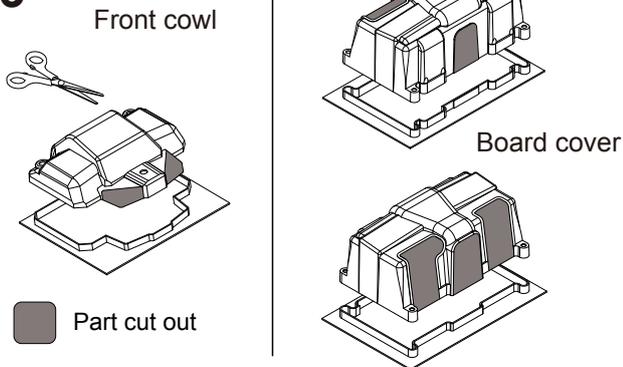
### The process of work

1. Remove oil from the reverse side of cowl by detergent or alcohol.
2. Dry it and paint it with spray for polycarbonate.

 **Danger** Ventilate the room when you use the spray. Also, using the fire is dangerous.

3. After drying, cut the cowl as in the figure. The part with dense color is cut.

3

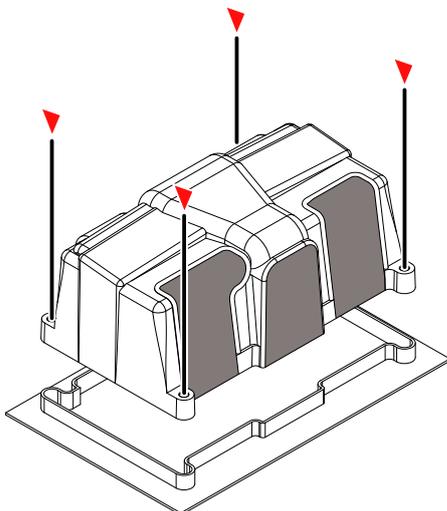


It is better to use sand paper.



