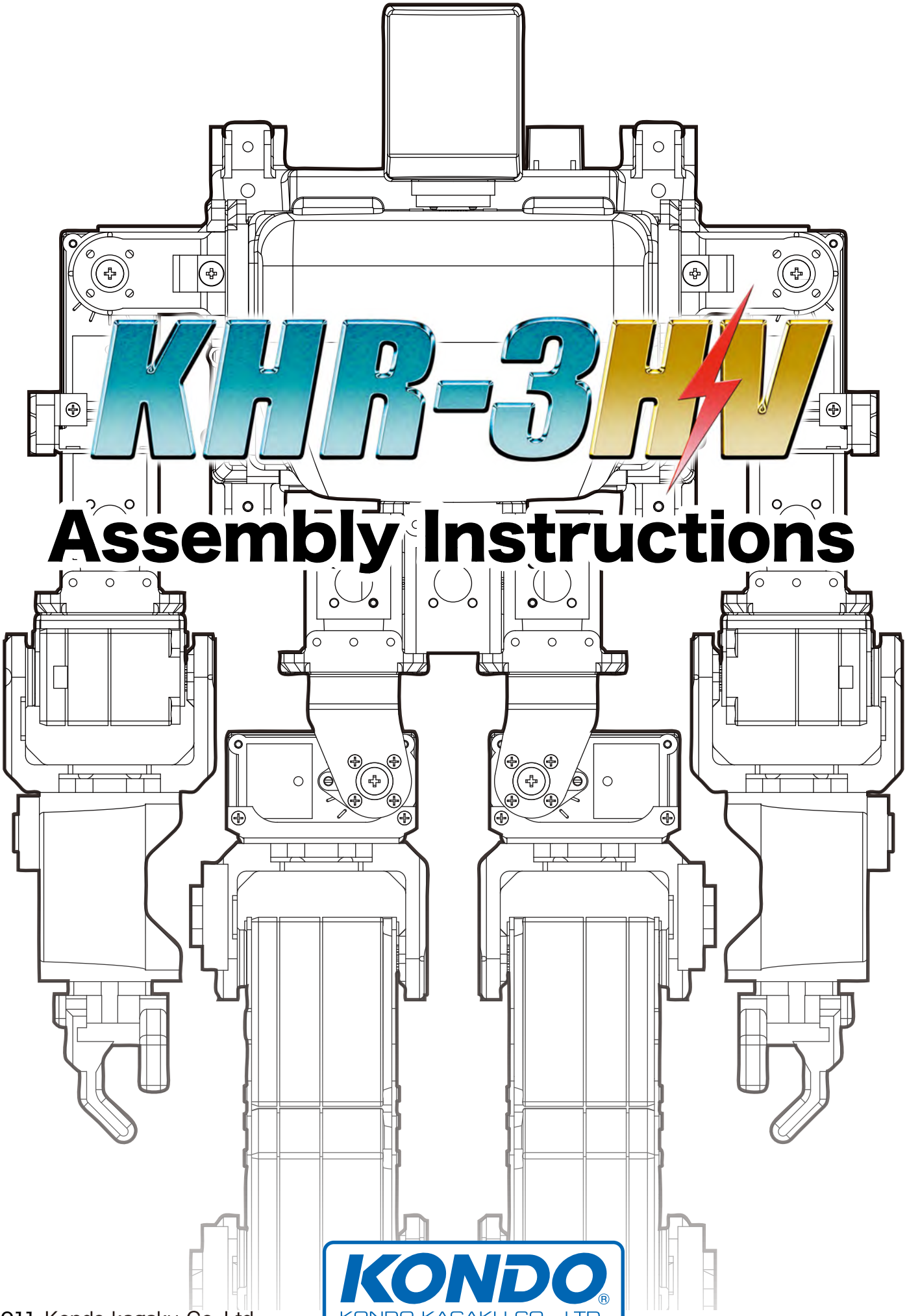


KHR-3HV

Assembly Instructions

KONDO
KONDO KAGAKU CO., LTD.

Safety Precautions

Due to the nature of this product as an assembly kit, consequences, damage , or injury resulting from the use of this product are the user's responsibility. Please use this product with that in mind. In order to prevent danger to the user and others, as well as property damages, the safety precautions listed below must be followed.

The following signs are used with each description to indicate the level of potential harm that may be caused by ignoring the precautions.

DANGER	: This sign indicates that "there is imminent danger of death or severe injury".
WARNING	: This sign indicates that "there is a possibility of death or severe injury".
CAUTION	: This sign indicates that "there is a possibility of injury or material damage".

The following graphics are used with corresponding descriptions according to the type of precaution. (The following are only part of the graphics used in this manual.)

	: This pictorial indication signifies that the action is "prohibited".
	: This pictorial indication signifies that the action is "mandatory".

DANGER

Work with sufficient space in a physically and emotionally alert and observant state.

There is danger of death or serious injury by unexpected accidents.

WARNING

Keep all parts away from small children.

Parts such as aluminum frame brackets can cause injury.

Disconnect the HV battery connector immediately if any thing abnormal occurs.

*Damage in the robots body. *Foreign objects in the robots body. *Smoke. *Odd smell. *Abnormal heat or warmth. Continued use under such conditions can result in fire or electric shock.

*Should any abnormalities be observed, immediately stop using the product and contact our service section.

Do not break the charger and cable.

Do not damage, modify, bring in close contact with thermal appliances, or use under forced pressure. Continuous use under such conditions can result in fire or electric shock.

*For repair of cords and cables, please contact our service section. *If the product becomes wet, please consult our service section.

Disconnect the power plug from electrical outlets when the charger is not being used.

When plugged to an outlet, a small amount of electricity flows into.

Do not disassemble or modify the servo or board of the finished product.

Disassembly and repair, other than those stated in this Instruction, is prohibited. Incorrect disassembly or assembly can cause malfunctions, fire and/or electric shock.

*In case of any malfunction, please contact our service section.

Do not allow the product to become wet or use under high humidity and conditions where dew condensation occurs.

Such conditions may result in malfunction since this product is composed of electronic parts. Such conditions can also result in electric shock and fire by electrical shorting.

During operation, always exercise caution and be prepared for unforeseen accidents.

Please always remember that due to the nature of this product as an assembly kit, safety is not guaranteed for the movements resulting from the operation of the product. Please take extra precautions since an injury of the fingertips and fracture of bones may result when movements of the product greatly differ from what you expect.

Recognize the possibility that components can short circuit.

Short circuit can easily occur since control board terminals are bare. Short circuits can cause the battery, components, and wiring materials to ignite. Incorrect wiring can also result in similar danger.

Safety Precautions

CAUTION

For overseas use, local approval or license may be needed. Please check.

In certain areas or countries, legal procedures may be necessary prior to using the product.
*Our support does not apply to the use of this product outside of Japan.

When detaching the charger and battery, firmly hold the connectors.

Detachment by holding the cord may cause breaking of wires and a possible short circuit, which can result in electric shock or fire.

Do not operate on an unstable work surface.

The product can lose balance and collapse or fall off causing injury.

The HV battery included with this product is a nickel-metal hydride battery. To protect valuable environmental resources, used batteries should be recycled, not disposed of as trash.

HV Battery Handling

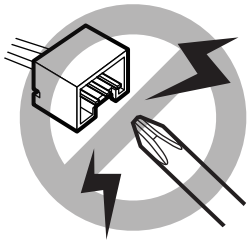
In this kit, a HV battery (nickel-metal hydride battery) is used as the operational power source. Although the nickel-metal hydride battery is a secondary battery that can be recharged and reused, misuse can result in serious accidents. This Instruction should be read carefully before use.

How to charge

1 :

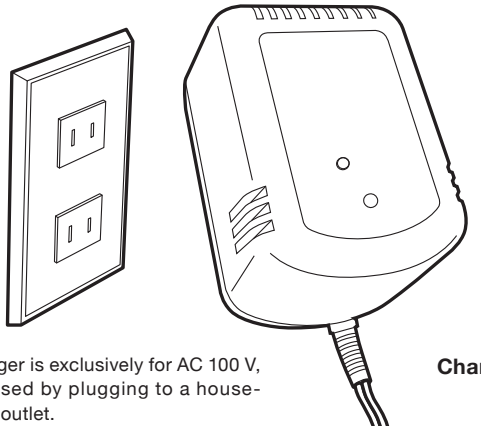
Plug the charger (MX-201) into an electrical outlet.

* Do not attach battery before plugging the charger into the outlet since that can cause a malfunction.



⚠ WARNING

Electrical current runs through the cord to the terminal pins when connected to the charger. Do not short circuit the pins with any conductive material.



* The charger is exclusively for AC 100 V, and is used by plugging to a household AC outlet.

Charger (MX-201)

2 :

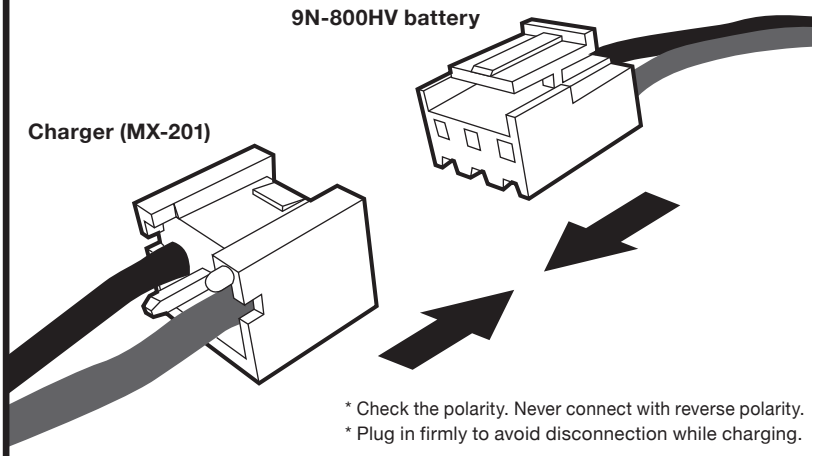
Insert the HV battery connector into the charger connector. The charger LED will turn red and charging starts automatically.

⚠ DANGER

Check the polarity. Never connect with reverse polarity.

⚠ WARNING

Beware of the state of the nickel-metal hydride battery while charging. Should you detect any abnormal heat, noise or smell, unplug and remove the nickel-metal hydride battery immediately.

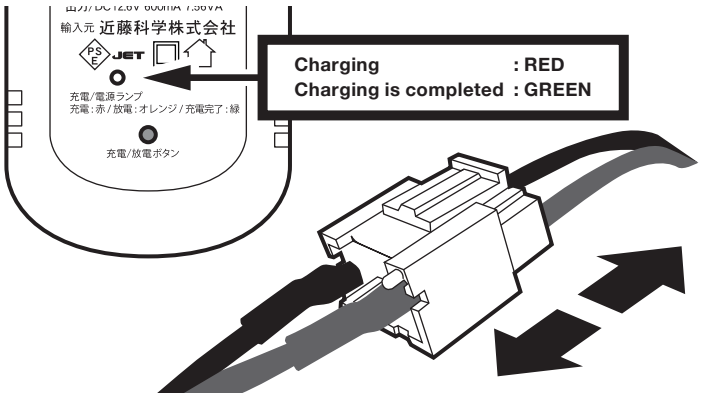


* Check the polarity. Never connect with reverse polarity.
* Plug in firmly to avoid disconnection while charging.

3 :

The LED will turn green when charging is completed. Disconnect the charger connector and the battery connector. Unplug the charger from the outlet if you don't need to charge another battery immediately.

* Charging time depends on the nickel-metal hydride battery charge remaining. Charging time for an empty battery is approximately one and a half hours.



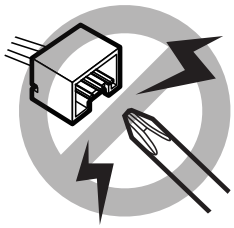
HV Battery Handling

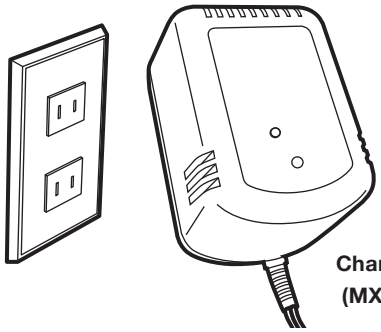
How to charge after discharge

1 :

Plug the charger (MX-201) to an outlet.

* Do not attach the battery before plugging the charger into an outlet because this can cause malfunction.





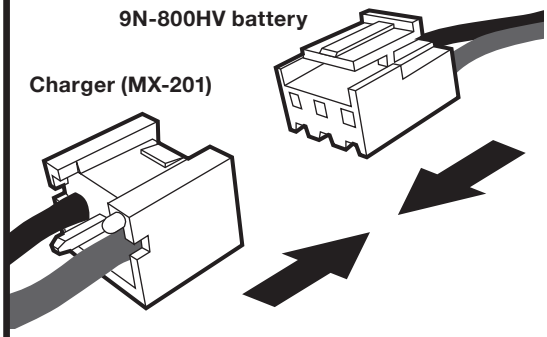
WARNING

Electrical current runs through the cord to the terminal pins when connected to the charger. Do not short circuit the pins with any conductive material.

2 :

Insert the HV battery connector to the charger connector. The charger LED will turn red.

* Plug in firmly to avoid disconnection while charging.



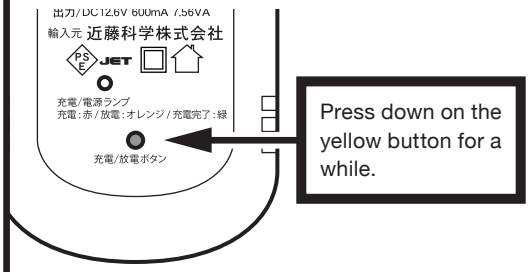
DANGER

Check the polarity. Never connect with reverse polarity.

3 :

Press and hold the charger yellow button. The charger LED will turn from red to orange and battery discharging begins.

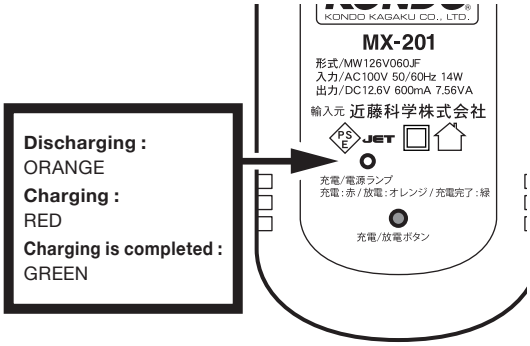
* Discharge time depends on the remaining amount of battery charge, but will take about five hours at most.
* In order to force charging to begin, press and hold the yellow button. The LED will change from Orange to Red and charging will begin.



4 :

Charging immediately begins when discharging is completed. The charger LED will turn from orange to red.

* The LED intensity will darken as charging proceeds, but will not dim completely.



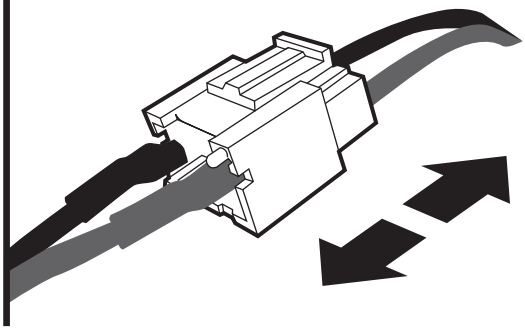
WARNING

Beware of the state of the nickel-metal hydride battery while charging or discharging. Should you detect any abnormal heat, noise or smell, unplug and remove the nickel-metal hydride battery immediately.

5 :

The LED will turn green when charging is completed. Disconnect the charger connector and the battery connector. Unplug the charger from the outlet if you don't need to charge another battery immediately.

* Charging time depends on the nickel-metal hydride battery charge remaining. Charging time for an empty battery is approximately one and a half hours.



Precautions for Use

DANGER

: The following actions are dangerous and are prohibited.

Removal of the connector and modification such as changing of cords. Do not short circuit the battery.

Short circuiting a battery can result in explosion, fire, and fluid leakage, which could cause injury and loss of eyesight. Short circuits can occur at pins even with connectors attached. Care and attention are always required during use.

Do not place the battery along side other objects during transportation and storage.

Short circuits caused by damage to connectors, wires or the wrapping of nickel-metal hydride batteries can result in fire and fluid leakage. Please keep batteries separate from other objects during transportation and storage. There have been reports of fire caused by batteries short circuiting with coins and car/house keys.

WARNING

: Should the following circumstances occur, take necessary.

In case of fluid leakage, any liquid on your hands or skin must be washed away immediately. Should you get any fluid in your eyes, wash thoroughly and seek medical attention.

The substance inside the battery is harmful and can affect the human body, as well as damage furniture and other household objects. Immediate attention is required as blindness can be caused if the battery fluid gets in the eye.

Unplug the battery connector from the board and charger when battery is not in use or when the battery is left unattended for a length of time.

To take necessary precautions in case of unexpected circumstances, always keep the battery in clear view. Do not leave the connector plugged for a long period of time as it may result in fire.

CAUTION

In order to protect valuable environmental resources, please take any used batteries to the store for recycling instead of disposing them as trash.

Nickel-Metal Hydride Battery Properties

Compared to dry-cell batteries, nickel-metal hydride batteries have the advantage of very low internal resistance and can produce large currents. On the other hand, if battery charging is attempted before the remaining charge is fully depleted, a condition called memory effect can occur. This can decrease the battery life span. In order to avoid memory effect occurring, nickel-metal hydride batteries should be recharged only after they are fully discharged.

Preface

Thank you for purchasing the "KHR-3HV" robot assembly kit.

This kit enables you to assemble a bipedal robot that can be operated and programmed to perform a wide range of motions. For its assembly, please read this Instruction, as well as the attached Operation Manual, carefully. In addition, we recommend that the instructions be printed out as necessary.

Caution

1 :

Please keep in mind that due to the nature of this product as an assembly kit, the motion of the assembled product cannot be guaranteed. Further, due to the fact that the movements of the assembled product depend in large part on the method by which it was assembled, we may not be able to provide precise answers to your questions regarding operations.

2 :

This product is constructed for people of all ages to enjoy a bipedal robot. However, this product is not a toy, and contains parts and tasks that would be difficult for young children to understand or perform. For those parts and tasks, parents or teachers should provide assistance.

3 :

The assembly and operation of this product requires the use of a personal computer (Windows XP(SP2) or Vista) with a USB port. It is assumed that the user has basic computer skills. Please note that we cannot provide answers to general questions or inquiries regarding computers or Windows.

- **All company names, trade names, and logo marks that appear in this Instruction are trade marks or registered trade marks of each respective company.**
- **The contents of this Instruction and product are subject to change without notice for improvement or other reasons.**

Preparation

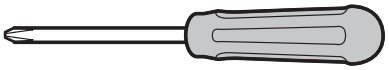
The following items are required for the assembly and operation of this product:

• Personal computer

Processor	: Pentium 4 2GHz or above, or equivalent
	: Microsoft Windows XP (SP2 or later) or Vista operating system
Hard Disk	: 32 MByte or larger (not including data files)
Memory	: 256 MByte or larger
Drive	: CD-ROM drive (for installation)
USB	: 1 or more USB 2.0 port(s)
Software	: Microsoft. NET Frame work 2.0 is required

• Tools

- #0 and #1 screwdriver
  Screwdrivers with thick handles and magnetic tips are most convenient.



- small blade
- nippers
  for cutting parts and board cover
- file
- (4mm) box wrench (or spanner)
  for tightening M2 nut
- screw locking adhesive (moderate strength)
  convenient for preventing screws and nuts from loosening.

Accessories

KRS-2552HV

The KRS-2552HV servo motor used in this kit is a FET servo using serial signals. Since the half-duplex serial transmitting and receiving method is used the servo cables utilize a multi-drop method that decreases the total number of cables from the control board and allows a simple wiring layout.

- A wide range of servo parameters can be set using the ICS USB adapter HS.
- Configuration items have been expanded using ICS 3.0 allowing ultra-high speed communication at 1.25 Mbps.
- The servos have been specifically designed for robot use enabling mounting using dual axial support.
- Although the servo size is almost the same as the KRS-788HV, it can produce much higher output torque.
- Utilizing an ultrasonic motor, the servo consumes less power than older products.
- Detects temperature and current values for safety.

• Major specifications

External size	: 41 ×21 × 31.5 (mm) *Not including projections
Weight	: 41.5 g * Not including cable and servo horn
Maximum operating angle	: 270°
Maximum Torque	: 14 kgcm (at 11.1 Vh/ at rest)
Maximum Speed	: 0.14 s/60°(at 11.1 Vh/ unloaded)
Rated voltage	: Direct current 9-12 V (our specified HV power source is recommended)

RCB-4HV

***Application software is required for its use.**

The RCB-4HV control board used in this kit contains eight SIO ports for two systems of ICS3.0 compliant device, and can connect up to 36 ICS3.0 devices.

With ten AD ports, multiple analog sensors can be used. AD input for power management is available separately. Ten PIO ports have been mounted. LED may easily be lit. The COM ports and SIO ports are capable of a maximum speed of 1.25 Mbps. EEPROM, known for its high-speed and high capacity has been adopted.

• Major specifications * For detailed specifications, see "Heart to Heart4 User's Manual".

Size	: 45×35×13 (mm) *About equal to RCB-3
Weight	: 12 g
Interface	: SIO port, COM port, AD port, PIO port
Rated voltage	: Direct current 9-12V (our specified HV power source is recommended)

After-sales Service

- **Inquiries regarding this product and accessories should be directed to our service section.**

Kondo Kagaku co., LTD. Service Section

4-17-7, Higashi Nippori, Arakawa, Tokyo

116-0014

Tel : 03-3807-7648 (Direct line to Service Section)

9:00-12:00 13:00-17:00

excluding Saturdays, Sundays and national holidays

- **Inquiry by email is welcomed at the following email address; however, please take note that replies may require some time.**

  support@kondo-robot.com

- **Notices and updates regarding this product are posted on our website.**

  http://www.kondo-robot.com

About the Instruction Manuals

There are five manuals (instructions) in total for this product.

1.Kit Guidance

The only printed manual. Provides overall description of the kit and how to view the other manuals.

2.KHR-3HV Assembly Instruction Manual

This Instruction. Describes how to assemble the kit.

3.HTH4 Users' Manual

Provided as PDF file. Describes RCB-4HV and "HeartToHeart4".

4.KONDO USB Driver Installation Manual

Provided as PDF file. Describes the installation of driver for serial USB adapter HS.

5.IDW Utility Manual

Provided as PDF file. Describes how to use the utility to rewrite servo motor ID.

Instruction and Outline of Assembly

This Instruction provides a step-by-step description covering the assembly of the main body.

In this kit, most assembly steps can be completed simply by tightening screws. However, setting each servo's origin position correctly is critical. For the first origin setting of a servo and the steps subsequent to step 6 shown in the left scheme, requires connecting the servo motor to the control board, and verifying the stop position of the initial condition (origin setting).

Please be aware that if the units are assembled without setting the origin, the range of servo rotation could differ resulting in abnormal movements, malfunction, or damage.

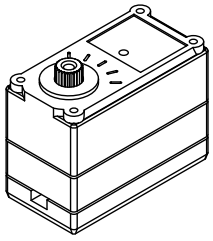
Therefore, before starting assembly, please charge the HV battery so that it will be ready when necessary.

When tightening multiple screws to assemble a part or sub assembly, all the screws should be temporarily screwed in lightly and then tightened further after all the screws are installed.

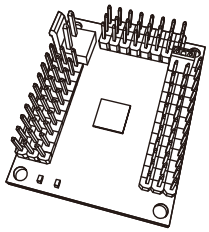
If individual screws are tightened separately in the beginning, subsequent screws may not fit into the holes or may deform the parts.

Component List

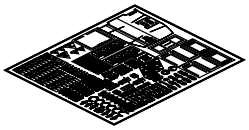
* Before beginning assembly, make sure that all parts in the quantities shown are present.
* Some parts are similar in shape. Please check the drawings carefully to correctly identify each part.



KRS-2552HV (17)

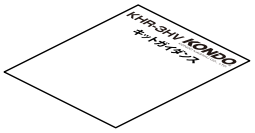


RCB-4HV (1)

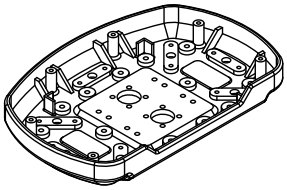


Decal (1)

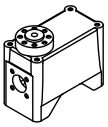
CD-ROM (1)



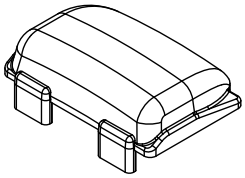
Kit Guidance (1)



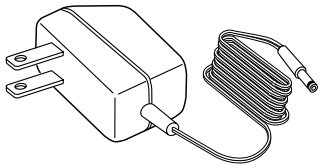
YHR-B1
Sole S-02 (2)



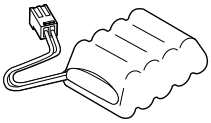
YHR-C2
Dummy Servo
2500A (7)



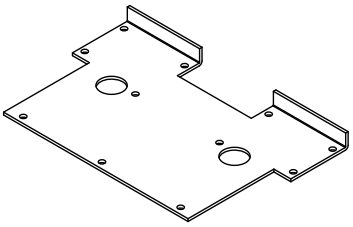
YHR-F1-2
Front Cowl (SD1) (1)



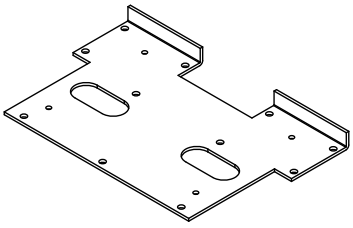
HV Charger
MX-201 (1)



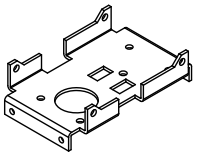
HV Battery
9N 800mAh (1)



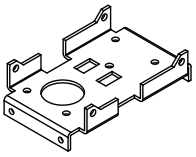
YHR-001
Body Frame F (1)



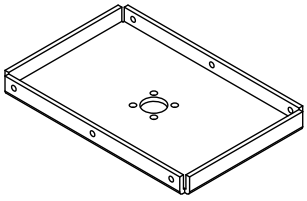
YHR-002
Body Frame B (1)



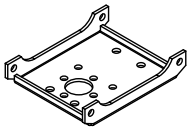
YHR-003
Shoulder Frame L (1)



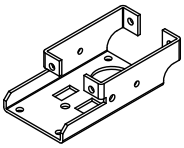
YHR-004
Shoulder Frame R (1)



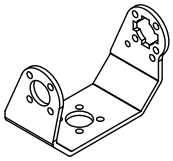
YHR-005
Body Base (1)



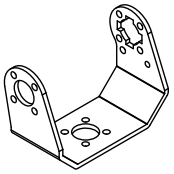
YHR-006
Servo Bracket A (6)



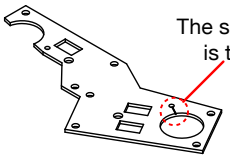
YHR-007
Elbow Joint A (2)



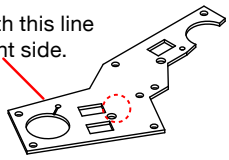
YHR-008
Offset Arm La (1)



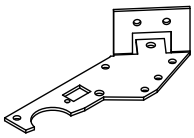
YHR-009
Offset Arm Ra (1)



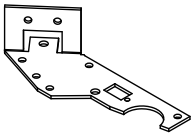
YHR-010
Side Joint L (2)



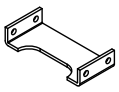
YHR-011
Side Joint R (2)



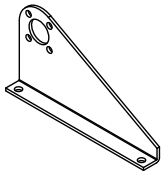
YHR-012
Leg Joint L (2)



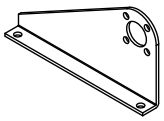
YHR-013
Leg Joint R (2)



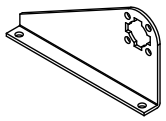
YHR-014
Leg Joint B (2)



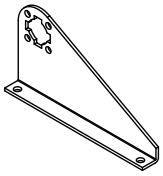
YHR-015
Foot Angle A-L (1)



YHR-016
Foot Angle A-R (1)



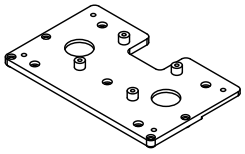
YHR-017
Foot Angle B-L (1)



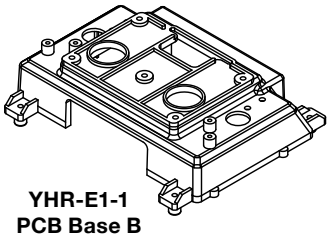
YHR-018
Foot Angle B-R (1)

Component List

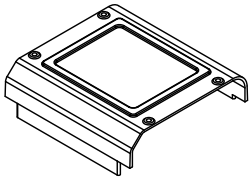
Parts Bag A



YHR-F1-1
Base Plate A
(1)

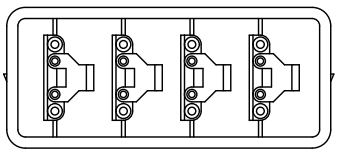


YHR-E1-1
PCB Base B
(1)



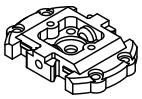
YHR-E1-6
Board Cover (SD1)
(1)

Parts Bag B



Cable Guide
(2 sheets)

Parts Bag C

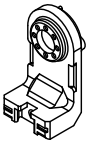


YHR-A1-1
Joint Base 2500A
(10)

Parts Bag D

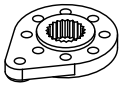
YHR-A1-2
Upper Arm 2500A
(10)

Parts Bag E



YHR-A1-3
Bottom Arm 2500A
(10)

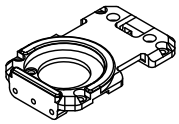
Parts Bag F



YHR-A1-4
Small Diameter Horn
(Offset 0) (12)

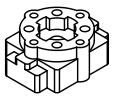
YHR-A1-5
Free Horn 2500B
(4)

Parts Bag G

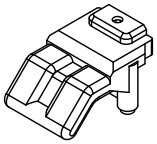


YHR-C1
Arm Supporter 2500A
(7)

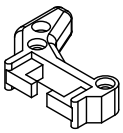
Parts Bag H



YHR-D1-1
Hand Base B
(2)

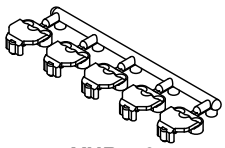


YHR-D1-2
Knuckle B
(2)



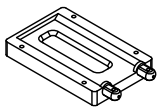
YHR-D1-3
Thumb B
(2)

Parts Bag I

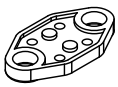


YHR-D2
Cable Guide (small)
(2)

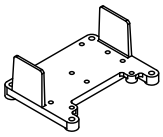
Parts Bag J



YHR-G1-1
Battery Holder A
(2)

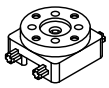


YHR-G1-2
Retainer B
(2)

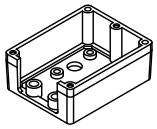


YHR-G1-3
Parts Mount A
(2)

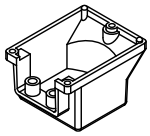
Parts Bag K



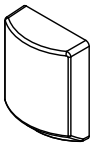
YHR-F2-1
Head Base A
(1)



YHR-F2-2
Face (SD1)
(1)

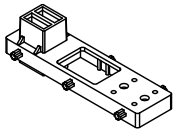


YHR-F2-3
Helmet (SD1)
(1)

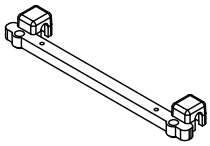


YHR-F2-4
Visor (SD1)
(1)

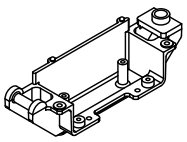
Parts Bag L



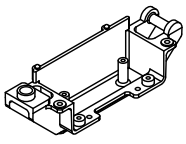
YHR-E1-2
Top Pannel B
(1)



YHR-E1-3
Top Cover B
(1)

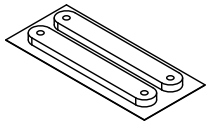


YHR-E1-4
Wing B-L
(1)



YHR-E1-5
Wing B-R
(1)

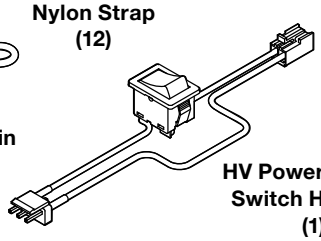
Parts Bag M



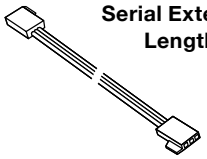
Battery-Holding Sponge
(1 sheet)

Nylon Strap
(12)

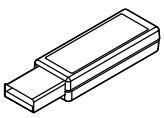
Body Pin
(6)



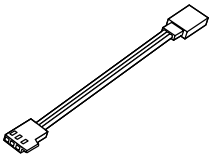
HV Power Source
Switch Harness
(1)



Serial Extension Cable
Length = 1.5 m
(1)



Serial USB Adapter HS
(1)



Extension Cable
Length = 100 mm
(1)

Component List

Parts Bag N

2.3-6BH Tapping Screw
(16)

Parts Bag O

2.6-10BH Tapping Screw
(24)

Parts Bag P

2.6-6 Flat Head Screw
(18)

Parts Bag Q

M3-8 Low Head Horn Screw
(24)

Parts Bag R

2-5 Low Head Tapping Screw
(200)

Parts Bag S

2-8 Low Head Tapping Screw
(43)

Parts Bag T

M2-4 Low Head Screw
(38)

Parts Bag U

M2-6BH Screw
(26)

Parts Bag V

M2 Nut
(10)

Parts Bag W

2-6 Flat Head Tapping Screw
(10)

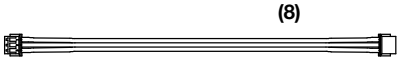
Parts Bag X

3-6 Flat Head Screw
(7)

Connection Cables

ZH Connection Cable A (ZH/ZH Connector) 50 mm
(3)

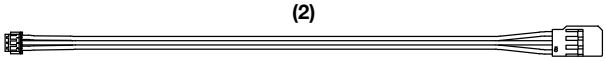
ZH Connection Cable A (ZH/ZH Connector) 100 mm
(8)



ZH Connection Cable A (ZH/ZH Connector) 200 mm
(2)

ZH Connection Cable B (ZH/Servo Connector) 100 mm
(2)

ZH Connection Cable B (ZH/Servo Connector) 200 mm
(2)



ZH Connection Cable B (ZH/Servo Connector) 300 mm
(2)

