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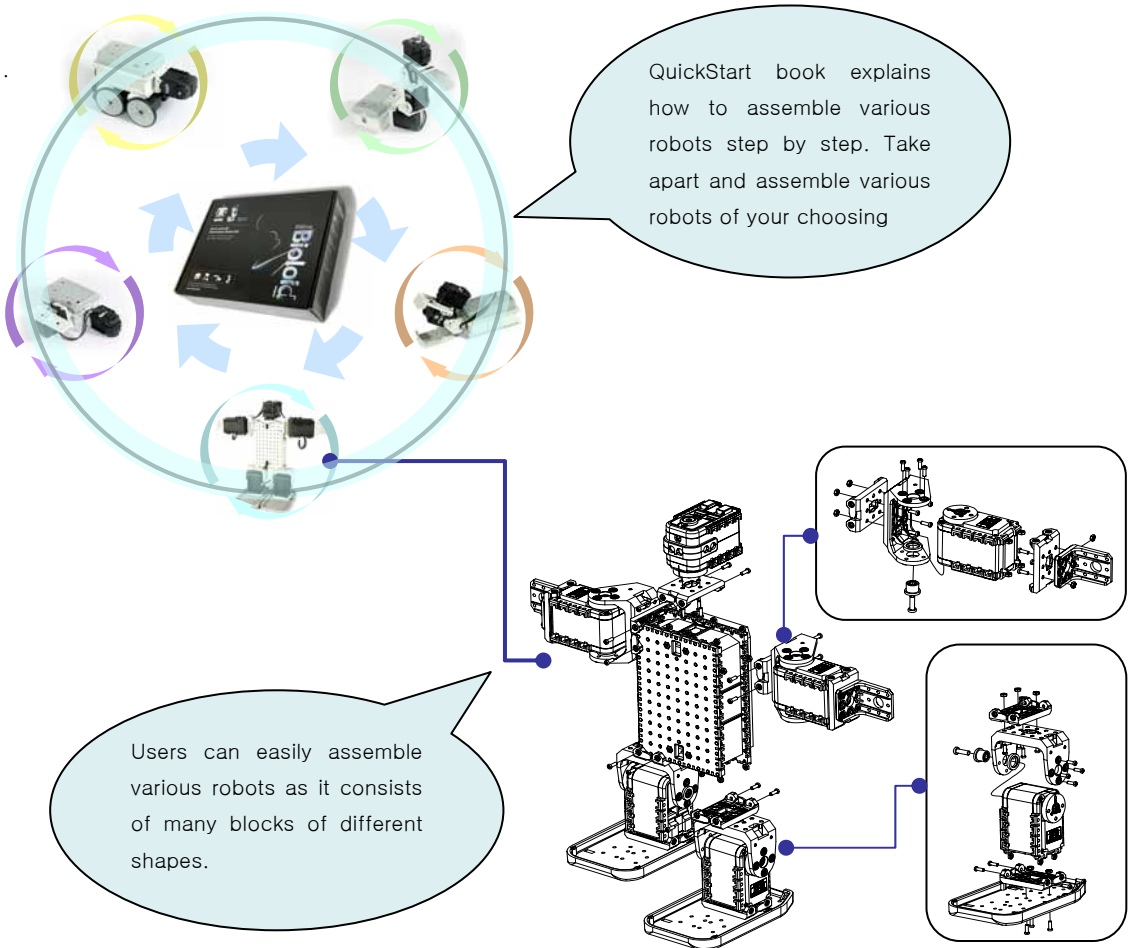
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1 . Starting Bioloid

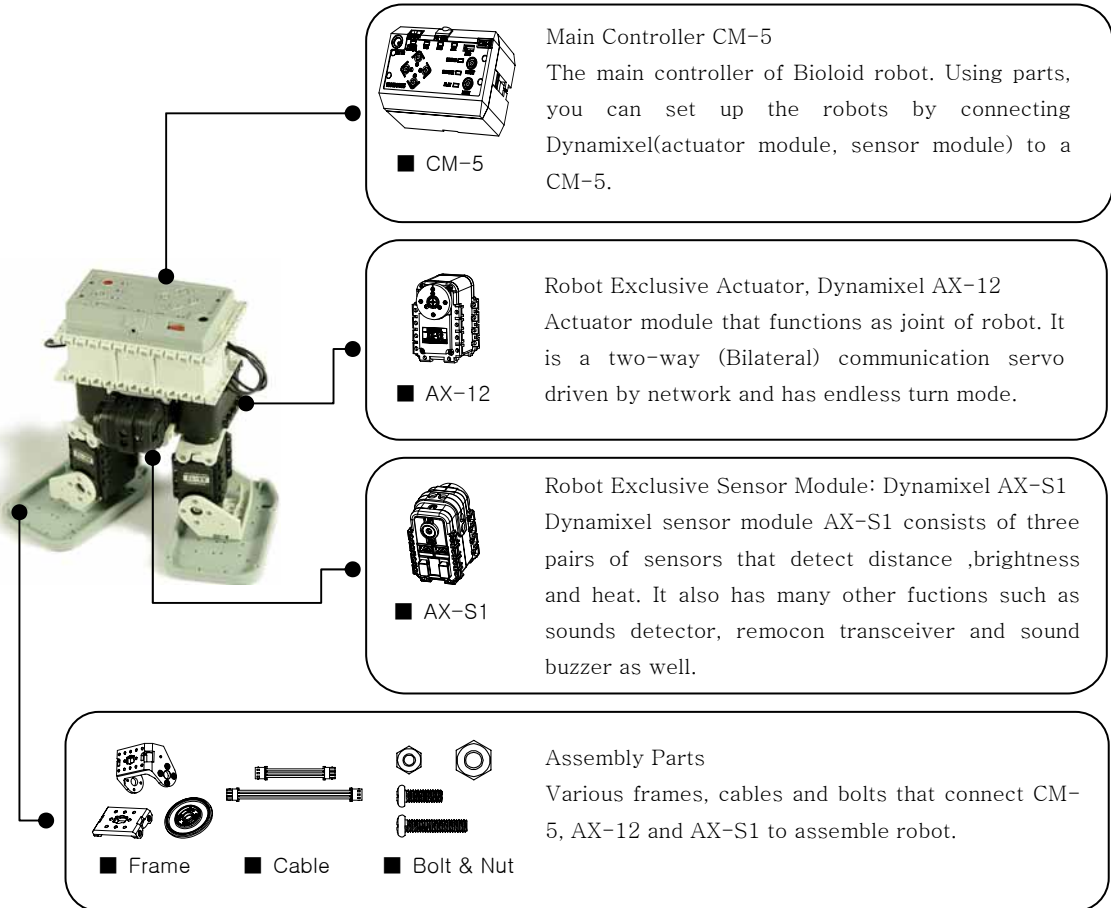
1 – 1 . What is Bioloid?

Bioloid is composed of block-shaped parts where users can assemble robots in various shapes and functions – making it truly all-around robot kit. Furthermore, we provide software that enable users to connect assembled robots to PC, allowing them to program the robots. With the instruction guides that clearly explain the details of assembling the robots, and with the downloadable materials that will further help users, the users can create the robots in any styles they choose.

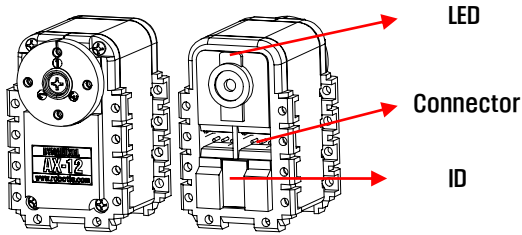


1 – 2 . Parts of Bioloid

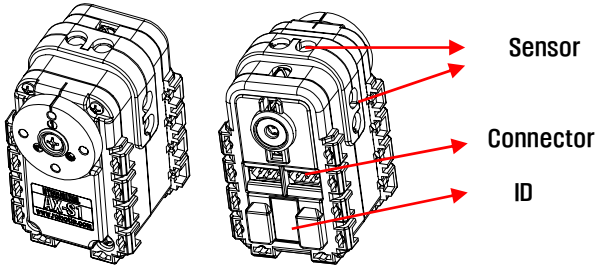
○ Main Parts of Bioloid



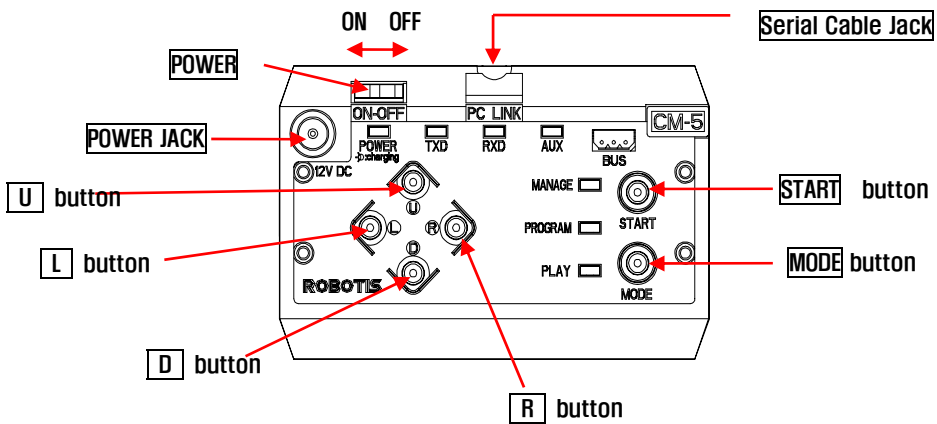
○ Names of each part of AX-12 (Actuator)



○ Names of each part of AX-S1 (Sensor Module)



○ Names of each part of CM-5








1 – 3. Installing Bioloid Software

1 – 3 – 1. The Contents of Bioloid' s CD

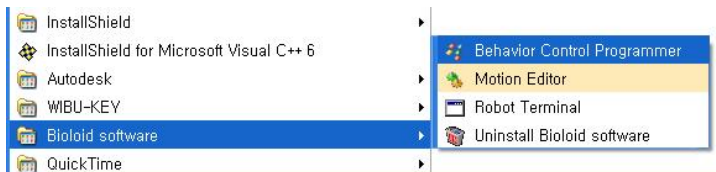
Many helpful materials and instruction are included in the CD.



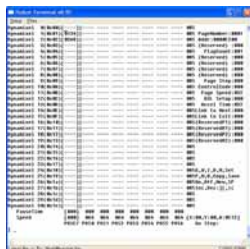
-  Software : Programs that needs to be installed in PC in order to operate Bioloid robot.
-  Manual : QuickStart, User's Guide and manuals for the Dynamixel (AX-12, AX-S1).
-  Applied Robots : Various programs and video clips for Bioloid robots
-  Examples : Robot program sources that are explained in the User's Guide.
-  Help Files : Help documents and video clips that assist in operating Bioloid robots

1 – 3 – 2. Installing Software

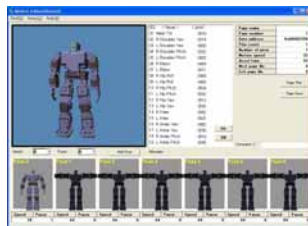
The CD will execute autorun when the users put the CD inside. If the automatic setup does not initialize, go to "Software\Setup.exe" and setup the program manually. When the setup is finished, Robot Terminal, Motion Editor, and Behavior Control Programmer will appear in the Start Menu of Window



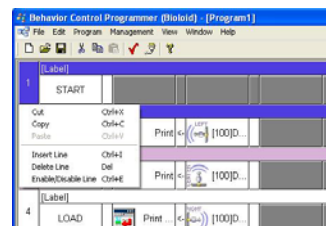
← When software is installed



Robot Terminal



Motion Editor



Behavior Control Programmer

1 – 4 . How to Use Bioloid

○ **Manuals**

▷ **QuickStart**



QuickStart explains how to assemble and operate robots quick and easily, and how to download a program. Printed QuickStart book is provided for your convenience.

▷ **User' s Guide**



User' s Guide explains the operating principle and the program process of Bioloid Robot in detail. Once mastered, the users can assemble robots in any styles that they like. The User' s Guide (PDF document) is included in the CD.