**Danger** Be careful for scissors and cutters.

4



4. Put through tapping screws into 4 parts of board cover.

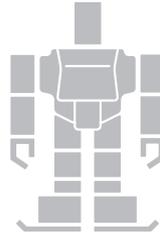
## Installing board cover

The image of a complete one

### Necessary parts

- Body (assembled) 1
- Board cover 1
- 2.6-6 tapping screw 4

Cowl and Cover



Explanation of the icons



Explaining the points



Knack to do the work well

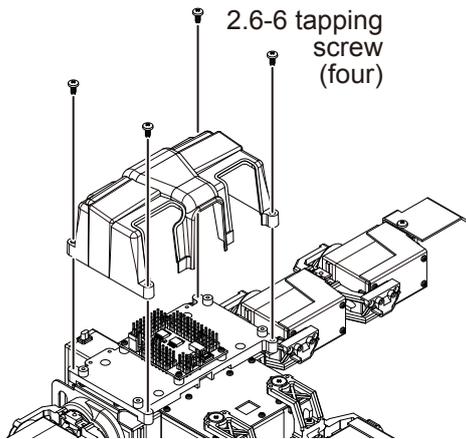


Caution of breaking



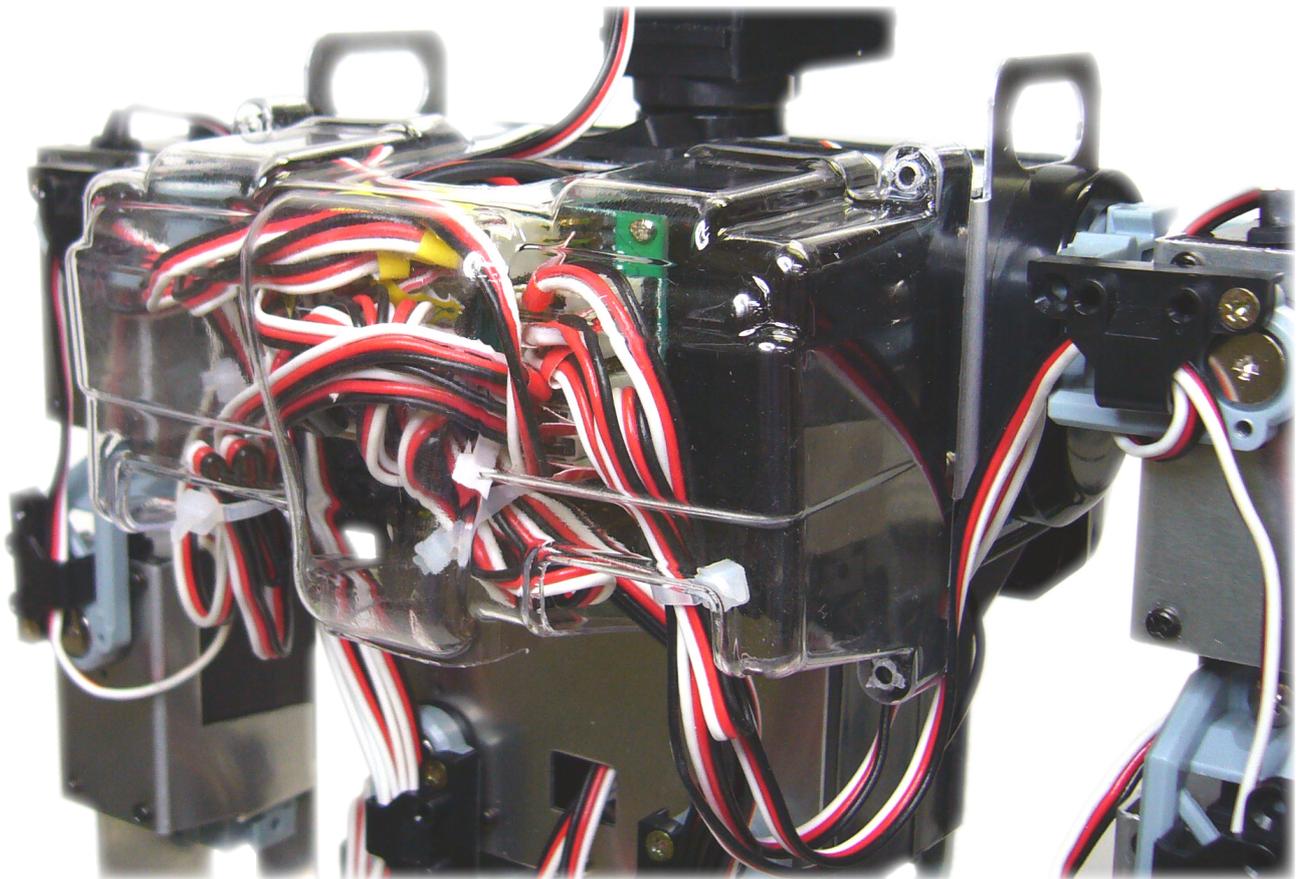
Need to be confirmed

1



The process of work

1. Attach board cover to PCB base.  
See the picture for wiring.

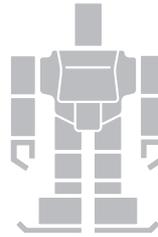


## Installing battery

### Necessary parts

- Front cowl 1
- Body pin 3
- Sponge 1
- HV battery 1

Cowl and Cover



The image of a complete one



Explanation of the icons



Explaining the points



Knack to do the work well

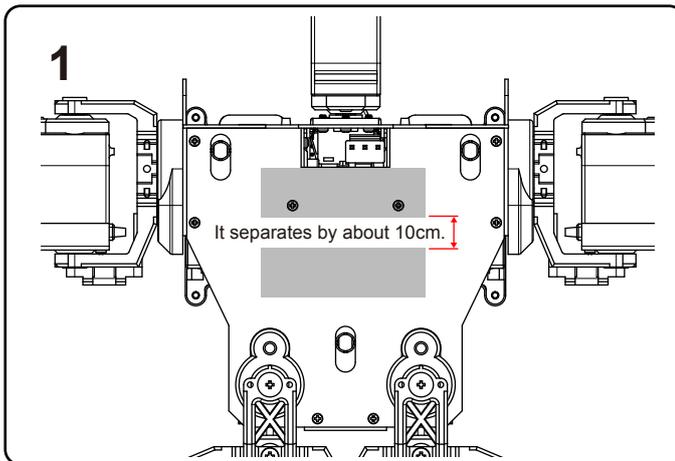


Caution of breaking

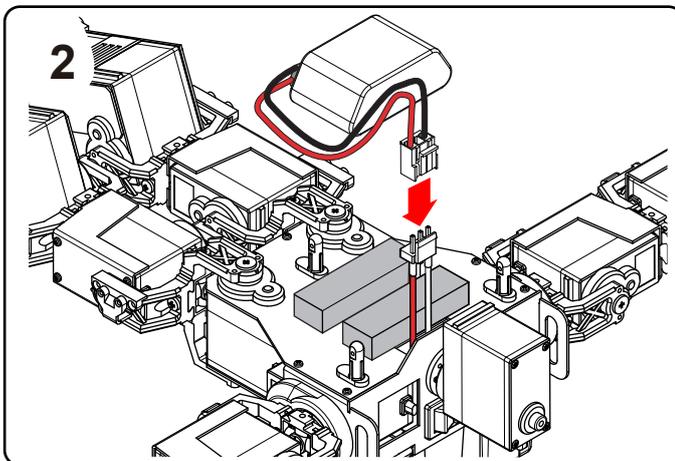


Need to be confirmed

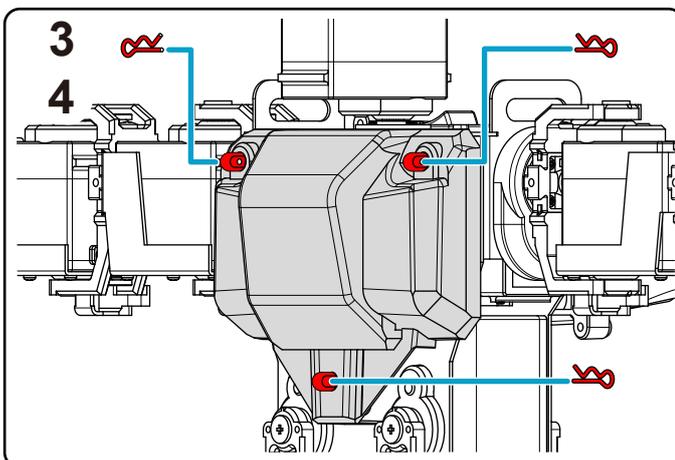
### The process of work



1. Cut the sponge into half and put the seal covering on the head of screws of body frame.



2. Connect the battery to power source switch harness.



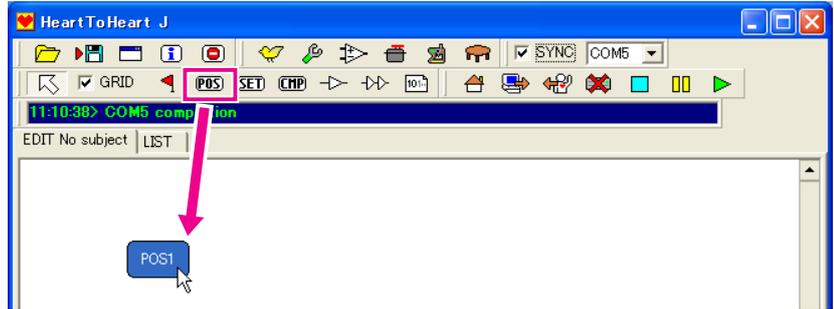
3. Attach front cowl to body post.

 Pay attention not to sandwich the cable of battery and power switch harness.

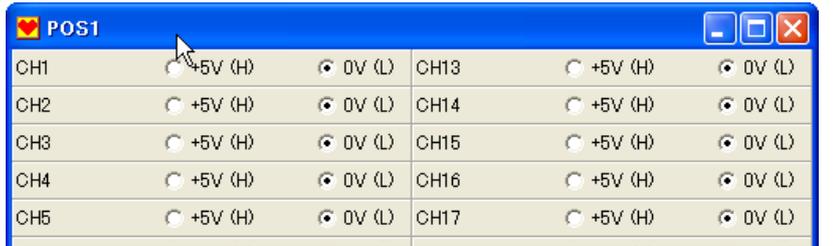
4. Insert body pin into body post and fix body cowl.