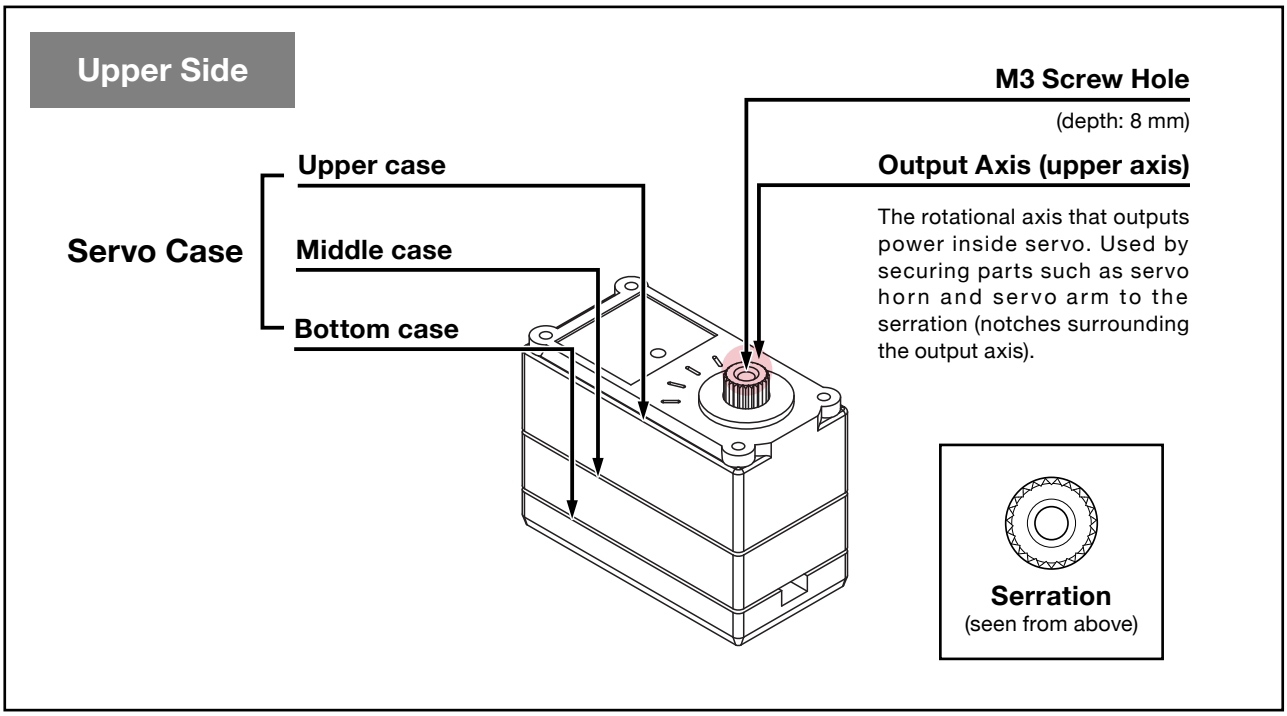
ZH Connection Cable B (ZH/Servo Connector) 450 mm
(2)

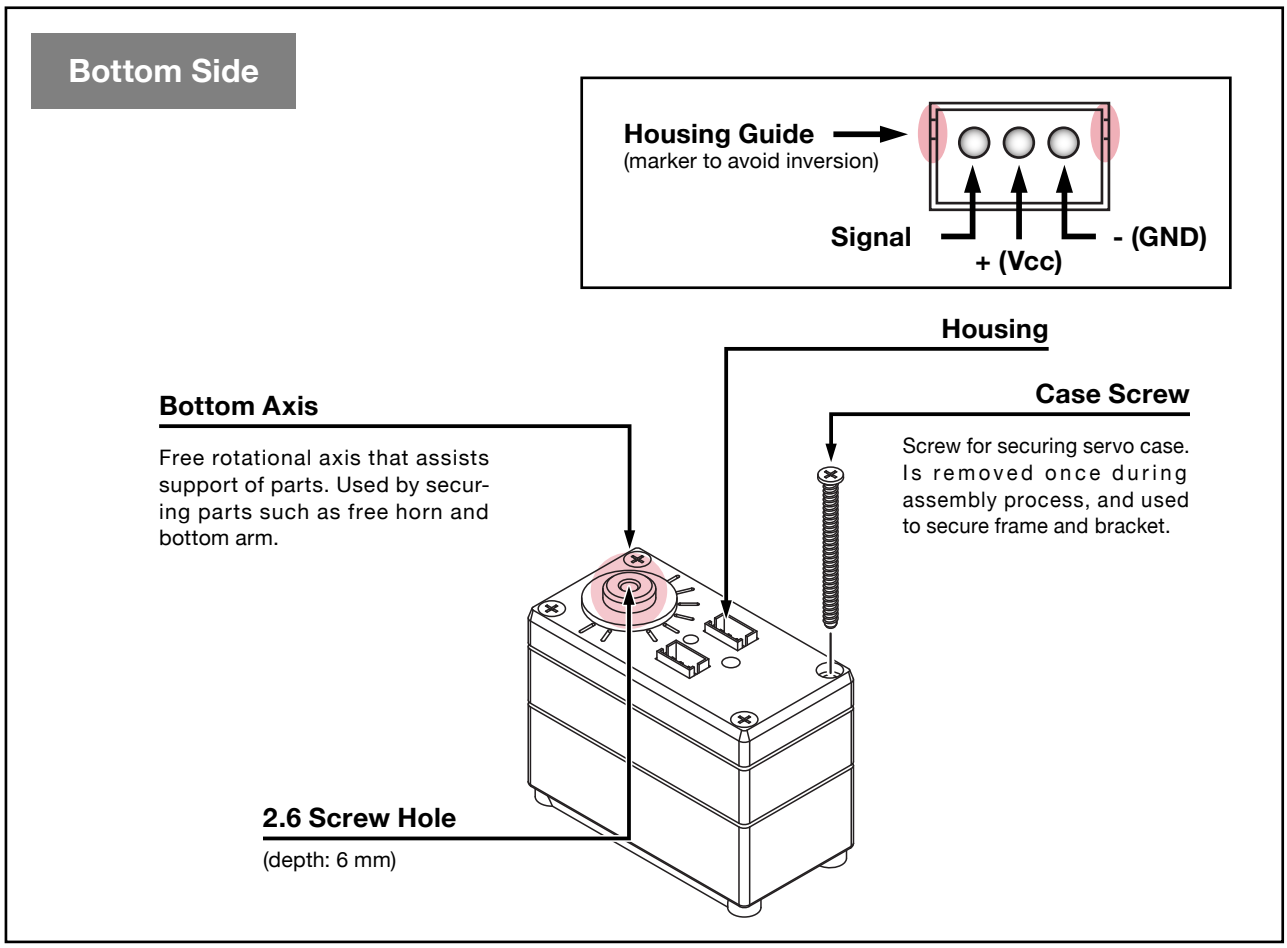
Table of Contents

Table of Contents

Prior to Assembly

Servo Motor (KRS-2552HV) Parts Names

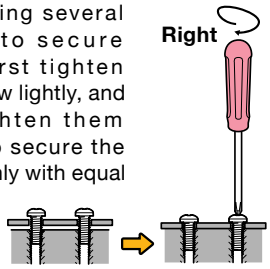




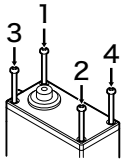
Types of screws and how to handle them

Screw
(coarse metric screw)

When using several screws to secure parts, first tighten each screw lightly, and then tighten them further to secure the parts evenly with equal force.



Further, when using more than four screws to secure parts avoid adding uneven pressure to the parts by alternately tightening screws that are diagonally aligned.



(Example or tightening order)

Characteristics

In the present kit, this screw is mostly used for securing aluminum parts together. (The "M" inscribed in the name of the screw indicates that it is a JIS standard metric screw.) This type of screw fits only in tapped hole. (You can see indentations matching the screw inside the hole.) This type of screw can be used repeatedly unless it wears out or deforms.

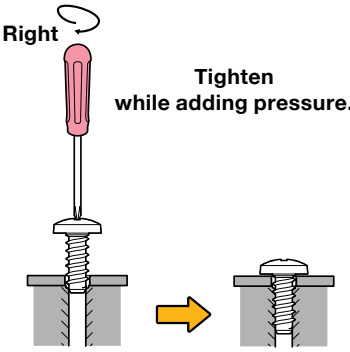
Tightening Suggestions

Be careful not to break the screw head with a screwdriver. (Using a poorly fitting screwdriver with the wrong size, and over-tightening can destroy the screw head.)
Replace the screw with a new one when its head is destroyed, since it will become impossible to remove with a screwdriver. When the screw stops while tightening, check to make sure that the screw is not bent. Continued use of a bent screw can cause deformation of the tapped hole, and will become impossible to tighten even when using new screws.

Maintenance

Vibration causes screws to eventually loosen, even if the screws are tightened securely. Check regularly that the screws are not loosened even after assembly is completed. If you find that the screws loosen or fall off frequently with motion, screw locking adhesives (such as Loctite® and Screw-Lock) can be effective.
*When using locking adhesive, follow instructions attached to the adhesive.
Beware that securing screws with instantaneous adhesive can cause the screws to be permanently locked or the holes to be clogged.

Tapping screw



Characteristic

This type of screw is used to secure plastic and some aluminum parts. The tapping screw thread is tapered and drill-shaped, and can secure parts by tapping threads into holes that have diameters smaller than the screw. (The action of cutting a spiral groove for the screw ridge to fit in a hole is called “tapping”.) Because the screws are tapped into the parts, they can be fastened more tightly than normal screws (metric screws), but will require more force to tighten them in the beginning. If the tapping screws are tightened and removed repeatedly, the holes will become larger and the screws may easily loosen.

Tightening Instructions

(1) Confirmation of screw holes

Before tightening tapping screws, always check to see if their positions and shapes are as shown in this Instruction.
* If tapping screws are screwed into normal screw holes or holes of ill-fitted sizes, the screw holes can deform, making it impossible to screw in the correct ones.

(2) Tapping

Tighten the tapping screw by pushing its head with a screwdriver so that the screw stands vertical.
* If screws are tightened too hard into plastic parts, the screw head may become embedded and deform. Tighten with care.

Retightening a screw after removing it

If a tapping screw is removed after tightening, grooves are already formed in the hole. Thus, retightening should be done as follows:

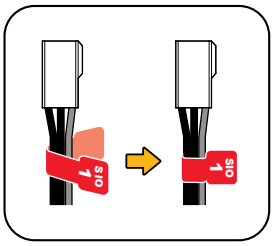
(1) Position the screw vertically

Rotate the screw counter-clock-wise before tightening to make sure it is positioned vertically.

(2) Screw in without pushing

Tighten it as with normal screws (metric screws).
* If you push the screw, the holes will be damaged and it will become impossible to secure the screw.

Servo and channel identification



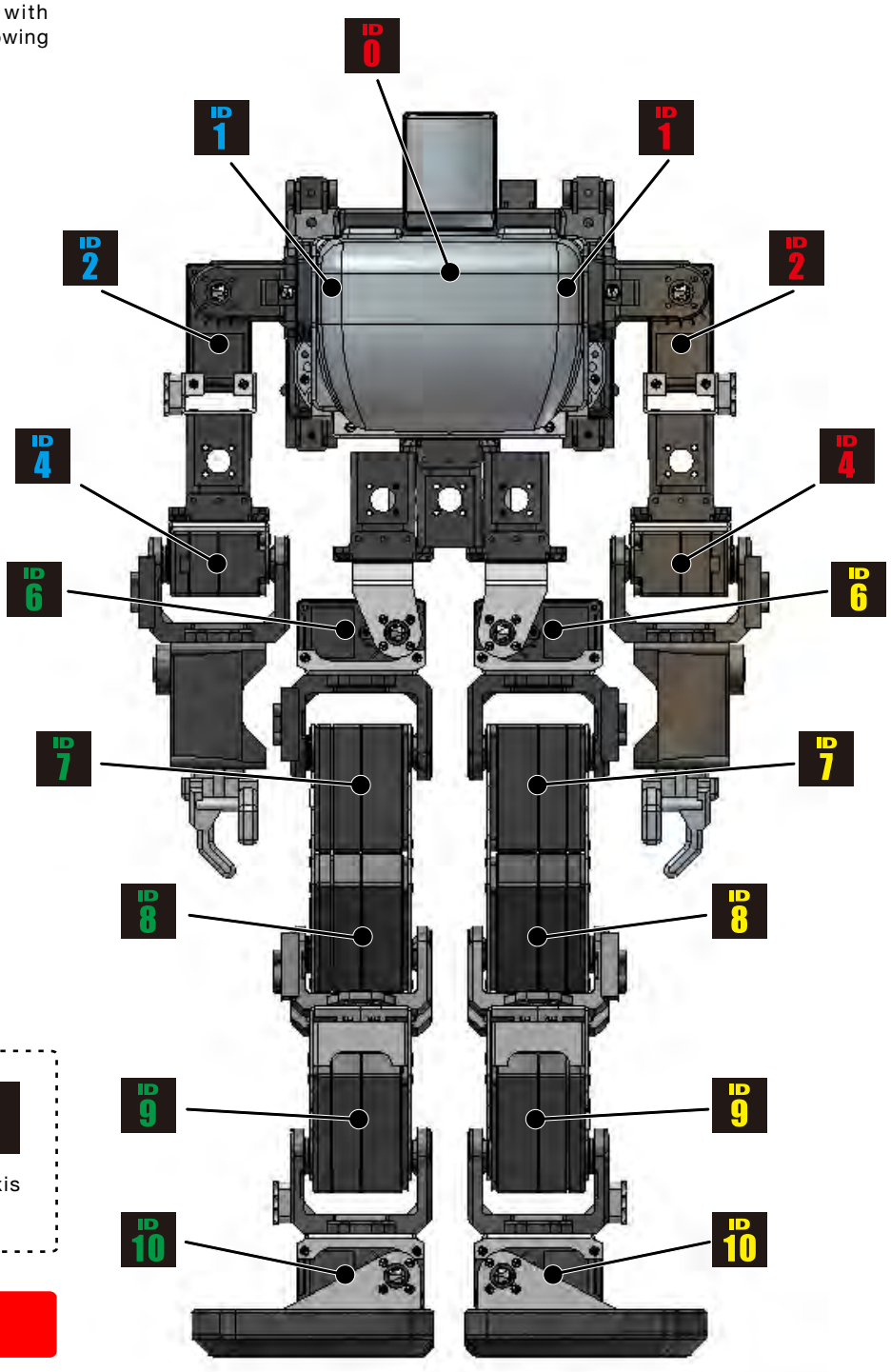
How to secure servo cable decals

Cutting the decal with a cutter or scissors beforehand makes it easier to handle.
Cut decal as you like with reference to the left drawing.

For attaching the channel number, refer to the “Process of Assembly” section or the “List of Channels” shown below.

List of IDs for KHR-3HV

For the assembly of this kit, each servo with attached IDs are used as shown in the following layout figure.



ID 3 ID 5 ID 0 ID 3 ID 5

Can be expanded from 17 axis to 22 axis using five KHR-3HV expansion sets.

*** This is a frontal view.**

Preparation

1. Charging The Battery

Battery should be charged beforehand.

See p 5-8 for charging methods.

In this kit, HV battery (Nickel-metal hydride battery) is used as a power source for operation. Charging typically takes about an hour and a half. The following sections refer to processes that use battery. While the battery is charging, install the exclusive “HeartToHeart4” software and the serial USB adapter HS driver, as well as reading all the instructions. Further, process 4 (Assembly of Chest Unit) and the subsequent 16 processes can be done in advance under your own judgment and responsibility.

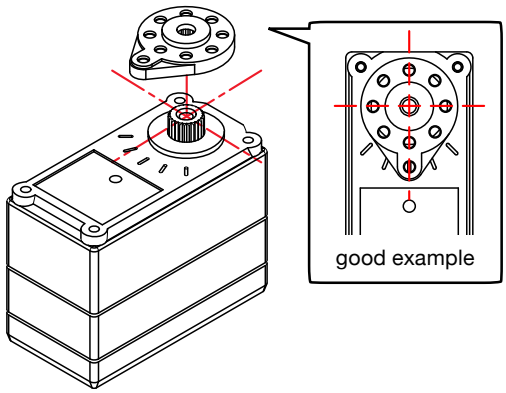
* Be attentive and prepared for any abnormalities while charging the battery.

** Stop all use immediately if abnormal heat or an odd odor is noticed.

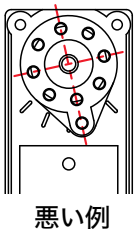
2. Setting Servo Origins

Securing parts to servo output axis and precautions

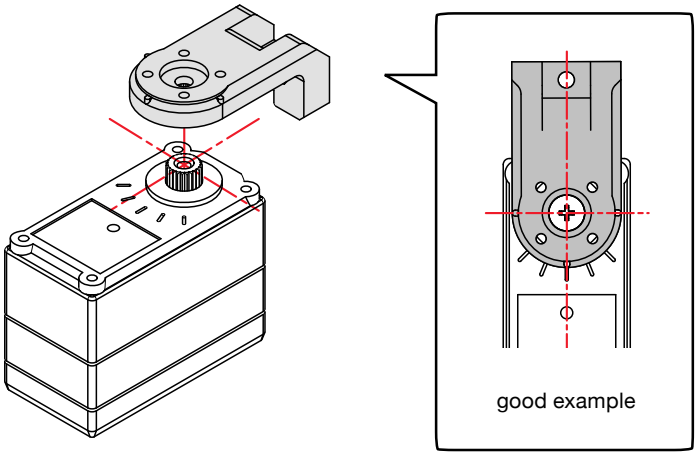
Mounting Small Diameter Horn



Origin Setting is an important process that decides the reference point of the servo rotation angle. Accurate origin setting will result in high reproducibility of sample motions.



Mounting the Servo Arm

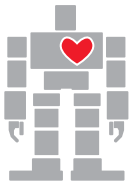


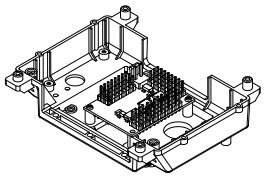
There is only one mounting direction for the servo arm, so if it does not exactly match the figure, shift it slightly to either the right or left. For instance, when setting the origin of servos in both shoulders, the more offset there is between the left and right shoulder servo origins, the more uneven the arms of the robot will be. Try to assemble by carefully finding the best positions.

Assembly - Control Unit

- **Required Parts**

RCB-4HV ---------- 1
PCB base B ---------- 1
2-5 Low head tapping screw ------ 2
Power switch harness ---------- 1



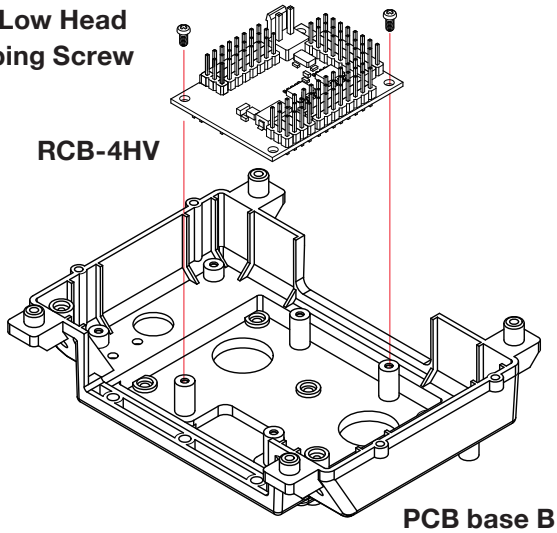


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

2-5 Low Head Tapping Screw

RCB-4HV



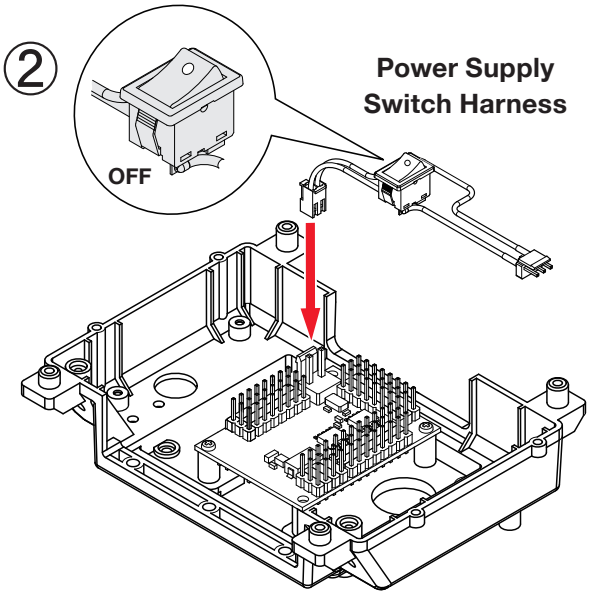
PCB base B

①

Temporarily Secure RCB-4HV to PCB base B using two 2-5 Low Head Tapping Screws.

* The screws will be taken off in a later process. The 2-5 Low Head Tapping Screws should be screwed on temporarily.

②



Power Supply Switch Harness

Connect the Power Source Switch Harness to the RCB-4HV power terminal.

DANGER The power switch on the Power Source Switch Harness must be turned OFF at all times unless directed otherwise. If the switch is turned ON, the robot may unexpectedly move and fall off, break, or cause injury when connected to a power source.

The connector is shaped so as to avoid reverse connection. Do not force the plug in incorrectly, as this may result in the connector breaking.

Setting Servo Origins

Servo-motor KRS-2552HV used in this product has a maximum operation angle of approximately 270 degrees. Like human joints, it does not turn limitlessly and is restricted in its angle of motion. For the robot to operate properly, it must be assembled taking into consideration its mechanical restrictions and actual operation.

Setting the origin of the servos is important in this respect.

If the origin is not correct, it might not operate properly when performing sample motions. Therefore, please understand the origin setting method and proceed carefully.

The origin must be set each time a servo arm is mounted on a servo.

Whenever origin setting is called for, the following process must be performed.

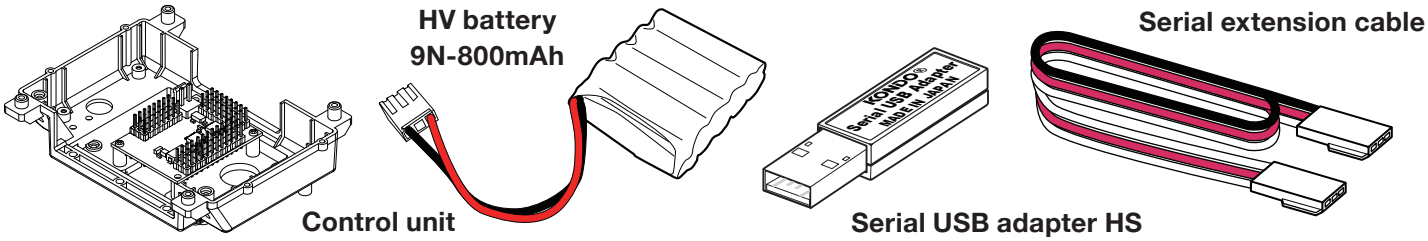
1. Things to prepare

Control Board RCB-4HV mounted on PCB base B in the preceding process is used.

The “HV battery 9N-800mAh” is used as the power source for RCB-4HV. Please charge beforehand. See p4-6 for charging method.

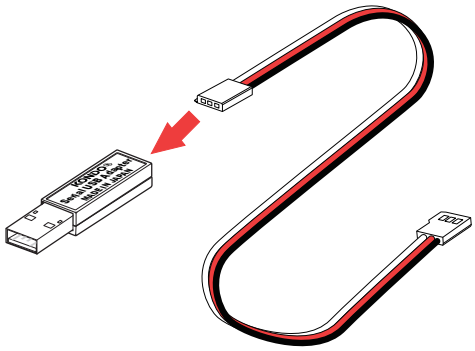
Furthermore, the motion creation software “Hear tToHeart4” must be installed in a personal computer.

Connect the RCB-4HV to the personal computer using the attached Serial USB Adapter HS and the Serial Extension Cable. Drivers should be installed in advance.



- For detailed description on the use of RCB-4HV, software and Serial USB Adapter HS, see “HTH4 user’s manual”.
- The personal computer should run Microsoft Windows XP or Vista.

Plug to the USB port of your computer after connecting Serial Extension Cable to serial USB adapter HS.



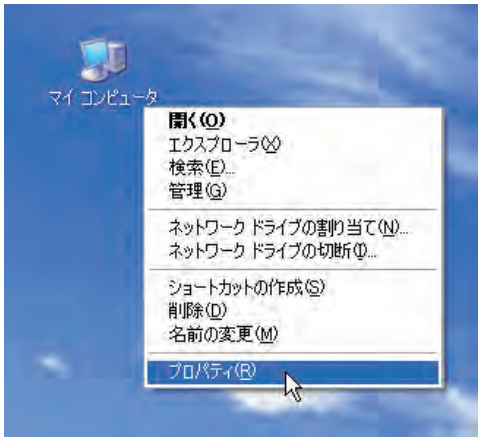
2. Confirm COM port for Serial USB adapter HS.

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

* When connecting for the first time, “Add New Hardware Wizard” runs.

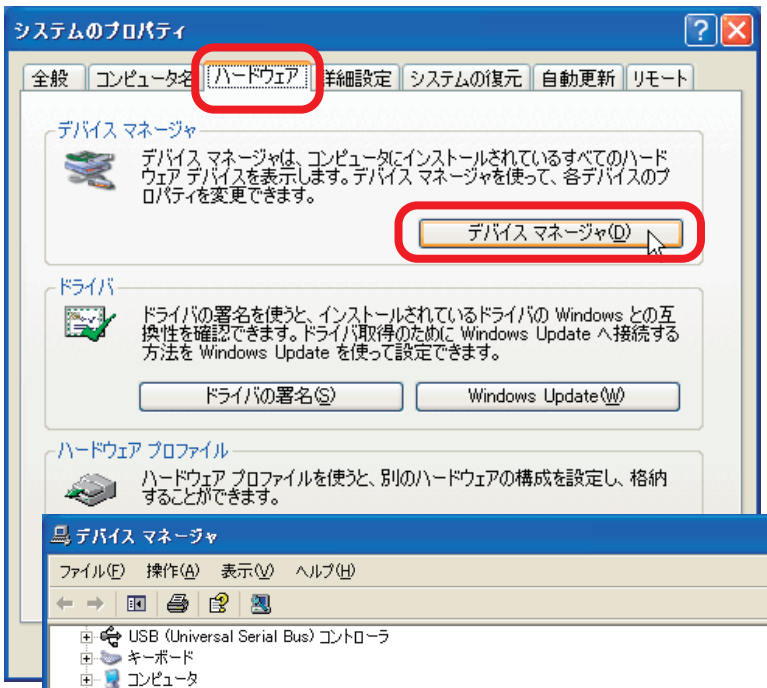
Complete the setup according to the KONDO USB Driver Installation Manual.

When installation of the driver for Serial USB adapter HS is completed, confirm the “COM Port Number”. This number is important when using the software, so write it down.

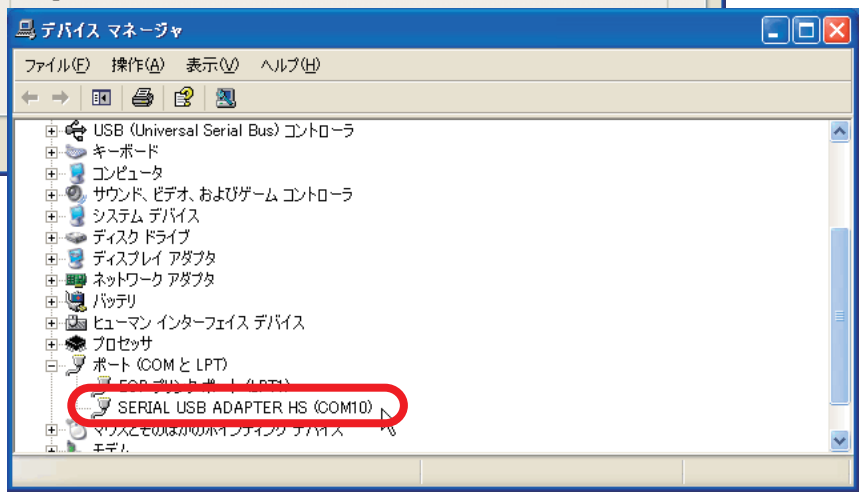


1. "Right click" on MY COMPUTER.
2. Select "Property".

   * This description is based on Windows XP.



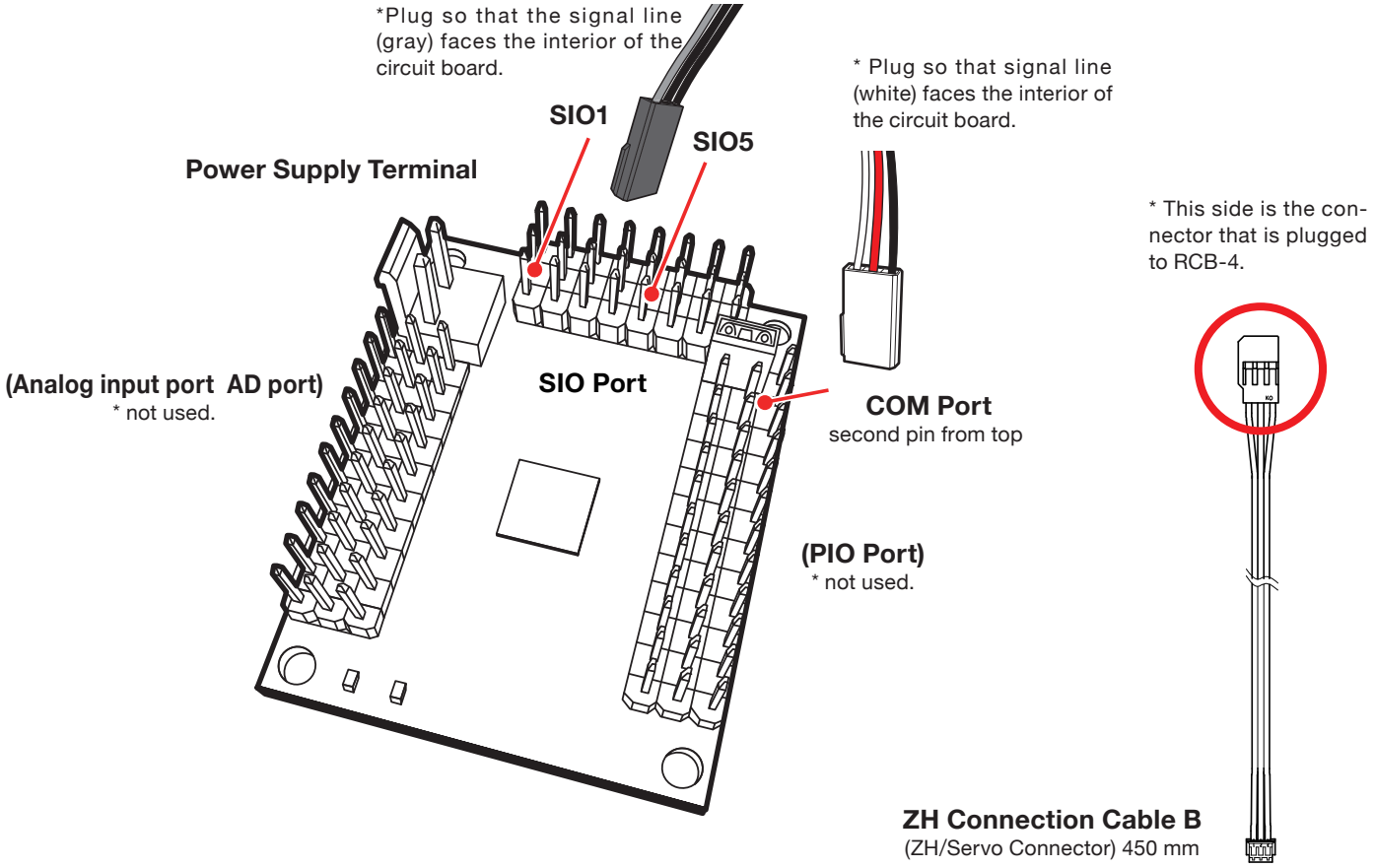
3. Click on the “Hardware” tab in the “System Property” window.
4. Click “Device Manager”



5. Click “+” for “Port (COM and LPT)” in Device Manager and check that SERIAL USB ADAPTER HS is displayed. Confirm the COM number that appears in the ( ). * If SERIAL USB ADAPTER HS does not appear, either the driver is not installed properly or the Serial USB Adapter is not connected to the computer.

3. Connection

1. Connect cable from Serial USB Adapter HS to COM terminal (port) of RCB-4HV.
2. Connect two ZH connection Cable B (ZH□Servo Connector) 450 mm to SIO1 and SIO5 of the SIO port.



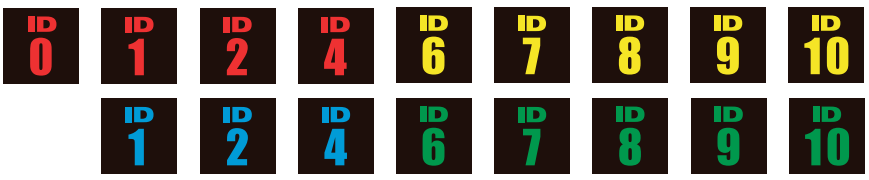
• Important Issues on Origin Setting

RCB-4 contains two systems of serial ports for servo driving: SIO1-4 and SIO5-8.

SIO1-SIO4 outputs the same signal and the servo motor operates the same way when connected to any of them. The same can be said for SIO5-SIO8.

In KHR-3HV, SIO1-SIO4 are used for the left side, and SIO5-SIO8 are used for the right side.

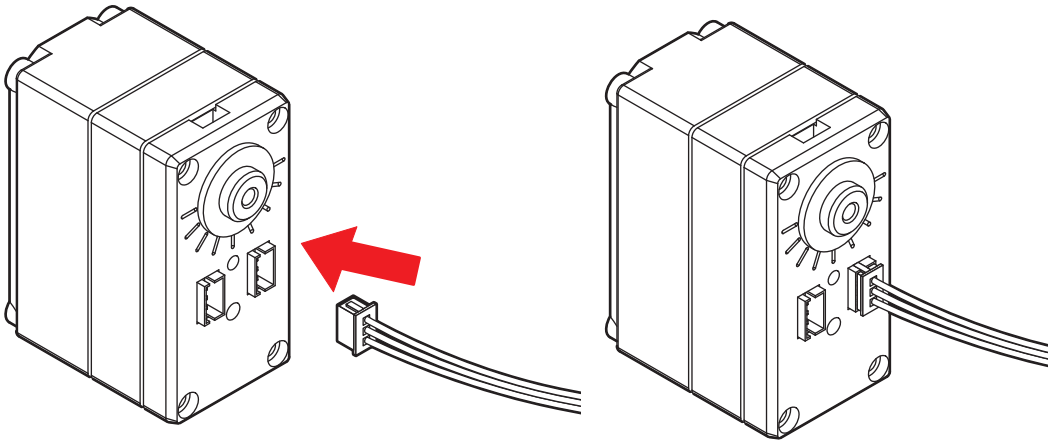
Therefore, servo motors with red and yellow ID decals are operated by connecting the cable from SIO1, and servo motors with blue and green ID decals are operated by connecting the cable from SIO5.



Left side of body / use SI01 cable

Right side of body / use SI05 cable

4. Connecting cable to servo motor for origin setting



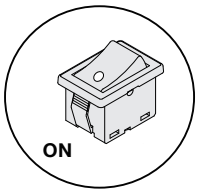
* Either of the connection terminals on the servo motor can be used.

5 Activate the software

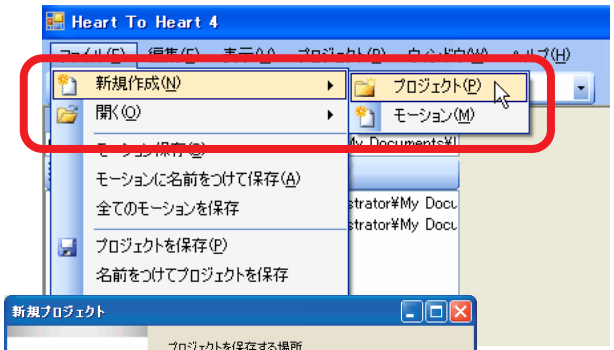
Activate the motion creating software “HeartToHeart4” and prepare for origin setting. If you have not finished installing ‘HeartToHeart4’, do so by using the CD-ROM provided.