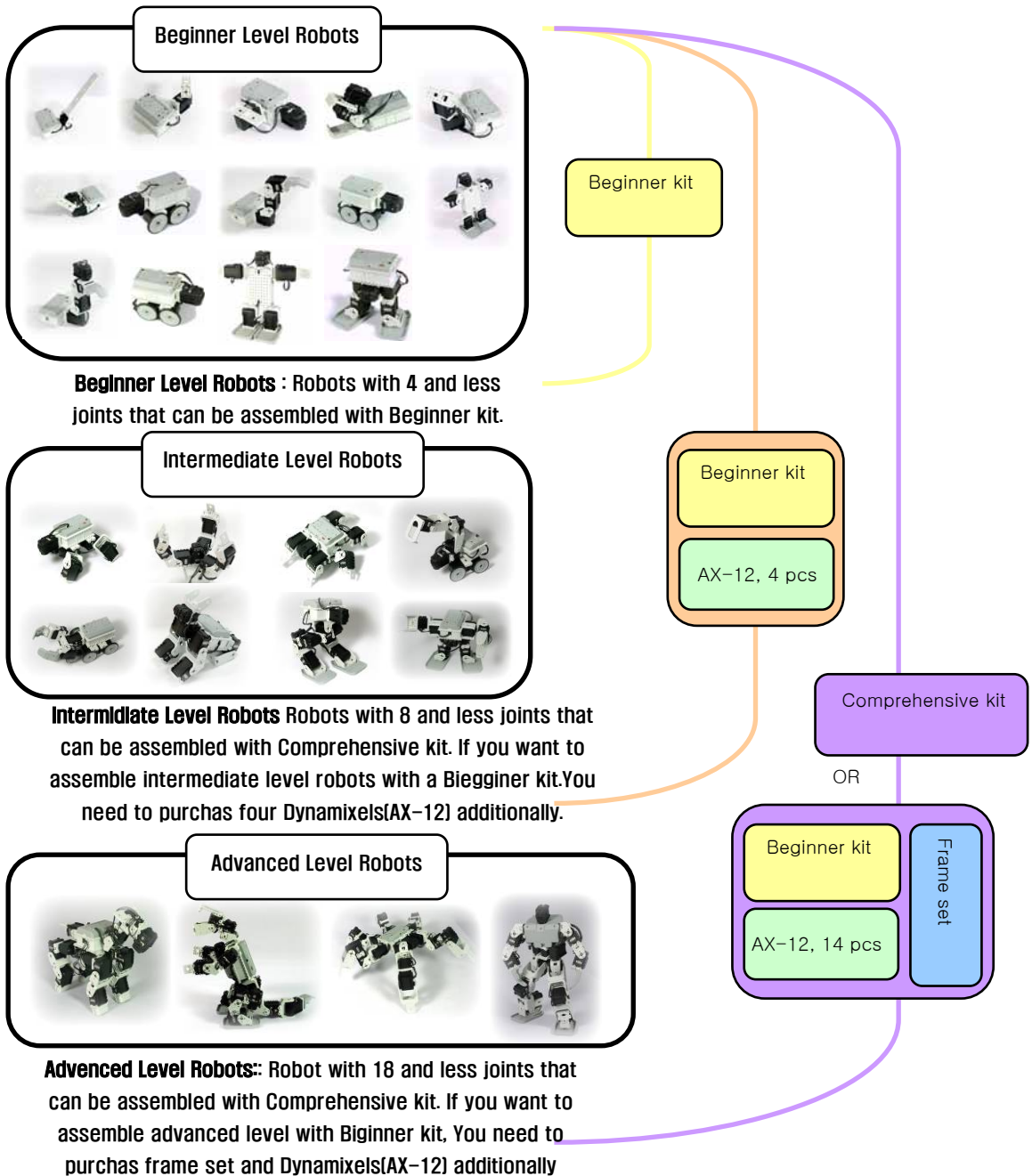
▷ **AX-12 Manual**

This manual is generally referred by the experts in the field. If the users want to know the advance functions of AX-12, they can check out this manual. It is a PDF document and it is included in the CD.

▷ **AX-S1 Manual**

This manual is generally referred by the experts in the field. If the users want to know the advance functions of AX-S1, they can check this manual. It is a PDF document and it is included in the CD.

○ Robot examples and Bioloid Kit Series

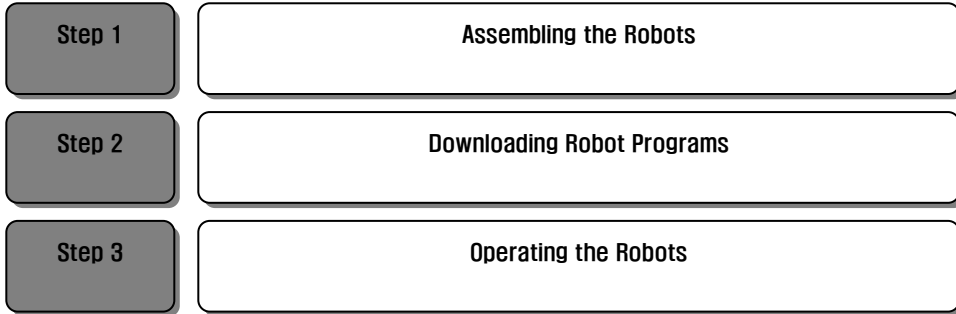


◆ In addition, you can assemble various robots in more creative ways. We also provide Expert Level kit that has systematic education process.

2 . Assembling Bioloid

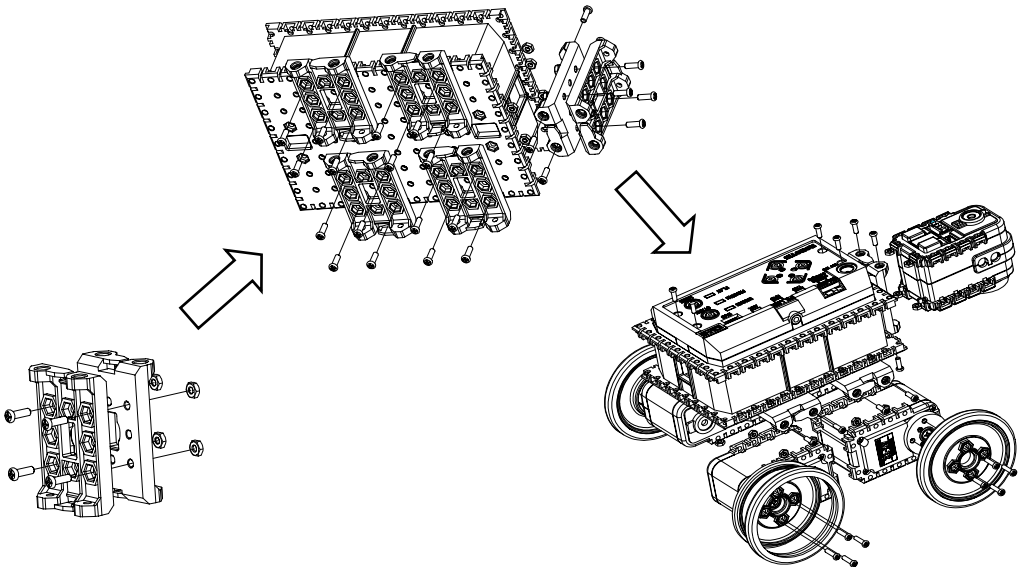
2 – 1 . Robot Assembling Orders

Robot assembling orders .



2-1-1 . Assembling the Robots

Assemble the robots in orderly refer to assembly map in QuickStart.

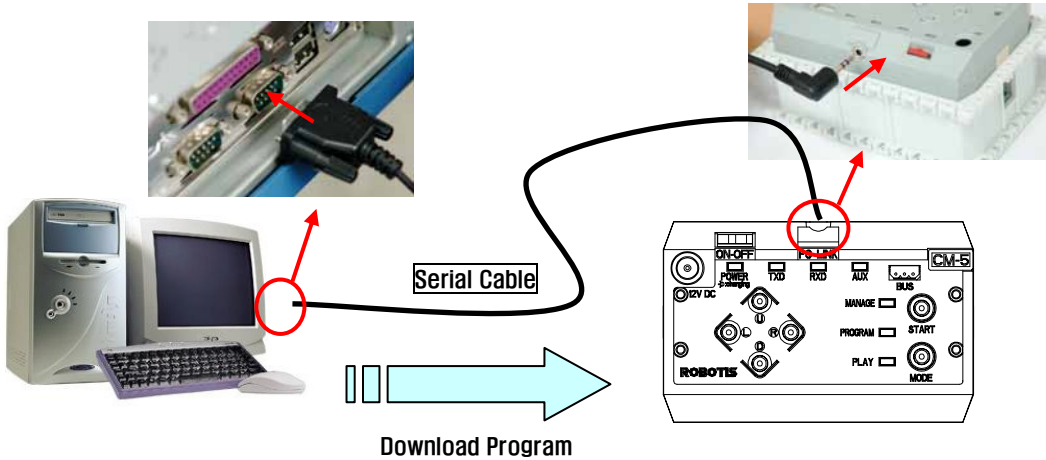


[Example]

※ Easy instruction to insert nuts for AX-12, refer to “Help Files\Inserting nuts for AX-12.wmv” video clip in CD.

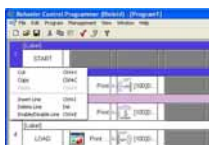
2-1-2. Downloading Robot Programs

To activate the robots, the users must use the program. Transferring robot program from the PC to CM-5 is called "download."

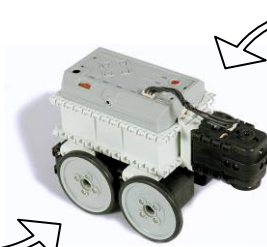


※ If your PC does not support Serial COM Port, install USB2Serial converter. USB2Serial converter is a device that converts USB port to Serial COM Port and can be easily found in PC accessory corners.

There are behavior control program and motion data for the robot program of Bioloid. As the name indicates, the behavior control program controls the movement of the robot. In case of robot that involves many number of joints, it is difficult to manage the robot's movement with the behavior control program only. Motion data was added to control the multi-joints movements of the robot additionally. Behavior control program is necessary all the time when you activate the robot but motion data does not essentially need.



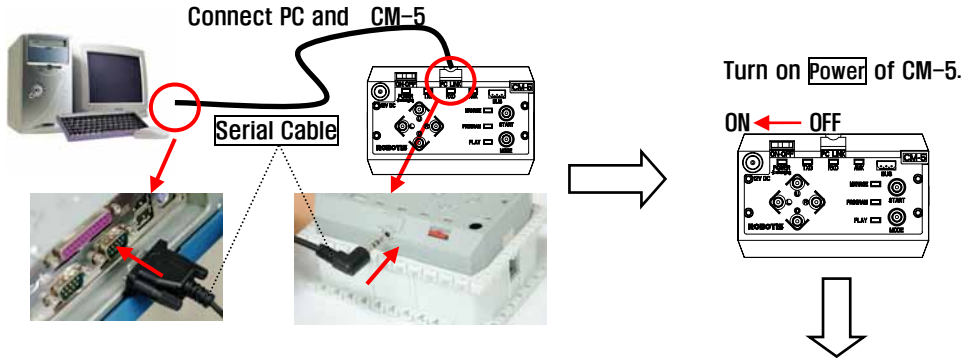
**Behavior Control Program Download
(Required)**



**Motion Data Download
(Optional)**

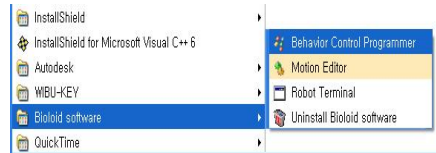
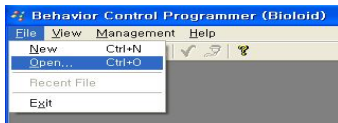
○ How to download Behavior Control Program

The filename extension of Behavior Control Program is “bpg.” The users must download this program to activate the robots.



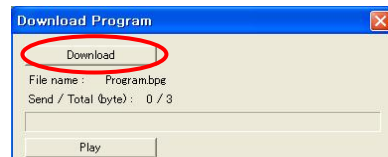
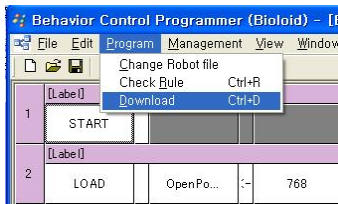
Go to File (F) =>Select Open(o) menu and open the behavior control program you want.

Execute Behavior Control Programmer (it doesn't need when a program already executed)

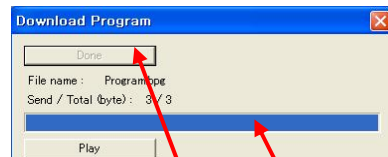


Select Program(P) => Download(D).menu

Click “Download” button.



Close the download dialog box

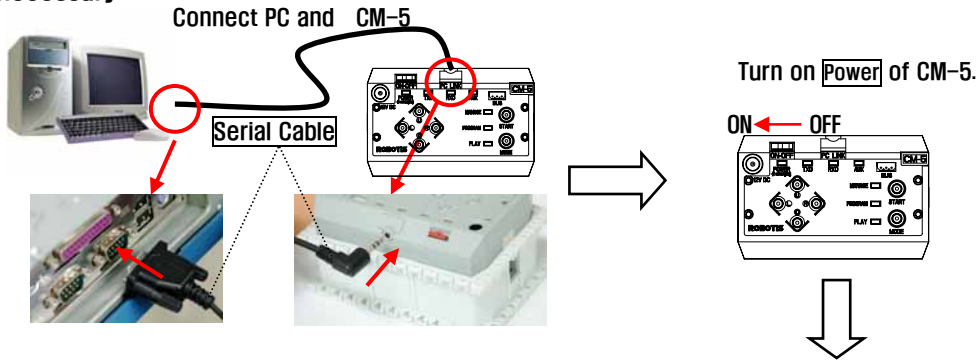


When download is complete, progress bar color changes and download button changes to complete.

※ If problem occurs in this progress above formality, refer to “Download Troubleshooting” from page “2-1-2. Downloading Robot Programs” .

○ How to download Motion Data

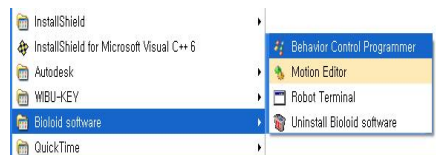
The filename extension of Motion Data is “mtn.” The users download this program whenever it is necessary..



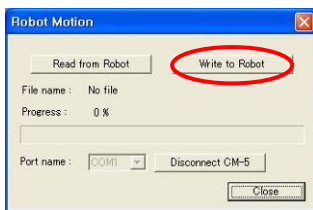
Select Management(M)⇒Robot Motion (R)menu.