## Setting home position 1

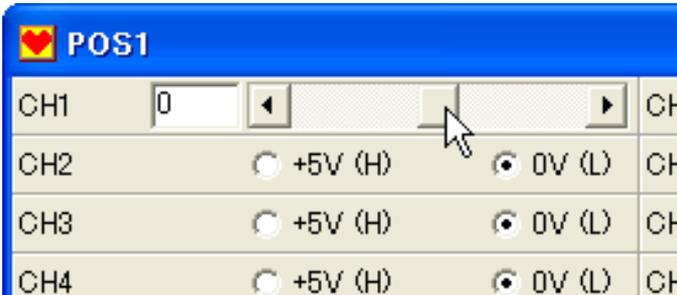
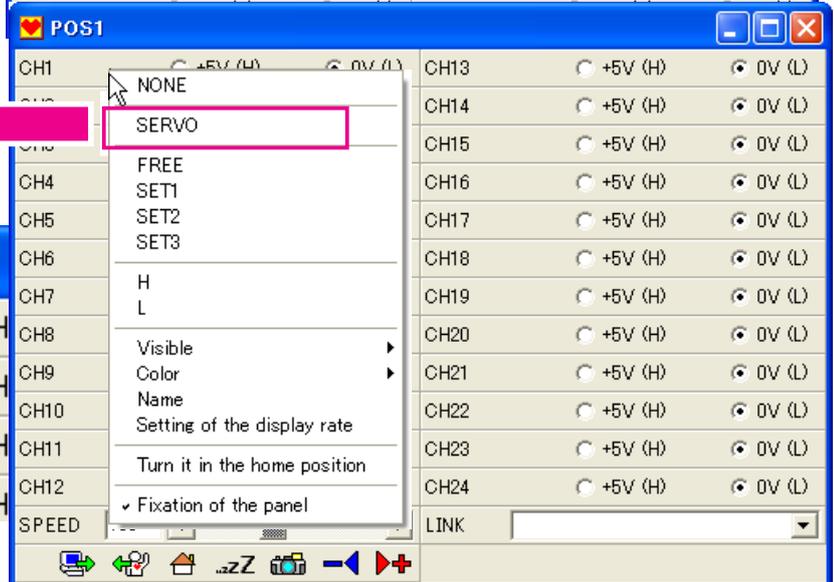
(1) As in the process of setting the origin, start the software and RCB3-J. Place position on the datasheet.



Double click the position that was put on the data sheet, and open the position window.

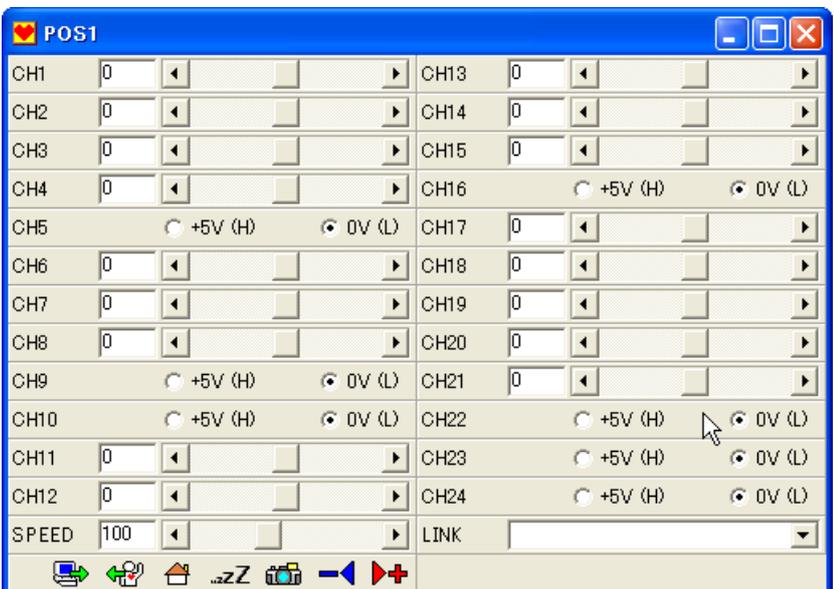


Right click the using channel and open the menu. Select SERVO.



**Danger** Be careful as the robot will move if you move the scroll bar. It is dangerous to put your finger to the moving body or to bring your face close to it.

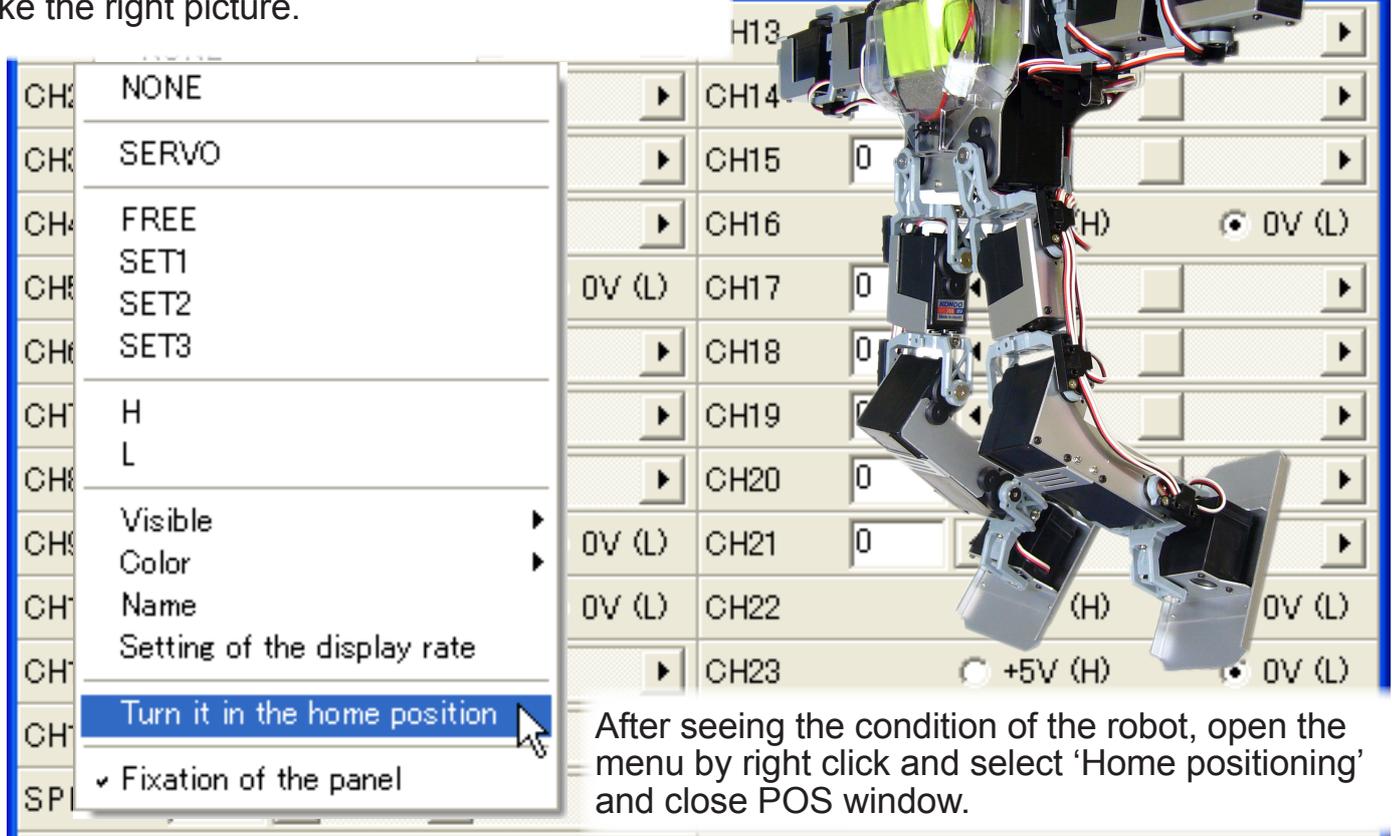
For all channels that are used, select servo and set 0.