* When first activating the software ‘HeartToHeart4’, a ‘HeartToHeart4’ folder is created automatically in the My Documents folder on your computer. Project files created must be saved in the “Projects” folder in the ‘HeartToHeart4’ folder.

1. Switch ON the RCB-4 Power Switch.
When motion creation software ‘HeartToHeart4’ is activated, create a “Neutral Setting” project in the ‘HeartToHeart4’ folder.

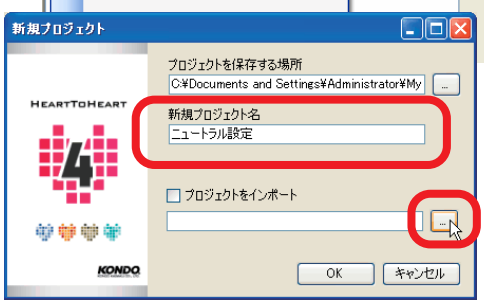


2. Click “File” > “New Document” > “Project”



3. In the New Project window, name the new project “Neutral Setting” .
* New projects may be given arbitrary names. Do not change the location for saving files unless necessary. Files are normally saved in the ‘HeartToHeart4’ folder in “My Documents” .

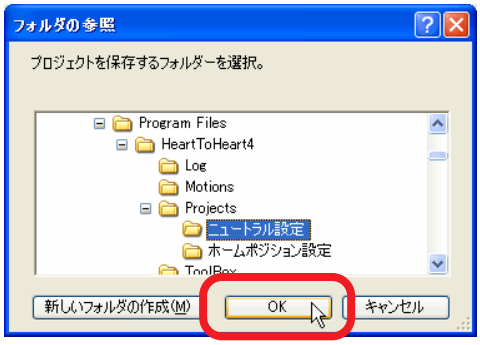
4. Click the Import Project button.

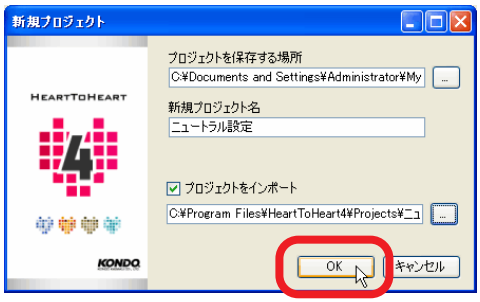


5. Select “Neutral Setting” in “Projects” in the ‘HeartToHeart4’ folder created in “Program Files” .

* Unless changed after installation of software, the ‘HeartToHeart4’ folder is under “C:\Program Files” .

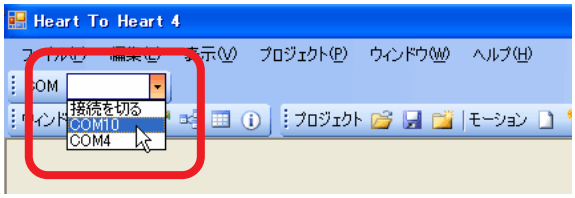
* When ‘HeartToHeart4’ software is installed, Sample Projects are saved in the “Program Files” folder. The project for Neutral Setting is inside this Sample Project, so the Neutral Setting Project must be loaded from the Sample Project according to the above instructions, and imported to the New Project as described above.





6. Go back to the New Project Window and Click OK.

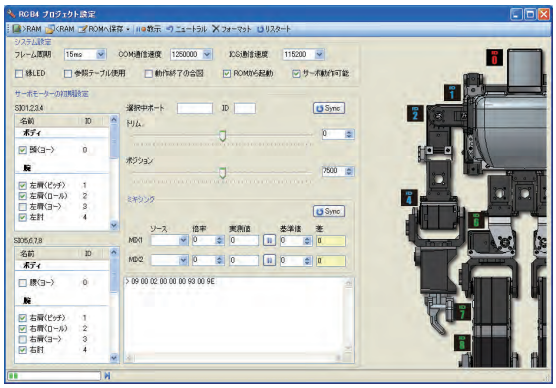
7. Select the previously-checked communication port number (COM).
* Here, COM10 is selected as an example.



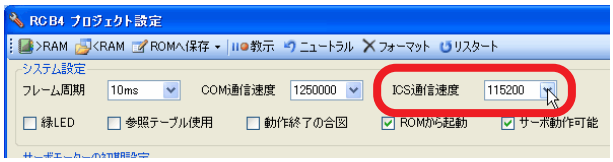
8. Select “Project Setting”

* An error message as shown in the right appears when communication problems occur for reasons such as robot not being switched ON, or communication port (COM) number not being selected.

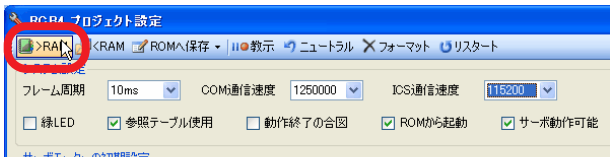
When normal connection is made, the following window appears.



9. Set ICS communication speed to 115200.

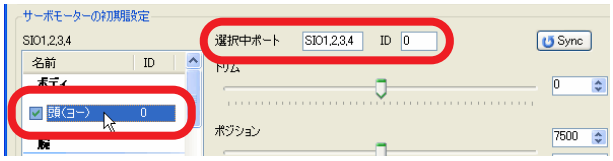


10. When “RAM” button is clicked, the project standard values are sent to RCB-4 and the servo becomes operable.



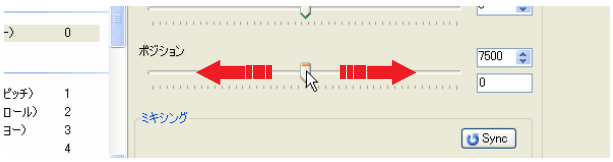
11. Select the servo motor that needs to be adjusted in “Servo Motor Initial Setting” .

In the following example, the origin for servo “ID 0” (red) connected to the SIO1 channel is set.



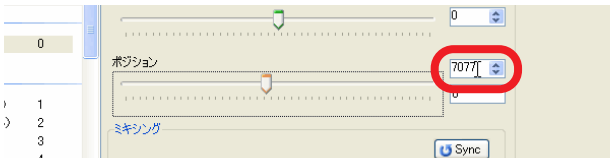
12. Press “Sync” button and check operation using the position slide bar.

* Servo moves with slide bar



13. When operation is confirmed, return position to “7500 (origin)” .

* Double clicking the value next to the slide bar automatically changes the value to “7500” .



14. Turn off RCB-4, plug in another servo that needs origin setting, and repeat steps 9-13.

The above are the process for origin setting. The origin should be set for all servos based on these steps.

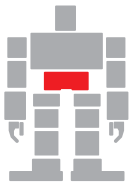
15, When all the procedures are completed, turn off RCB-4 and close the “RCB4 Project Setup” window.

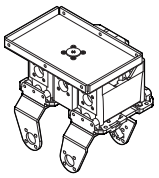
Assembly

3. Assembly - Hip Unit

- **Required Parts**

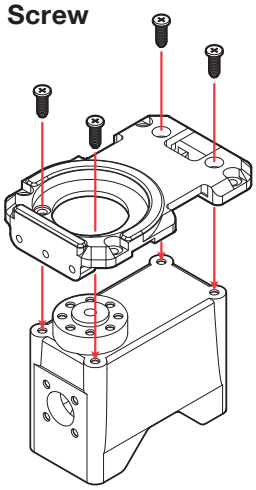
Dummy Servo 2500A---------- 3
Arm Supporter 2500A ---------- 3
YHR-005_Body Base ---------- 1
YHR-008_Offset Arm La---------- 1
YHR-009_Offset Arm Ra---------- 1
2-5 Low Head Tapping Screw---- 32
3-6 Flat Head Screw ---------- 3



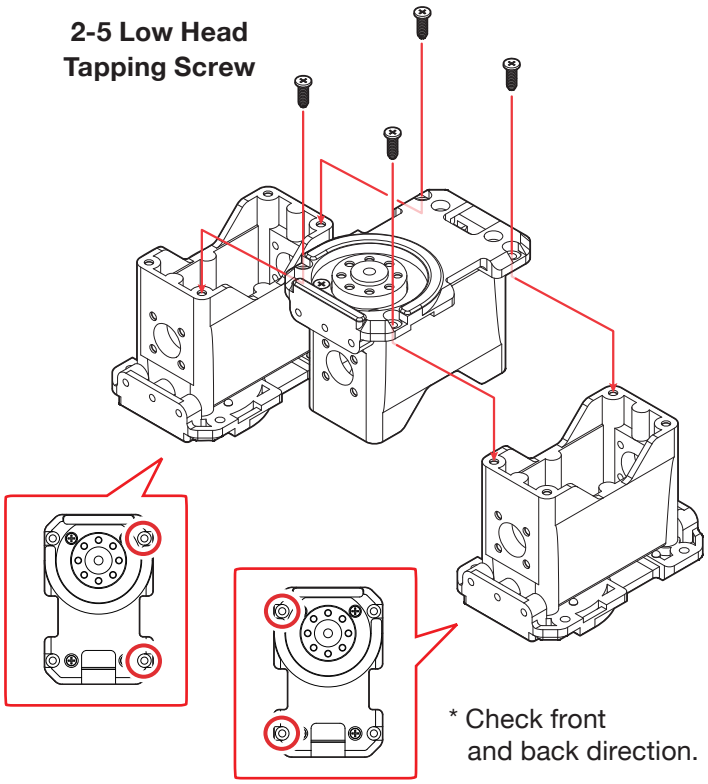


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm



Prepare 3 sets of the same unit.



* Check front and back direction.

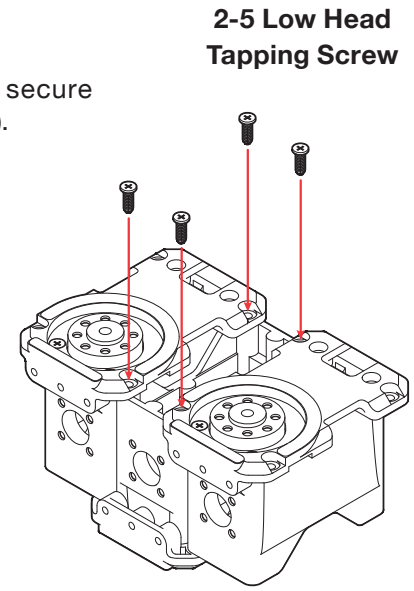
① Mount Arm Supporter 2500A (1 each) to Dummy Servo 2500A using 2-5 Low Head Tapping Screws (4 each).

② Connect the three units prepared in step (1) using four 2-5 Low Head Tapping Screws, as shown in the figure.

* Make sure the front and back sides are correct.

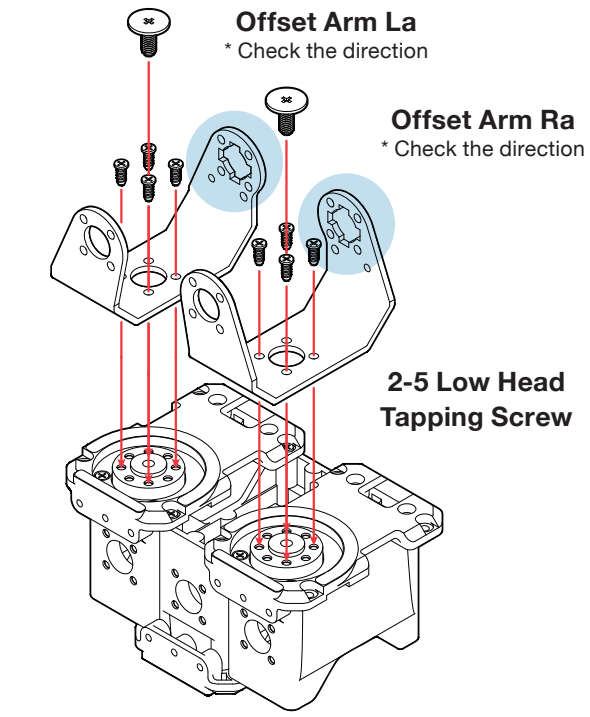
③

Use four 2-5 Low Head Tapping Screws to secure the back side of the unit assembled in step (2).



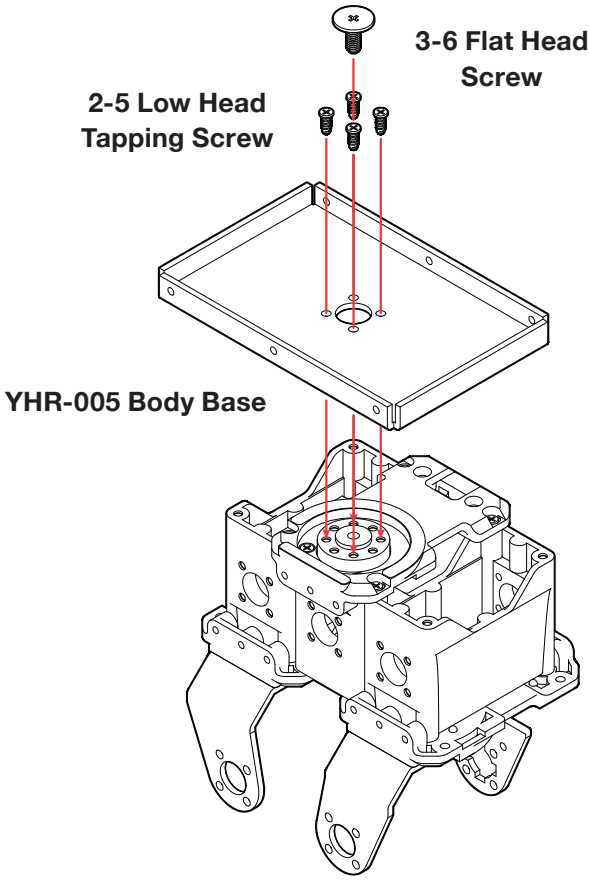
④

Using eight 2-5 Low Head Tapping Screws, mount the YHR-008_Offset Arm La and the YHR-009_Offset Arm Ra as shown in the figure. Use two 3-6 Flat Head Screws to secure the center.



⑤

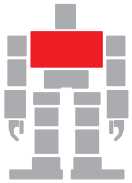
Mount the YHR-005_Body Base using four 2-5 Low Head Tapping Screws and one 3-6 Flat Head Screw as shown.

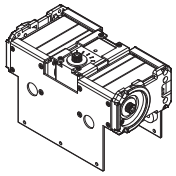


4. Assembly - Chest Unit

- **Required Parts**

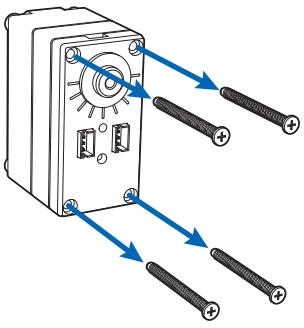
Servo Motor KRS-2552 [ID 0]------ 1
Servo Motor KRS-2552 [ID 1] ----- 2
YHR-001_Body Frame F ---------- 1
YHR-002_Body Frame B ---------- 1
YHR-003_Shoulder Frame L ------ 1
YHR-004_Shoulder Frame R ------ 1
Arm Supporter 2500A ---------- 2
Battery-Holding Sponge ---------- 1
2-5 Low Head Tapping Screw ---- 20
M2-4 Low Head Screw ---------- 8
ZH Connection Cable A 200 mm-- 2
ZH Connection Cable A 50 mm --- 1
ZH Connection Cable B 100 mm-- 2



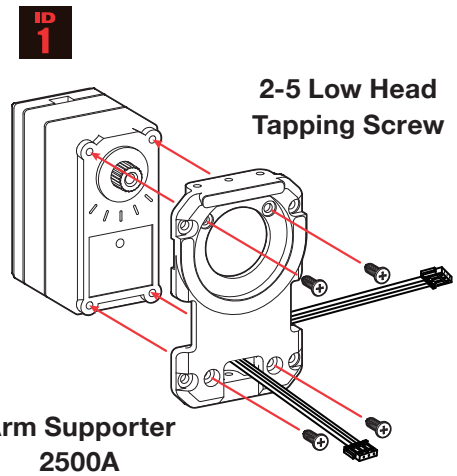


Completed Process Image

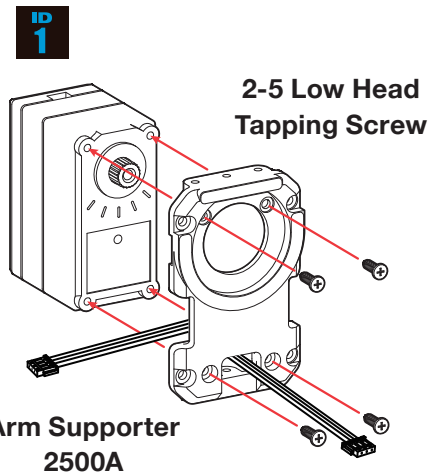
Icon Descriptions Points Tips Damage Warning Confirm



Servo Case Screw



Connection Cable
(ZH Connection Cable A 200 mm)



Connection Cable
(ZH Connection Cable A 200 mm)

①

Take out the Servo Motors with [ID 0] (red), [ID 1] (red) and [ID 1] (blue), and remove all servo case screws (4 each).

②

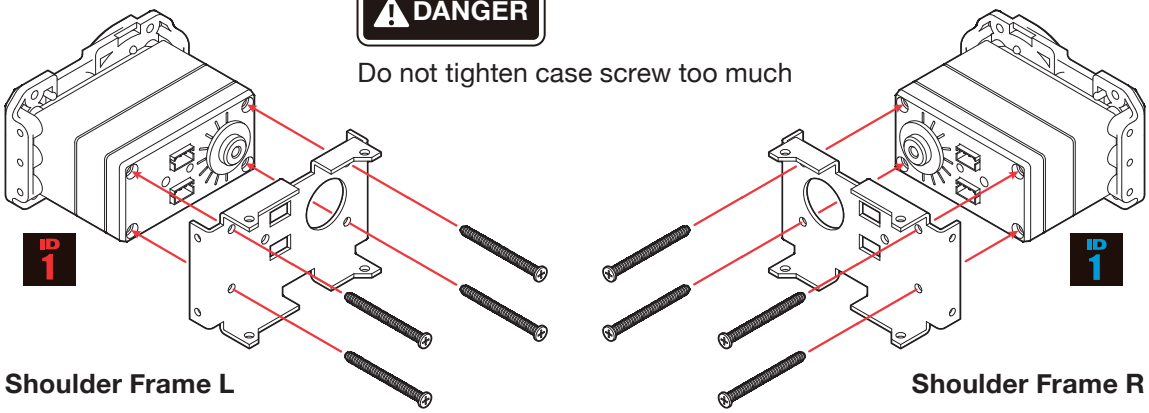
Put Connection Cable (ZH Connection Cable A 200 mm) through the Arm Supporter, and secure the Arm Supporter 2500 A to the Servo Motors [ID 1] (red) and [ID1] (blue), using 2-5 Low Head Tapping Screws (4 each).

* The direction of the cables differs between the two servos. Check the ID numbers in the figure.

③ Using the servo screw removed in step (1), mount the YHR-003_Shoulder Frame L to the Servo Motor [ID1] (red), and the YHR-004_Shoulder Frame R to the Servo Motor [ID1] (blue). Make sure the directions of the frames are correct.

DANGER

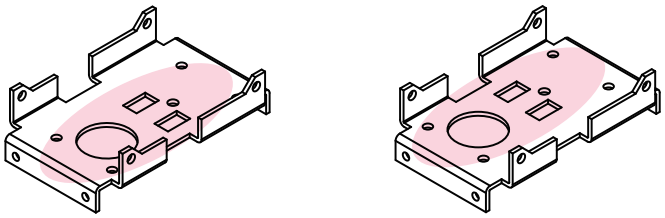
Do not tighten case screw too much



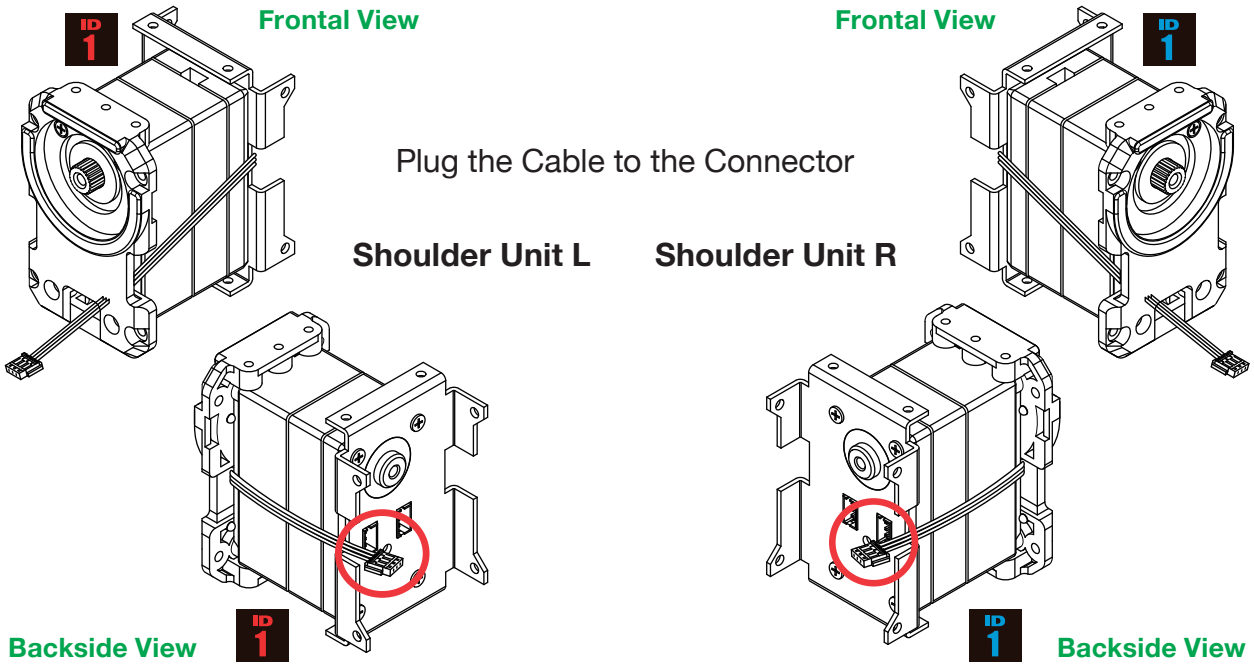
Shoulder Frame L **Shoulder Frame R**

Servo Case Screw **Servo Case Screw**

* The Shoulder Frames have different shapes on the left and right. Identify them by carefully checking the position of the holes.

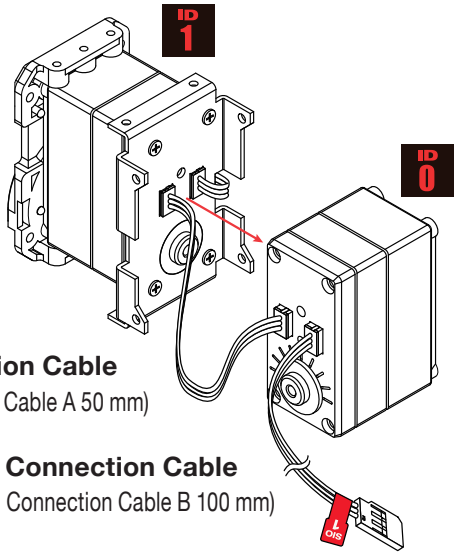


YHR-003 Shoulder Frame L **YHR-004 Shoulder Frame R**



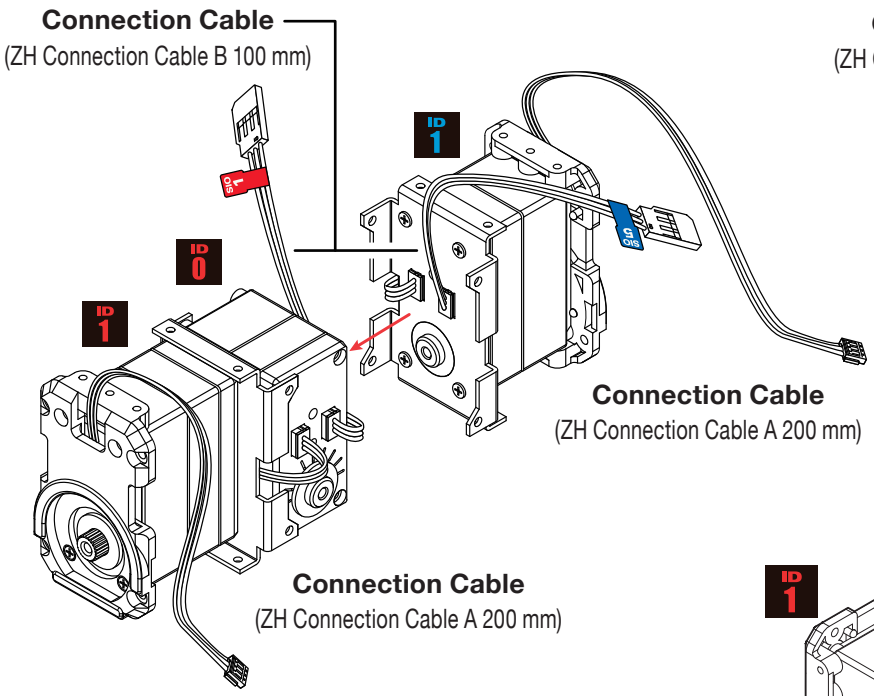
④ Connect the Servo Motor [ID 0] (red) to [ID 1] (red) using the Connection Cable (ZH Connection Cable A 50 mm), then connect the Connection Cable (ZH Connection Cable B 100 mm) to [ID 0] (red).

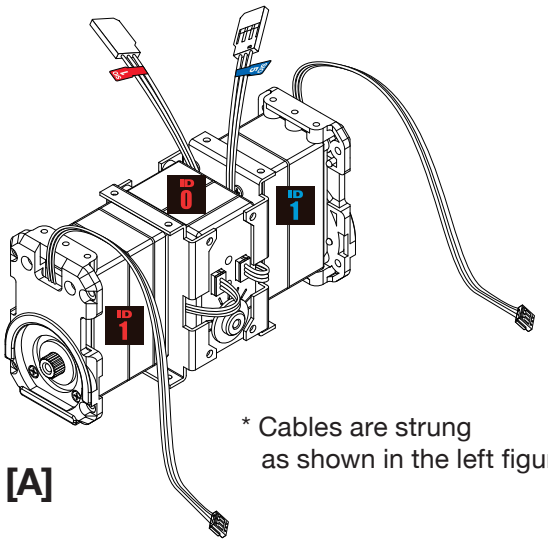
* In this process, the length of the cables are important. Please check carefully.



* Stick a decal for the servo lead on ZH Connection Cable B 100 mm.

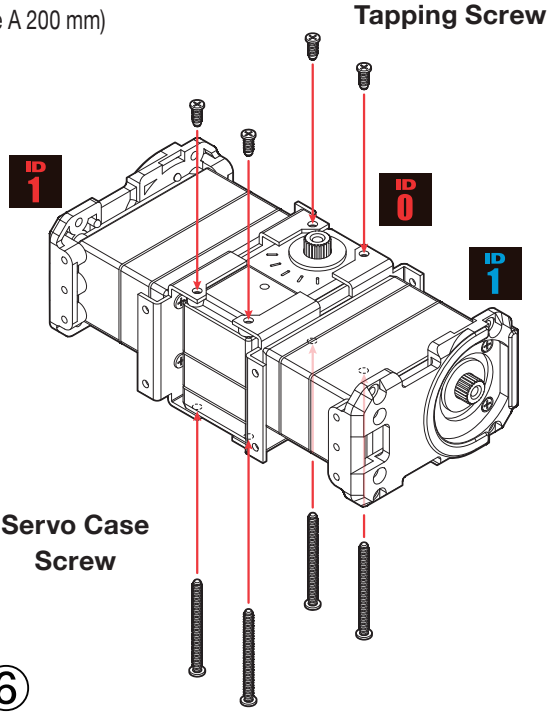
⑤ Connect the Connection Cable (ZH Connection Cable B 100 mm) to [ID 1] (blue). Make sure the cables are positioned as shown in Figure [A].





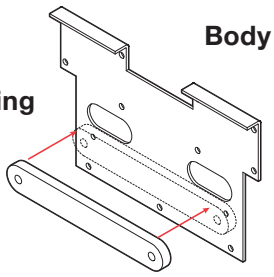
* Cables are strung as shown in the left figure

[A]



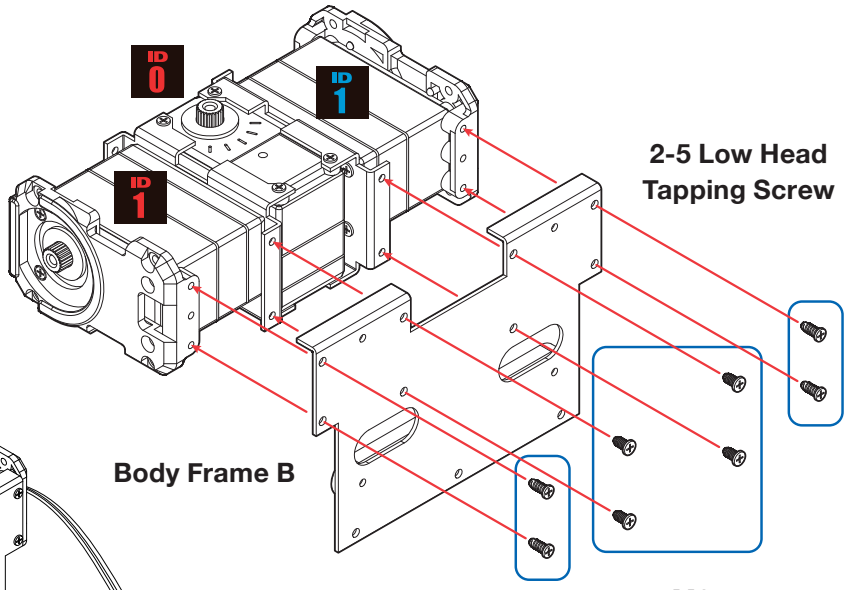
⑥ Use four 2-5 Low Head Tapping Screws on the servo output axis side and the four servo case screws taken off in step (1) on the bottom side.

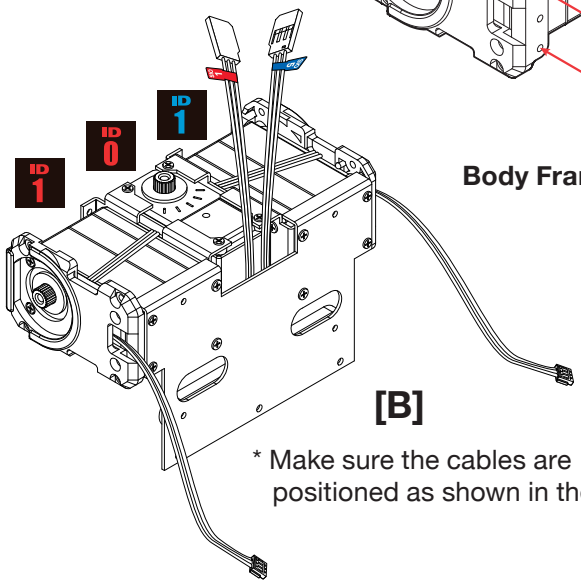
⑦ Stick one Battery Holding Sponge to YHR-002_Body Frame B.



* Stick on to match the screw holes.

⑧ Using four 2-5 Low Head Tapping Screws and four M2-4 Low Head Screws, mount the YHR-002_Body Frame B with Sponge attached, to the unit assembled in step (6). Make sure the cables are positioned as shown in Figure [B]

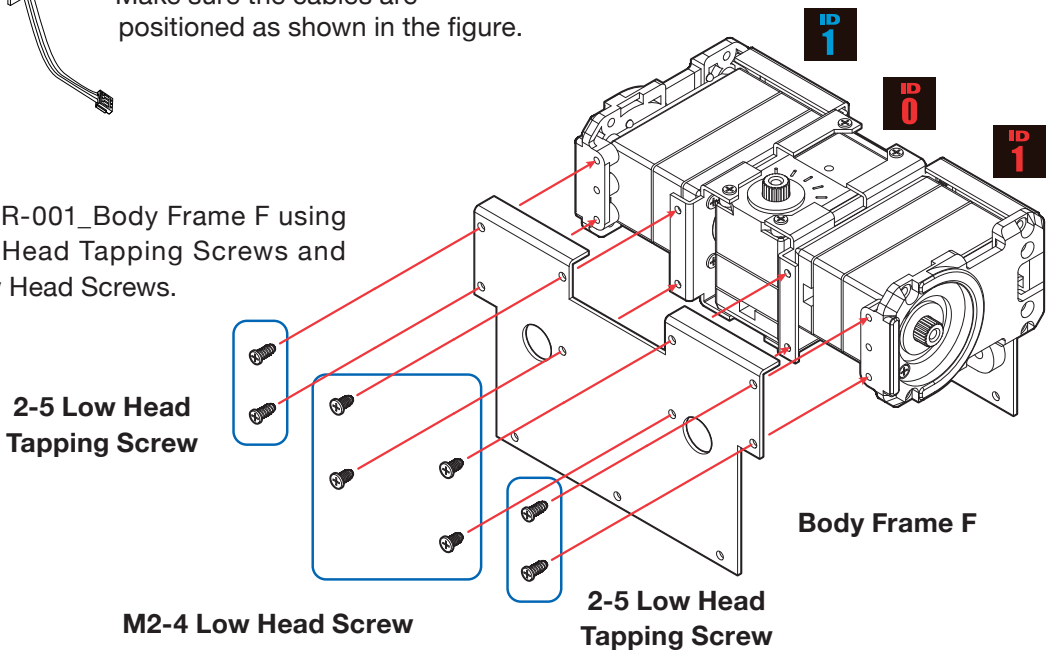




[B]

* Make sure the cables are positioned as shown in the figure.

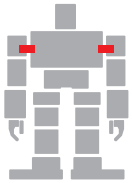
⑨ Mount the YHR-001_Body Frame F using four 2-5 Low Head Tapping Screws and four M2-4 Low Head Screws.

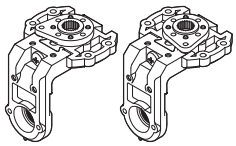


5. Assembly - Servo Arm (Shoulder)

- **Required Parts**

Joint Base 2500A ---------- 2
Bottom Arm 2500A ---------- 2
Small Diameter Horn ---------- 2
2.6-10BH Tapping Screw ---------- 2
M2-6BH Screw ---------- 8



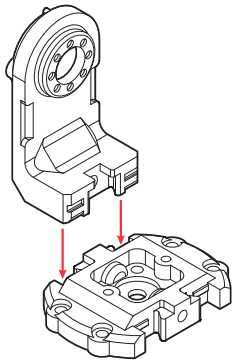


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Insert the Bottom Arm 2500A into the Joint Base 2500A.

* Check the direction (front / back) of the Joint Base.



Bottom Arm 2500A

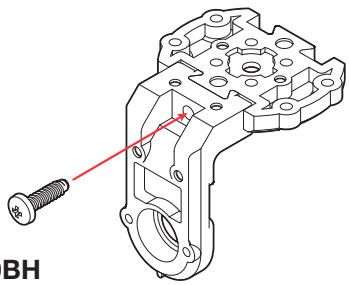
Joint Base 2500 A

Check the front and back

Prepare two sets of the same unit.

② Secure the connecting parts using one 2.6-10BH Tapping Screw each.

Prepare two sets of the same unit.