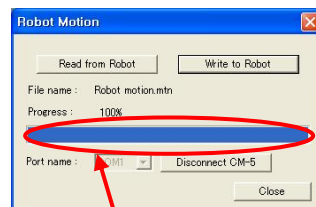
Execute Behavior Control Programmer
(If it has done previously,not necessary)



Select “Write to Robot” and open
the motion data file you want.

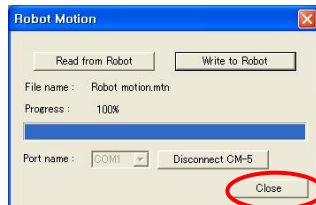


Download is completed.



When download is complete,
progress bar color changes.

Close the download dialog box.

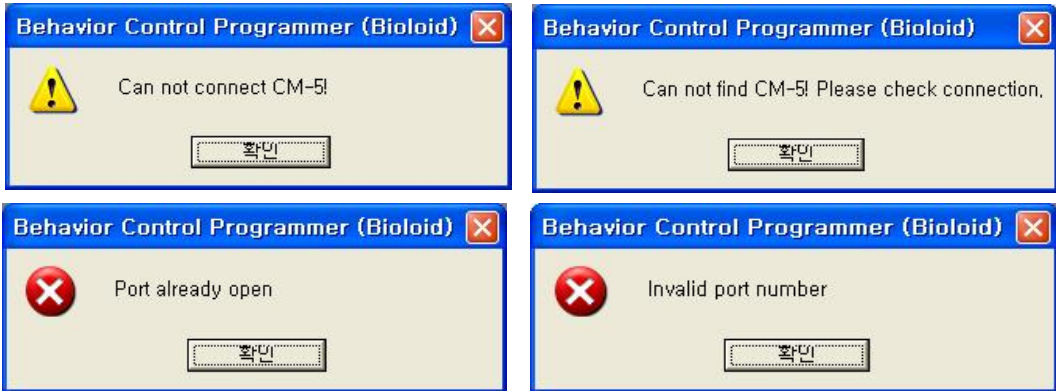


※ If problem occurs in this progress above formality, refer to “Download Troubleshooting” from page “2-1-2. Downloading Robot Programs” .

○ Download Troubleshooting

If the users see error messages while downloading a program, take the following steps.

[Types of Error Message]

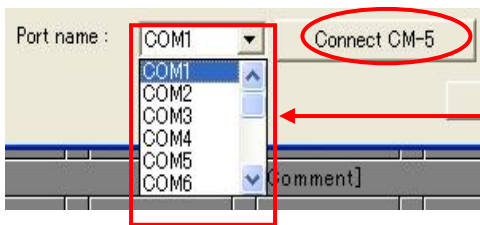


[Troubleshooting Step 1] Make sure CM-5 is connected to the PC.

[Troubleshooting Step 2] Make sure CM-5 power is on.

[Troubleshooting Step 3] Close the programs that are using the communication port and try it again.

[Troubleshooting Step 4] Set up correct communication port number.



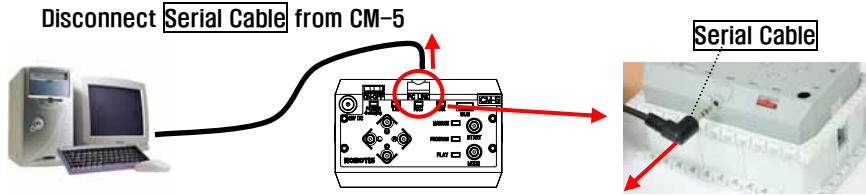
After setting up correct communication port number, try the connection again by clicking "Connect CM-5."

※ To find the correct communication port number, refer to **"Finding the Serial COM Port Number of the PC"** from **"3. Bioid Operation and Maintenance."**

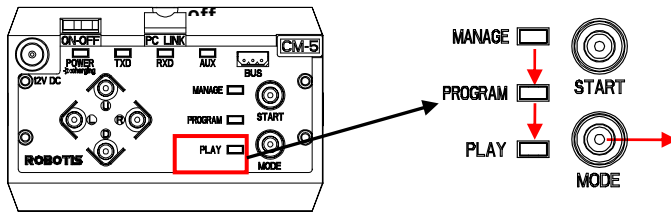
2-1-3. Operating the Robots

◎ **Offline Robot Activation**

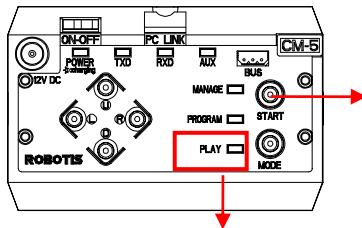
Offline robot activation, as name indicates, is the operation of the robots without the connection to PC.



Press **MODE** button to make **PLAY** LED flash on and



Whenever **MODE** button is pressed LED will be on in the order.

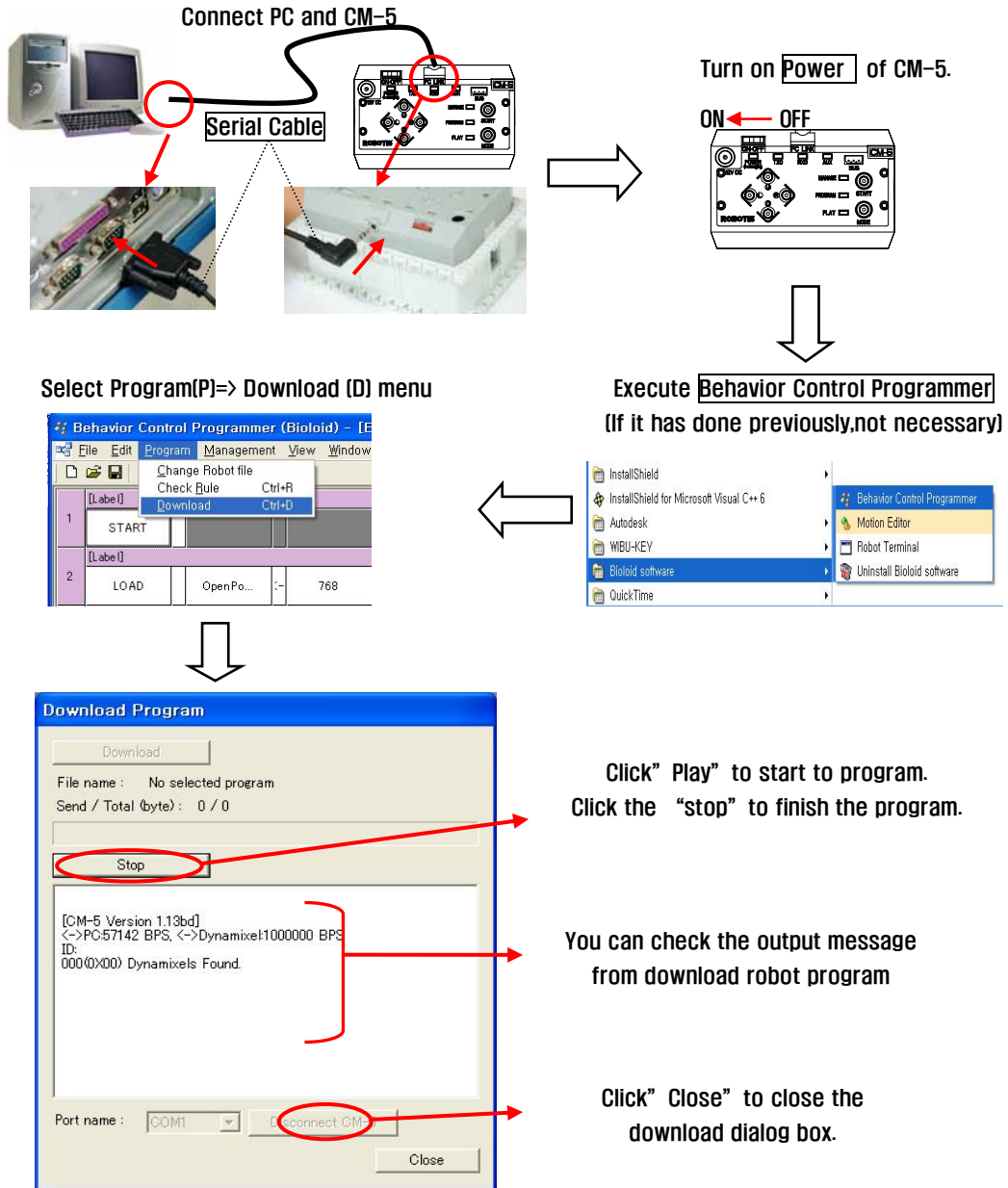


When **START** button is pressed, program is executed

When program is executed the LED no longer flashes on and off, but it is still turned on.

○ **Online Robot Activation**

Online robot activation, as name indicates, is the operation of the robots with the connection to PC. This mode involves the confirmation of the message via monitor when the robot is sending a message to the PC.



※ If problem occurs in this progress above formality, refer to "Download Troubleshooting" from page "2-1-2. Downloading Robot Programs" .

2 – 2 . Examples of Beginner Level



1. Crossing Gate



8. Robot Arm



2. Universal Gauge



9. Cliff Detection Car



3. Sound-Level Meter



10. Greeting Penguin



4. Crocodile Mouth



11. Attacking Duck



5. Pan Tilt



12. Obstacle Detection Car



6. Parking Gate



13. Clapping Penguin



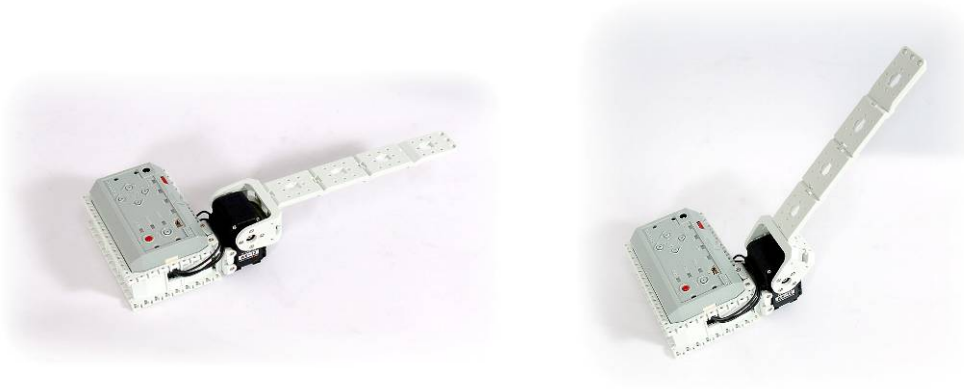
7. Melody Car



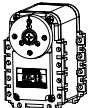
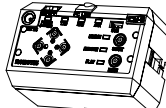
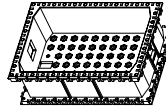

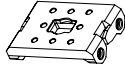
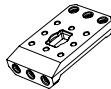


14. Waking Droid

2-2-1. Crossing Gate





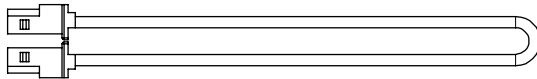
Let's build a crossing gate that opens and closes with a button.