# Setting

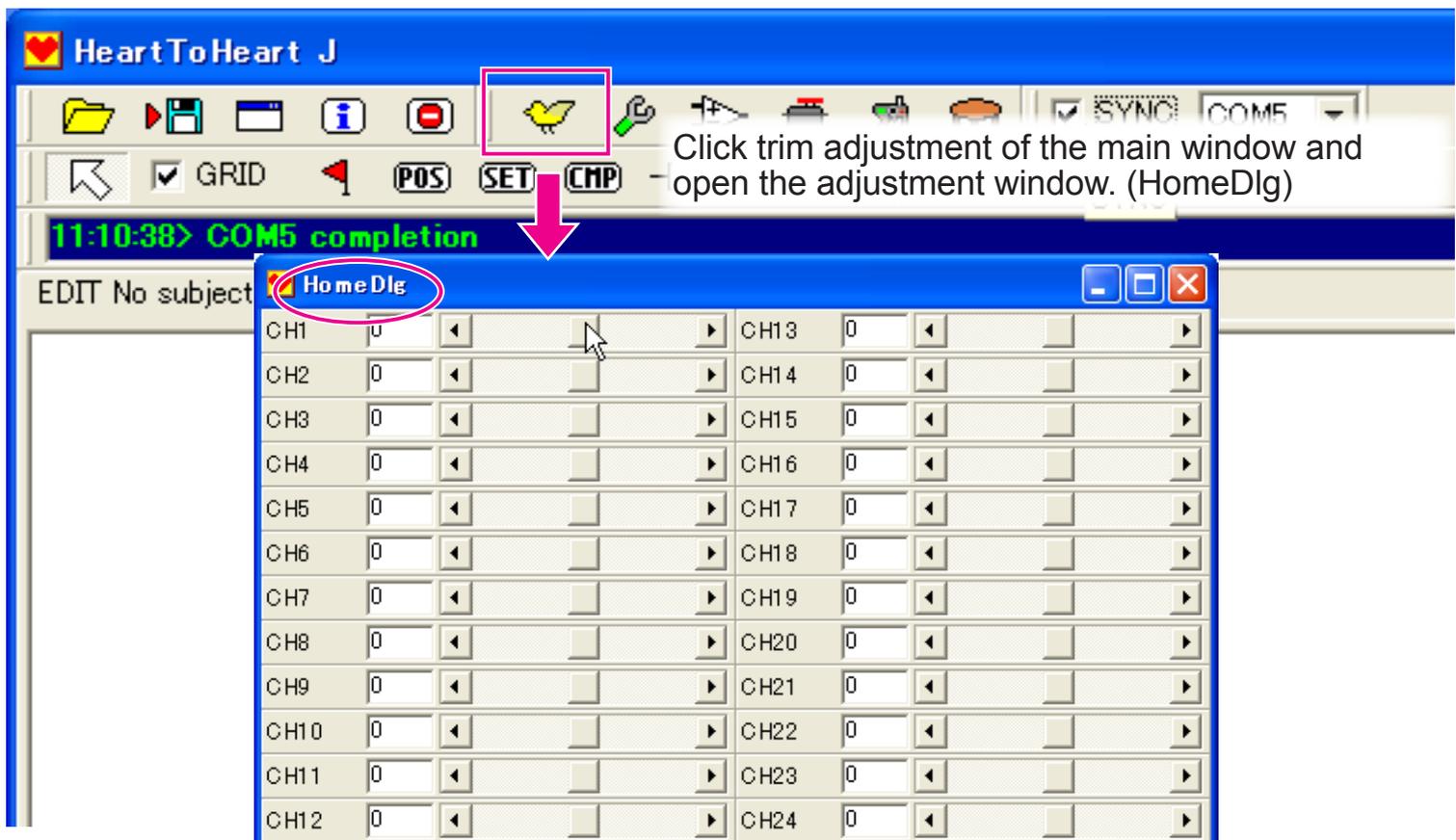
## Setting home position 2

In the condition, the body is supposed to be like the right picture.



After seeing the condition of the robot, open the menu by right click and select 'Home positioning' and close POS window.

(2) Adjust the position of the home position on the adjustment window.



Click trim adjustment of the main window and open the adjustment window. (HomeDlg)

## Setting home position 3

In the adjustment window, adjust the position of each servo and the position of home position. Select the home position which stands upright.

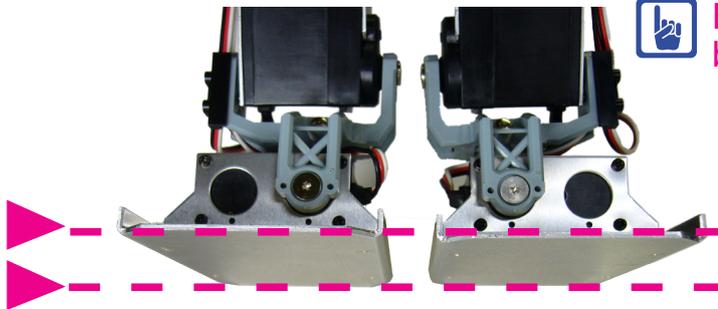
Home position is the important position when operating motions.

Especially, adjust left and right legs correctly. See the picture below.

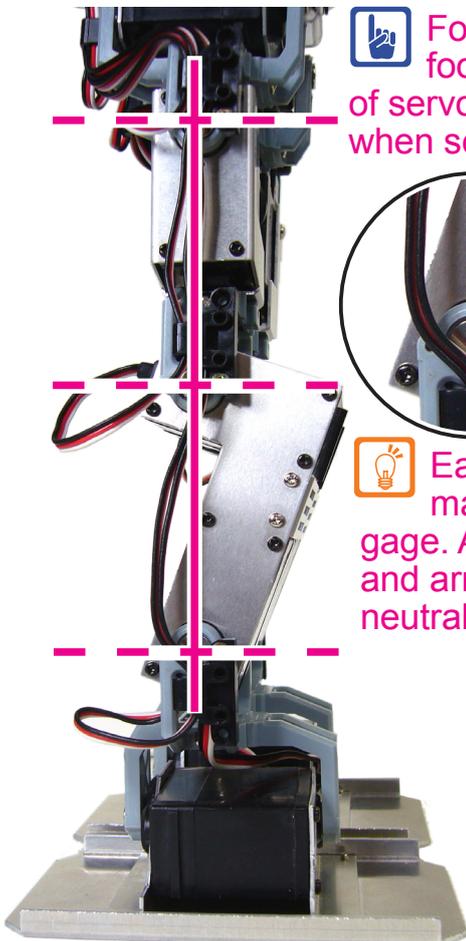
HomeDlg							
CH1	1	◀	▶	CH13	119	◀	▶
CH2	-251	◀	▶	CH14	-48	◀	▶
CH3	-255	◀	▶	CH15	14	◀	▶
CH4	2	◀	▶	CH16	0	◀	▶
CH5	0	◀	▶	CH17	5	◀	▶
CH6	262	◀	▶	CH18	-2	◀	▶
CH7	260	◀	▶	CH19	-114	◀	▶
CH8	-5	◀	▶	CH20	56	◀	▶
CH9	0	◀	▶	CH21	-15	◀	▶
CH10	0	◀	▶	CH22	0	◀	▶
CH11	0	◀	▶	CH23	0	◀	▶
CH12	9	◀	▶	CH24	0	◀	▶

\* The setting is automatically saved when the window is closed.