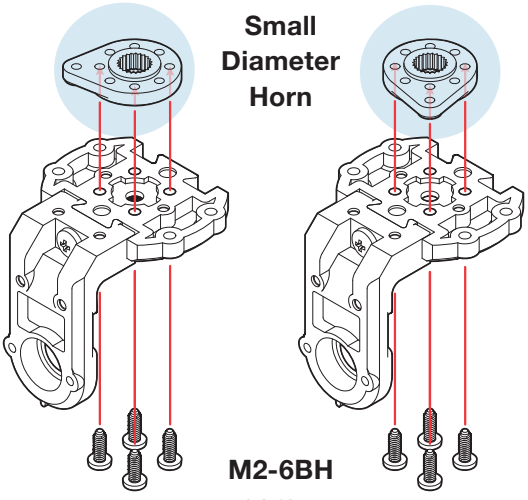


2.6-10BH Tapping Screw

③ Mount the Small Diameter Horn as indicated in the figure and secure using four M2-6BH screws.

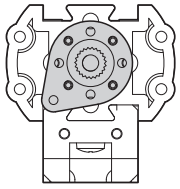
Caution: The position of the Small Diameter Horns differ by 90˚ for each arm.

*check the front and back

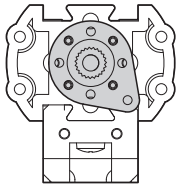


Small Diameter Horn

M2-6BH screw



Shoulder Servo Arm (left)

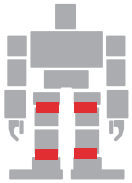


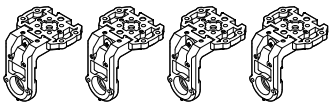
Shoulder Servo Arm (right)

6. Assembly - Servo Arm (Ankle - Thigh)

- **Required Parts**

Joint Base 2500A ---------- 4
Bottom Arm 2500A ---------- 4
2.6-10BH Tapping Screw ---------- 2



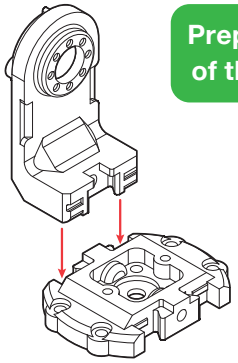


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Insert the Bottom Arm 2500A into the Joint Base 2500A.

* Check the direction (front / back) of the Joint Base.



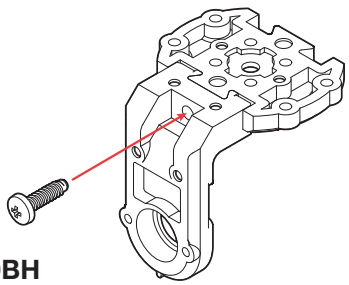
Prepare four sets of the same unit.

Bottom Arm 2500A

Joint Base 2500 A

Check the front and back

② Secure the connecting parts using one 2.6-10BH Tapping Screw.



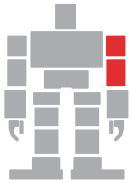
Prepare four sets of the same unit.

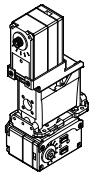
2.6-10BH Tapping Screw

7. Assembly - Elbow Unit L

- **Required Parts**

Servo Motor KRS-2552 [ID2] ------ 1
Servo Motor KRS-2552 [ID 4]------ 1
YHR-006_Servo Bracket A -------- 1
YHR-007_Elbow Joint A ---------- 1
Dummy Servo 2500A--------------- 1
Arm Supporter 2500A------------- 1
2-5 Low Head Tapping Screw-----16
3-6 Flat Head Screw ------------- 1

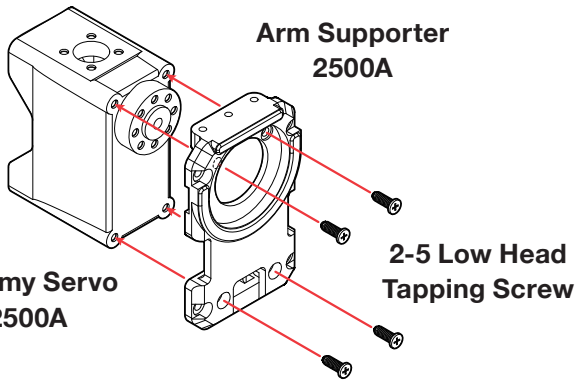




Completed Process Image

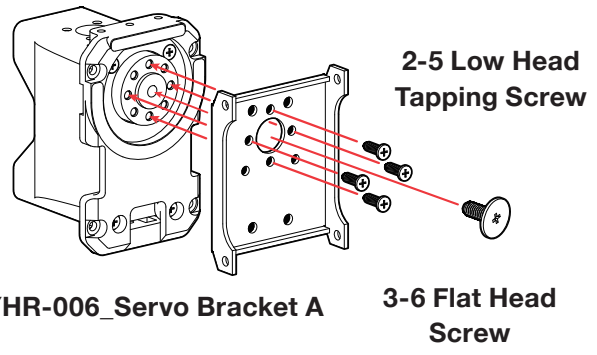
Icon Descriptions Points Tips Damage Warning Confirm

①



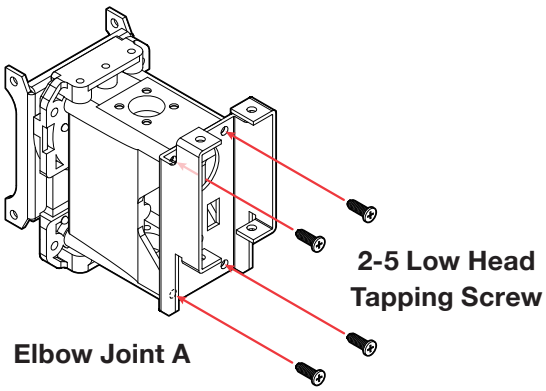
Mount the Arm Supporter 2500A on the Dummy Servo 2500A using four 2-5 Low Head Tapping Screws.

②



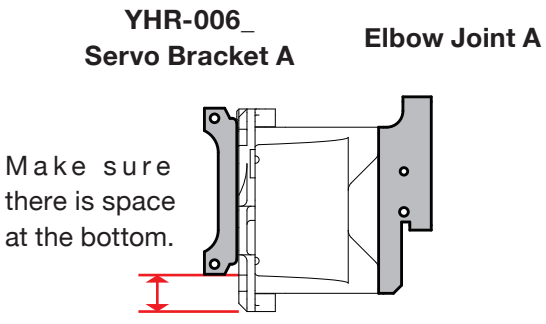
Mount the YHR-006_Servo Bracket A using four 2-5 Low Head Tapping Screws and one 3-6 Flat Head Screw.

③



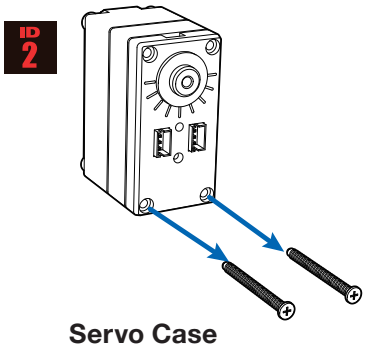
Mount the YHR-007_Elbow Joint A using four 2-5 Low Head Tapping Screws.

* Elbow Joints can be mounted on the top or bottom. Check the following figure carefully and mount accordingly.

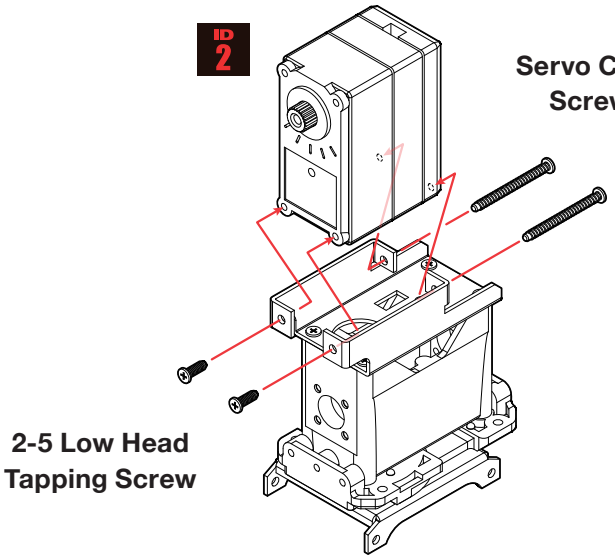


Side View

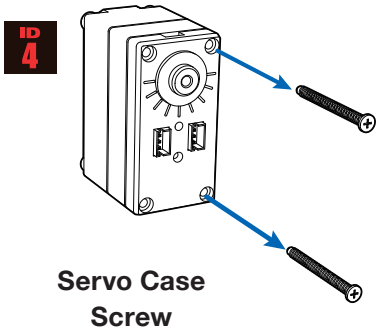
④ Unscrew the two case screws on the bottom from the Servo Motor [ID 2] (red).



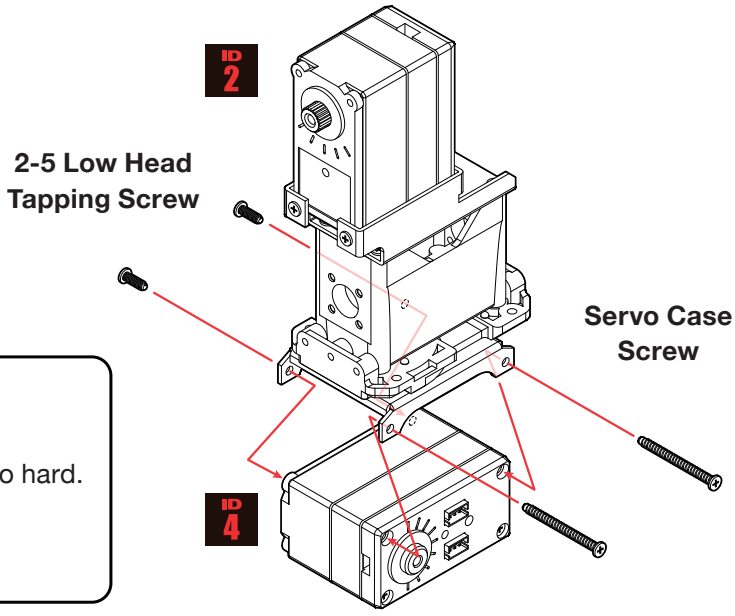
⑤ Mount the Servo Motor [ID2] (red) to the unit prepared in step (3). Use two 2-5 Low Head Tapping Screws on the servo output axis side, and the two servo case screws taken off in step (4) on the bottom side.



⑥ Take two of the case screws on the right side (viewed from the bottom side) of Servo Motor [ID 4] (red).



⑦ Mount the Servo Motor [ID 4] (red) on the parts prepared in step 5. Use two 2-5 Low Head Tapping Screws on the servo output axis side, and two servo case screws taken off in step (6) on the bottom side.



⚠ DANGER

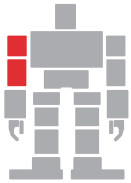
Be careful not to tighten the case screws too hard.

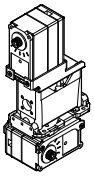
* Check the direction carefully when mounting the Servo Motor.

8. Assembly - Elbow Unit R

- **Required Parts**

Servo Motor KRS-2552 [ID2] ------ 1
Servo Motor KRS-2552 [ID 4]------ 1
YHR-006_Servo Bracket A -------- 1
YHR-007_Elbow joint A ---------- 1
Dummy Servo 2500A---------- 1
Arm Supporter 2500A---------- 1
2-5 Low Head Tapping Screw-----16
3-6 Flat Head Screw ---------- 1

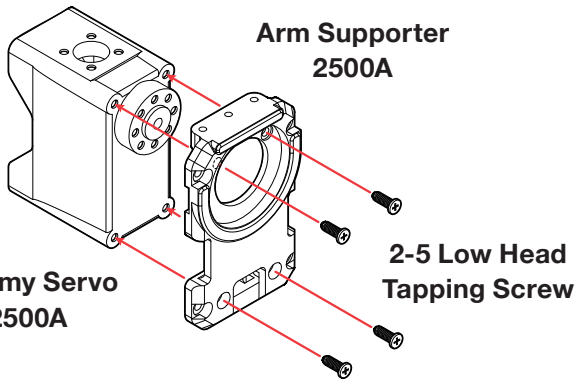




Completed Process Image

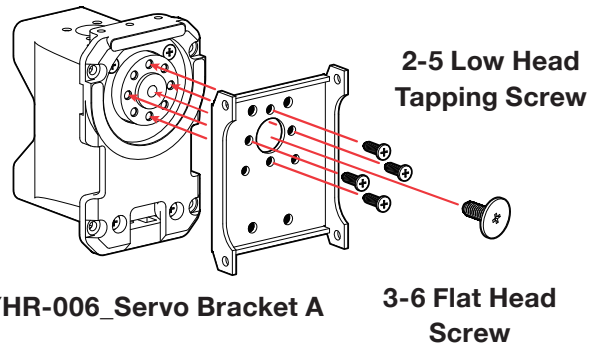
Icon Descriptions Points Tips Damage Warning Confirm

①



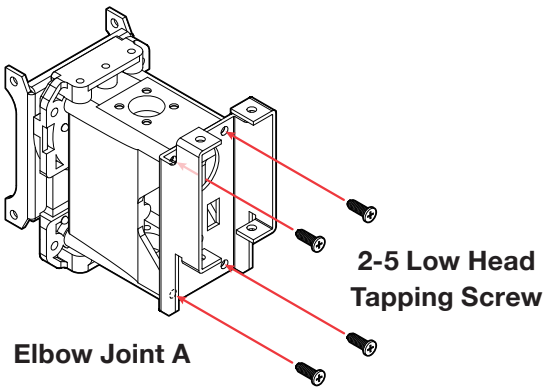
Mount the Arm Supporter 2500A on the Dummy Servo 2500A using four 2-5 Low Head Tapping Screws.

②



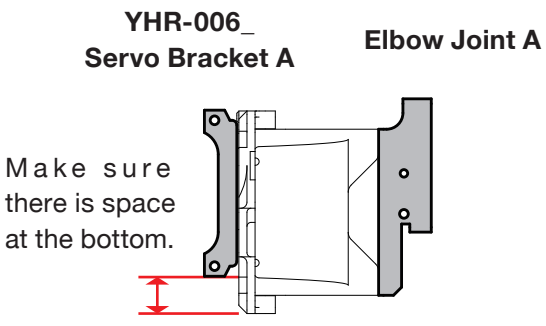
Mount the YHR-006_Servo Bracket A using four 2-5 Low Head Tapping Screws and one 3-6 Flat Head Screw.

③



Mount the YHR-007_Elbow Joint using four 2-5 low head tapping screws.

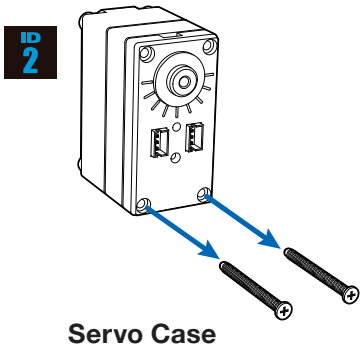
* Elbow Joints can be mounted on the top or bottom. Check the following figure carefully and mount accordingly.



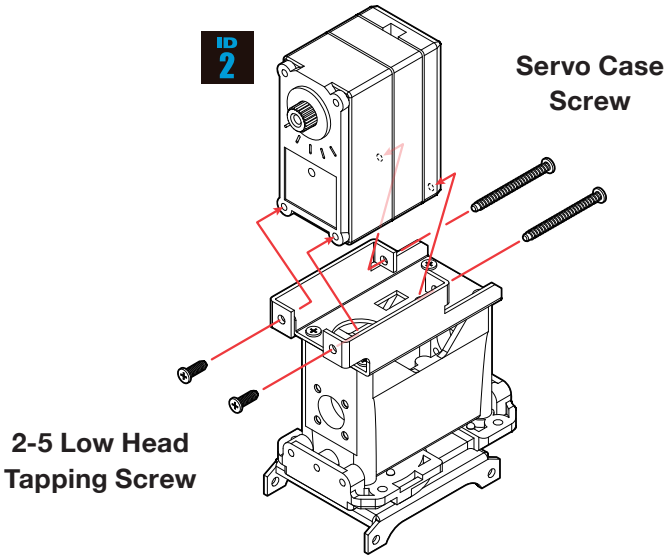
Side View

Assembly

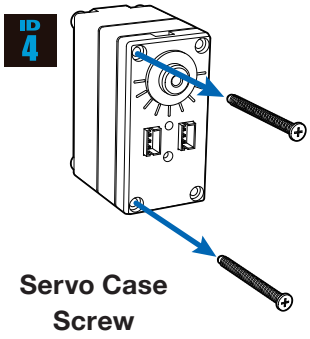
④ Unscrew the two case screws on the bottom from the Servo Motor [ID 2] (blue).



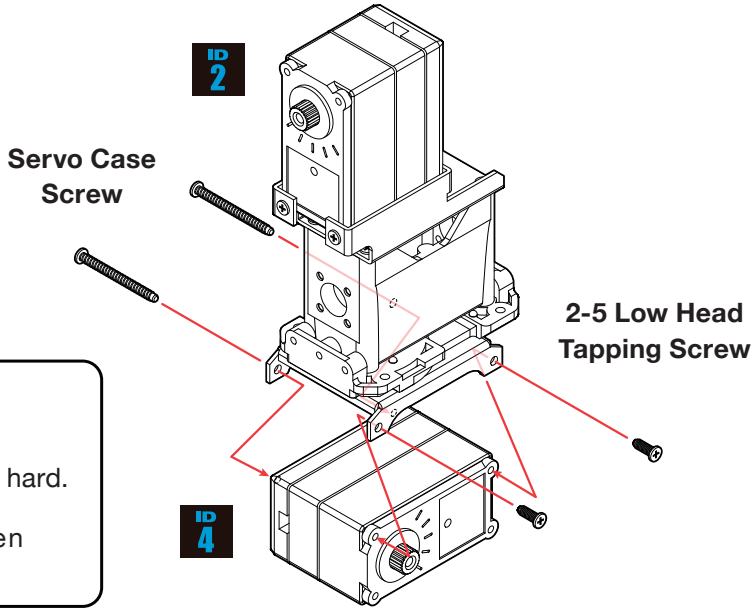
⑤ Mount the Servo Motor [ID 2] (blue) to the parts prepared in step (3). Use two 2-5 Low Head Tapping Screws on the servo output axis side, and two servo case screws taken off in step (4) on the bottom side.



⑥ Take two of the case screws on the left side (viewed from the bottom side) of Servo Motor [ID 4] (blue) .



⑦ Mount the Servo Motor [ID 4] (blue) on the parts prepared in step (5). Use two 2-5 Low Head Tapping Screws on the servo output axis side, and two servo case screws taken off in step (6) on the bottom side.



⚠ DANGER

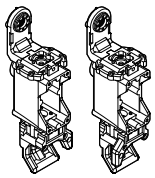
Be careful not to tighten case screw too hard.

* Check the orientaton carefully when mounting the Servo Motor.

9. Assembly - Arm Unit

- **Required Parts**

Hand Base B ---------- 2
Dummy Servo 2500A---------- 2
Joint Base 2500A---------- 2
Bottom Arm 2500A ---------- 2
Joint Base 2500A---------- 2
Bottom Arm 2500A ---------- 2
2-8 Low Head Tapping Screw ---- 20
2.6-10BH Tapping Screw ---------- 2
Knuckle B ---------- 2
Thumb B---------- 2



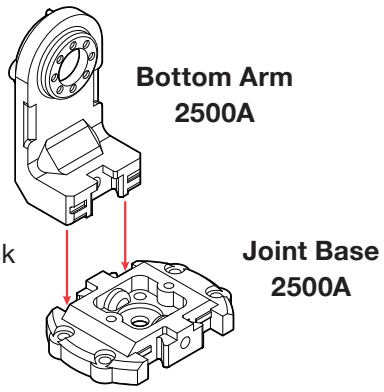
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

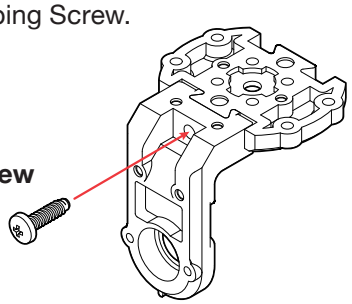
① As in the previous process “Assembly - Shoulder Servo Arm”, insert the Bottom Arm 2500A to the Joint Base 2500A.

* Make sure to check the direction (front / back) of the Joint Base.

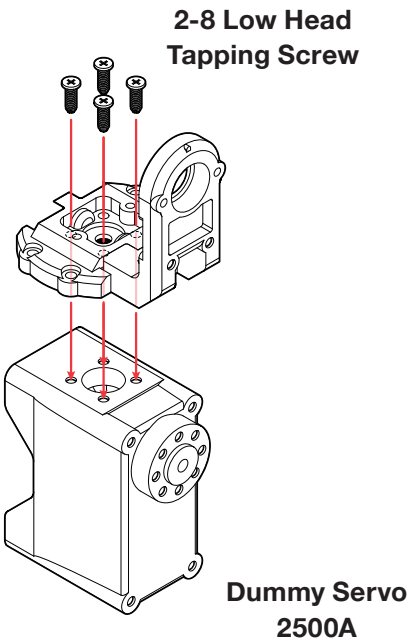
Check the front and back



② Secure the Arm's connecting parts using one 2.6-10BH Tapping Screw.

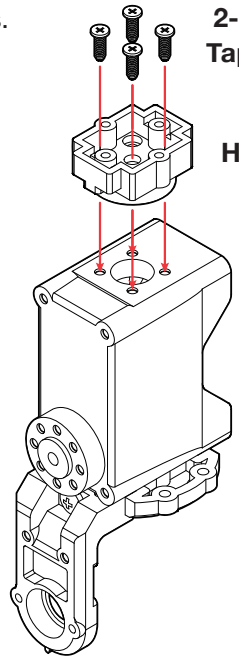


③ Mount the Dummy Servo 2500A as shown in the figure and secure using four 2-8 Low Head Tapping Screws. Make sure that the horn on the Dummy Servo 2500A is on the same side as the Bottom Arm 2500A.



Prepare two sets of the same.

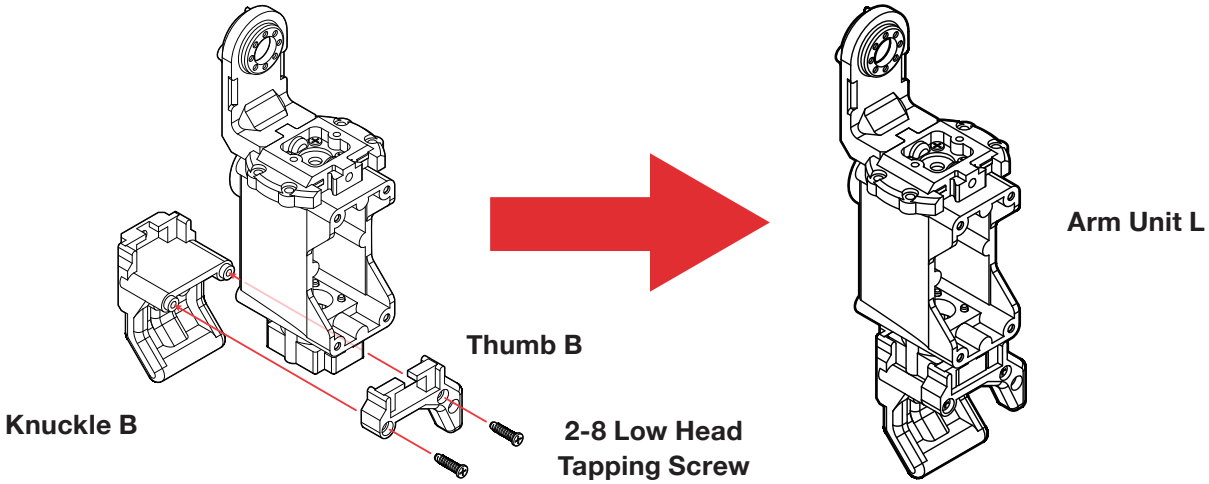
④ Mount the Hand Base B using four 2-8 Low Head Tapping Screws.

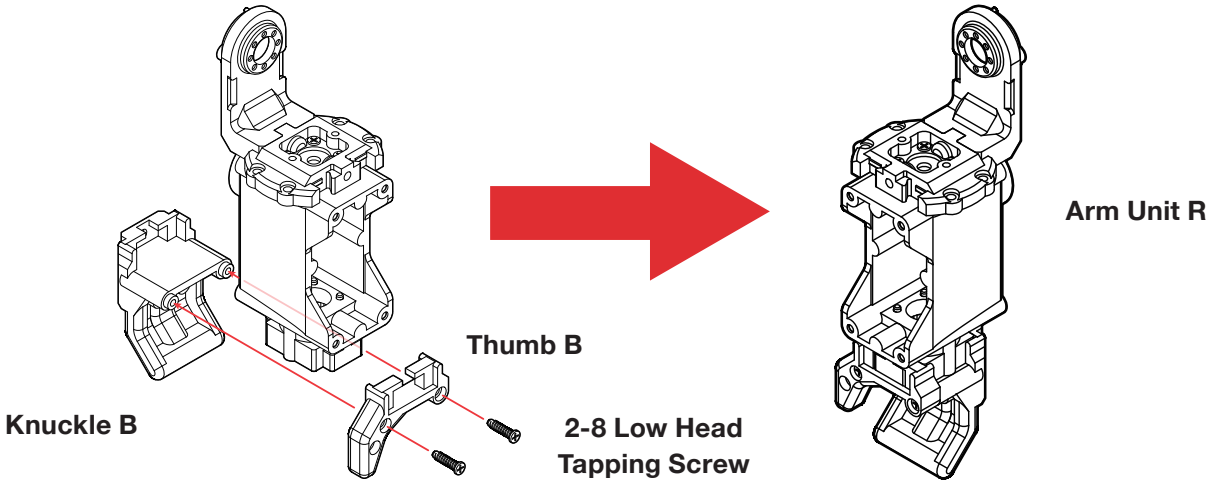


Prepare two sets of the same.

⑤ Insert the Knuckle B and the Thumb B into the Hand Base B and secure using two 2-8 Low Head Tapping Screws.

* Take precaution as the orientation of Thumb B differs between the left and right arms.

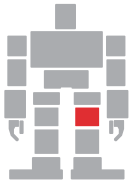


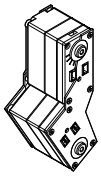


10. Assembly - Thigh Unit L

- **Required Parts**

YHR-010_Thigh Joint L ---------- 1
YHR-011_Thigh Joint R ---------- 1
Servo Motor KRS-2552 [ID 7] ----- 1
Servo Motor KRS-2552 [ID 8]------ 1
2-5 Low Head Tapping Screw ----- 7

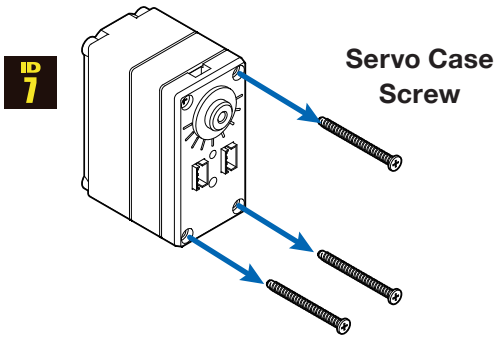




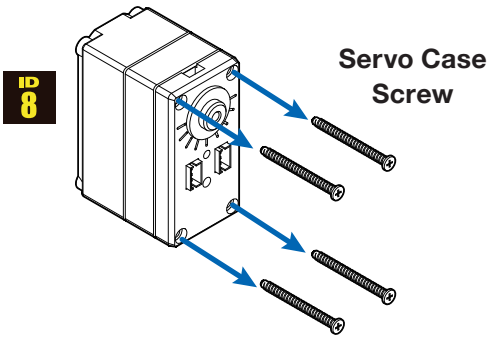
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Unscrew three of the case screws from the Servo Motor [ID7] (yellow), as shown in the figure.

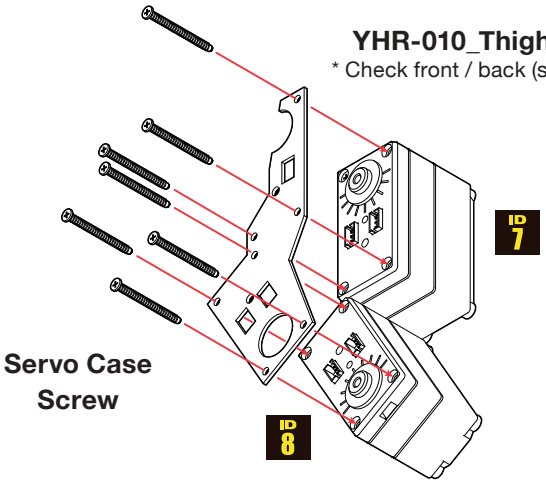


② Unscrew all four of the case screws from the Servo Motor [ID8] (yellow).

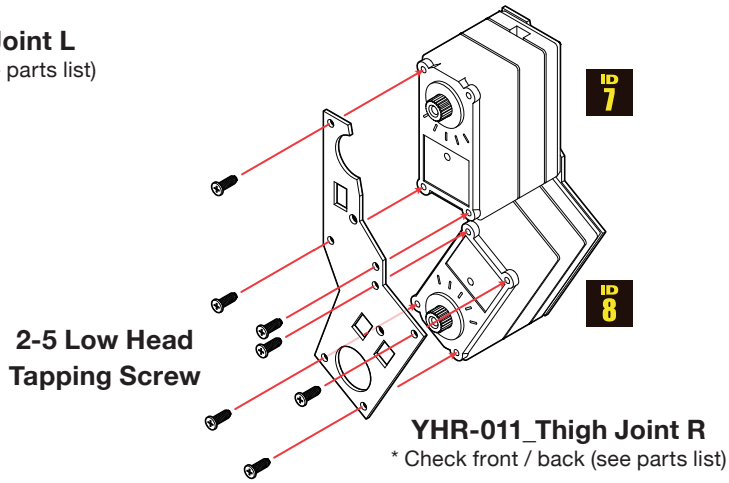


③ Mount YHR-010_Thigh Joint L to the bottom side of servo using the seven servo case screws taken off in the preceding steps.

* Check the servo ID carefully.



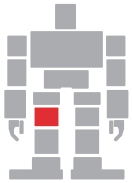
④ Mount the YHR-011_Thigh Joint R to the output axis side of the servo using seven 2-5 Low Head Tapping Screws.

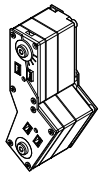


11. Assembly - Thigh Unit R

- **Required Parts**

YHR-010_Thigh Joint L ---------- 1
YHR-011_Thigh Joint R ---------- 1
Servo Motor KRS-2552 [ID 7] ----- 1
Servo Motor KRS-2552 [ID 8]------ 1
2-5 Low Head Tapping Screw ----- 7

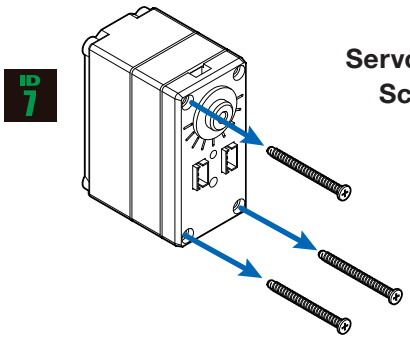




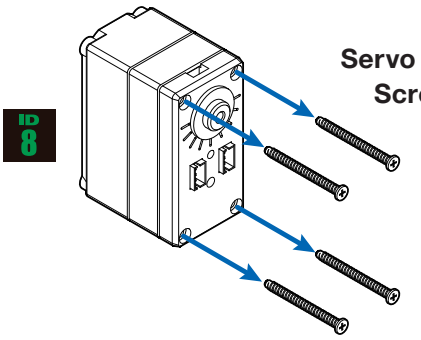
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Unscrew three of the case screws from the Servo Motor [ID7] (green), as shown in the figure.

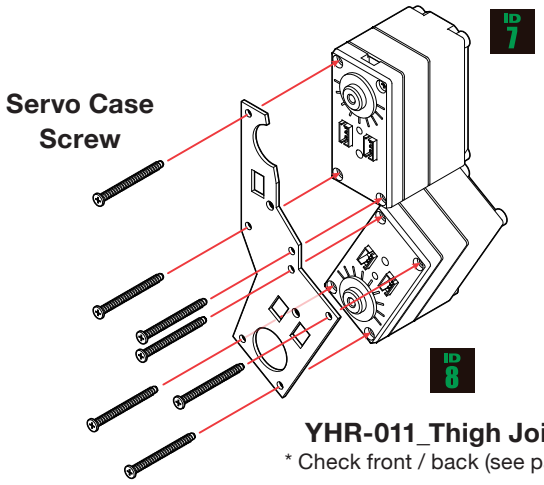


② Unscrew all four of the case screws from the Servo Motor [ID8] (green).



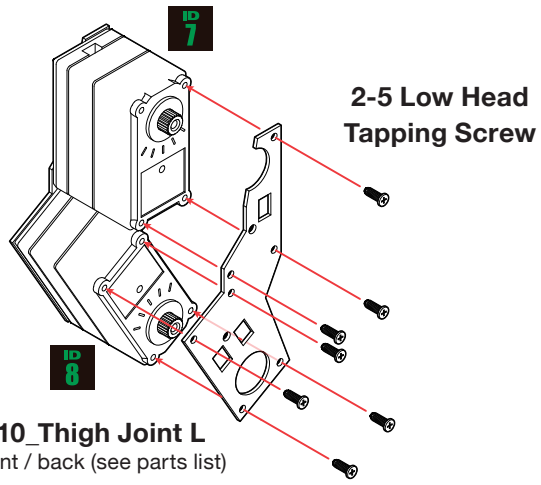
③ Mount the YHR-011_Thigh Joint R to the bottom side of the servo using the seven servo case screws taken off in the preceding steps.

* Check the servo ID carefully.



YHR-011_Thigh Joint R
* Check front / back (see parts list)

④ Mount the YHR-010_Thigh Joint L to the output axis side of servo using seven 2-5 Low Head Tapping Screws.

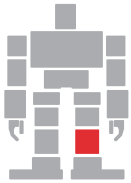


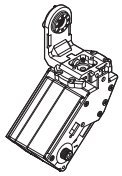
YHR-010_Thigh Joint L
* Check front / back (see parts list)

12. Assembly - Leg Unit L

- **Required Parts**

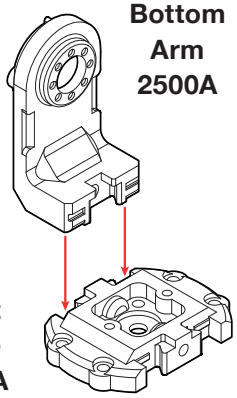
Servo Motor KRS-2552 [ID 9]------ 1
YHR-012_Leg Joint L ---------- 1
YHR-013_Leg Joint R ---------- 1
YHR-014_Leg Joint B ---------- 1
Joint Base 2500A---------- 1
Bottom Arm 2500A ---------- 1
2.3-6BH Tapping Screw ---------- 4
2.6-10 Tapping Screw ---------- 1
M2-4 Low Head Screw---------- 4
2-5 Low Head Tapping Screw ----- 3





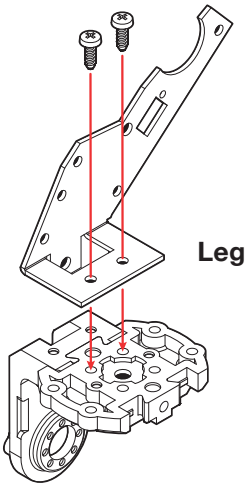
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

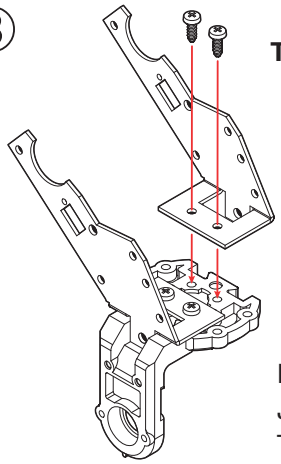
① 

As in the previous process "Assembly - Shoulder Servo Arm", insert the Bottom Arm 2500A to the Joint Base 2500A.