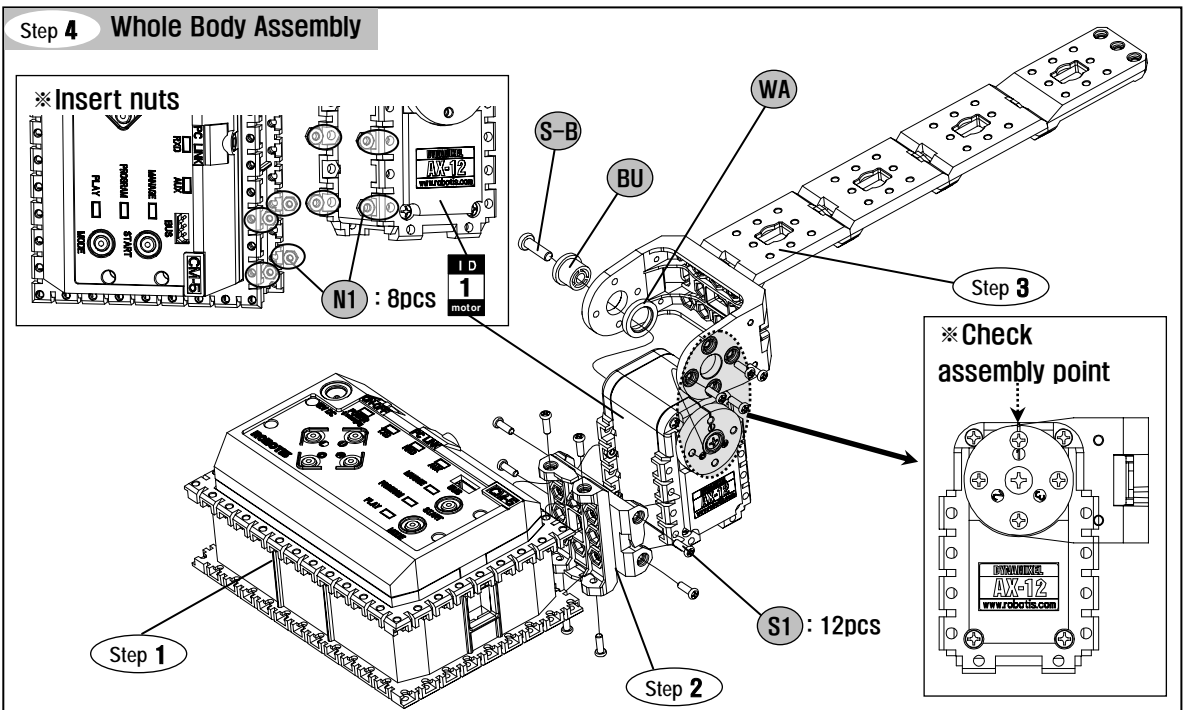
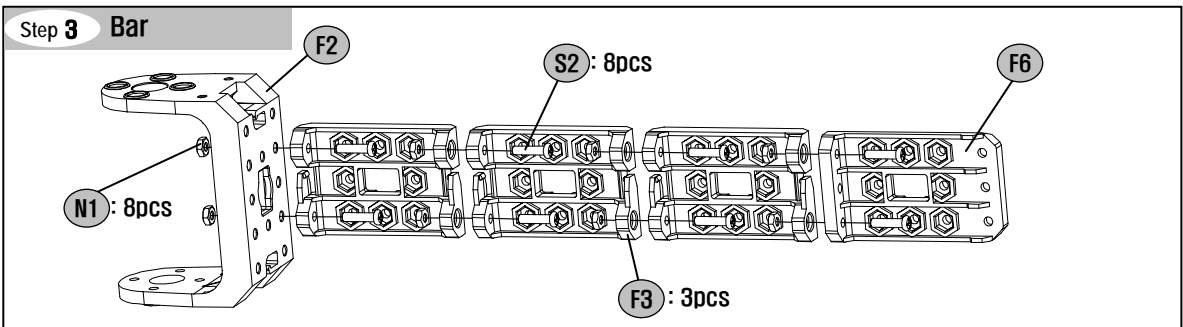
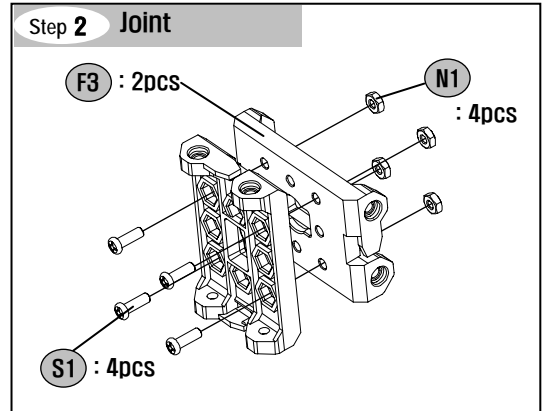
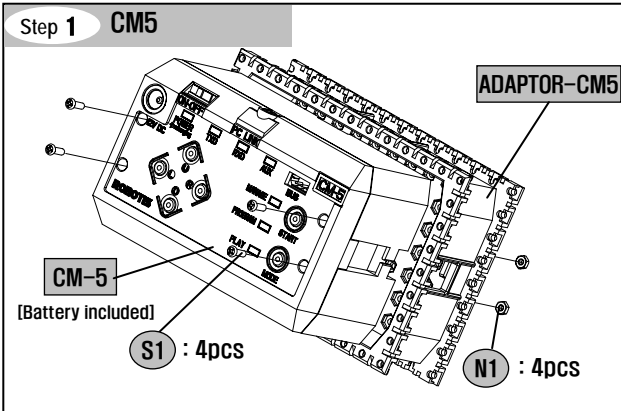
(1) Necessary parts

	ID 1 motor AX-12 × 1		CM-5 × 1		ADAPTOR-CM5 × 1
	F2 × 1		F3 × 5		F6 × 1
			BU × 1		WA × 1

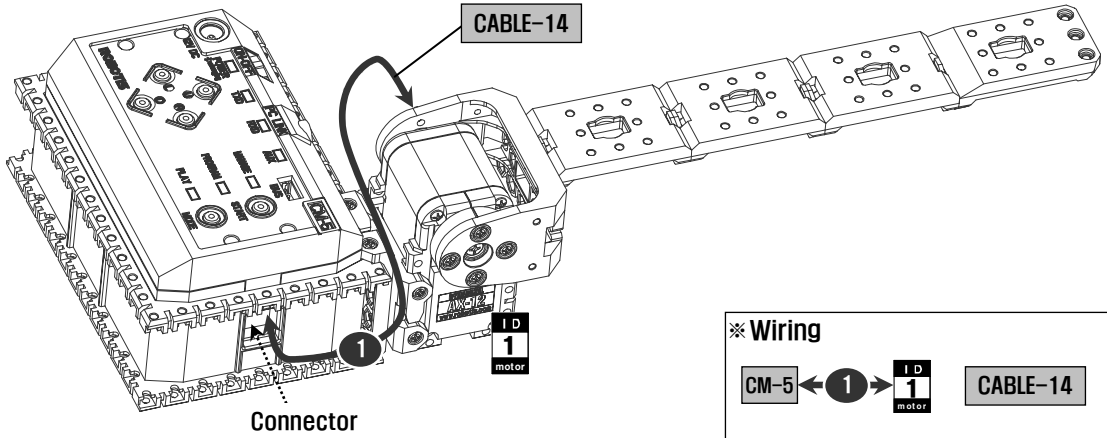
***Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.**

	N1 × 24		S1 × 20		S2 × 8		S-B × 1
							CABLE-14 × 1

(2) Assembling



Step 5 Wiring and Completion



※ Using side connector of **CM-5** , connect **1** cable.

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Crossing Gate\CheckAssembly\(Crossing Gate\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