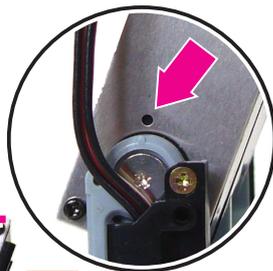
\* This window is an example. The numbers might differ.



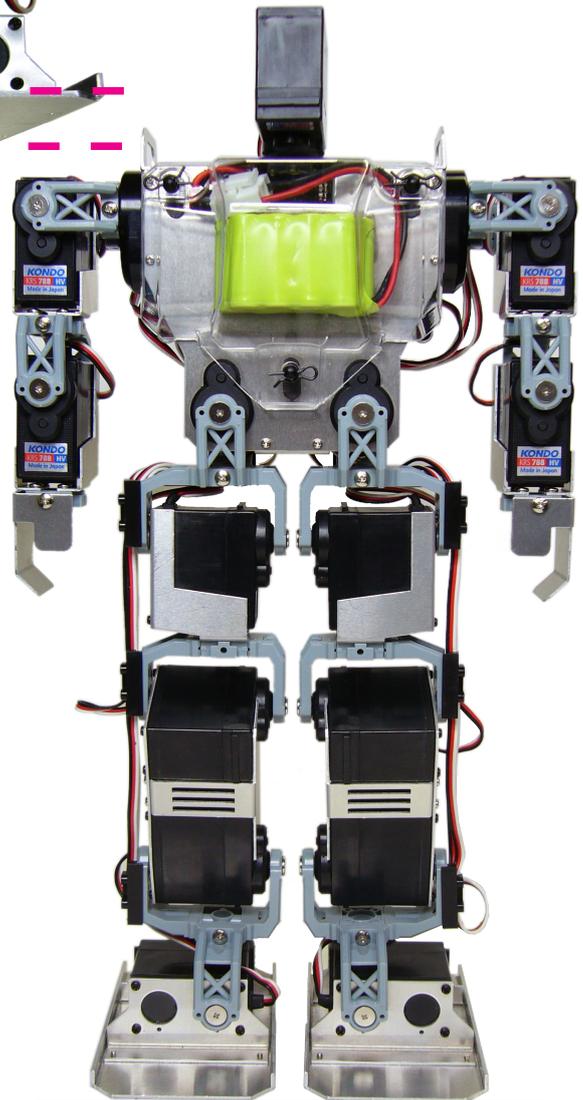
Especially, the position of the back of feet is important.



For each servo of the foot, put the output axis of servo on the straight line when seen from the side.



Each frame has the mark called neutral gage. Adjusting this mark and arm, you can see the neutral position.



## Operating sample motion

For the moment, setting of home position is completed for the robot (KHR-2HV). But it does not move as motions are not registered. Also, home position does not start even if you turn it on. Here, it will be explained about the register and the operation of sample motions and the operation of basic walking motions so that it will move safely to home position.

## Registering start up motion

See the instruction manual of RCB-3J to make start up motion.

Here, sample motions in the CD will be read.

## Connection

Connect KHR-2HV and a computer and then connect serial USB adapter.

- 1, Start 'HeartToHeart3J' on the computer.
- 2, Connect the battery to KHR-2HV and turn the switch on.
- 3, Check SYNC on the software.

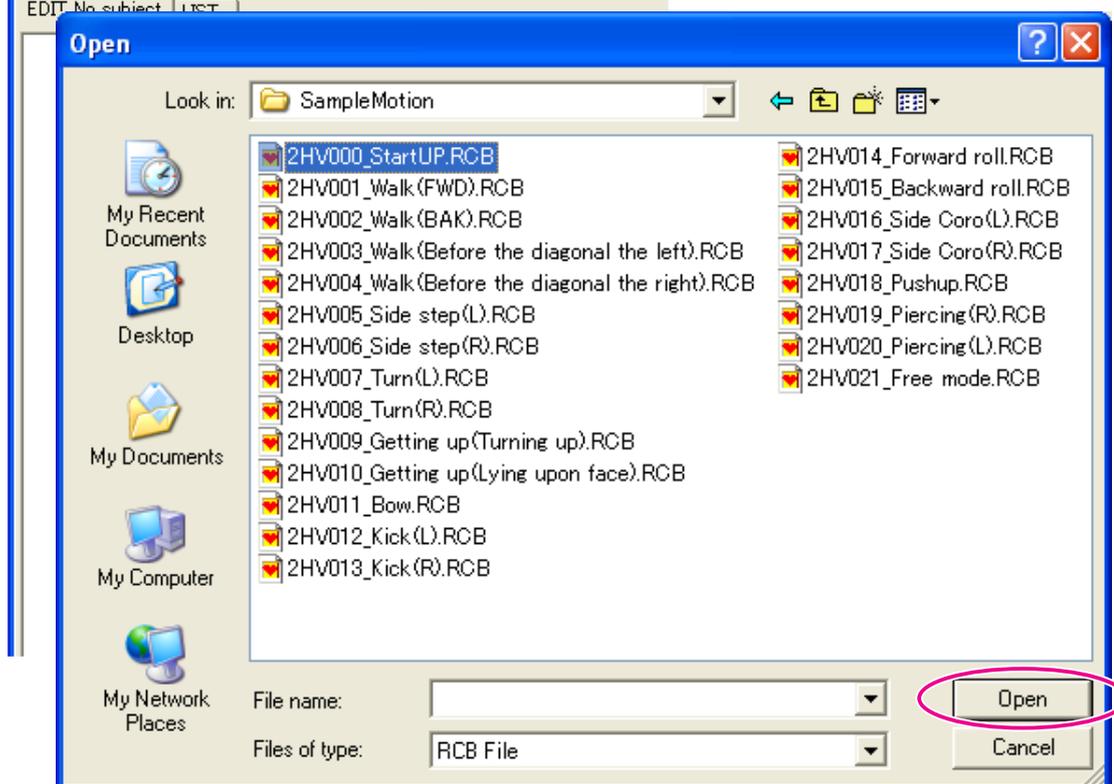
In this condition, it looks like KHR-2HV is off. Each servo is free on the initial condition.