* Make sure to check the direction (front / back) of the Joint Base.

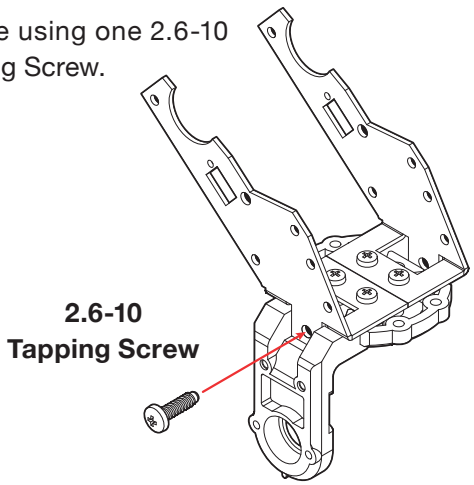
② 

Mount the Arm assembled in step (1) to one YHR-012_Leg Joint L using two 2.3-6BH Tapping Screws.

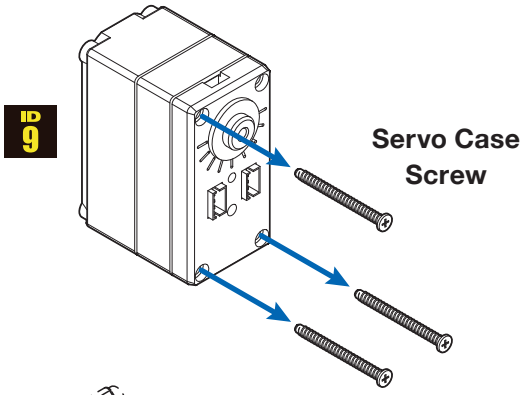
③ 

Mount one YHR-013_Leg Joint R using two 2.3-6BH Tapping Screws.

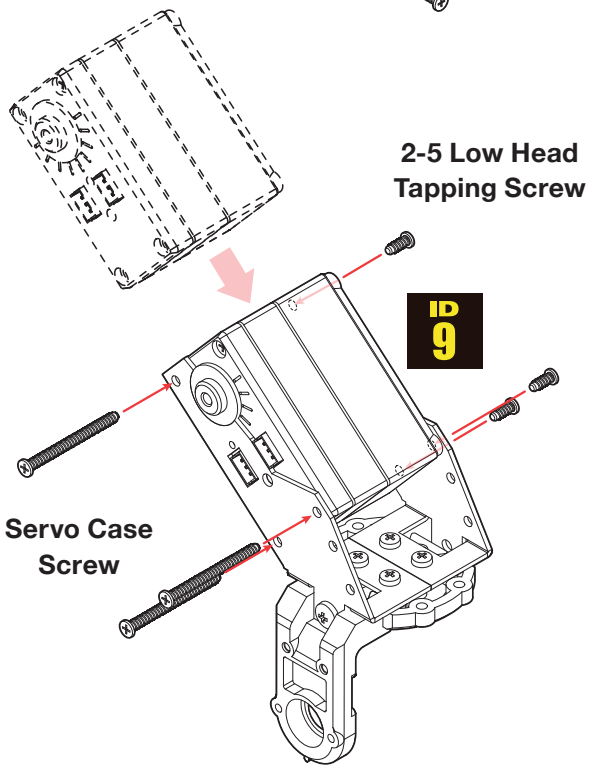
④ Secure using one 2.6-10 Tapping Screw.



⑤ Unscrew three of the case screws from Servo Motor [ID 9] (yellow), as shown in the figure.

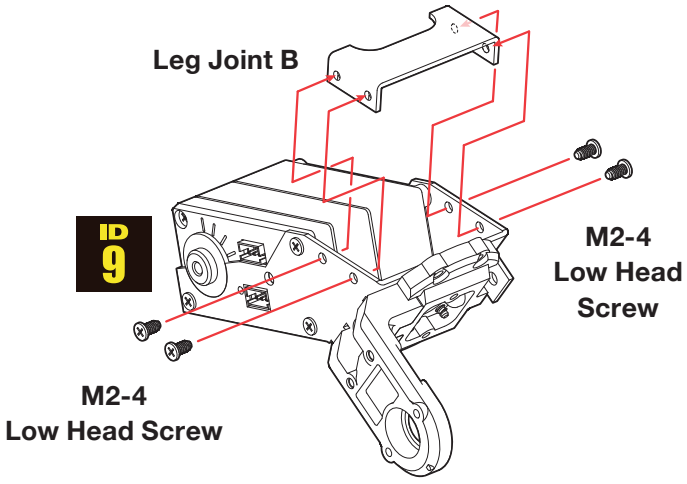


⑥ Insert the servo so that YHR-012_Leg Joint L is on the bottom side of the servo and YHR-013_Leg Joint R is on the output axis side of the servo. Secure using the three servo case screws taken off on the bottom side, and three 2-5 Low Head Tapping Screw on the output axis side.



⑦ Secure YHR-014_Leg Joint B using four M2-4 Low Head Screws.

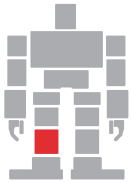
* If you find it difficult to mount Leg Joint B, loosen the three 2-5 Low Head Screws first, and then retighten.

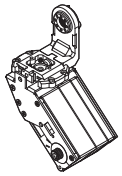


13. Assembly - Leg Unit R

- **Required Parts**

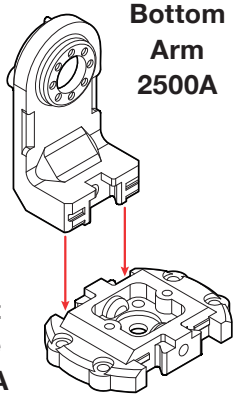
Servo Motor KRS-2552 [ID 9]------ 1
YHR-012_Leg Joint L ---------- 1
YHR-013_Leg Joint R ---------- 1
YHR-014_Leg Joint B ---------- 1
Joint Base 2500A---------- 1
Bottom Arm 2500A ---------- 1
2.3-6BH Tapping Screw ---------- 4
2.6-10 Tapping Screw ---------- 1
M2-4 Low Head Screw---------- 4
2-5 Low Head Tapping Screw ----- 3





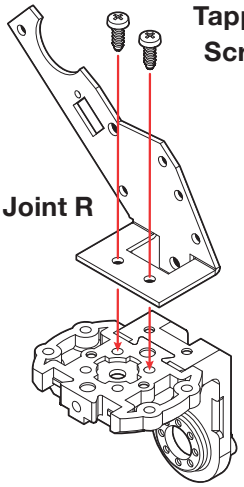
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① 

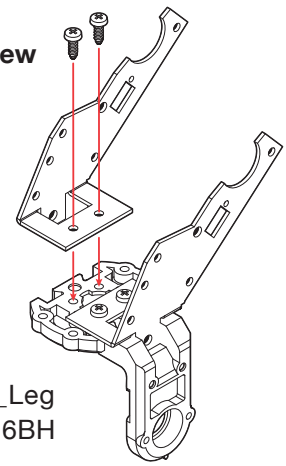
As in the previous process "Assembly - Shoulder Servo Arm", insert the Bottom Arm 2500A to the Joint Base 2500A.

* Make sure to check the orientation (front / back) of the Joint Base.

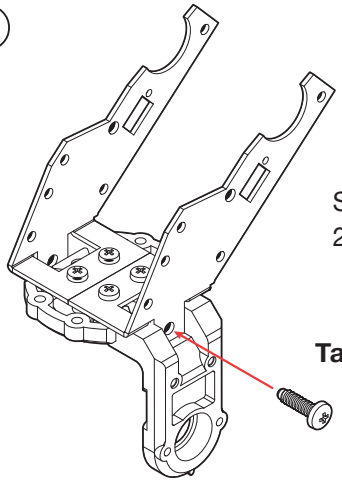
② 

Mount the Arm assembled in step (1) to one YHR-013_Leg Joint R using two 2.3-6BH Tapping Screws.

*The frame mounted here differs from that used in the previous process. Please recheck.

③ 

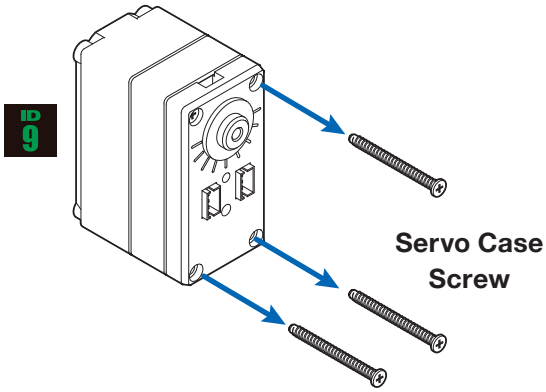
Mount one YHR-012_Leg Joint L using two 2.3-6BH Tapping Screws.

④ 

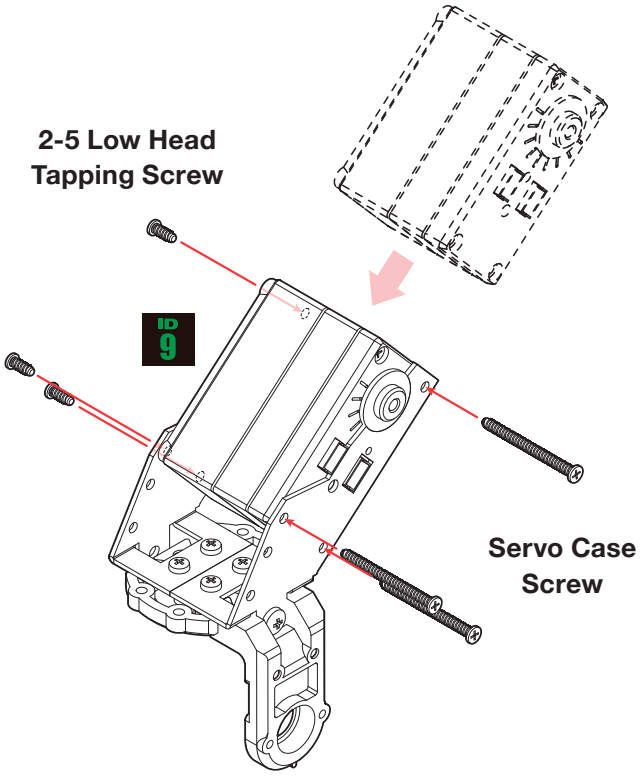
Secure using one 2.6-10 Tapping Screw.

2.6-10 Tapping Screw

⑤ Unscrew three of the case screws from Servo Motor [ID 9] (green), as shown in the figure.

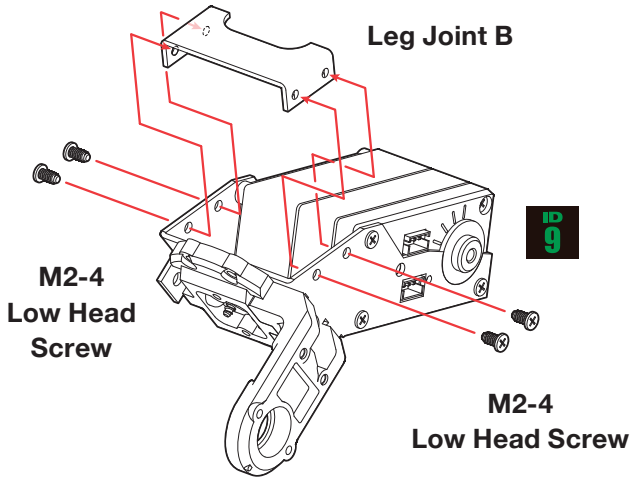


⑥ Insert the servo so that the YHR-012_Leg Joint L is on the output axis side of the servo and the YHR-013_Leg Joint R is on the bottom side of the servo. Secure using the three servo case screws taken off on the bottom side, and three 2-5 Low Head Tapping Screws on the output axis side.



⑦ Secure the YHR-014_Leg Joint B using four M2-4 Low Head Screws.

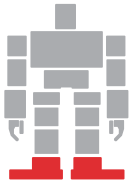
* If you find it difficult to mount Leg Joint B, loosen the three 2-5 Low Head Screws first, and then retighten.

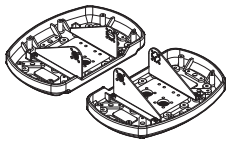


14. Assembly - Sole

- **Required Parts**

Sole S-02---------- 2
YHR-015_Foot Angle A-L---------- 1
YHR-016_Foot Angle A-R --------- 1
YHR-017_Foot Angle B-L ---------- 1
YHR-018_Foot Angle B-R --------- 1
M2-6BH Screw ---------- 8
M2 Nut---------- 8

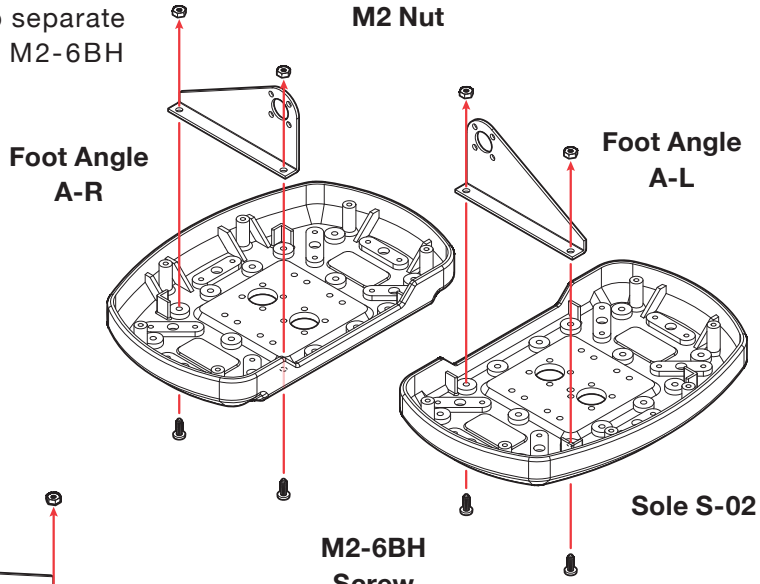


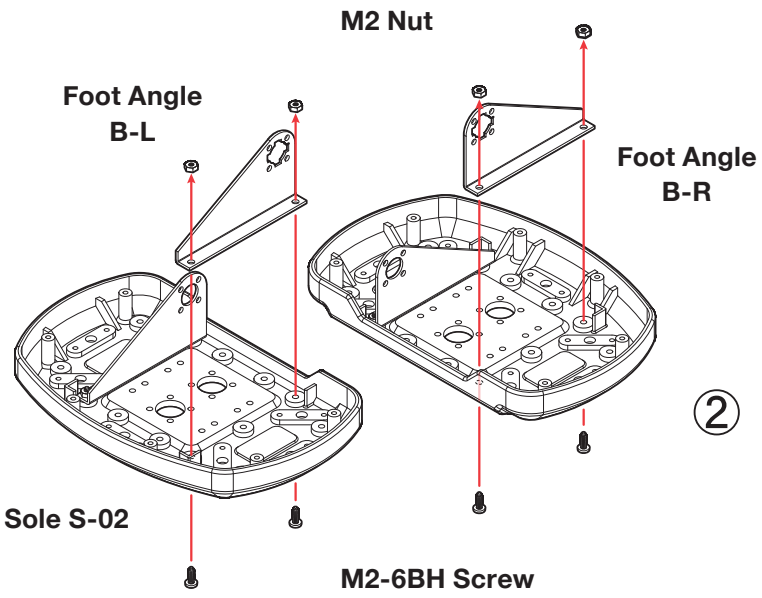


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Mount one YHR-015_Foot Angle A-L and one YHR-016_Foot Angle A-R to two separate 5-1924_Sole S-02s using two M2-6BH Screws and two M2 Nuts each.





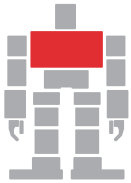
② Accordingly, mount one YHR-017_Foot Angle B-L and one YHR-018_Foot Angle B-R using two M2-6BH Screws and two M2 Nuts each.

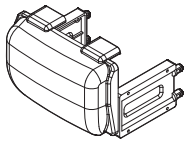
Use of screw locking adhesive is recommended if the nut loosens.

15. Assembly - Front Cowl

- **Required Parts**

Base Plate A ---------- 1
Front Cowl (SD1)---------- 1
Battery Holder A---------- 2
2-8 Low Head Tapping Screw----- 4
2-5 Low Head Tapping Screw----- 4



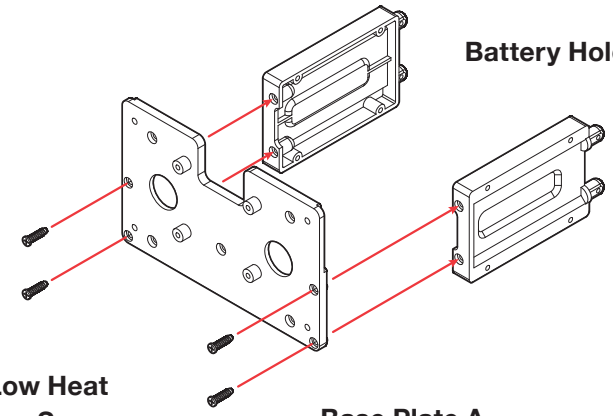


Completed Process Image

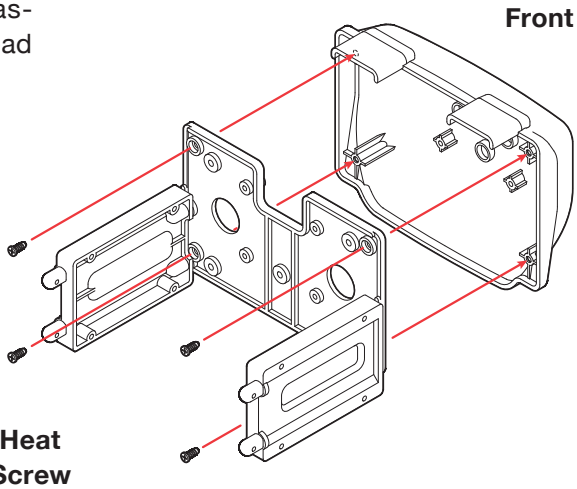
Icon Descriptions Points Tips Damage Warning Confirm

① Secure two Battery Holders on one Base Plate A using four 2-8 Low Head Tapping Screws.

* The concave side of the base plate should face inward.



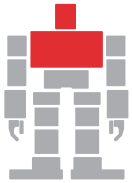
② Secure the Front Cowl (SD1) to the unit assembled in step (1) using four 2-5 Low Head Tapping Screws.

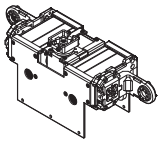


16. Installation - Units (Head - Torso)

- **Required Parts**

Chest Unit [Process 4] ---------- 1
Shoulder Servo Arm [Process 5] -- left, right 1 each
Small Diameter Horn ---------- 1
Head Base A ---------- 1
2-5 Low Head Tapping Screw ----- 4
M3-8 Low Head Horn Fixing Screw--- 3





Completed Process Image

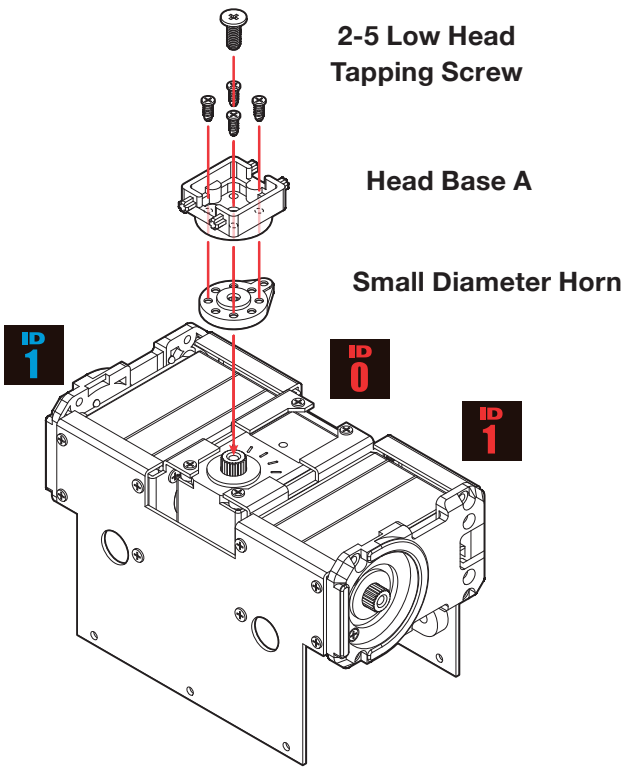
Icon Descriptions Points Tips Damage Warning Confirm

The following processes require servo motors with the origin setting completed. If the Origin Setting has not been completed, go back to [Process 2] "Setting Origin," and do so prior to proceeding.

① Insert the Small Diameter Horn as indicated in the figure and secure the Head Base A over it using four 2-5 Low Head Tapping Screws.

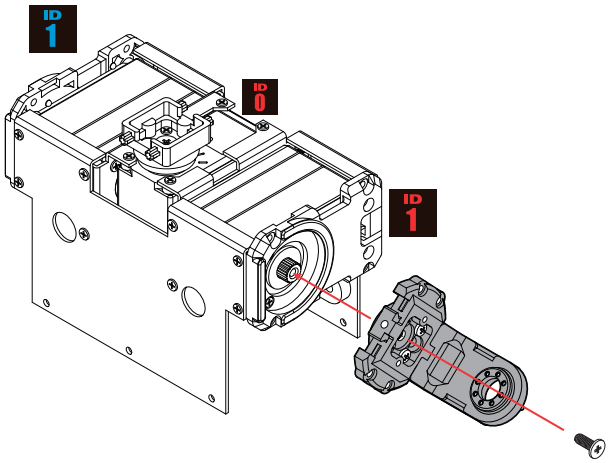
(You may secure the Small Diameter Horn and the Head Base A with 2-5 Low Head Tapping Screws beforehand.)

Secure one M3-8 Low Head Horn Fixing Screw at the center of the Head Base A.

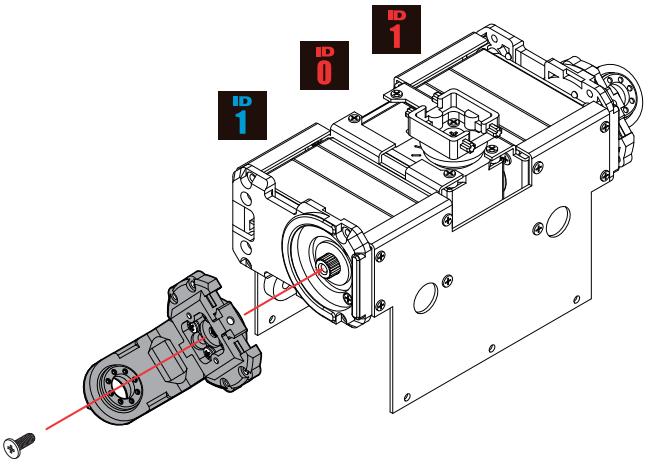


Assembly

② Insert the Left Shoulder Servo Arm assembled in process 5 to the Servo Motor [ID 1] (red), and secure using one M3-8 Low Head Horn Fixing Screw.

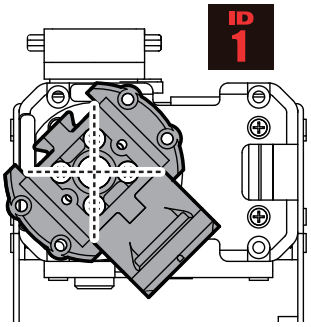


③ Insert the Right Shoulder Servo Arm assembled in process 5 to the Servo Motor [ID 1] (blue), and secure using one M3-8 Low Head Horn Fixing Screw.

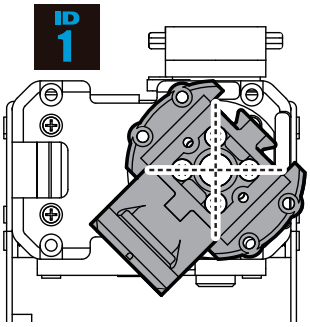


M3-8 Low Head Horn Fixing Screw

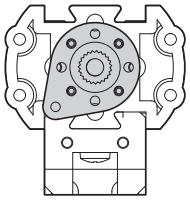
View from left side



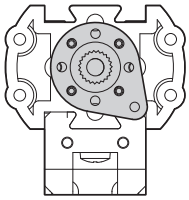
View from right side



* Mount so that the screws on the servo base form a cross.



Shoulder Servo Arm (left)

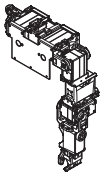


Shoulder Servo Arm (right)

17. Installation - Units (Arm, Left)

- **Required Parts**

Chest Unit [Process 16] ---------- 1
Elbow Unit L [Process 7] ---------- 1
Arm Unit L [Process 9] ---------- 1
Upper Arm 2500A ---------- 2
M3-8 Low Head Horn Fixing Screw--- 2
2.6-10BH Tapping Screw ---------- 2
2.6-6 Flat Head Screw ---------- 2

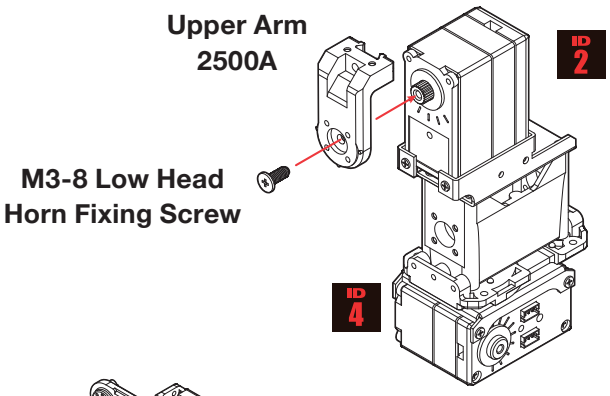


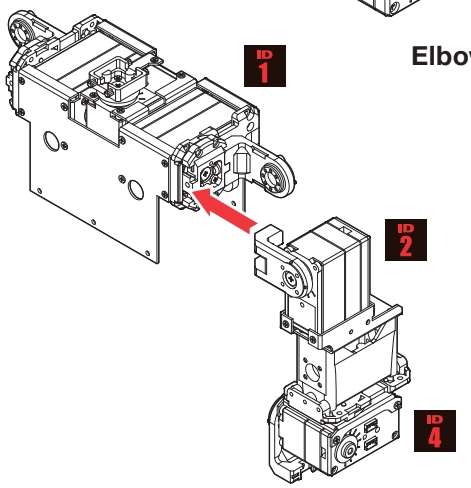
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

① Insert one Upper Arm 2500A into the Servo Motor [ID 2] (red) and secure using one M3-8 Low Head Horn Fixing Screw.

* Upper Arm 2500A must be secured straight in relation to the servo motor.

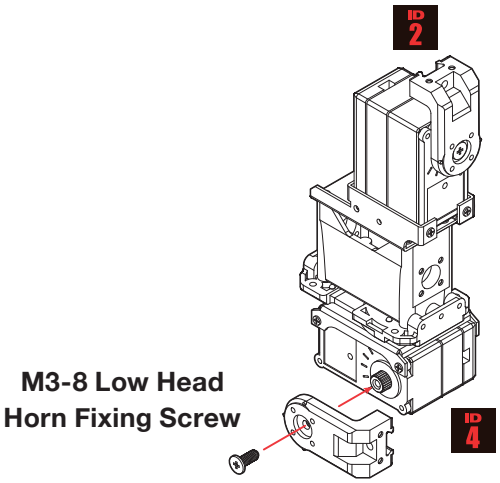




Elbow Unit L

② Insert one Upper Arm 2500A into the Servo Motor [ID 4] (red) and secure using one M3-8 Low Head Horn Fixing Screw.

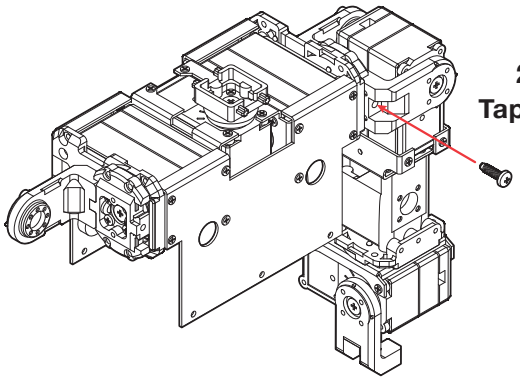
* Upper Arm 2500A must be secured straight in relation to the servo motor.



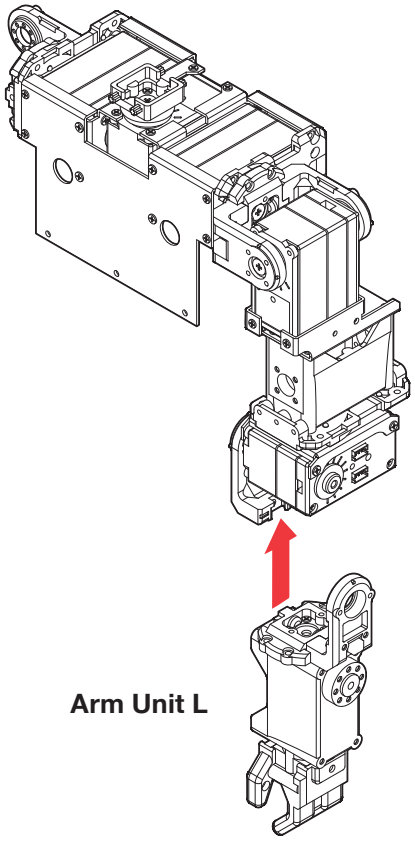
Upper Arm 2500A

③ Insert the left arm part of the Chest Unit assembled in Process 16 to the Joint Base part. The parts will click to fit if the connecting part of the upper arm is first inserted to the base and then lifted towards the servo bottom.

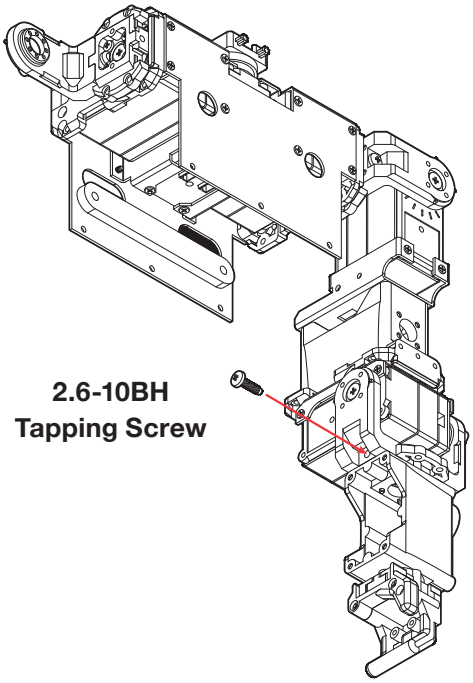
④ Secure the connecting parts of the arm using one 2.6-10BH Tapping Screw.

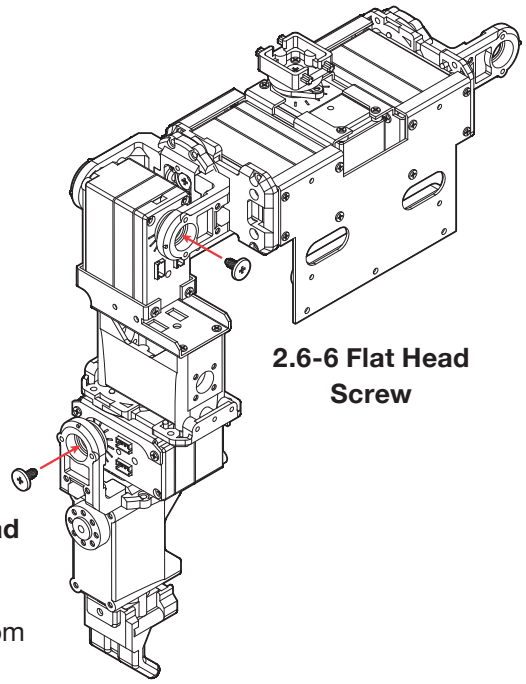


⑤ Insert the left arm part of the Arm Unit assembled in Process 9 to the Joint Base part.



⑥ Secure the connecting parts of the arm using one 2.6-10BH Tapping Screw for each.



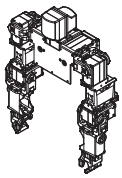


⑦ Secure using two 2.6-6 Flat Head Screws on the bottom side.

18. Installation - Units (Arm, Right)

- **Required Parts**

Chest Unit [Process 17] ---------- 1
Elbow Unit R [Process 8] ---------- 1
Arm Unit R [Process 9] ---------- 1
Upper Arm 2500A ---------- 2
Face (SD1) ---------- 1
Visor (SC1) ---------- 1
Helmet (SD1) ---------- 1
M3-8 Low Head Horn Fixing Screw --- 2
2.6-10BH Tapping Screw ---------- 2
2.6-6 Flat Head Screw ---------- 2
2-8 Low Head Tapping Screw ----- 5

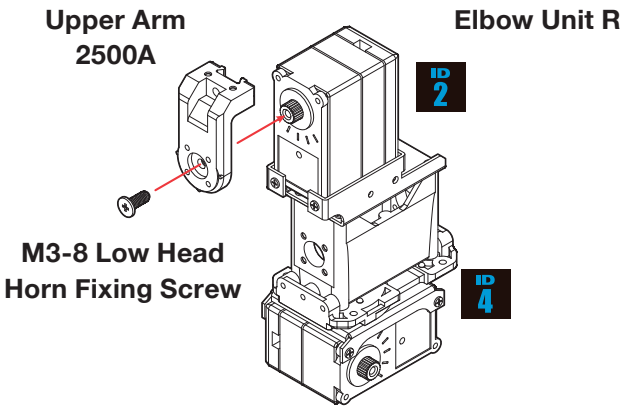


Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

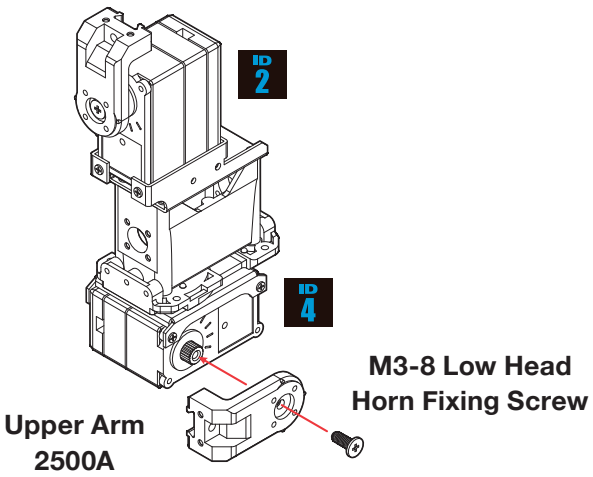
① Insert Upper Arm 2500A into the Servo Motor [ID 2] (blue) and secure using one M3-8 Low Head Horn Fixing Screw.

* Upper Arm 2500A must be secured straight relative to the servo motor.