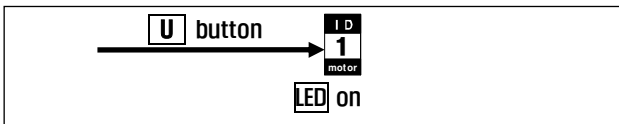
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.10]
<->PC:57142 BPS. <->Dynamixel:1000000 BPS
ID:001
001[0X01] Dynamixels Found.
```

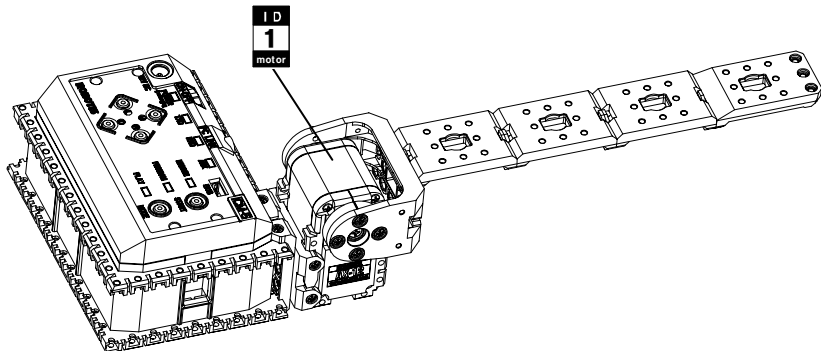
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.



※For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



The Bar is parallel to surface.

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Crossing Gate\DemoExample\(Crossing Gate\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you press **U** button of CM-5, the Crossing Gate opens.
- When you press **D** button of CM-5, the Crossing Gate closes.

Step 4 Compare with the provided video clip

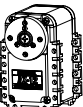
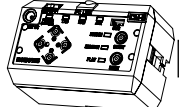
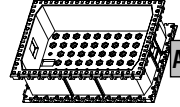

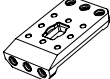

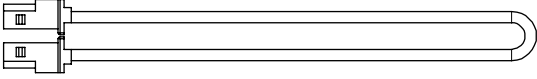


(In CD, [Applied Robots\Beginner\Crossing Gate\DemoExample\(Crossing Gate\).wmv](#))

2-2-2. Universal Gauge

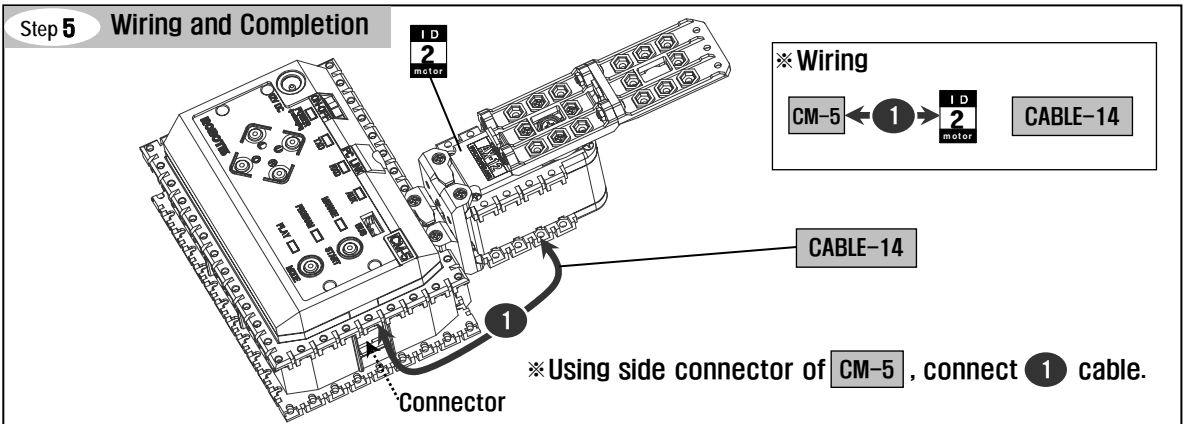
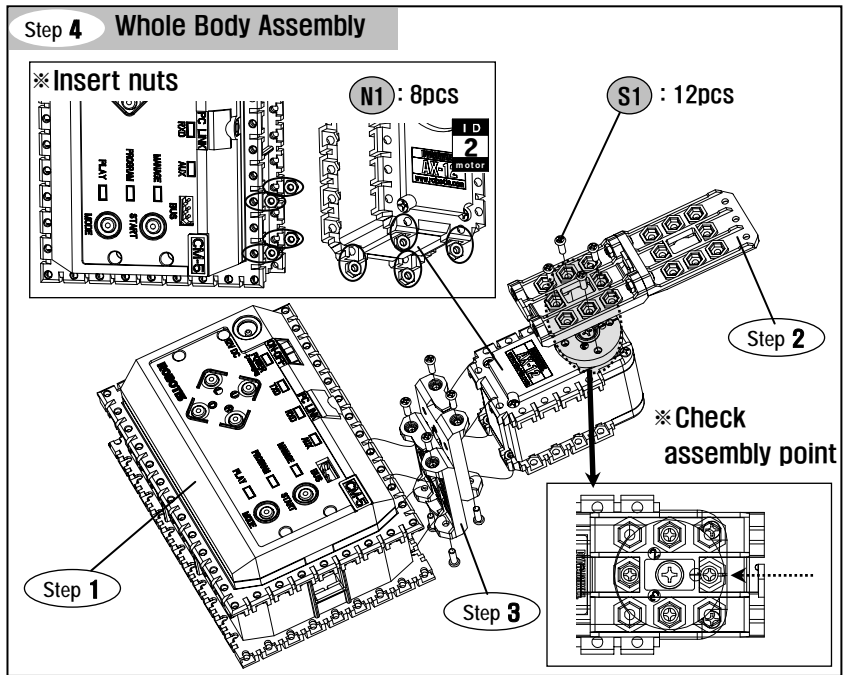
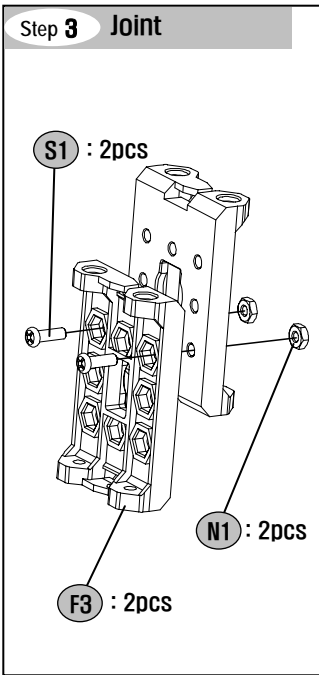
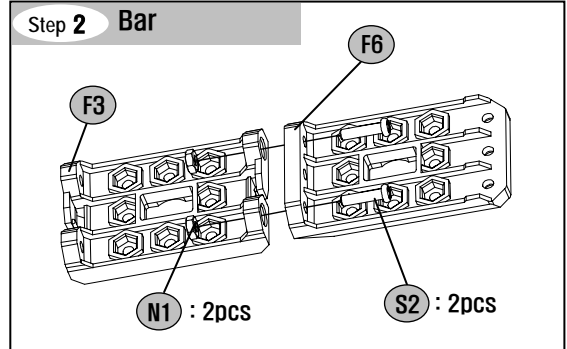
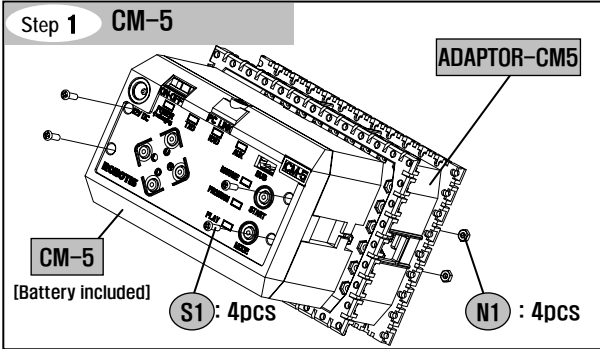
Let's build a Universal gauge that can control the movement speed of gauge with buttons.



(1) Necessary parts

 AX-12 × 1	 CM-5 × 1	 ADAPTOR-CM5 × 1	 F3 × 3	 F6 × 1
<p>※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.</p>				
 N1 × 16	 CABLE-14 × 1			
 S1 × 18				
 S2 × 2				

(2) Assembling



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Universal Guage\CheckAssembly\(Universal Guage\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.10]

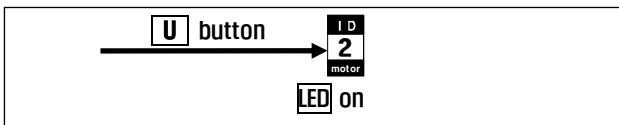
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:002
001[0X01] Dynamixels Found.

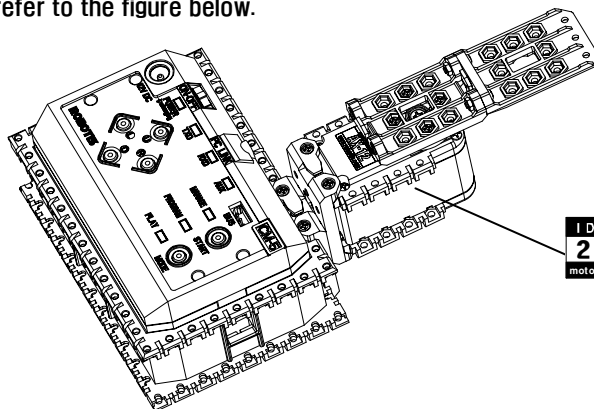
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.

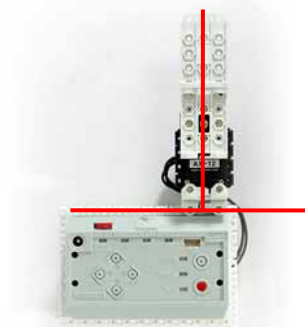


※For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Top View



The bar is perpendicular to **CM-5** .

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Universal Guage\DemoExample\(Universal Guage\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- If you keep pressing **U** button of CM-5, the speed of gauge increases.
- If you keep pressing **D** button of CM-5, the speed of gauge decreases.

Step 4 Compare with the provided video clip

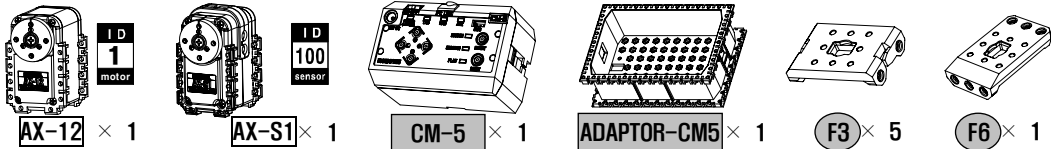
(In CD, [Applied Robots\Beginner\Universal Guage \DemoExample\(Universal Guage\).wmv](#))

2-2-3. Sound-Level Meter

Let's build a sound-level meter that shows the sound level in a gauge when a sensor detects sound.



(1) Necessary parts

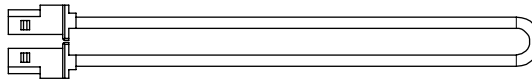


※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

N1 × 28

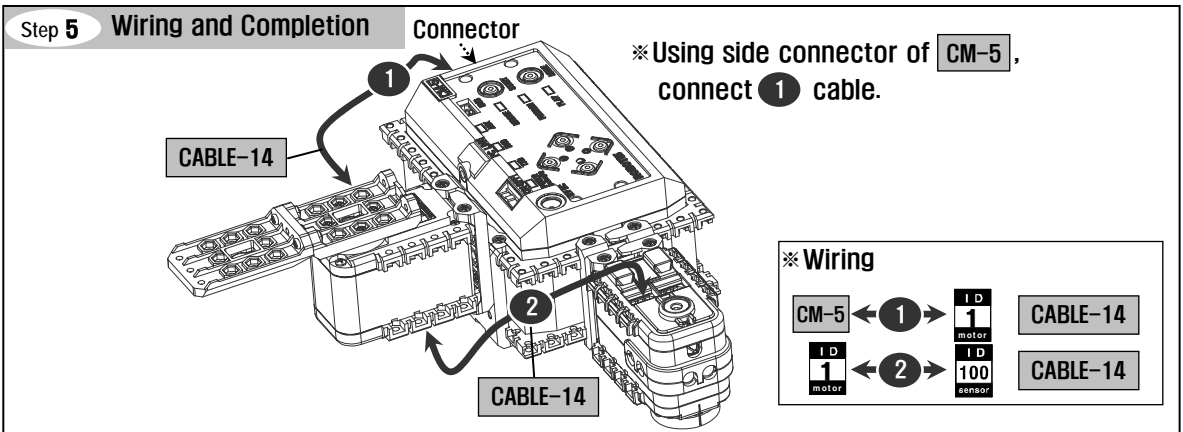
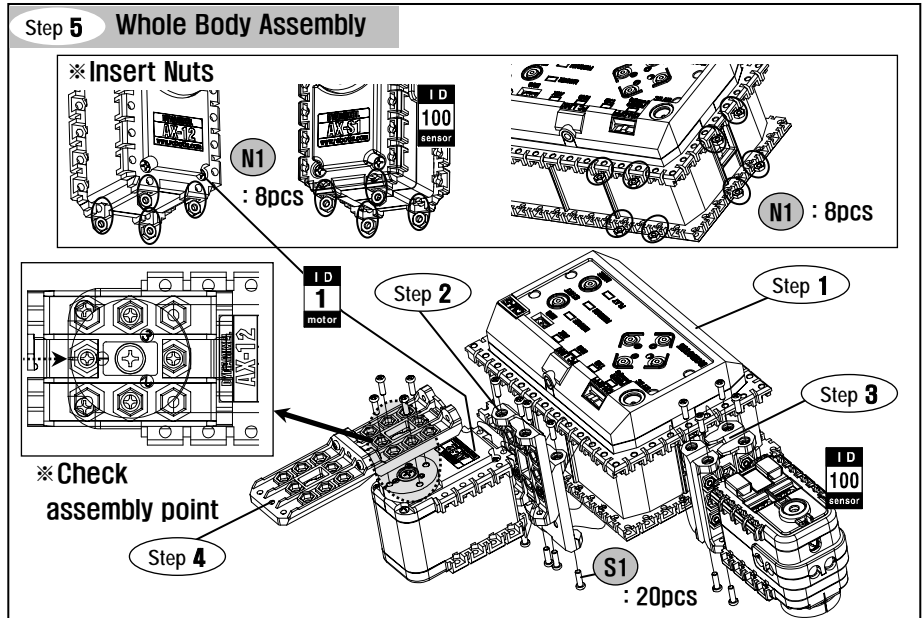
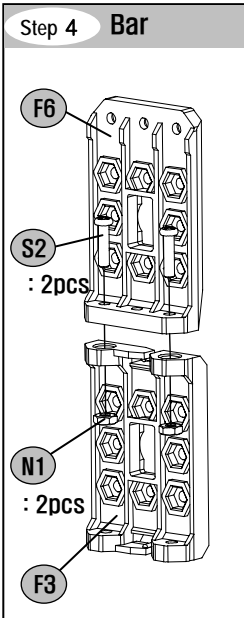
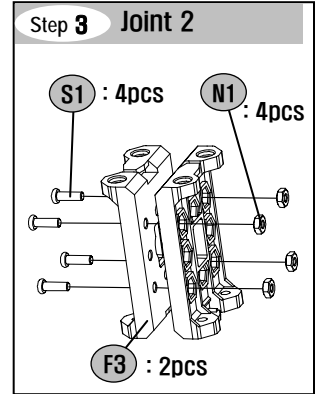
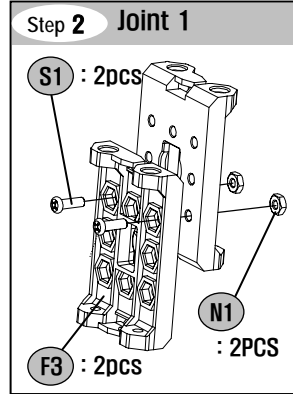
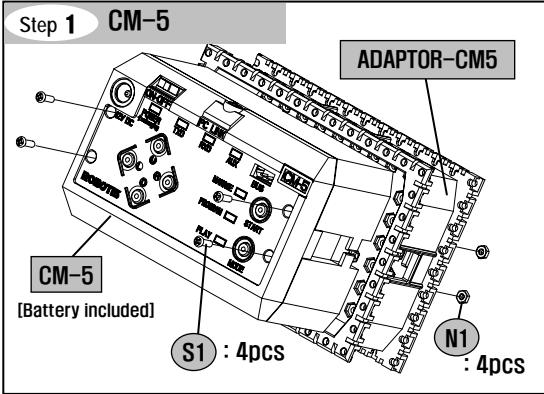
S1 × 30

S2 × 2



CABLE-14 × 2

(2) Assembling



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
 (In CD, [Applied Robots\Beginner\ Sound-Level Meter \CheckAssembly\(Sound-Level Meter\).bpg](#))
 ※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.
 ※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

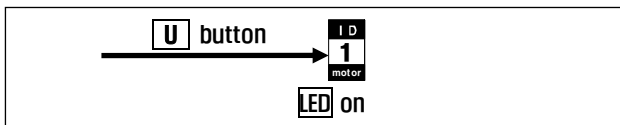
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.10]
<->PC:57142 BPS, <->Dynamixel:1000000 BPS
ID:001 100
002[0X02] Dynamixels Found.
```

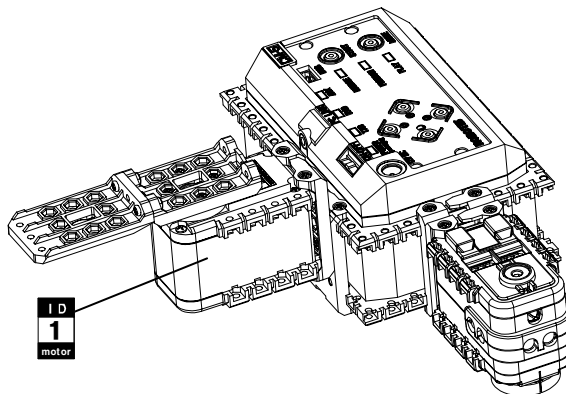
comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.

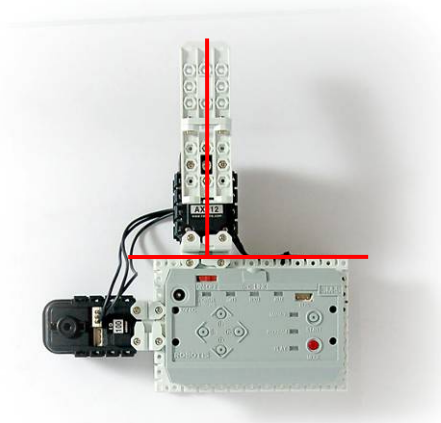


※For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Top View



The bar is perpendicular to **CM-5** .

Step 6 Close the CM-5 online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Sound-Level Meter\DemoExample\(Sound-Level Meter\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you make a sound on the sensor, the gauge moves equivalent to the loudness

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\ Sound-Level Meter \DemoExample\(Sound-Level Meter\).wmv](#))

2-2-4. Crocodile Mouth

Let's build a crocodile mouth that opens a mouth when a sensor detects an object and that makes sound when an object is not detected by a sensor in front for a certain period of time.