## Read start up motions from the file



Click load button on the main window of the software.

Click the icon and the dialogue box 'Open the file' will appear.

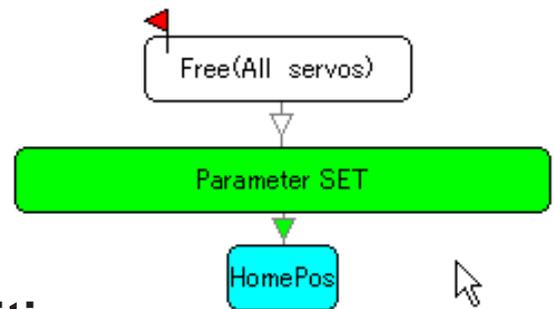


Select the folder of sample motion from the folders that were copied from the attached CD or hard disc.

From this folder, open the file 'start up motion'.

## Start up motion appears

Start up motion like the figure on the right will appear on the data sheet.

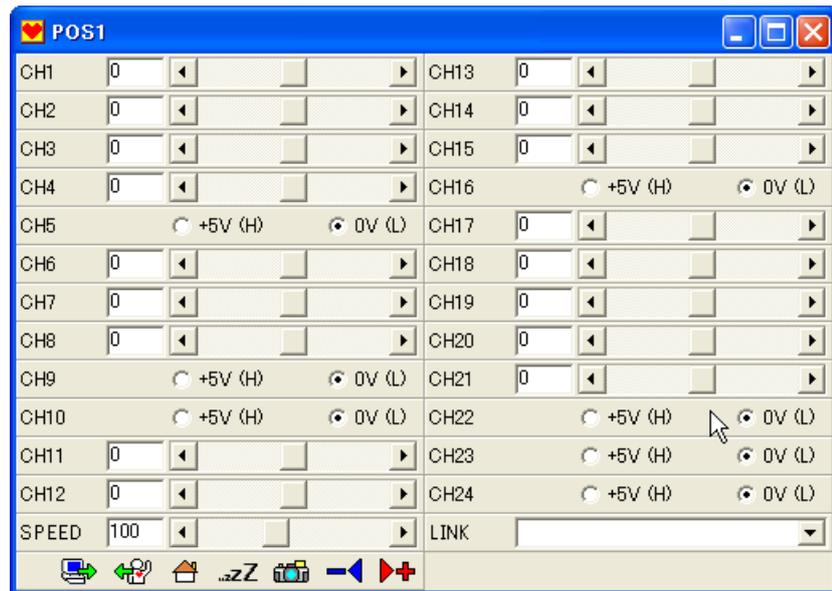


## Write it changing to the home position

Change the last position of start up motion to the current home position. If you have made the home position as in this manual, you don't have to change it.

 If you click this position, the position window on the right will appear.

 If you click this icon, it will change to the home position whose data is set.

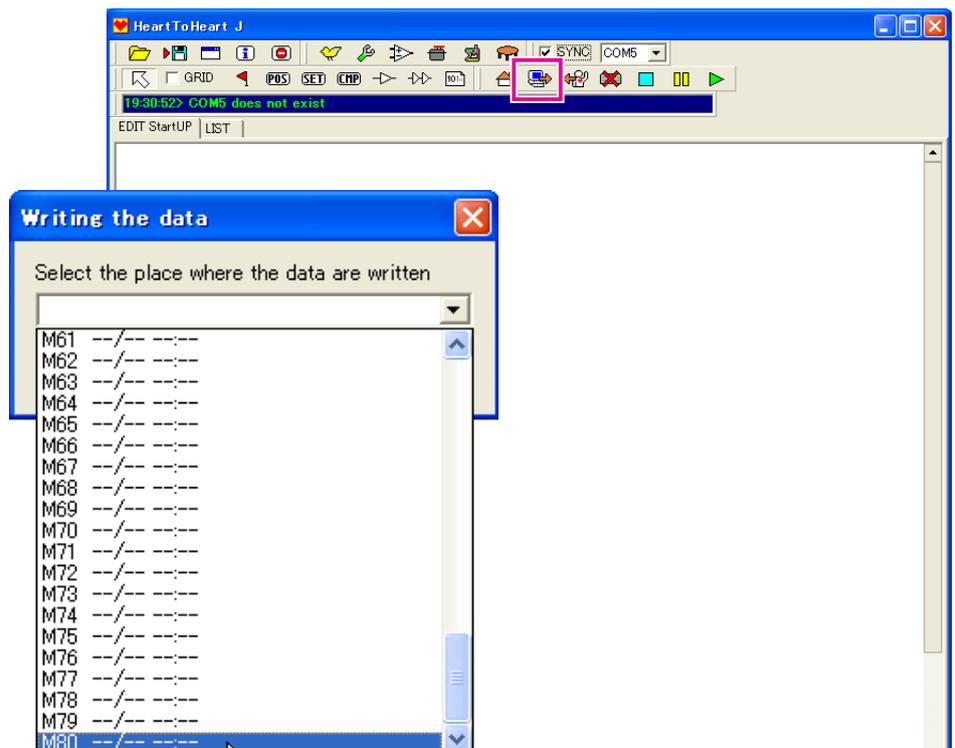


\* If you did the process as in this manual, all servo are at the position of 0. Close the window after confirming it.

## Write motion

Motions are operated after they are written on the board. If you click the Write button, the dialogue box will appear. M80 is chosen as an example here.

 You can write it on any of them.



## See the motions that were written

 If you click data table button, the window on the right appears and you can see the list of motions in the board.

 If you click play button, the dialogue on the right appears. By selecting a motion, you can operate it.

 If you click this button, you can stop a motion for a while.

 If you click stop button, you can stop the motion.

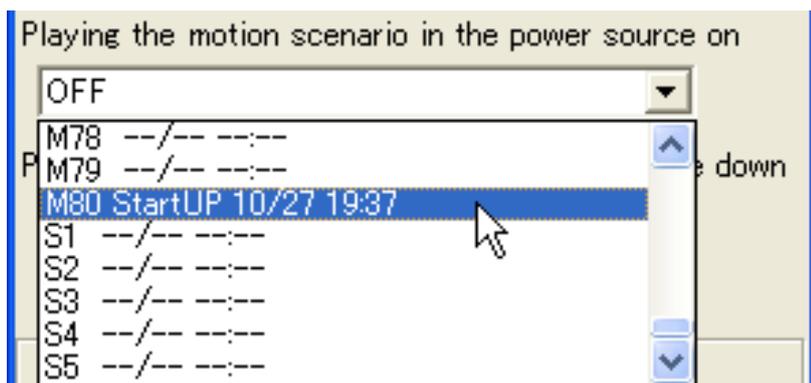


\* The contents of this motion are used when all servos are free. You cannot see if it's operating when it's done with servo working (home position).