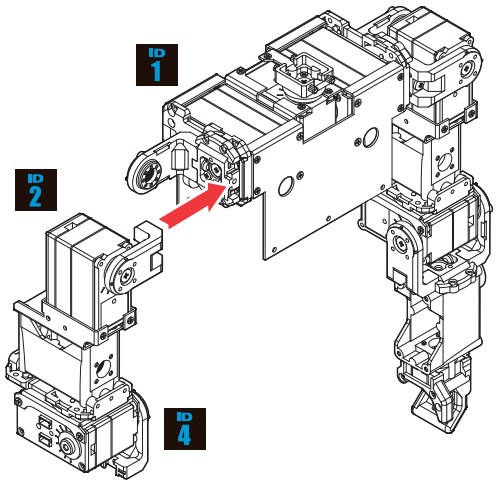


② Insert the Upper Arm 2500A into the Servo Motor [ID 4] (blue) and secure using one M3-8 Low Head Horn Fixing Screw.

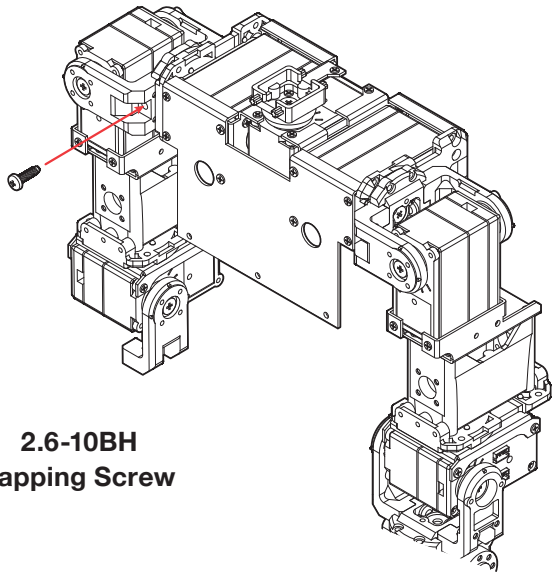
* Upper Arm 2500A must be secured straight relative to the servo motor.



③ Insert the right arm part of the unit assembled in the previous process to the Joint Base part.

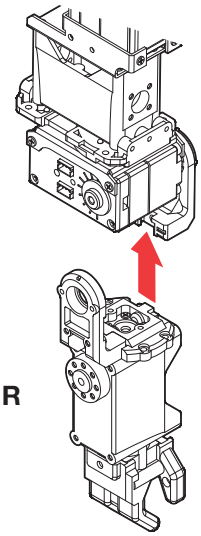


④ Secure the connecting parts of the arm using one 2.6-10BH Tapping Screw.



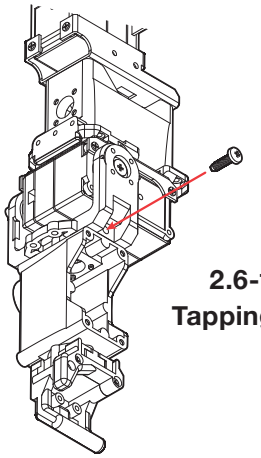
2.6-10BH Tapping Screw

⑤ Insert the right arm part of the Arm Unit assembled in Process 9 to the Joint Base part.



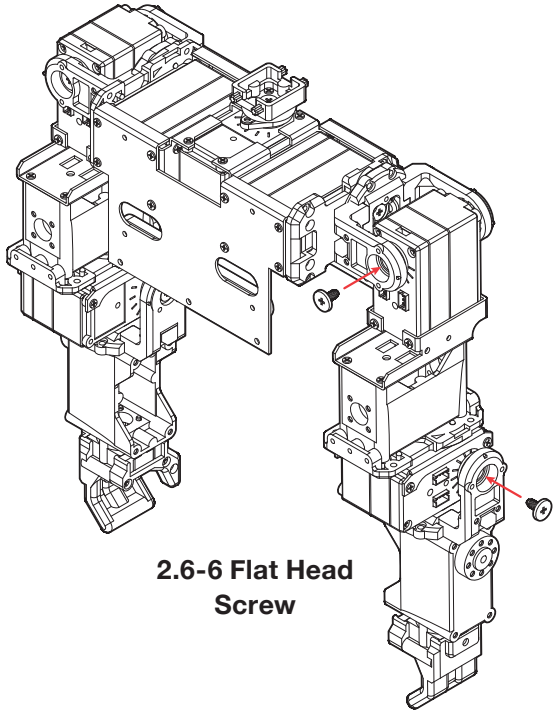
Arm Unit R

⑥ Secure the connecting parts of the arm using one 2.6-10BH Tapping Screw.



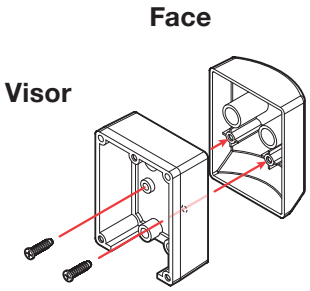
2.6-10BH Tapping Screw

⑦ Secure using two 2.6-6 Flat Head Screws on the bottom side.



2.6-6 Flat Head Screw

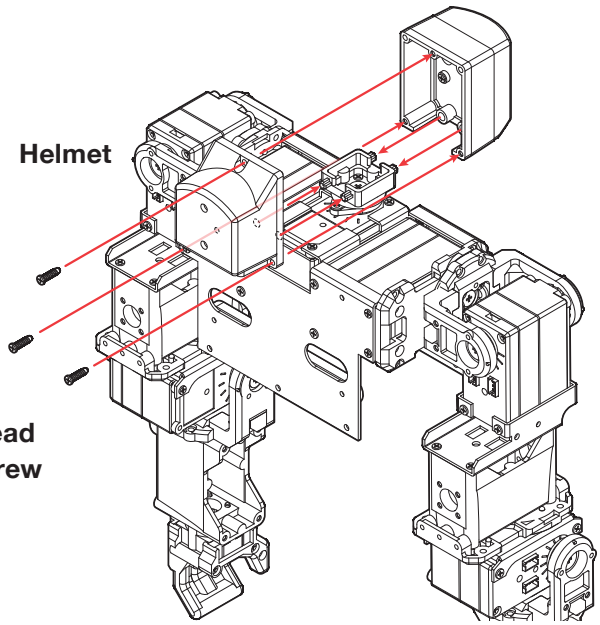
⑧ Mount the Visor (SD1) to the Face (SD1) using two 2-8 Low Head Tapping Screws.



2-8 Low Head Tapping Screw

⑨ Sandwich the Head Base with the Face and the Helmet (SD1) and secure using three 2-8 Low Head Tapping Screws.

* The protrusion on the Head Base should fit the Face and Helmet.

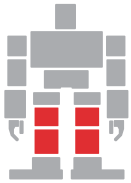


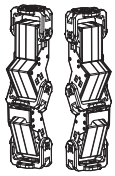
2-8 Low Head Tapping Screw

19. Installation - Units (Leg 1)

- **Required Parts**

Servo Arm [Process 6] ---------- 4
Thigh Unit L [Process 10] ---------- 1
Thigh Unit R [Process 11] ---------- 1
Leg Unit L [Process 12] ---------- 1
Leg Unit R [Process 13] ---------- 1
Upper Arm 2500A ---------- 6
M3-8 Low Head Horn Fixing Screw--- 6
2.6-10BH Tapping Screw ---------- 6
2.6-6 Flat Head Screw ---------- 6

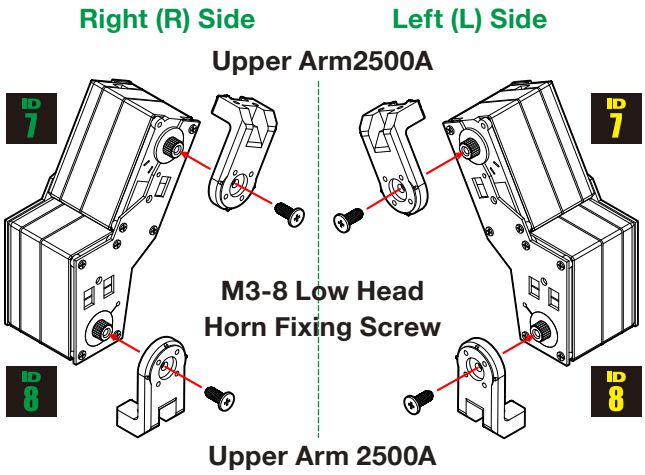




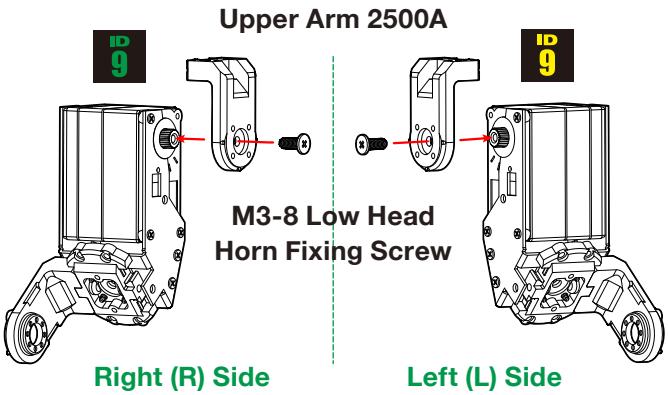
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

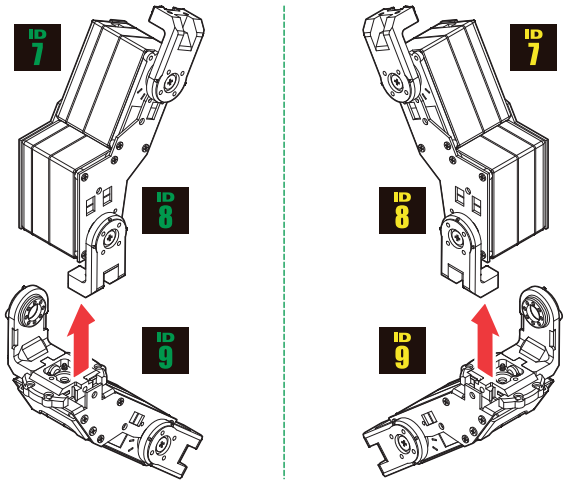
① Mount the Upper Arm 2500A (one each) onto the Thigh Unit L and the Thigh Unit R, and secure using M3-8 Low Head Horn Fixing Screws (one each).



② Mount the Upper Arm 2500A (one each) onto the Leg Unit L and the Leg Unit R and secure using M3-8 Low Head Horn Fixing Screws (one each).



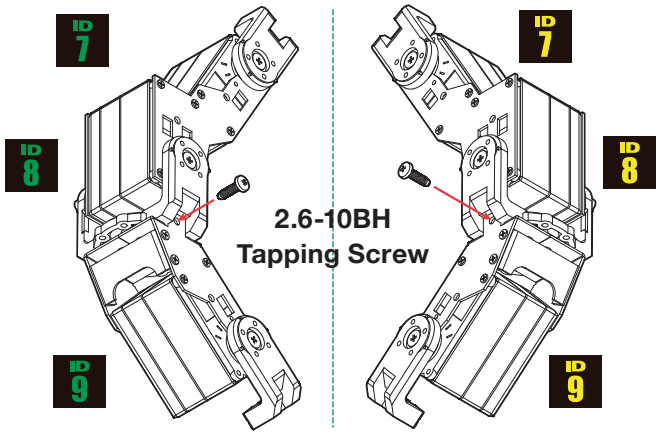
③ Attach the Leg Unit L to the Thigh Unit L, and the Leg Unit R to the Thigh Unit R.



Right (R) Side　　Left (L) Side

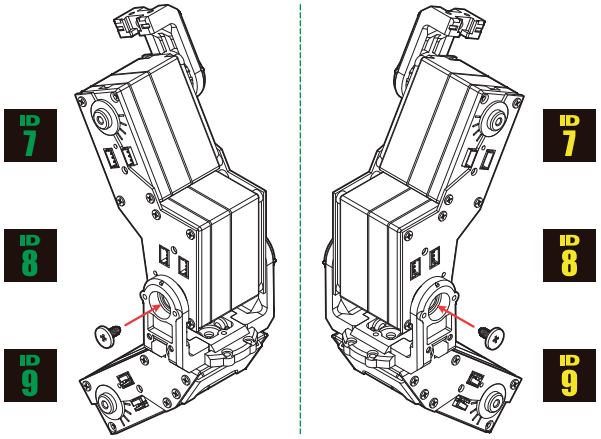
④ Secure the connecting parts using one 2.6-10BH Tapping Screw for each.

Right (R) Side　　Left (L) Side



⑤ Secure one 2.6-6 Flat Head Screw on each Bottom Arm 2500A.

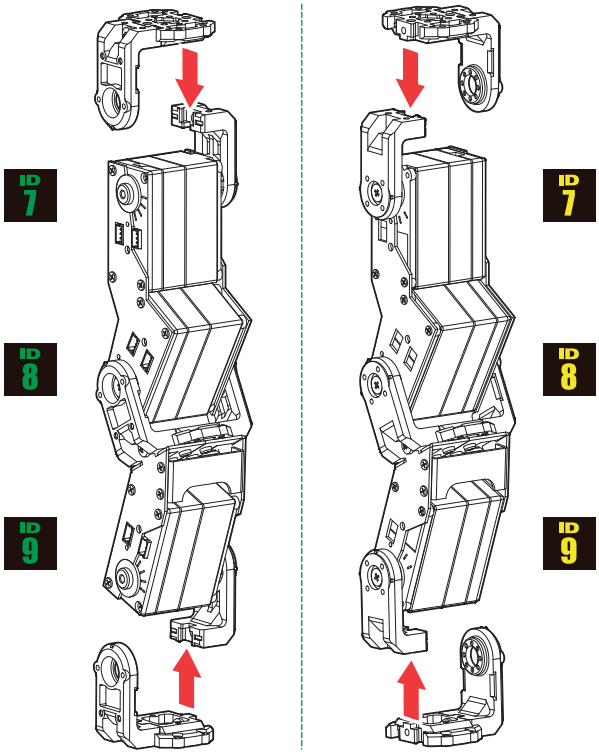
Right (R) Side　　Left (L) Side



2.6-6 Flat Head Screw

⑥ Attach the Servo Arm to the Upper Arm.

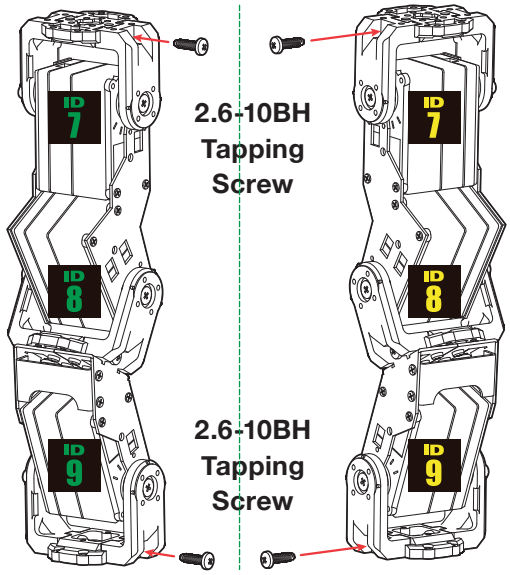
Servo Arm



Servo Arm

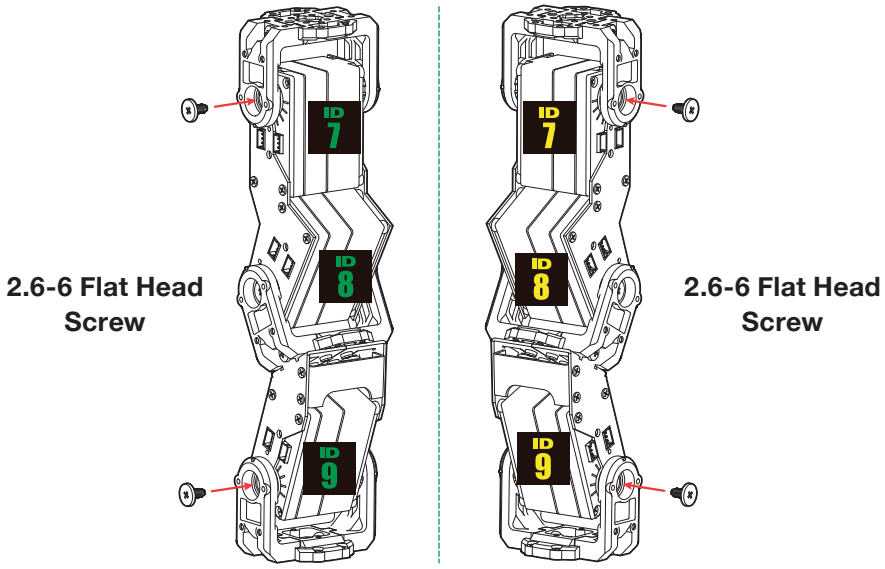
Right (R) Side　　Left (L) Side

⑦ Secure the connecting parts using one 2.6-10BH Tapping Screw for each.



Right (R) Side Left (L) Side

⑧ Secure one 2.6-6 Flat Head Screw on each Bottom Arm 2500A.

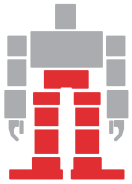


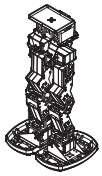
Right (R) Side Left (L) Side

20. Installation - Units (Leg 2)

- **Required Parts**

Foot Unit L [Process 19] ---------- 1
Foot Unit R [Process 19] ---------- 1
Sole L [Process 14] ---------- 1
Sole R [Process 14]---------- 1
Servo Motor KRS-2552 [ID 6]------ 2
Servo Motor KRS-2552 [ID 10] ---- 2
YHR-006_Servo Bracket A -------- 4
Small Diameter Horn ---------- 4
Free Horn ---------- 4
M3-8 Low Head Horn Fixing Screw4
2.6-6 Flat Head Screw ---------- 4
2-5 Low Head Tapping Screw---- 56
M2-4 Low Head Screw---------- 8

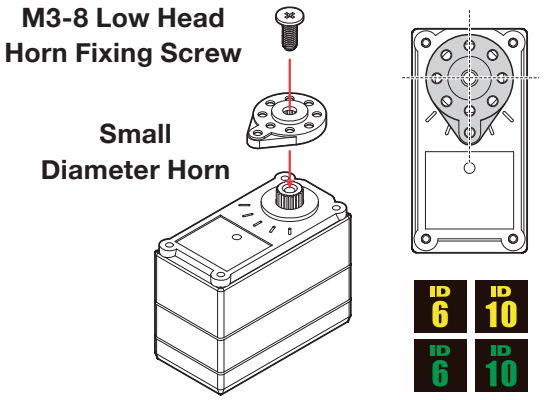




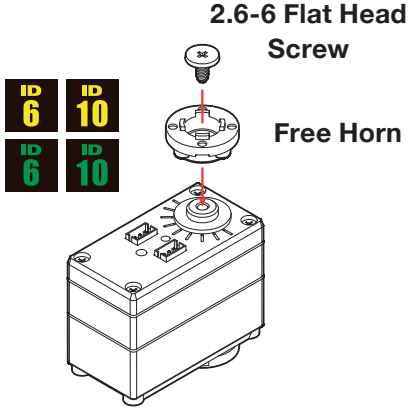
Completed Process Image

Icon Descriptions Points Tips Damage Warning Confirm

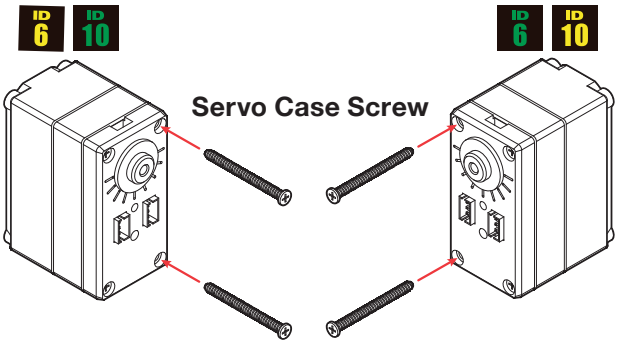
① Mount one Small Diameter Horn each on Servo Motors [ID 6] (yellow), [ID10] (yellow), [ID 6] (green) and [ID10] (green), and secure using one M3-8 Low Head Horn Fixing Screw for each.

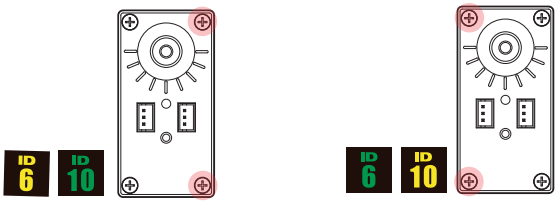


② Mount one Free Horn each on the bottom side of all four servo motors and secure using one 2.6-6 Flat Head Screw for each.



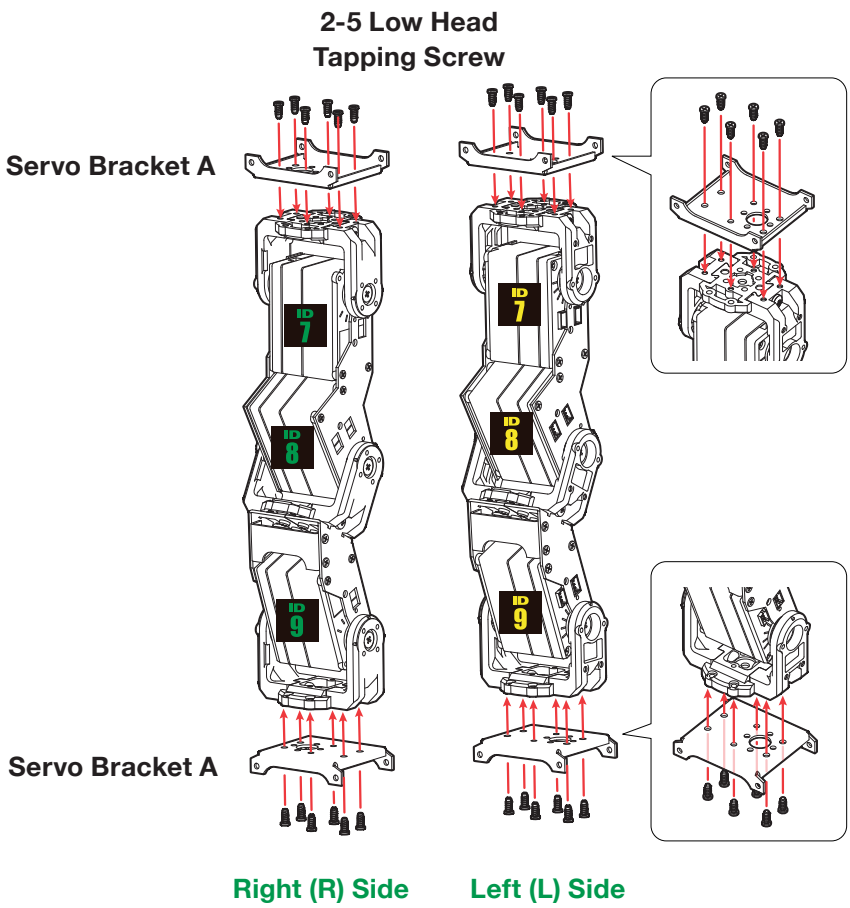
③ Remove two servo screws as indicated in the figure.



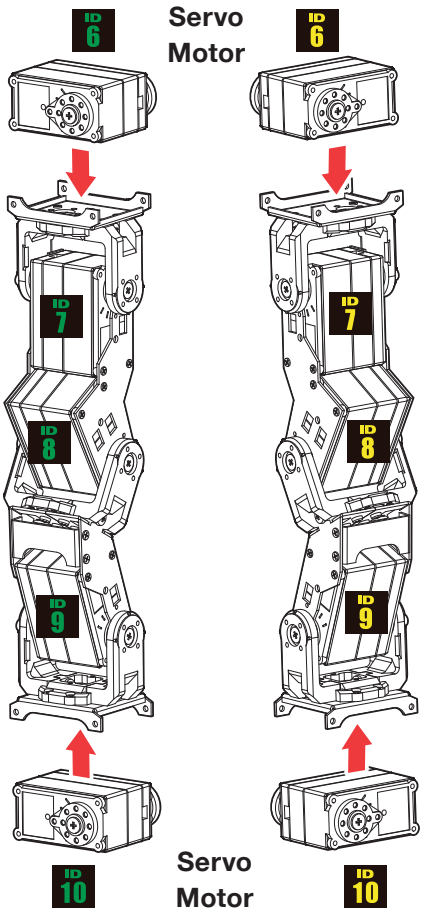


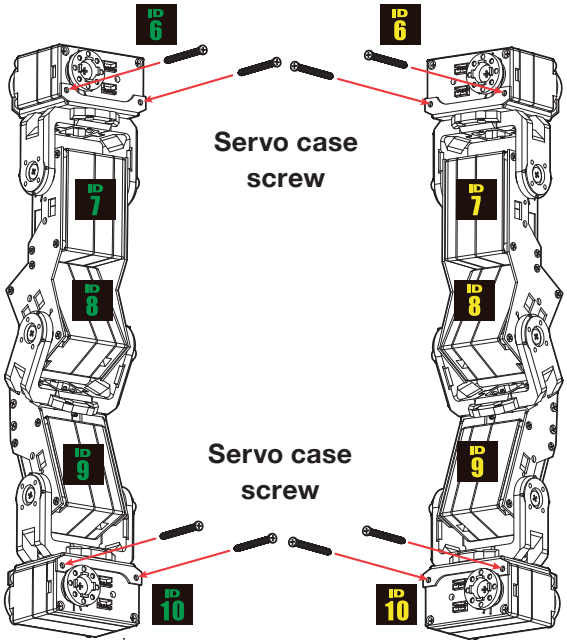
* Remove the servo screws indicated with ●

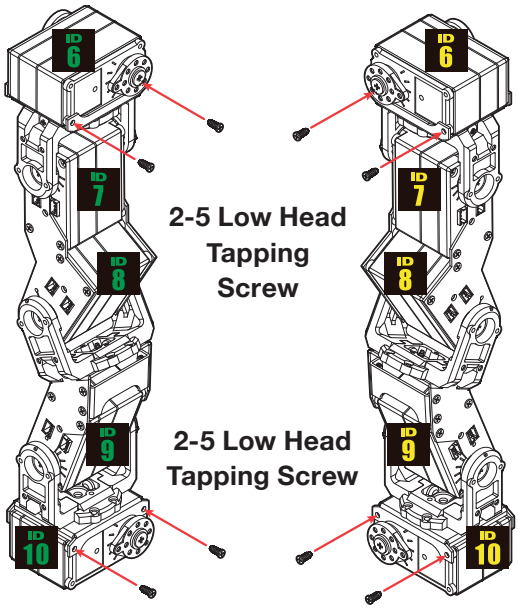
④ Secure four Servo Bracket A to the Servo Base 2500A using six 2-5 Low Head Tapping Screws for each. Be careful of the orientation.



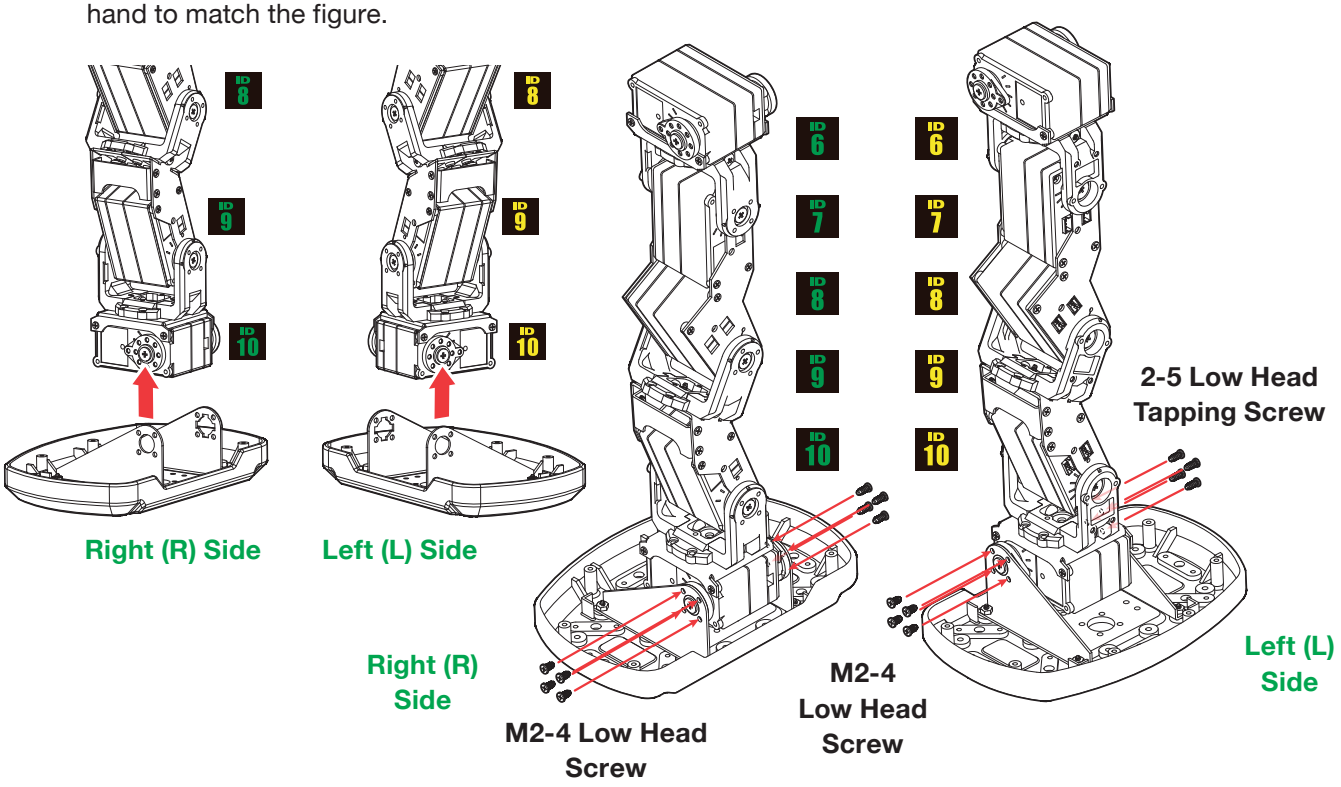
⑤ Secure each Servo Motor to the Servo Bracket A using the four servo screws removed and four 2-5 Low Head Tapping Screws.



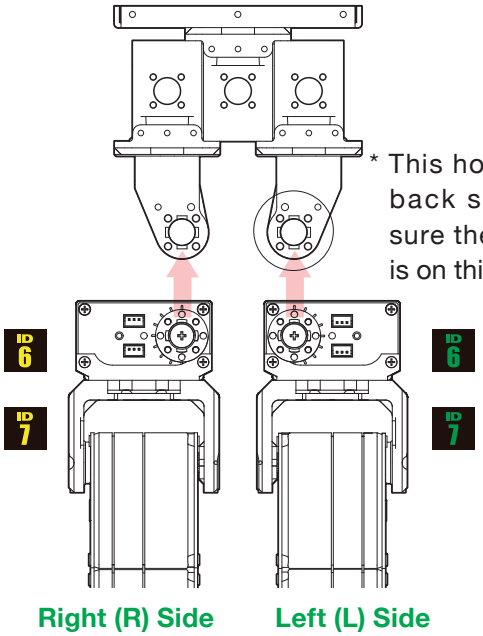




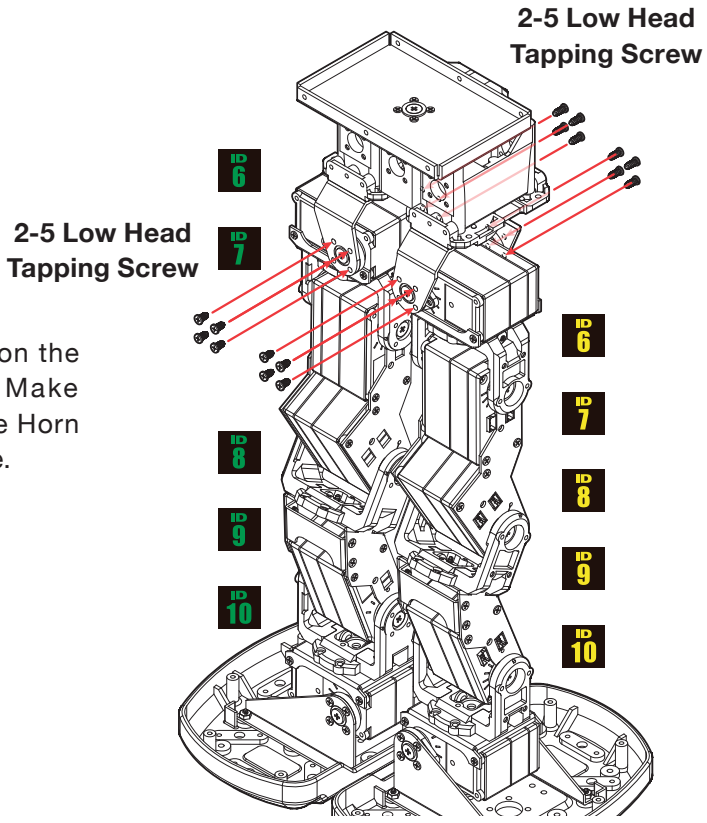
⑥ Mount each sole. Secure the Small Diameter Horn using four M2-4 Low Head Screws each and the Free Horn using four 2-5 Low Head Tapping Screws. Check the direction of the protrusion on the Small Diameter Horn. If the protrusion is not as shown in the figure, turn the Small Diameter Horn by hand to match the figure.



⑦ Mount both legs on the Hip Unit. Both the Small Diameter Horn and the Free Horn should be secured using 2-5 Low Head Tapping Screws (4 each).



* This hole is on the back side. Make sure the Free Horn is on this side.