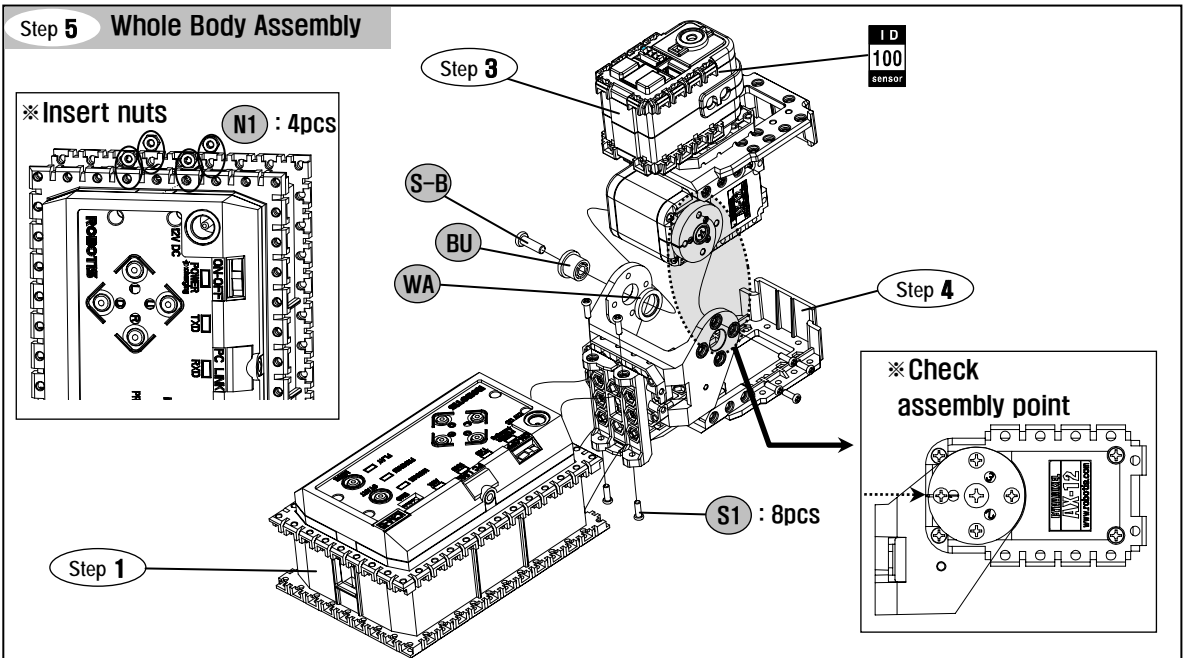
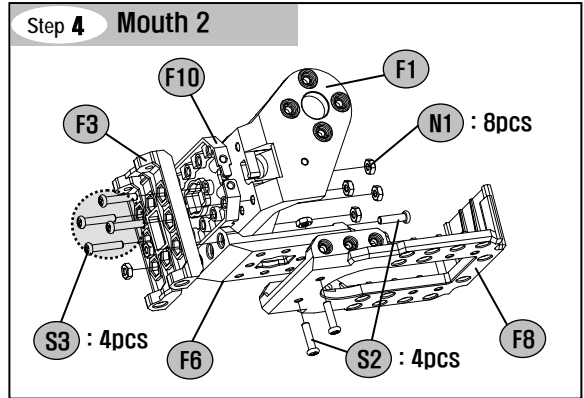
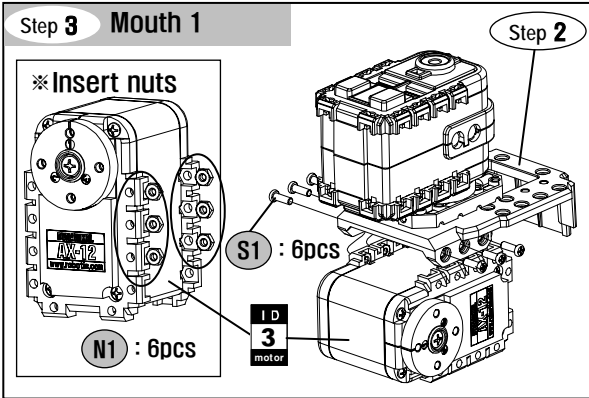
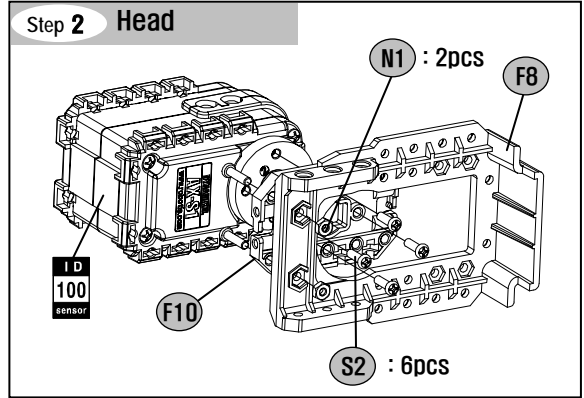
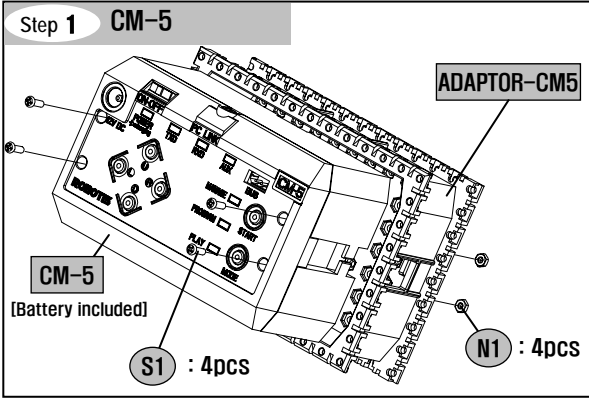
(1) Necessary parts

	ID 3 motor		ID 100 sensor		CM-5		ADAPTOR-CM5
AX-12 × 1		AX-S1 × 1		× 1		× 1	
	F1 × 1		F3 × 1		F6 × 1		F8 × 2
	F10 × 2		BU × 1		WA × 1		

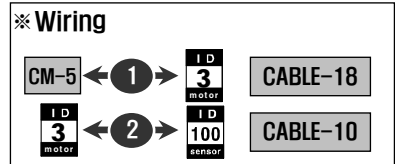
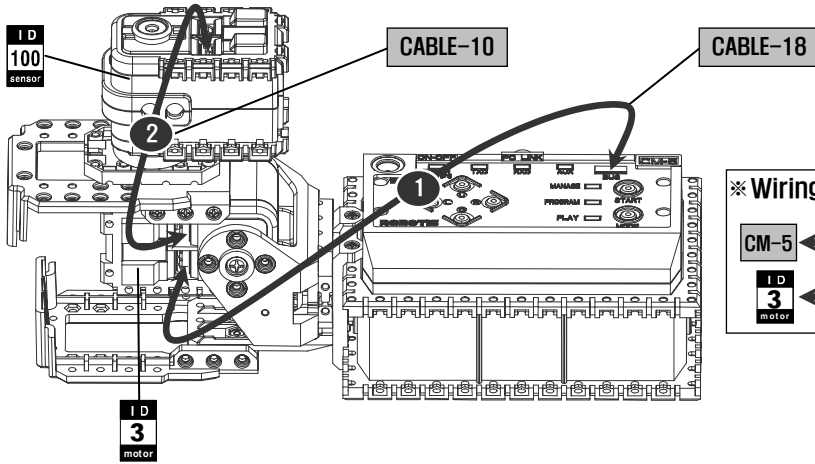
※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 24		CABLE-10 × 1
	S1 × 18		
	S2 × 10		CABLE-18 × 1
	S3 × 4		
	S-B × 1		

(2) Assembling



Step 6 Wiring and Completion



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
 (In CD, [Applied Robots\Beginner\ Crocodile Mouth \CheckAssembly\(Crocodile Mouth\).bpg](#))
 ※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.
 ※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