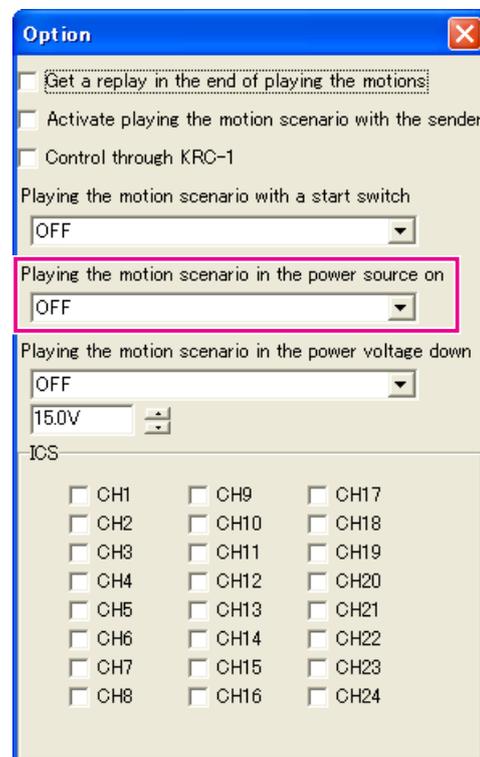
## Automatic operation when the power is on

The motions can be played after it started, but RCB-3J has the function that plays a selected motion automatically when the power is on. The following shows its setting.

 If you click the option button, the option window on the right opens.



On the topic, 'play motion scenario when the power is on', select the start up motion that was registered. Close the window, and this setting is confirmed.



## Operating start up motion

After registering start up motion, turn the switch off and turn it on again. If each servo moves slowly to home position when the power is on, registering is finished.

## The mechanism of start up motion and sample motion

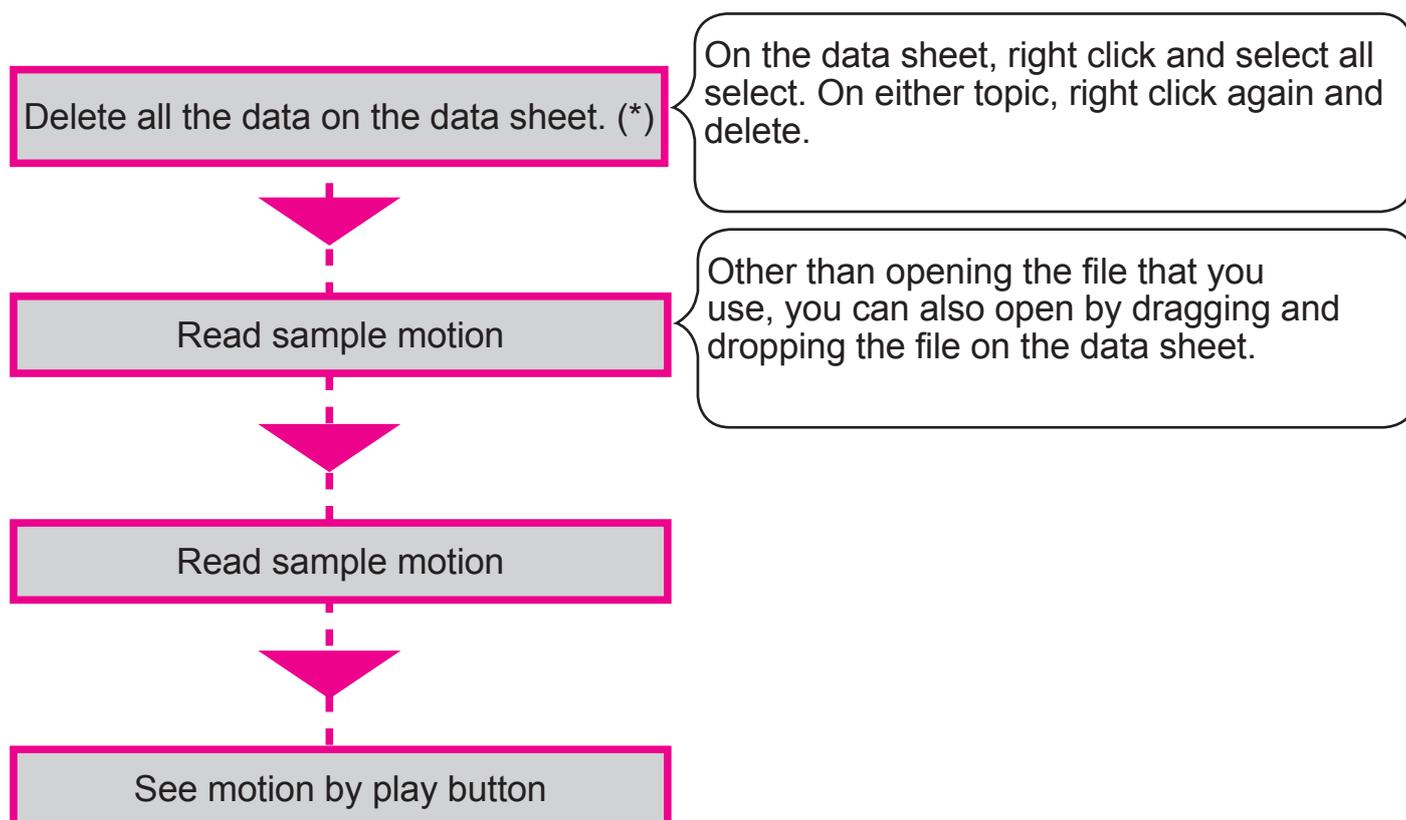
Start up motion is an example of motions that utilize the functions of RCB-3J and KRS-788HV.

When the power is on, servo tries to move to the position that was first given, but as the position when the power is on is not stable, it moves at the highest speed to the initial position. This is not safe as it moves suddenly.

In start up motion, select FREE for all servo at the initial position. When FREE is selected, KRS-788HV releases the control of servo but also returns the current position of the output axis to the control board. The next SET substitutes the returned position to the position of each servo making use of the mechanism of instruction.

In the last position, home position is selected. For the original position that moves to home position, the position which was taken by instruction becomes standard, and the speed that was selected at the position becomes the speed of servo.

The process of the register of start up motions contains basic contents for operating other sample motions or making motions. The following is the process of using sample motion.



\* When it reads to the data sheet from the file, it becomes additional reading and original data are necessary. When motion is read from the board, it becomes superscription. (The originally data does not remain.)