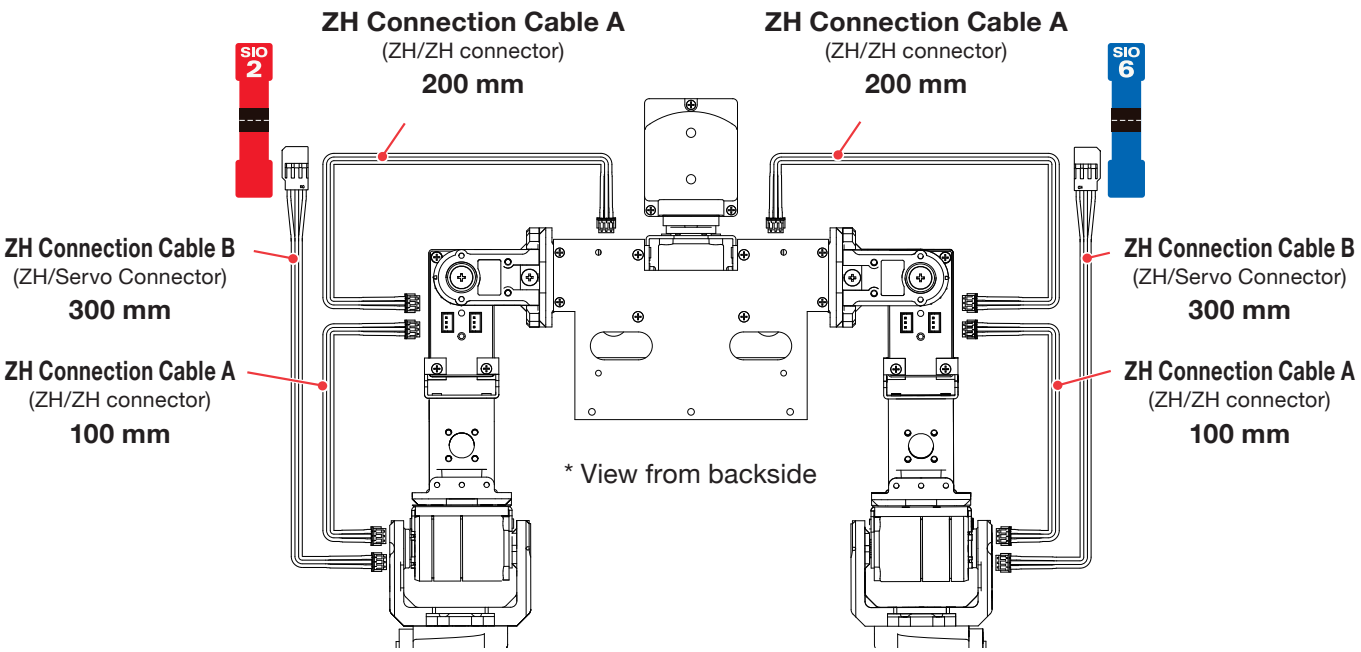


21. Wiring and Binding of Wiring

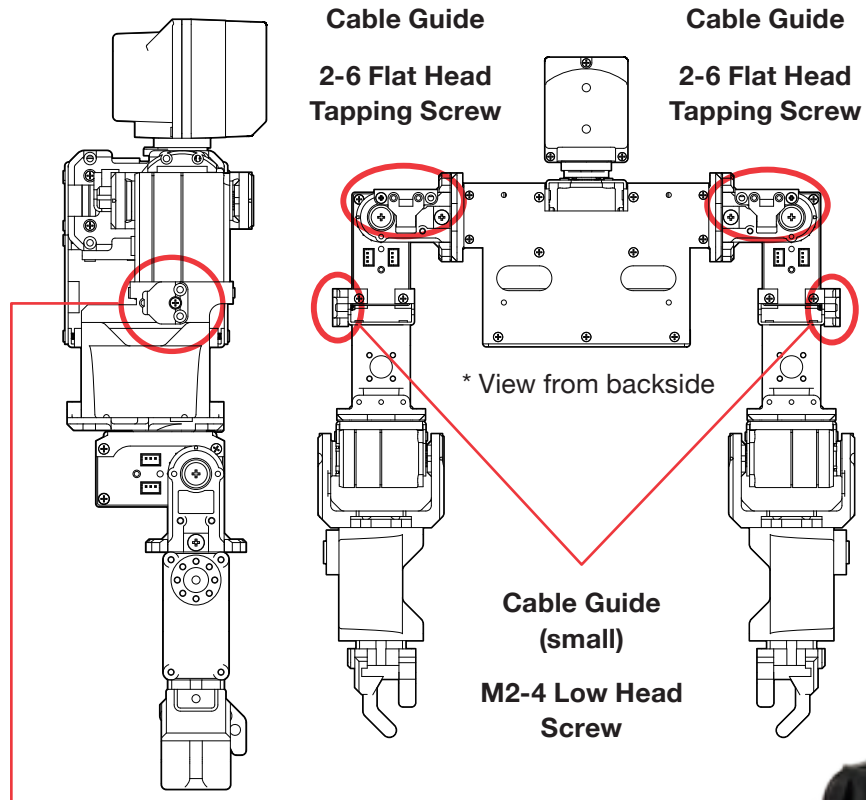
- **Required Parts**

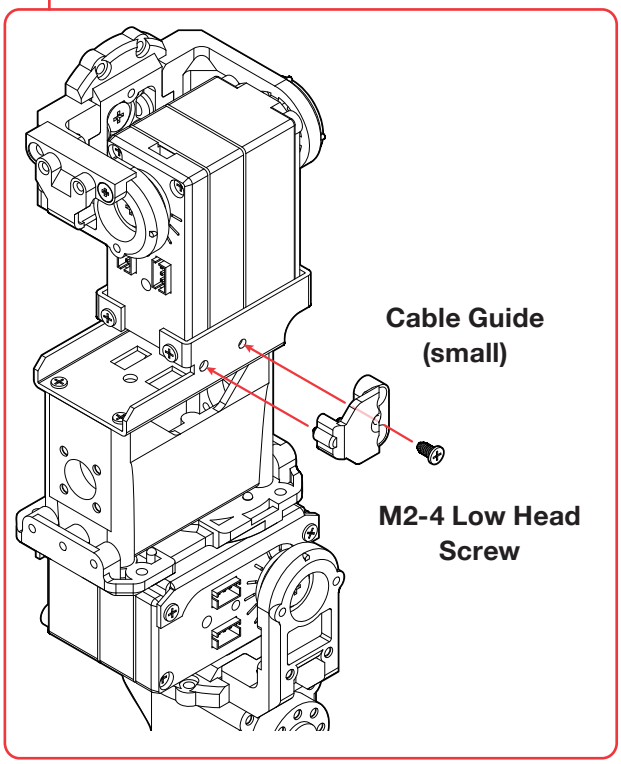
Cable Guide---------- 8
Cable Guide (small)---------- 6
M2-4 Low Head Screw---------- 4
2-5 Low Head Tapping Screw----- 4
2-6 Flat Head Tapping Screw ----- 8

① Wire the Arms in accordance with the wiring diagram.



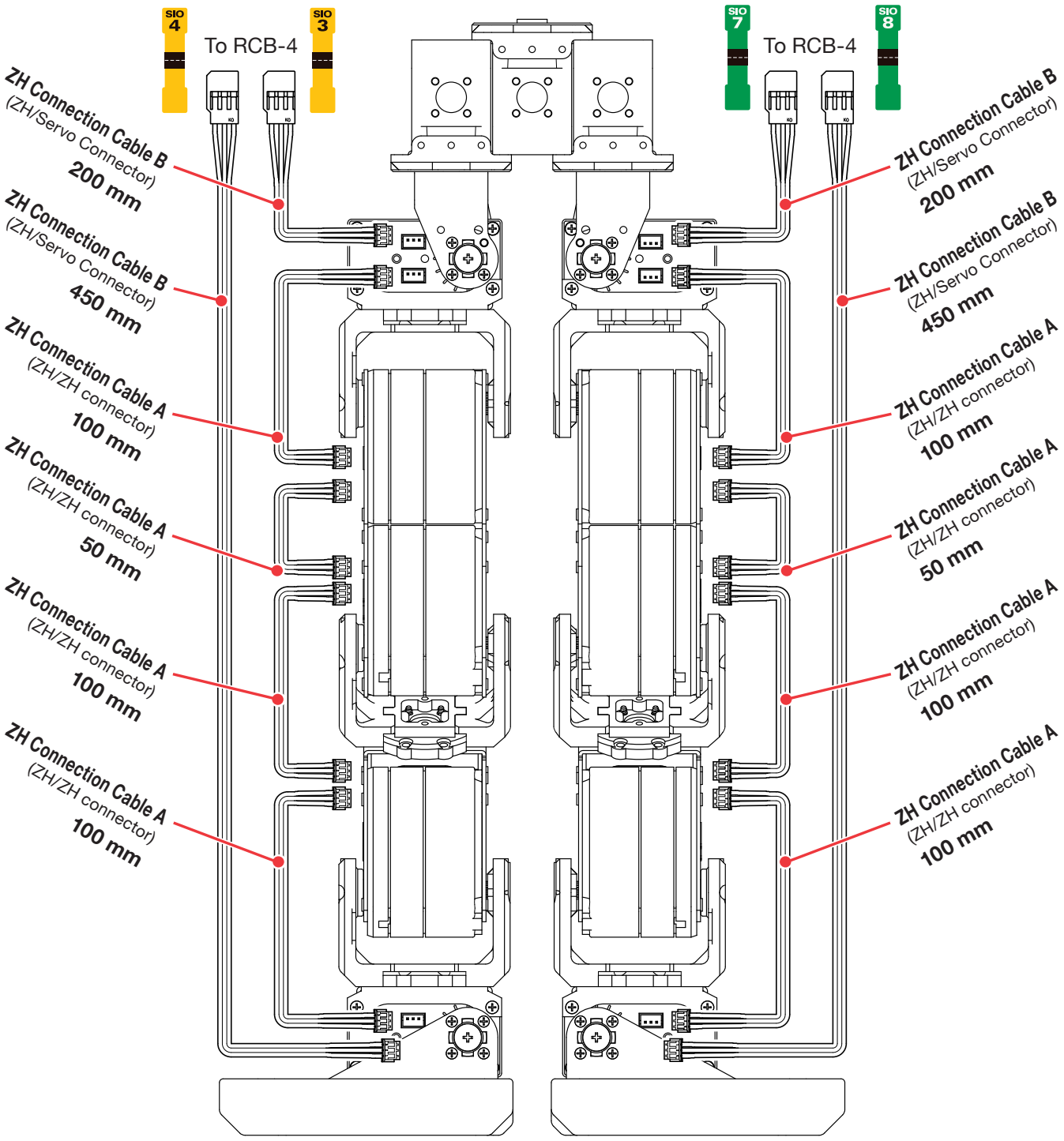
② Organize the cables using the Cable Guides and the Cable Guides (small), in accordance with the figure.





③ Leg Wiring Diagram

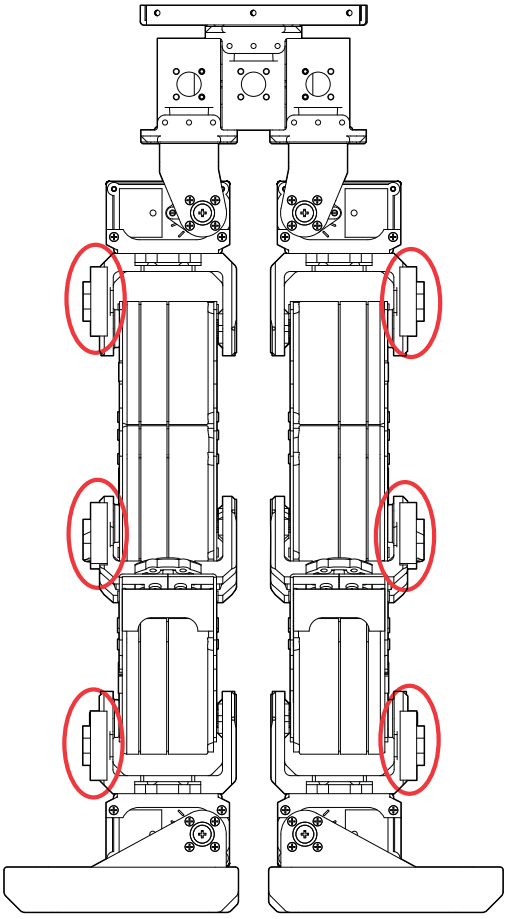
Wire the Legs in accordance with the wiring diagram.



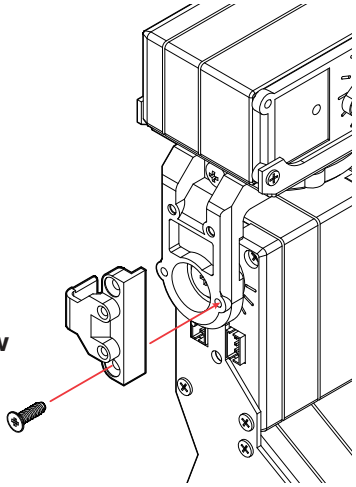
* View from backside

④ Mounting Cable Guide (6)

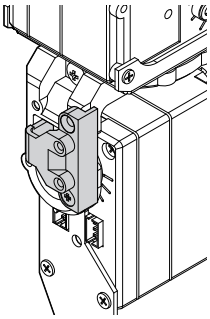
Mount Cable Guide in accordance with the figure.



* Frontal View



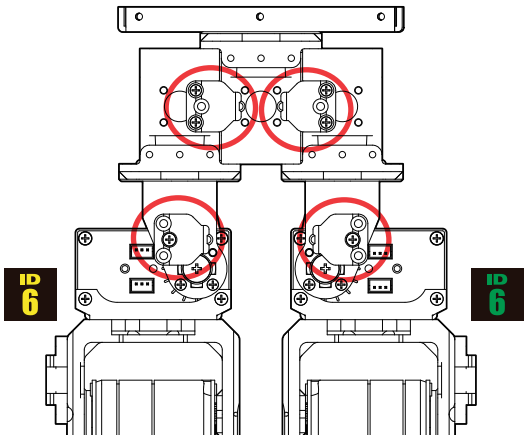
2-6 Flat Head Tapping Screw (one each)

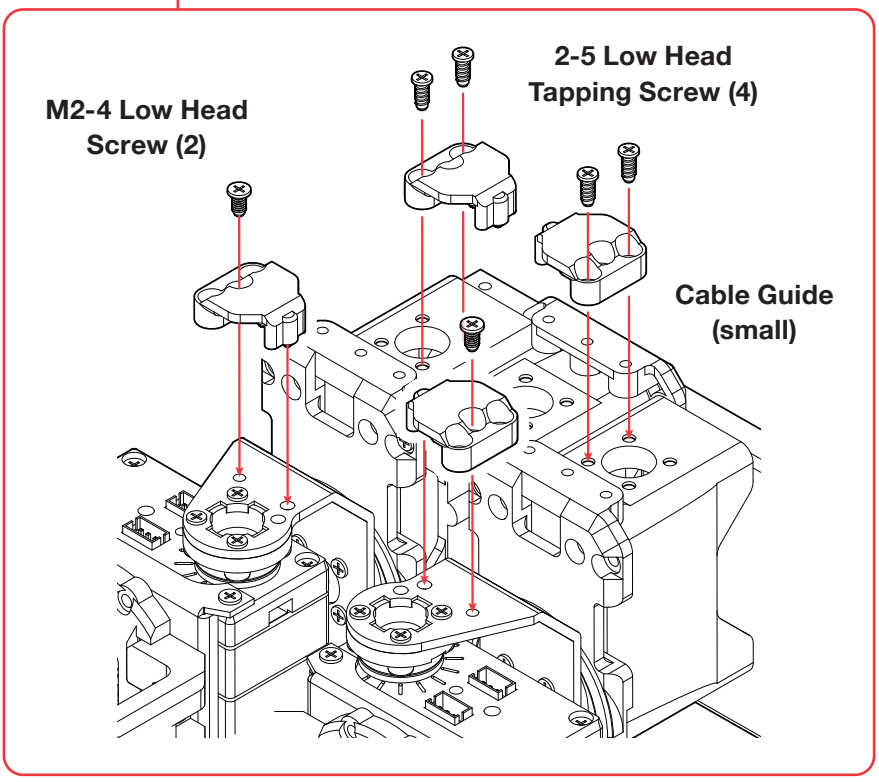


⑤ Mounting Cable Guide (small) (4)

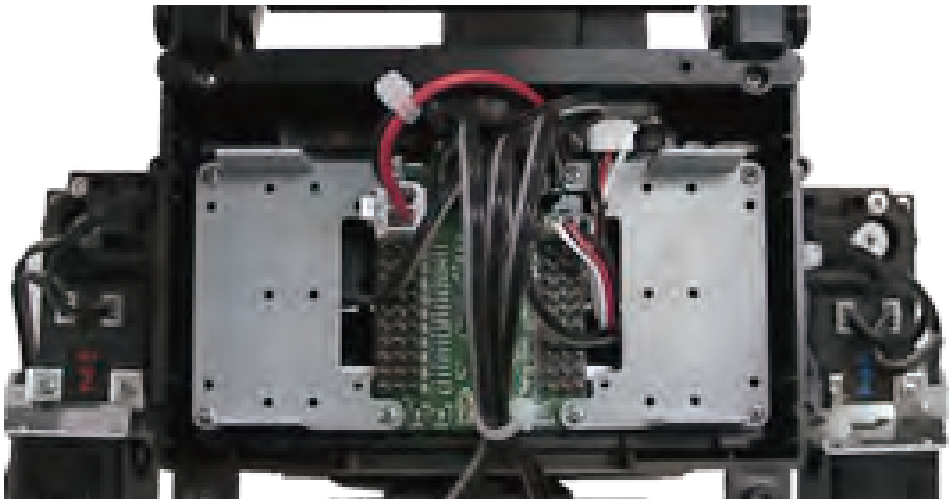
Mount Cable Guide (small) in accordance with the diagram.

* Backside View





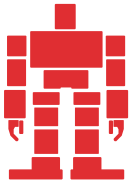
⑥ Bundle the cables using the Nylon Straps.



22. Overall Assembly

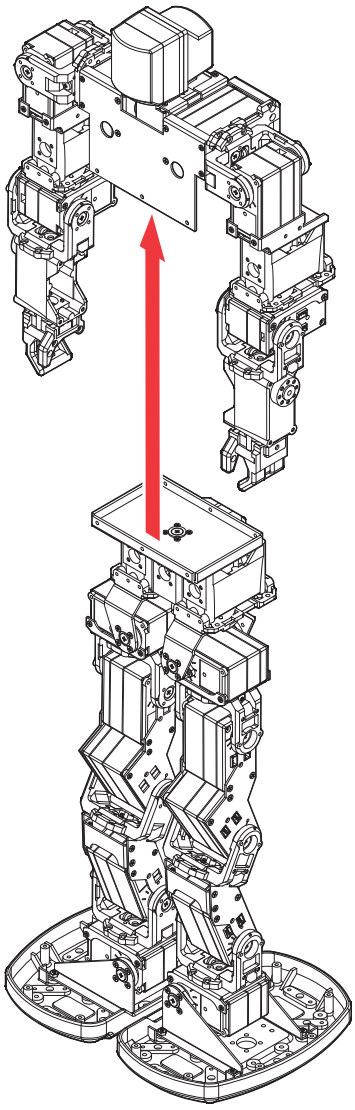
- **Required Parts**

  M2-4 Low Head Screw---------- 6

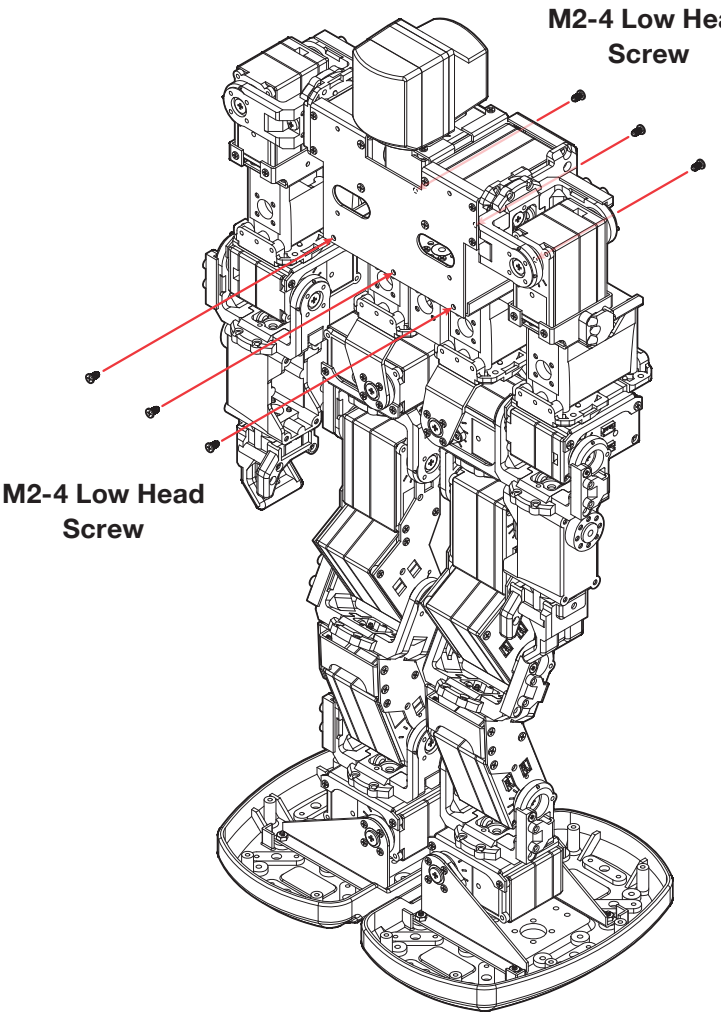


Icon Descriptions Points Tips Damage Warning Confirm

① Insert Leg Part to Torso Part.



② Secure using six M2-4 Low Head Screws.



23. Attachment - Back Pack

- **Required Parts**

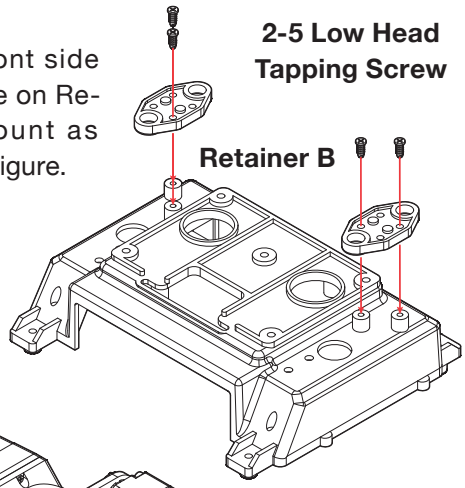
Retainer B ---------- 2
PCB Base B ---------- 1
Top Panel B ---------- 1
Top Cover B ---------- 1
Wing B-L ---------- 1
Wing B-R ---------- 1
HV Power Switch Harness --------- 1
Servo Extension Cord ---------- 1
2-5 Low Head Tapping Screw ----- 4
M2-6BH Screw ---------- 6
2-8 Low Head Tapping Screw ----- 2

Icon Descriptions Points Tips Damage Warning Confirm

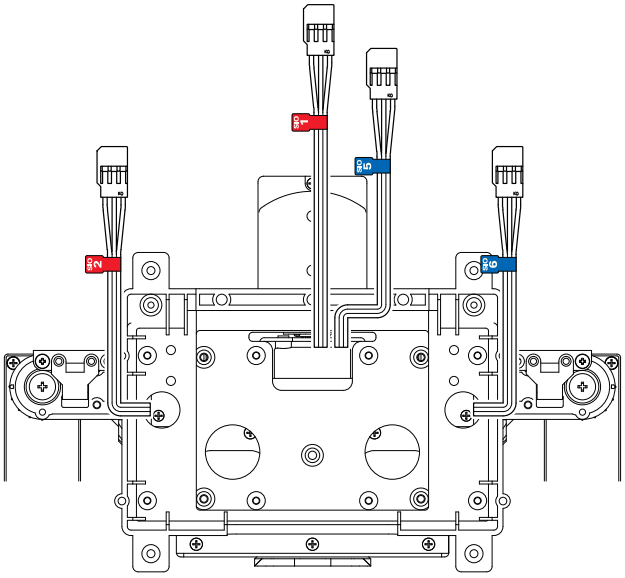
① Unplug the RCB-4HV, Power Switch and Extension Cord used for Origin Setting.

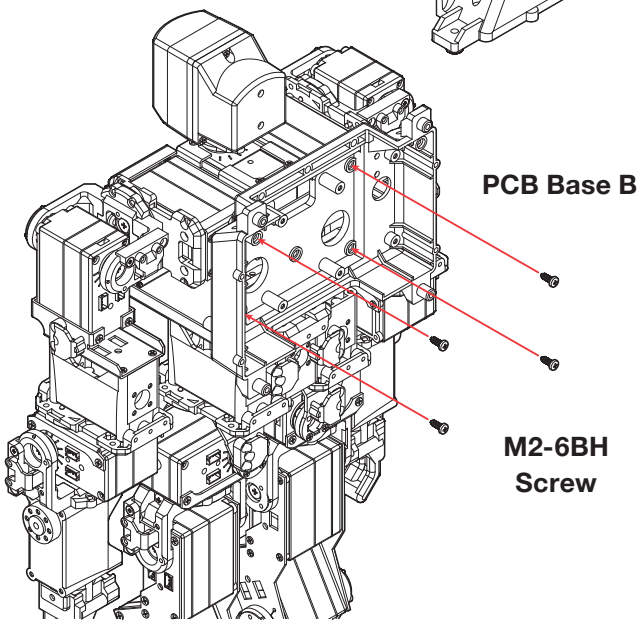
② Mount two Retainer B using two 2-5 Low Head Tapping Screws for each.

* There is a front side and back side on Retainer B. Mount as shown in the figure.

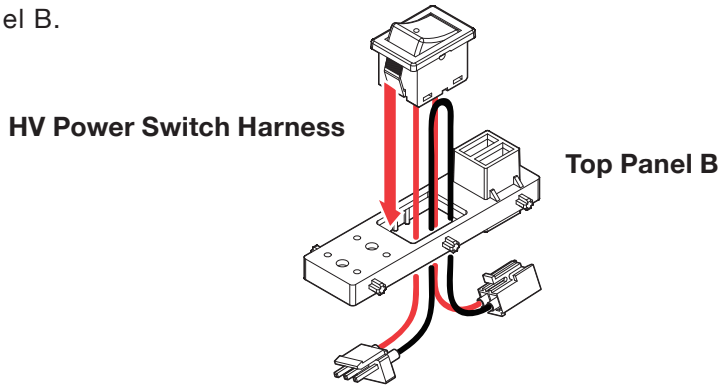


③ Route the cables as shown in the figure and mount the PCB Base B to the back of the body using four M2-6BH screws.

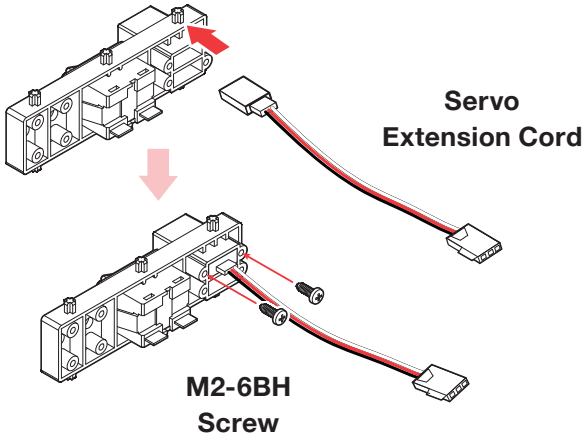




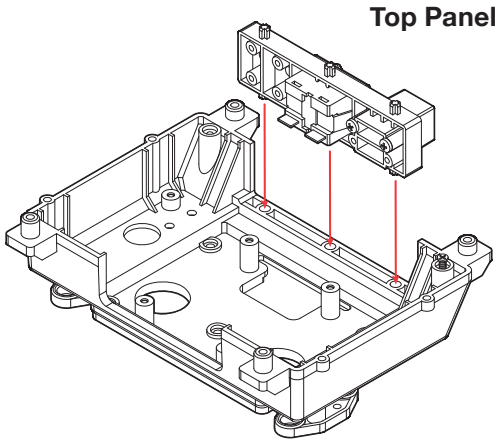
④ Plug the Power Switch to the Top Panel B.
(Push until it clicks firmly into place.)



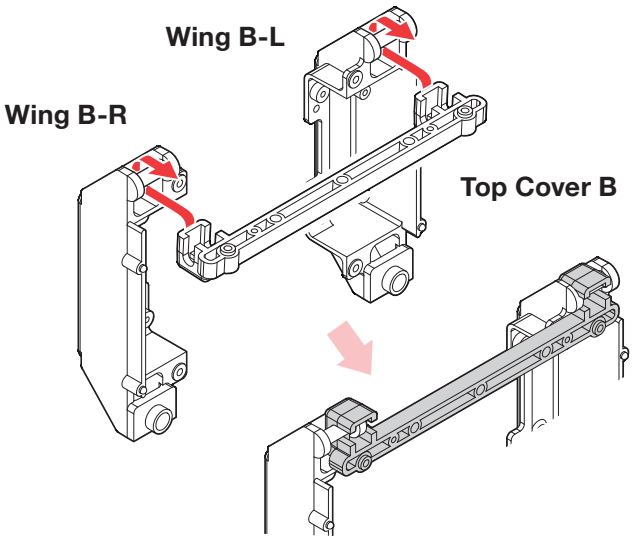
⑤ Plug the Extension Cord to the port entrance and secure it using two M2-6BH screws to avoid loosening.



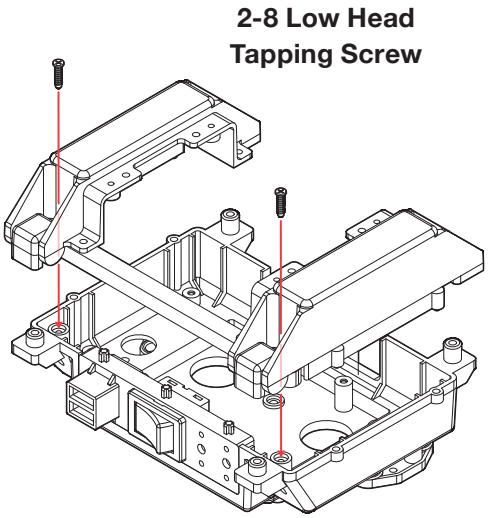
⑥ Insert the Top Panel B to the top of PCB Base B.



⑦ Hook the Wing B-L and the Wing B-R onto Top Cover B and insert it into the top of the PCB Base B.



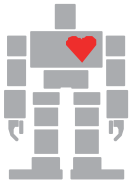
⑧ Secure using two 2-8 Low Head Tapping Screws.



24. Mounting Control Board

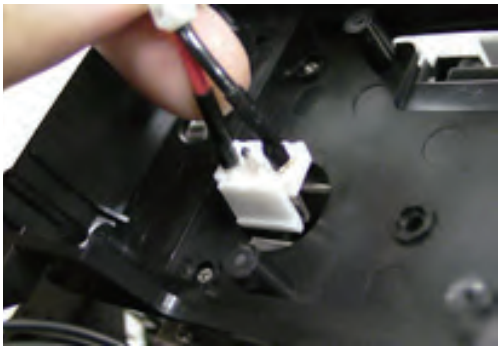
- **Required Parts**

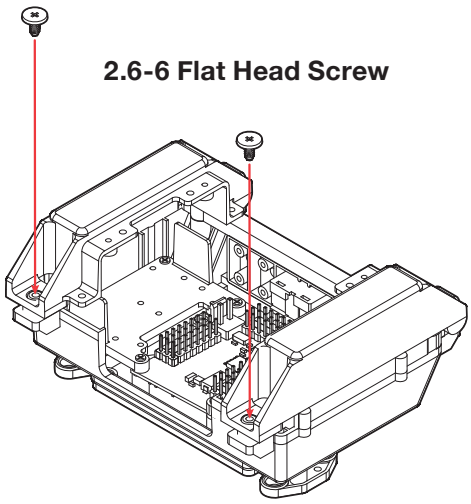
Parts Mount A---------- 2
RCB-4HV---------- 1
2-8 Low Head Tapping Screw----- 8
2.6-6 Flat Head Screw ---------- 2



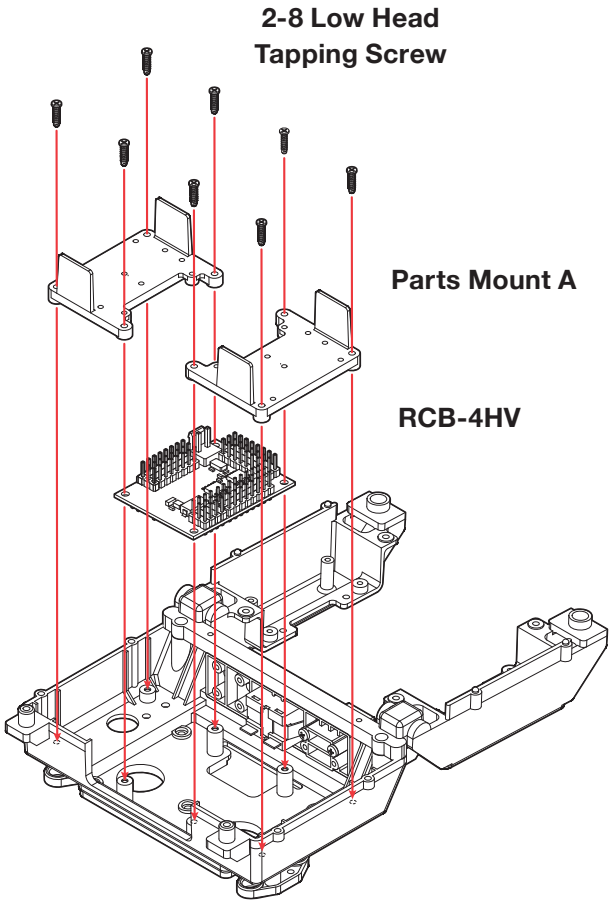
Icon Descriptions Points Tips Damage Warning Confirm

① Put the HV Connector inside the body as shown in the picture.





② Open the Wing and mount the RCB-4HV using eight 2-8 Low Head Tapping Screws so that it comes between the PCB Base B and the Parts Mount A.



③ Close both wings and secure using two 2.6-6 Flat Head Screw.

25. Wiring to the Control Board

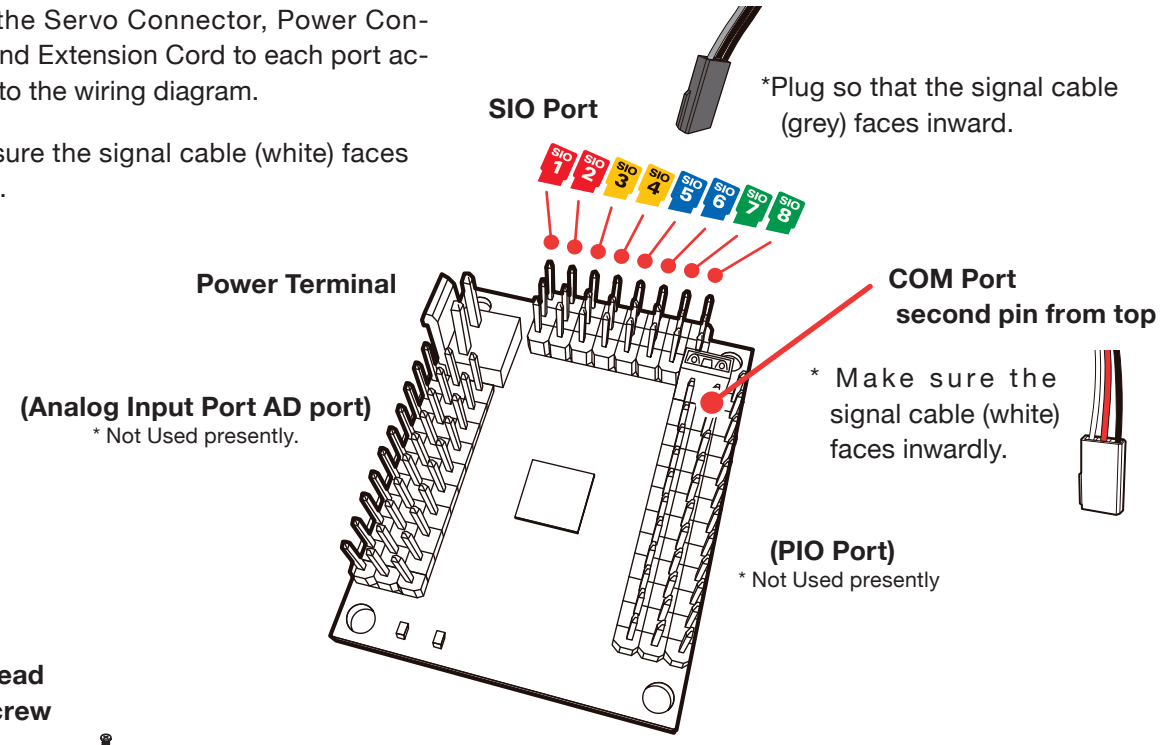
- **Required Parts**

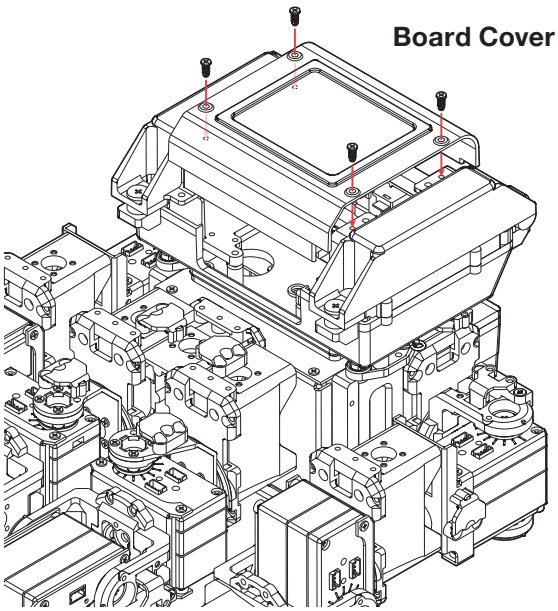
  2-5 Low Head Tapping Screw ---- 4
  Board Cover (SD1)---------- 1

Icon Descriptions Points Tips Damage Warning Confirm

① Plug in the Servo Connector, Power Connector and Extension Cord to each port according to the wiring diagram.