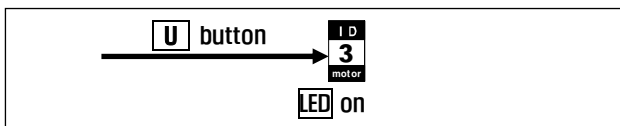
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.10]
<>PC:57142 BPS, <>Dynamixel:1000000 BPS
ID:003 100
002[0X02] Dynamixels Found.
```

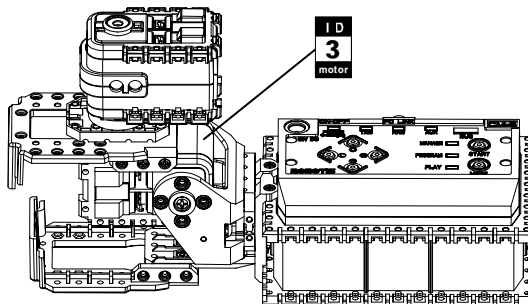
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.

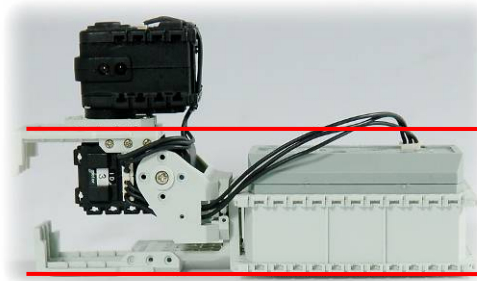


※For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



The Mouth of crocodile is parallel to surface.

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Crocodile Mouth\DemoExample\(Crocodile Mouth\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you place a hand on the front of the sensor, it opens the mouth and when you remove your hand, it closes.
- If there is an object inside of a mouth when the Crocodile Mouth closes, it opens the mouth again.
- When an object is not detected by the sensor for 10 seconds, it chimes.

Step 4 Compare with the provided video clip

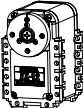


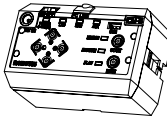
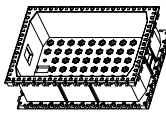

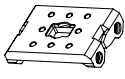


(In CD, [Applied Robots\Beginner\Crocodile Mouth \DemoExample\(Crocodile Mouth\).wmv](#))

2-2-5. Pan Tilt


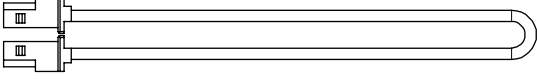


Let' s build a pan tilt robot that can be controlled with the pan(right and left) and tilt(up and down) buttons.



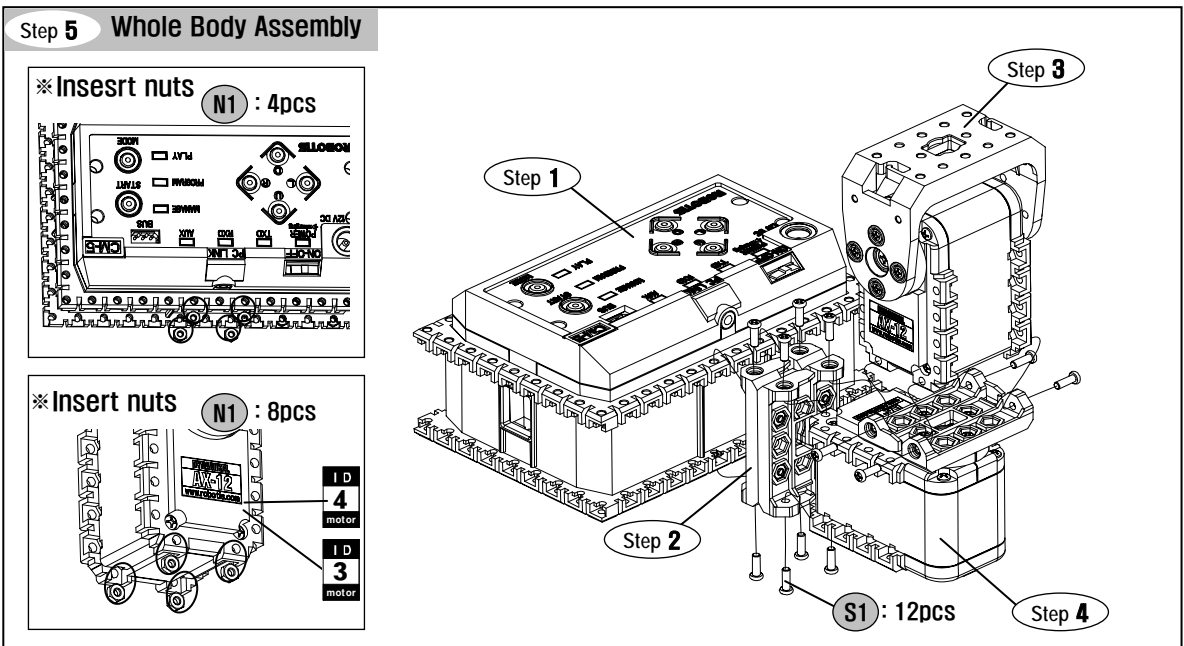
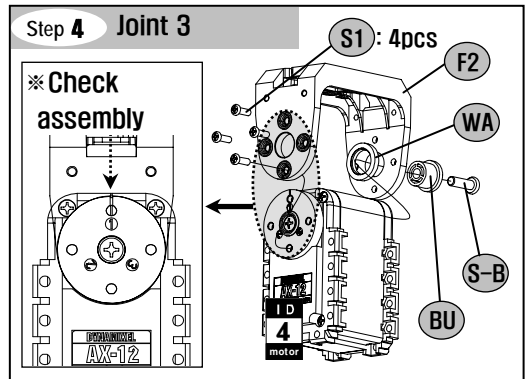
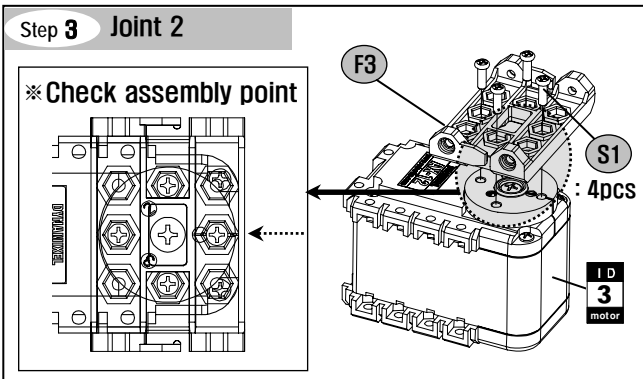
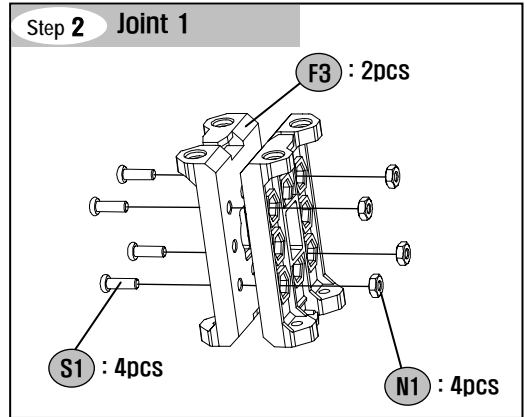
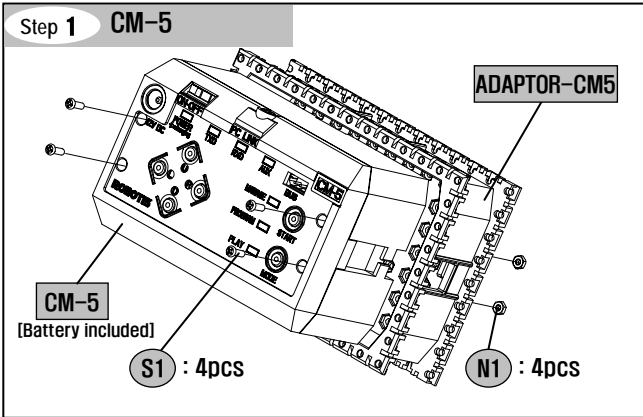
(1) Necessary parts

								BU × 1
AX-12 × 2			CM-5 × 1	ADAPTOR-CM5 × 1	F2 × 1	F3 × 3		WA × 1

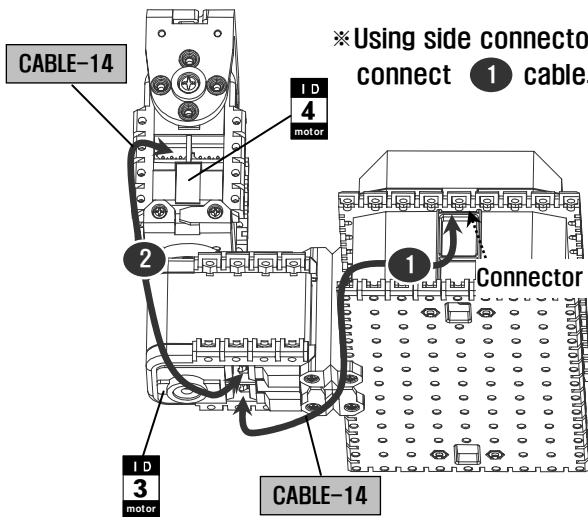
※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 20		CABLE-14 × 2
	S1 × 28		
	S-B × 1		

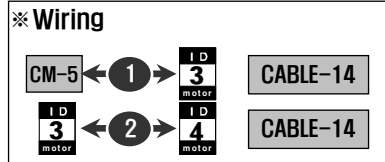
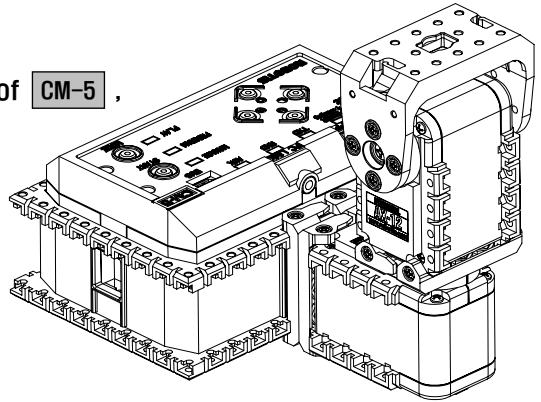
(2) Assembling



Step 6 Wiring and Completion



※ Using side connector of CM-5 , connect ① cable.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Pan Tilt\CheckAssembly\(Pan Tilt\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.10]

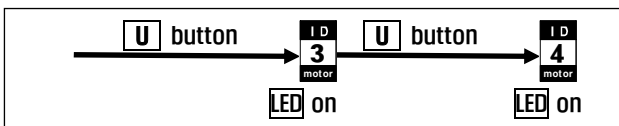
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:003 004
002[0X02] Dynamixels Found.

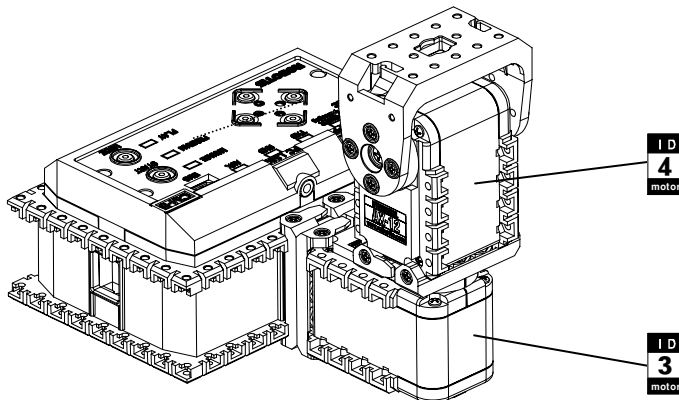
comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure

※Whenever **U** button is pressed **LED** is on in the order shown below.

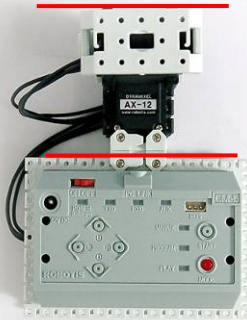


※For ID of **Dynamixel** refer to the figure below.



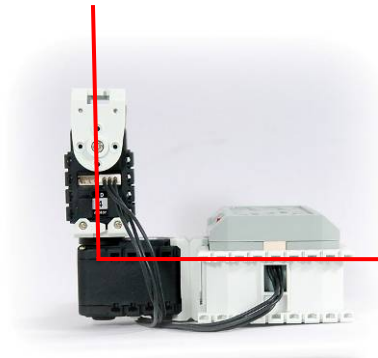
Step 5 When **START** button of **CM-5** is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram..

※ Top View



The Pan Tilt is parallel to **CM-5** .

※ Side View



The Pan Tilt is perpendicular to **CM-5** .

Step 6 Close the **CM-5** online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Pan Tilt\DemoExample\(Pan Tilt\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- If you keep pressing **U** button of **CM-5**, the tilt joint moves upward.
- If you keep pressing **D** button of **CM-5**, the tilt joint moves downward
- If you keep pressing **R** button of **CM-5**, the pan joint rotates to the right.
- If you keep pressing **L** button of **CM-5**, the pan joint rotates to the left

Step 4 Compare with the provided video clip

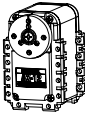
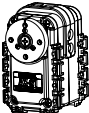
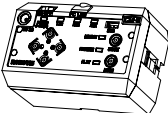
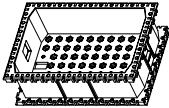
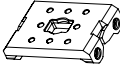
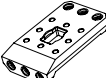
(In CD, [Applied Robots\Beginner\Pan Tilt \DemoExample\(Pan Tilt\).wmv](#))

2-2-6. Parking Gate




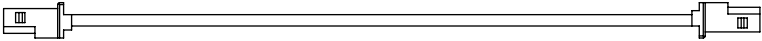
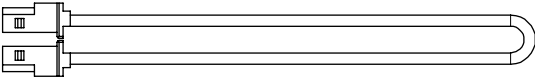
Let's build a parking gate that automatically opens and closes the door when a sensor detects an object.



(1) Necessary parts

 AX-12 × 2	 AX-S1 × 1	 CM-5 × 1	 ADAPTOR-CM5 × 1	 F3 × 8	 F6 × 1
--	--	---	--	--	---

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

 N1 × 36  S1 × 38  S2 × 6	 CABLE-10 × 2  CABLE-14 × 1
---	--

(2) Assembling

Step 1 CM-5

ADAPTOR-CM5

CM-5
[Battery included]

S1 : 4pcs

N1 : 4pcs

Step 2 Joint

※ Check assembly point

S1 : 4pcs

F3

ID 1 motor

Step 3 Bar

※ Check assembly point

ID 2 motor

F3 : 3pcs

N1 : 6pcs

S2 : 6pcs

F6

S1 : 4pcs

Step 4 Joint 1

F3 : 2pcs

S1 : 2pcs

N1 : 2pcs

Step 6 Whole Body Assembly

※ Insert nuts N1 : 8pcs

ID 1 motor

ID 2 motor

N1 : 8pcs

Step 5 Joint 2

F3 : 2pcs

S1 : 4pcs

N1 : 4pcs

Step 1

Step 5

Step 3

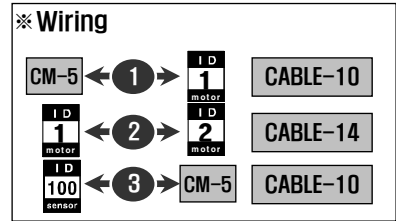
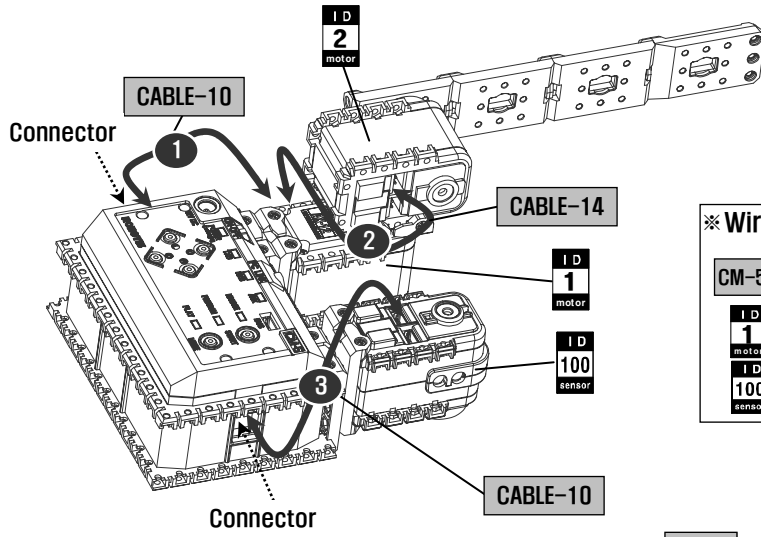
Step 4

Step 2

※ Insert nuts N1 : 4pcs

ID 100 sensor

Step 7 Wiring and Completion



※ Using side connectors of **CM-5**, connect **1 3** cables.

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Parking Gate \CheckAssembly\(Parking Gate\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.10]

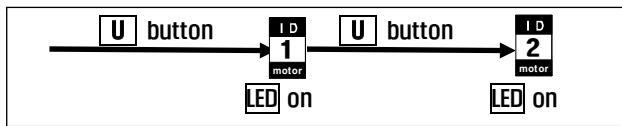
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 100
003[0X03] Dynamixels Found.

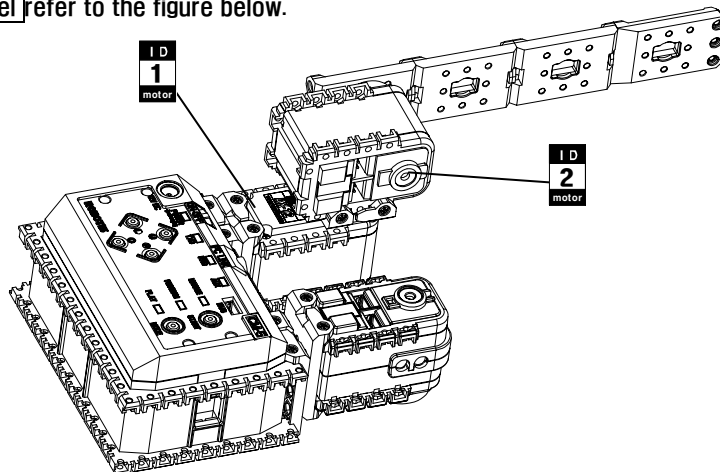
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever **U** button is pressed **LED** is on in the order shown below.

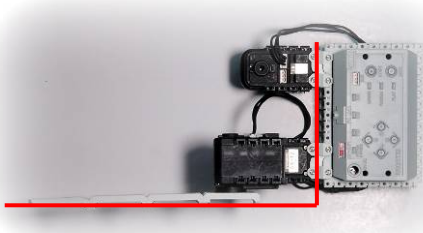


※ For ID of **Dynamixel** refer to the figure below.



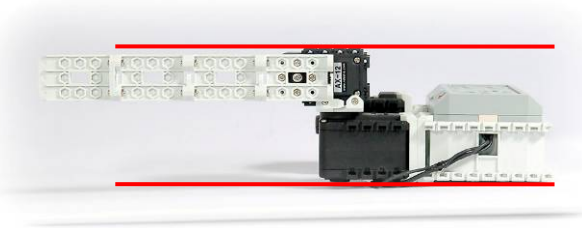
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Top View



The bar is perpendicular to **CM-5** .

※Side View



The bar is parallel to the surface.

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download "Example" file which is behavior control program.

(In CD, [Applied Robots\Beginner\Parking Gate\DemoExample\(Parking Gate\).bpg](#))

※Refer to "How to download Behavior Control Program" from "2-1-2 Downloading Robot Programs."

Step 2 Operate offline robot.

※Refer to "Offline Robot Activation" from "2-1-3. Operating the Robots" .

Step 3 Operation of the robot

- When the sensor detects an object, the crossing bar opens vertically.
- When the sensor detects an object and the crossing bar is pushed by an object at the same time, the crossing bar opens horizontally.
- When an object is not detected by the sensor, the crossing bar closes.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\Parking Gate\DemoExample\(Parking Gate\).wmv](#))

2-2-7. Melody Car

Let's build a melody car that chimes and moves in a direction corresponding to a button



(1) Necessary parts

AX-12 × 4					AX-S1 × 1		CM-5 × 1	ADAPTOR-CM5 × 1
F3 × 6	F13 × 4	F14 × 4		Sticker × 10				

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 48		CABLE-6 × 2
	S1 × 48		CABLE-10 × 2
	S2 × 16		CABLE-14 × 1

(2) Assembling

Step 1 Left Wheel : 2 sets

※ Assemble 2 sets using **ID 2** and **ID 4** motor.

※ Insert nuts **N1** : 4pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

※ Assemble taking note of the inserted location of nuts .

Step 2 Right Wheel : 2 sets

※ Assemble 2 sets using **ID 1** and **ID 3** motor.

※ Insert nuts **N1** : 4pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

※ Assemble taking note of the inserted location of nuts .

Step 3 Joint

N1 : 4pcs

F3 : 2pcs

S1 : 4pcs

Step 4 Head Assembly

※ Insert nuts **N1** : 8pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

S1 : 8pcs

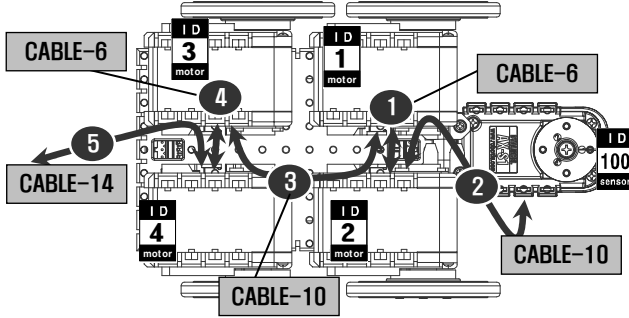
ADAPTOR-CM5

ID 100 sensor

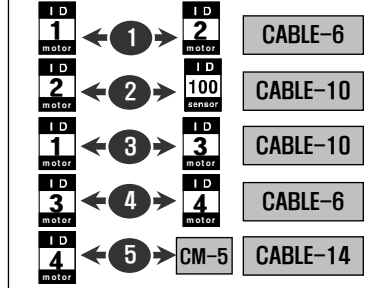
Step 3

Step 5 Wiring and Whole Body Assembly

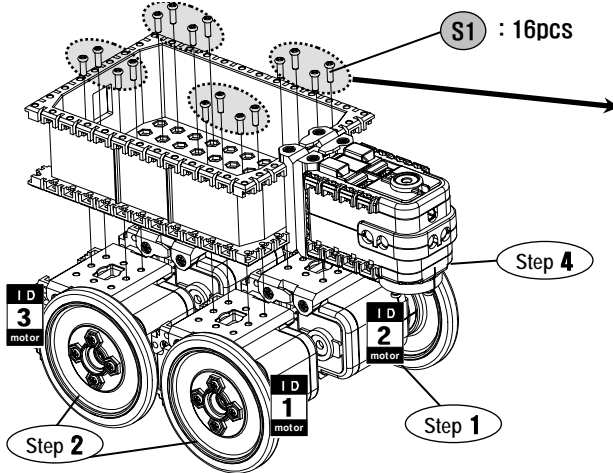
※ Bottom view



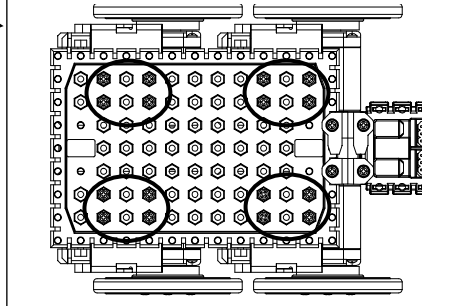
※ Wiring



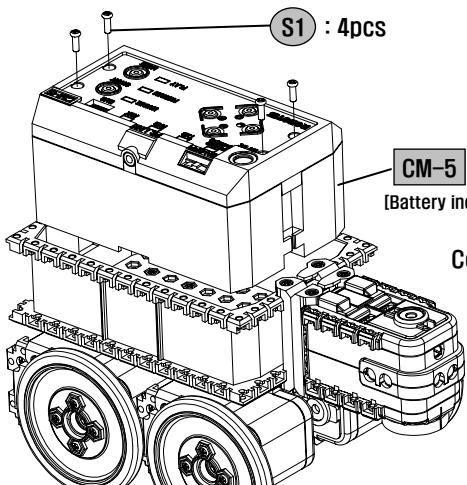
※ Assemble after wiring is finished



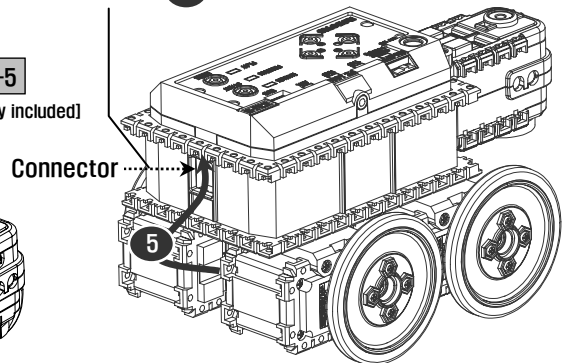
※ Top view : Check screw assembly point



Step 6 Completion



※ Using side connector of CM-5, connect 5 cable.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Melody Car \CheckAssembly\(Melody Car\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

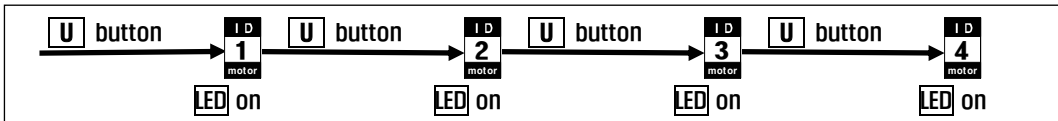
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.11c]
<->PC:57142 BPS, <->Dynamixel:1000000 BPS
ID:001 002 003 004 100
005[0X05] Dynamixels Found.
```