## Setting ICS

In the setting of home position and start up motion, servo might vibrate and does not stop. You can react to this by changing motion characteristics of each servo. In RCB-3J, you can do this with control board connected to servo.

### What is ICS?

ICS (Interactive Communication System) can change and gain each parameter of the inside by communicating servo motor, PC and the control board for the robot.

It also has the function of instruction and characteristic change.

The function of instruction changes the position data of each servo when the robot is posed as you like to the position data.

Characteristic change can remember 3 types of the setting of servo and change it when necessary.

### The process of the setting

1. See if the power of the body is on and it is connected to the computer.

2. Click option button and open the setting window.



3. On the topic of ICS function on option window, check the channel that servo is connected to. Close the option window.

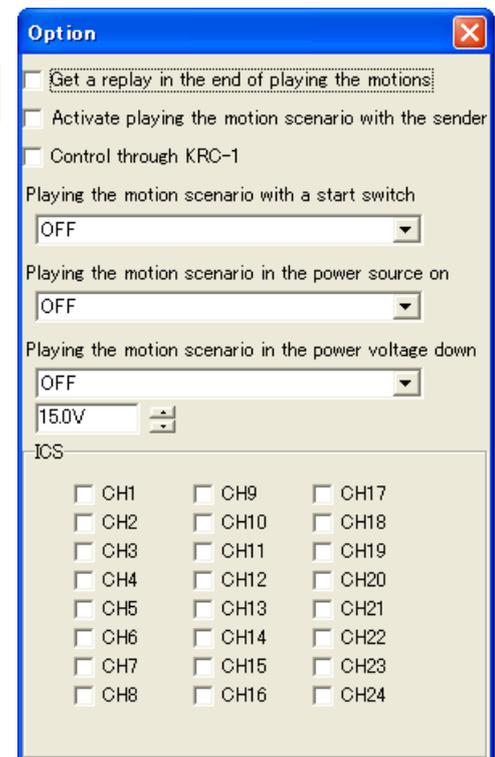


This setting does not have to be done again.

4. Click ICS setting button and open the ICS setting window.



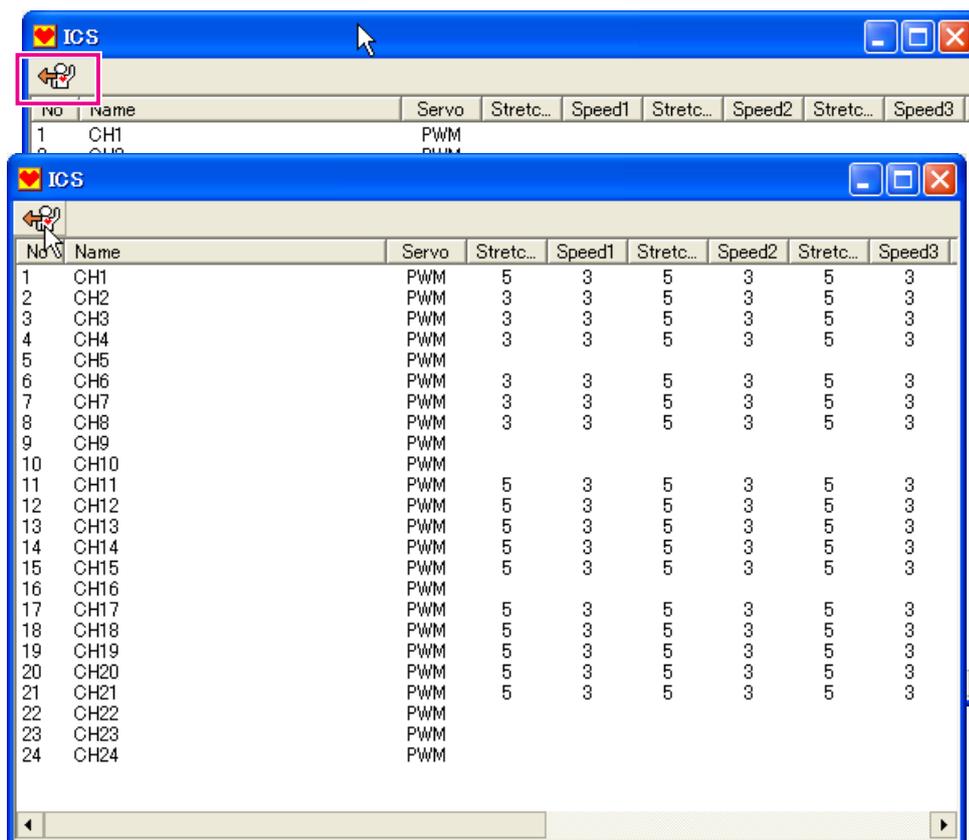
Turn the switch off and turn it on again. If the LED lights up in red, RCB-3J is in ICS mode.



- Click read button on ICS setting window and read parameter of each servo that is connected to RCB-3J.



Reconfirm ICS setting of option setting when parameter is not read. When it's not in ICS mode, the error message will appear.

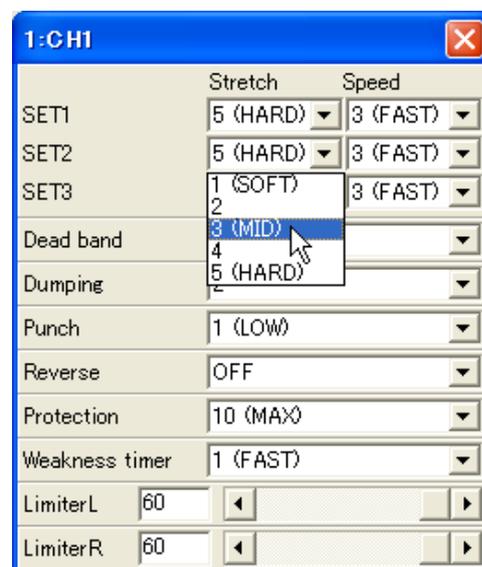


- Double click CH1 and open parameter setting window of servo. Change pulse stretch of SET1 to 3 (MIDI). Do this for CH2, 3, 4, 6, 7, 8.



## The meaning of settings

Pulse stretch( initial value = 5) sets the saving characteristic of servo. As the value is higher, the saving characteristic is stronger. In KHR-2V, the value is optimized like the value is small to prevent the head or arms from having damage.



- After the setting, close the window of ICS setting. Turn it off and turn it on again.

The servo using ICS, changes mode of normal moving mode and communication mode by ICS when the power is on. Both case require the reboot when the ICS settings window is open.



**KHR-2HV**

The text "KHR-2HV" is rendered in a bold, italicized, sans-serif font. The characters "KHR-2" are colored red with a blue gradient, while the characters "HV" are colored blue with a red gradient.