* Make sure the signal cable (white) faces inward.





② Secure the Board Cover using four 2-5 Low Head Tapping Screws.

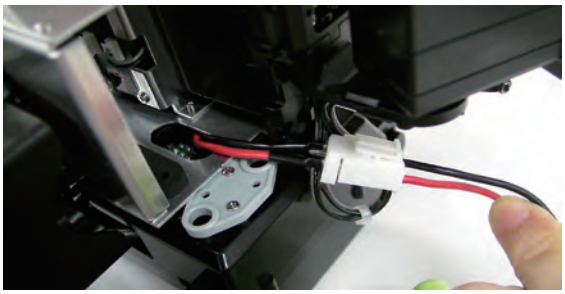
* When the cover is opened, these screws or the two 2.6-6 Flat Head Screws on the Wing are unscrewed.

26. Battery Mounting

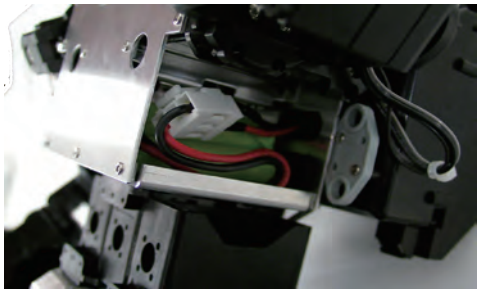
- **Required Parts**
  Charged HV Battery

Icon Descriptions Points Tips Damage Warning Confirm

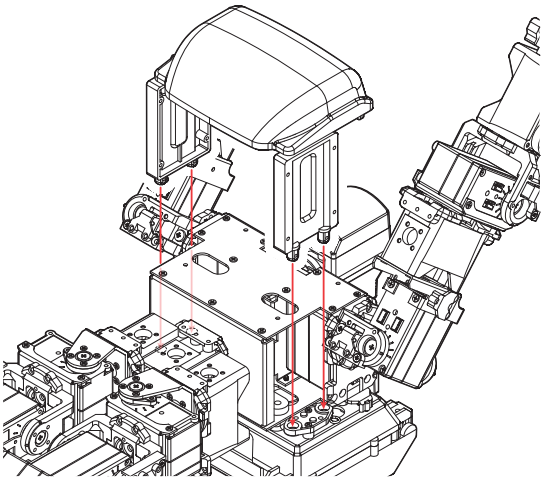
① Plug in the HV Connector for Power.



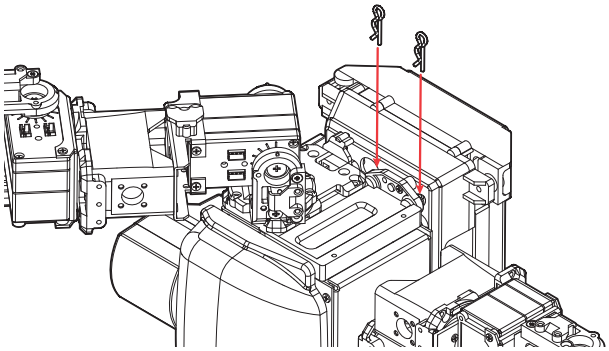
② Insert the Battery. Tilting the connector upward as shown in the picture makes it easier to insert.



③ Fit in the Front Cowl by sliding it in.



④ Fasten four Body Pins as shown in the diagram.



Setting

Trim Position Confirmation

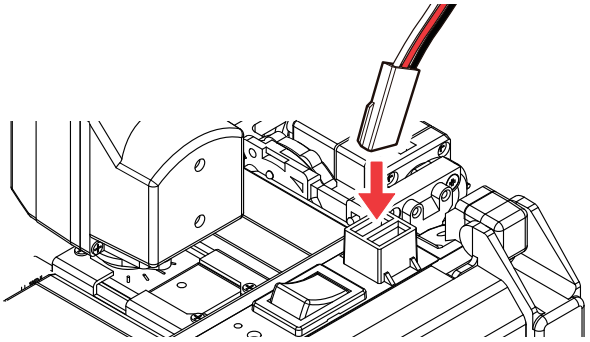
What is the Trim Position?

Up to this point, for the assembly of all units, the servo horns and servo arms were assembled at their origin (neutral position). This process is to confirm that the origin is accurately read out and that the horns and arms are mounted correctly.

If the Trim Position is set normally, proceed to set the Home Position by the following steps. “Trim Position” and “Home Position” are confusing concepts, but are very important for robots. “Trim Position” refers to the state where trim data is “0” and position data is “7500” , and servo motor is at its origin. On the other hand, the “Home Position” refers to the Robot’ s original posture (position) for the “Sample Motions” of this product to operate normally. To operate the sample motions correctly and to improve their reproducibility, the “Home Position” setting becomes very important.

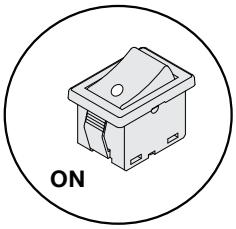
1 Connect the Serial USB Adapter HS Cable.

Connect the Serial USB Adapter HS Cable plugged from the computer to the port connector at the top of the Back Pack.



2 Run the ‘HeartToHeart4’ software application.

3 Turn the KHR-3HV power switch on.

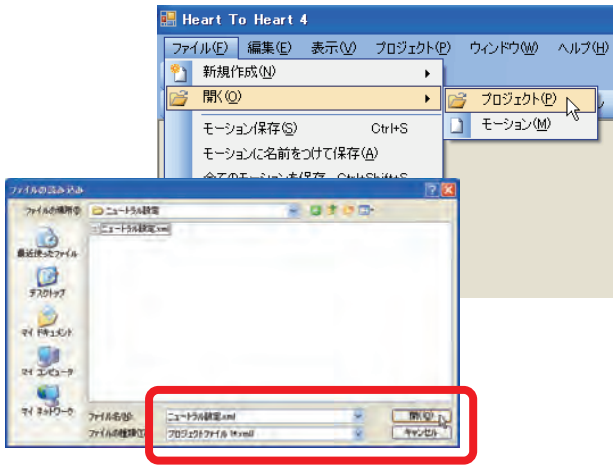


4 Open “Neutral Setting” project.

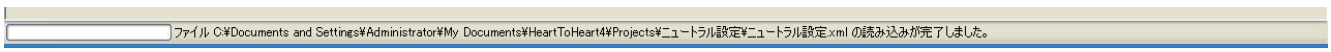
The “Neutral Setting” project created during the Origin Setting process is used.

Select “File” > “Open” > “Project” > “Neutral Setting” > “Neutral Setting .xml”

* Under standard conditions, the HeartToHeart4 folder is created in My Documents.

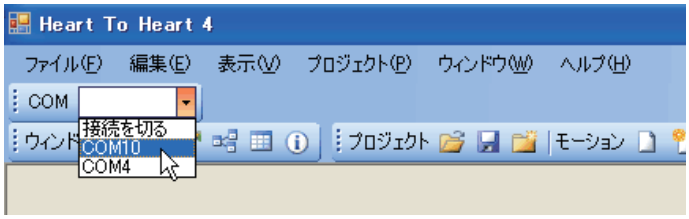


If project is opened normally, the following will appear at the bottom of the software window.

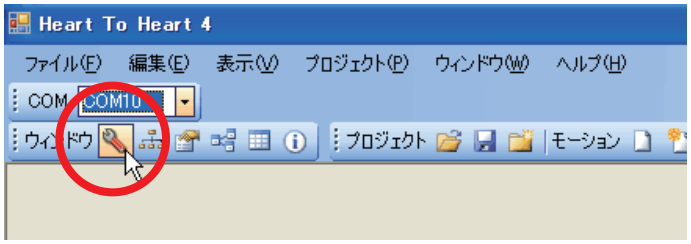


5 Assign Communication Port (COM) Number

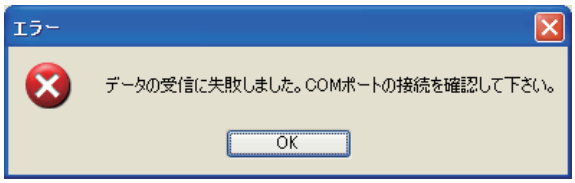
* Here, COM10 is used as an example.



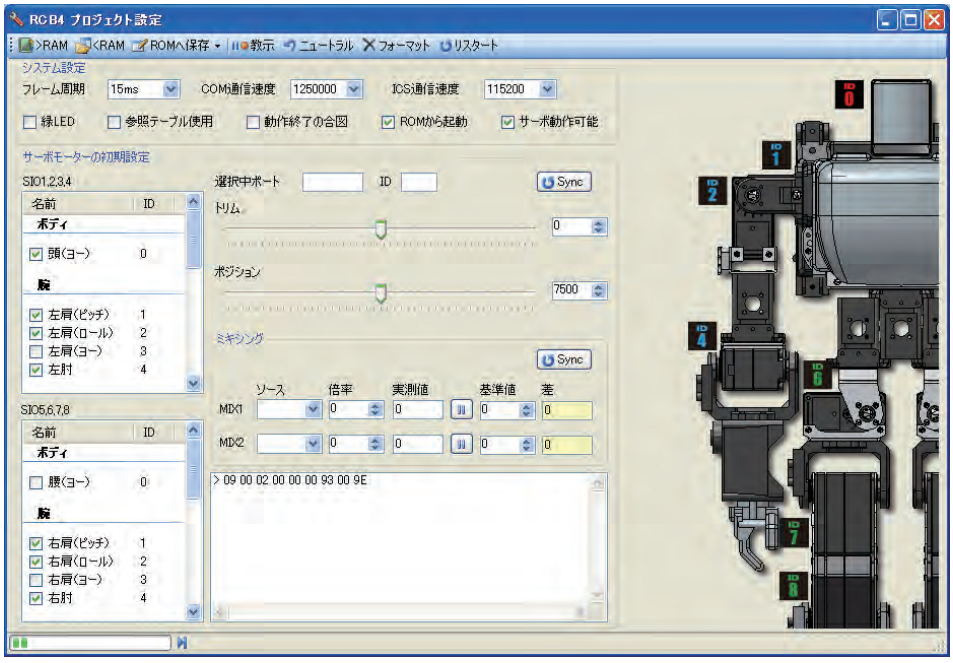
6 Select “Project Setting”



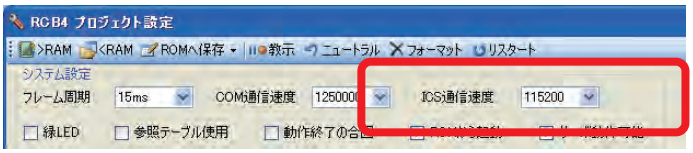
* An error message (shown in the right figure) appears when there is no communication for reasons such as robot not turned on, or communication port (COM) number not being selected.



The following window appears when normal communication is established.

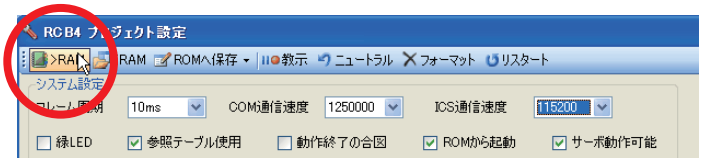


7 Set ICS communication rate to “115200”



8 Click “RAM” button.

The robot will slowly move to its trim position.



⚠ DANGER

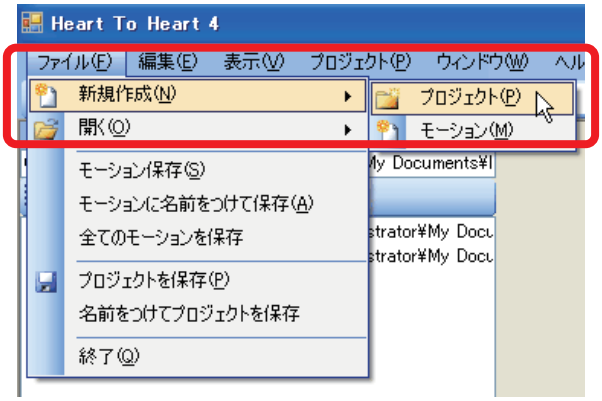
When the RAM button is clicked, the robot will assume this posture. If this is not the robots pose, then the origin setting is incorrect and must be adjusted before proceeding. Retrace the origin setting steps for the part of the robot that doesn’t match the posture shown.

Proceeding to set the Home Position without confirming this posture can cause damage to the servo motor. Make sure this posture is assumed by the robot before continuing on.

Setting the Home Position

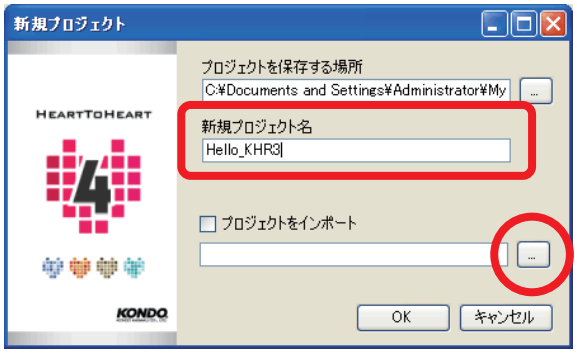
As in the preceding steps, the Home Position is set using a personal computer. The robot will finally move when this setting is completed.

1 Click “File” > “New Document” > “Project” in order.



2 In the New Project window, name the new project “Hello_KHR3” and click the Project Import button.

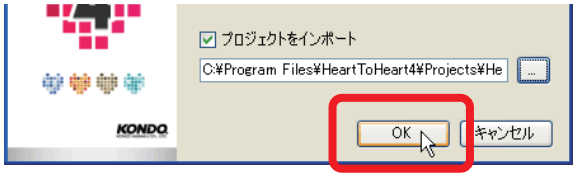
*The New Project may be named arbitrarily. Do not change location of file unless necessary. Under standard conditions, projects are saved in the HeartToHeart4 folder in My Documents.



3 Select “Hello_KHR3” in “Projects” from the “HeartToHeart4” folder created in “Program Files” , and click “OK” .

* Unless changed after installation of software, “HeartToHeart4” folder should be found in “C:\Program Files” .

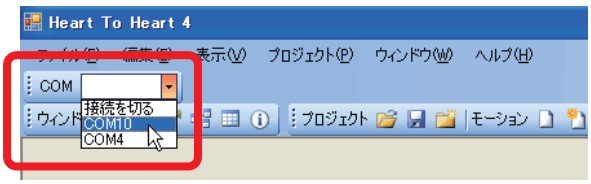
4 Return to the New Project window and click “OK” .



5 Assign a Communication Port (COM) number in the main window.

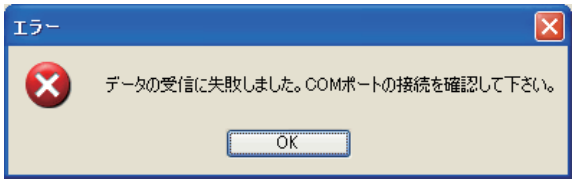
* This step is unnecessary if it has already been set.

* Here, COM10 is used as an example.

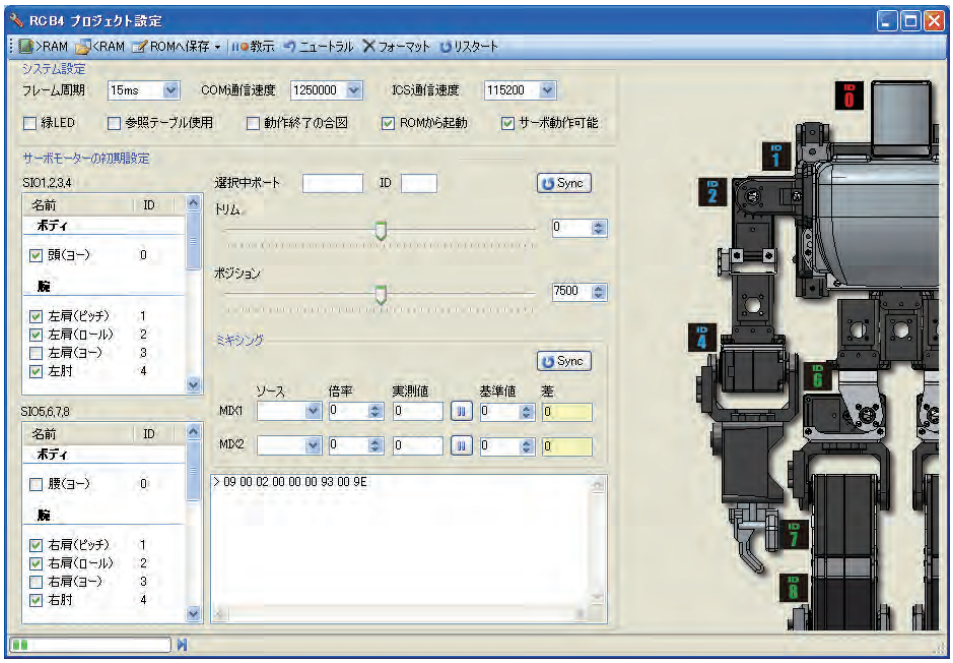


6 Select “Project Settings” .

* An error message as shown in the right figure appears when the robot is not turned on, or the communication port (COM) number is not selected.



The following window appears when normal communication is made.

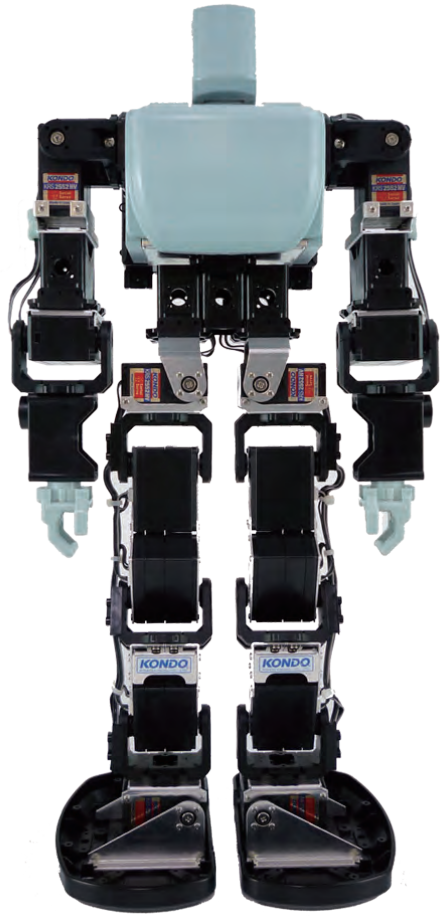


7 Set the ICS communication rate to “115200” .

* This step is unnecessary if it has already been set.

8 When the “RAM” button is clicked, the project standard values are sent to the RCB-4 and the robots servos will operate.

The robot will slowly move to its Home Position.



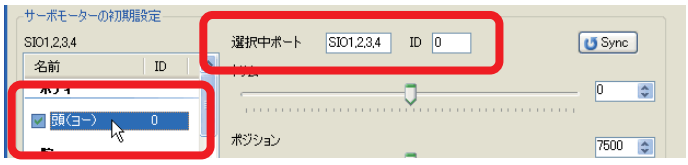
When the RAM button is clicked, the robot will assume the posture indicated in this picture. This Home Position is a rough approximation and may differ slightly depending on the method of assembly. (* It is necessary to be as close as possible.)

The posture offset is adjusted by the steps indicated in the following section.

If the position assumed is not as shown in the graphic (upright position), there may have been a mistake in the servo mounting during the assembly process, for example. Check the servo IDs with reference to p. 18 “List of KHR-3HV IDs” in detail.

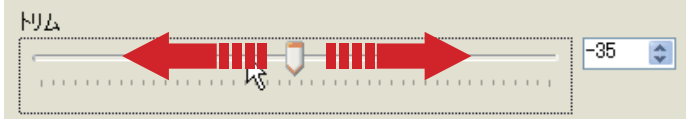
9 Choose the servo motor you want to adjust in the “Servo Motor Initial Setting” section.

The servo motor [ID 0] (red) connected to SIO1 channel is used as an example.



10 Press “Sync” button and adjust using “Trim” slide bar.

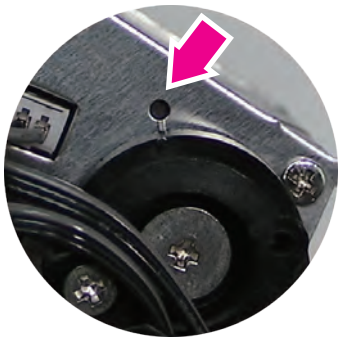
* The servo will move in sync with the slide bar.



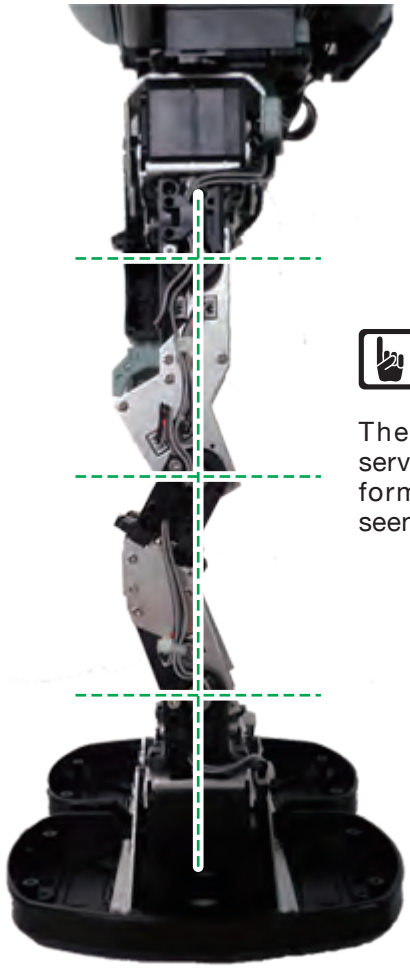
11 Adjust the other servos using the same steps.

Adjust the position of each servo in the open adjustment window and adjust the Home Position. Home Position is defined as the upright standing position. Home Position is an important position and becomes the base or reference point in performing motions. In particular, the left and right feet must be aligned accurately or else sample motions such as walking may not proceed smoothly. Align the robot servos accurately by referring to the following picture.

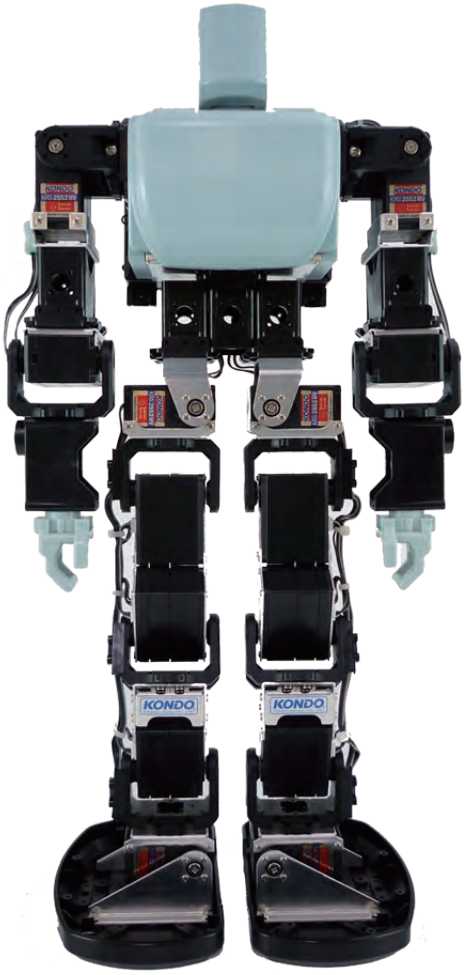
The position of the back side of the feet is especially important. Stability can not be obtained unless both feet are aligned.



There are marks (holes) called Neutral Gauge on each frame. Aligning this mark and the protrusion on the arm can be used as a reference indicator for the Neutral Position.

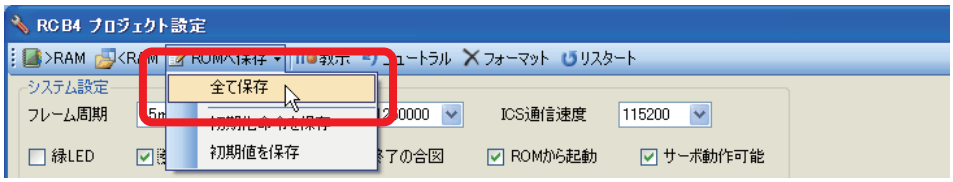


The output axis of each servo on the leg/feet should form a straight line when seen from the side.

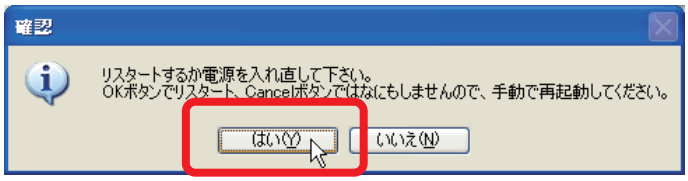


12 After setting each servo, select “Save All” in “Save to ROM” .

* clicking this button sends data to the robot and Home Position is recorded.

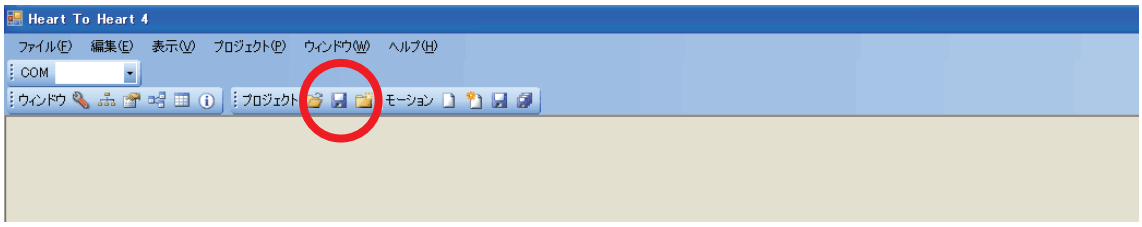


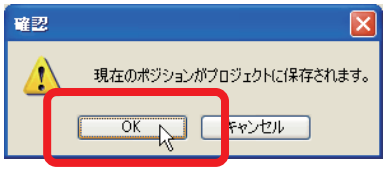
13 A confirmation screen appears. Press “YES” .

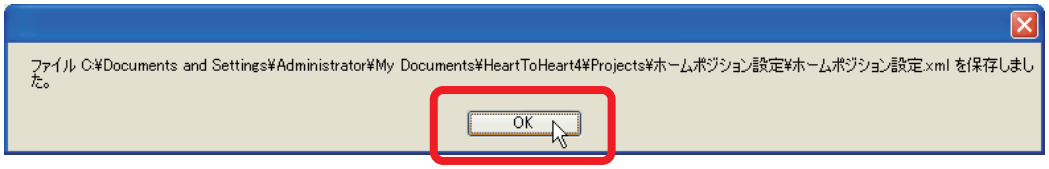


14 Return to the Main Window and press “Save Project” .

* clicking this button saves data in the computer, making it possible to read this data next time.





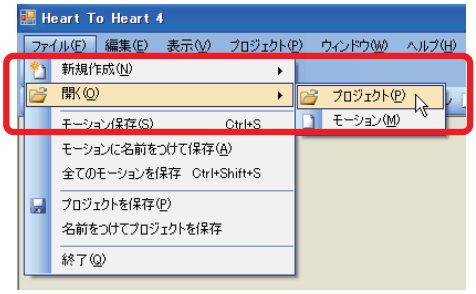


15 In order to confirm the setting process was successful, turn the robot OFF and then turn it ON again. If the robot slowly moves to the set position, the Home Position Setting was successfully completed.

Playing Sample Motions

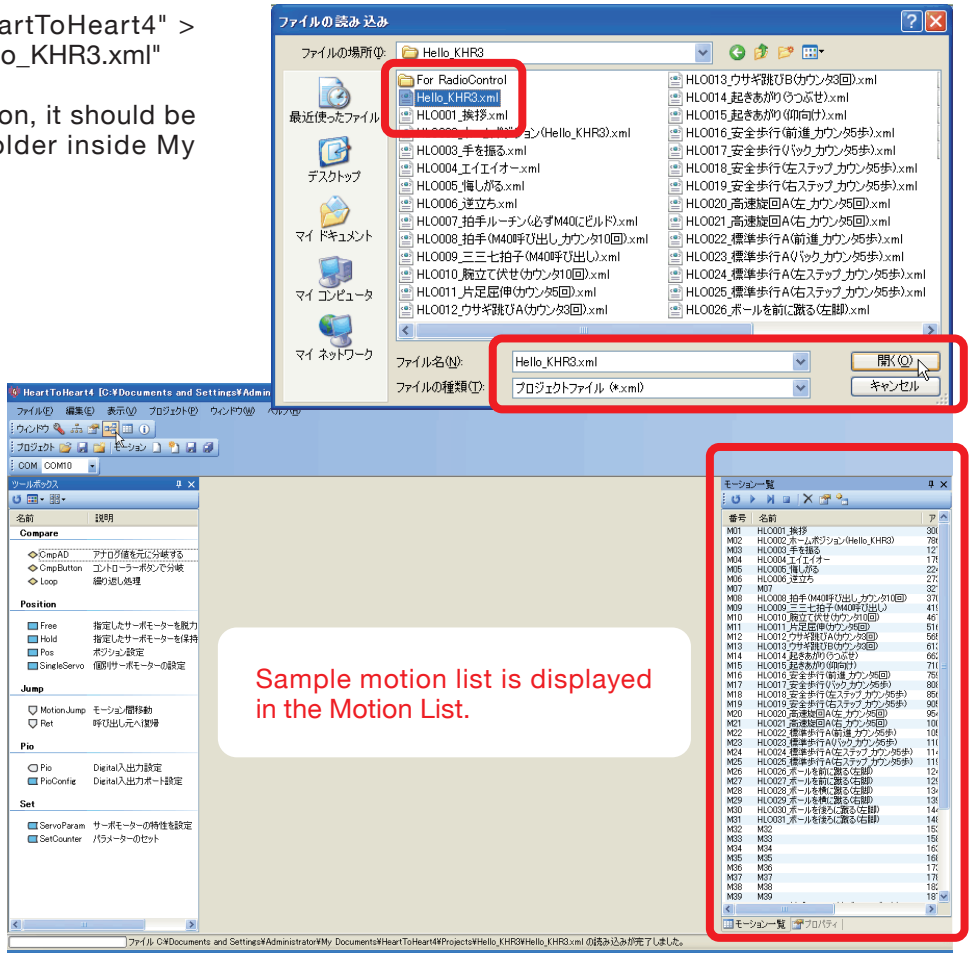
Load and play the sample motions for KHR-3HV. If the robot falls or does not move normally, go back to "Home Position Setting".

1 Click “File” > “Open” > “Project” in order.

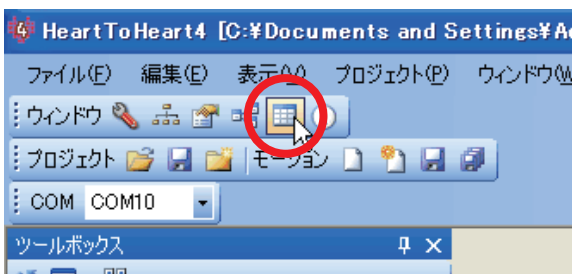


2 Select "My Documents" > “HeartToHeart4" > “Projects" > “Hello_KHR3" > “Hello_KHR3.xml"

* Unless changed after installation, it should be found in the HeartToHeart4 folder inside My Documents.

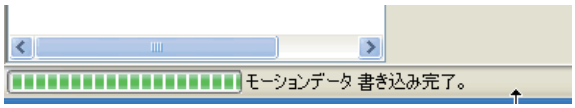


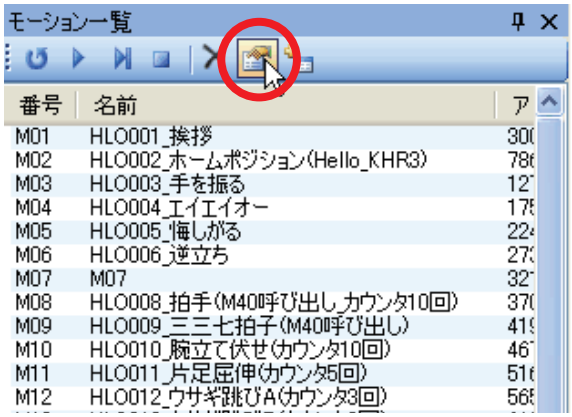
* If the Motion List window is not displayed, press the Display Motion List button in the top left corner of the screen.



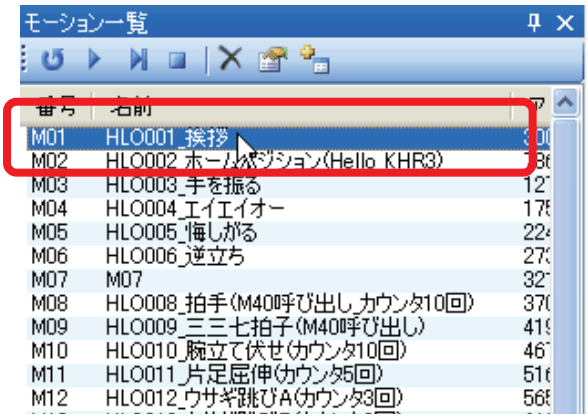
3 Press the "Write Motion Data" button in the Motion List.

* When the write is completed, the Write Completion Status will appear at the bottom left corner of the screen.



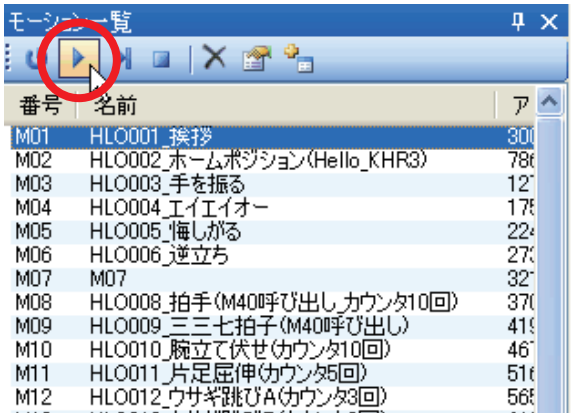


4 Click the motion name you wish to play in the Motion List.



5 Press the Play button in the Motion List window.

* Caution! The robot will actually start moving once the Play button is pressed.



To play other motions, repeat steps 4 to 5. If you wish to stop the robot, press the Stop button.

That completes the instructions on assembly and motion production. For the software operation instructions, refer to the “HeartToHeart4 User’ s Manual” document file.

KONDO

KONDO KAGAKU CO., LTD.

KHR-3HV