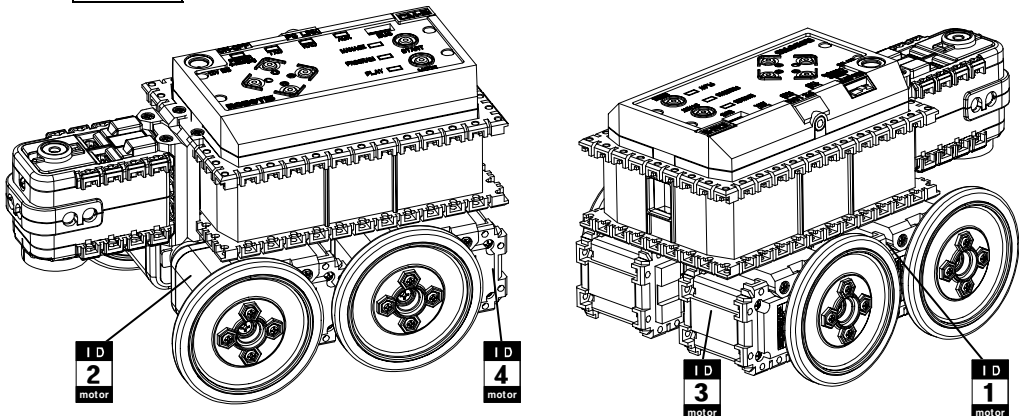
Comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.



※For ID of **Dynamixel** refer to the figure below.



Step 5 Close the CM-5 online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Melody Car\DemoExample\(\Melody Car\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots” .

Step 3 Operation of the robot

- When you press **L** button of CM-5, the Melody Car chimes and moves forward at a set distance..
- When you press **R** button of CM-5, the Melody Car chimes and moves backward at a set distance.
- When you press **U** button of CM-5, the Melody Car chimes and turn to the right.
- When you press **D** button of CM-5, the Melody Car chimes and turn to the left.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\Melody Car \DemoExample\(\Melody Car\).wmv](#))

2-2-8. Robot Arm

Let's build a robot arm that can be controlled by a button.



(1) Necessary parts

	AX-12 × 3		CM-5 × 1		ADAPTOR-CM5 × 1
	F1 × 1		F2 × 1		F3 × 4
	F9 × 1		F11 × 1		BU × 2
	WA × 2	<p>※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.</p>			
	N1 × 36		CABLE-10 × 1		
	S1 × 48		CABLE-14 × 2		
	S-B × 2				

(2) Assembling

Step 1 CM-5

ADAPTOR-CM5

CM-5
[Battery included]

S1 : 4pcs **N1 : 4pcs**

Step 2 Joint 1

F3 : 2pcs

S1 : 4pcs **N1 : 4pcs**

Step 3 Joint 2

*** Check assembly point**

S1 : 4pcs

F1

ID 1 motor

Step 4 Joint 3

N1 : 4pcs

F3 **F2**

S1 : 4pcs

Step 5 Hand

F3 **F9**

N1 : 8pcs

F11 **S1 : 8pcs**

Step 6 Whole Body Assembly

*** Insert nuts N1 : 12pcs**

N1 : 12pcs

ID 3 motor

S1 : 24pcs

WA : 2pcs

S-B : 2pcs

BU : 2pcs

ID 2 motor

ID 1 motor

Step 1 **Step 2** **Step 3** **Step 4** **Step 5**

*** Check assembly point**

*** Check assembly point**

*** Insert nuts N1 : 4pcs**

N1 : 4pcs

CM-5

ROBOTIS

POWER PC LINK CHARGE

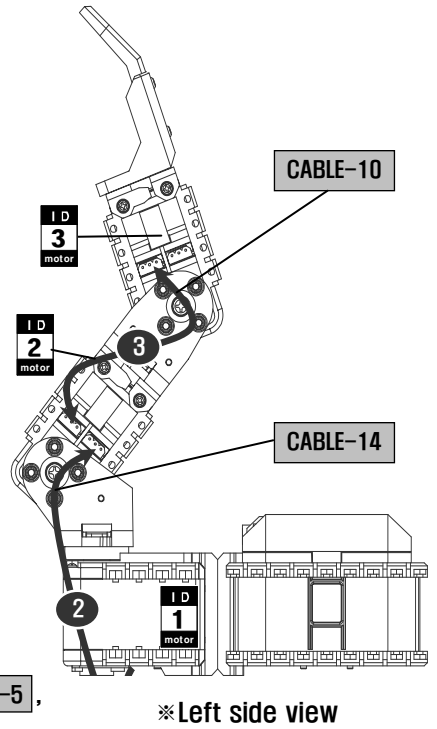
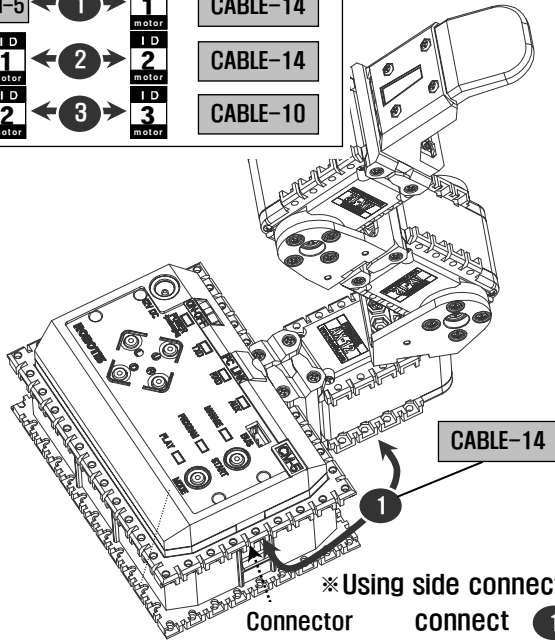
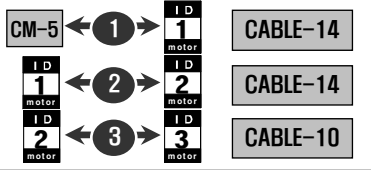
REVERSE STOP FORWARD

PROGRAM START PLAY MODE

54

Step 7 Complete Wiring and Assembly

※ Wiring



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Robot Arm\CheckAssembly\(Robot Arm\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.06]

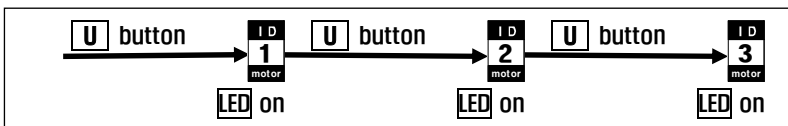
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003
003[0X03] Dynamixels Found.

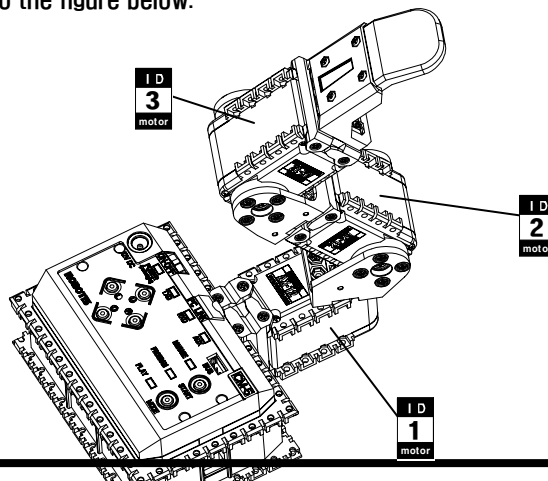
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.



※For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Front View



The palm of the hand is facing the front.

※Side View



The robot arm is perpendicular to **CM-5** .

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Robot Arm\DemoExample\(Robot Arm\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you press **R** button of CM-5, the Robot Arm rotates to the right.
- When you press **L** button of CM-5, the Robot Arm rotates to the left.
- When you press **U** button of CM-5, an elbow of the Robot Arm extends.
- When you press **D** button of CM-5, an elbow of the Robot Arm folds.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\Robot Arm\DemoExample\(Robot Arm\).wmv](#))

2-2-9. Obstacle Detection Car

Let's build a car that detects an obstacle with a sensor and that avoid the obstacle automatically.



(1) Necessary parts

ID 1 motor	ID 2 motor	ID 3 motor	ID 4 motor	ID 100 sensor	CM-5	ADAPTOR-CM5
AX-12 × 4				AX-S1 × 1	× 1	× 1
F3 × 6	F13 × 4	F14 × 4	Sticker × 10			

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 48		CABLE-6 × 2
	S1 × 48		CABLE-10 × 2
	S2 × 16		CABLE-14 × 1

(2) Assembling

Step 1 Left Wheel : 2 sets

※ Assemble 2 sets using **ID 2 motor** and **ID 4 motor**

※ Insert nuts **N1 : 4pcs**

※ Attach nut stickers :
Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

ID 2 motor **ID 4 motor**

F3 **S1 : 4pcs** **F13** **F14** **S2 : 4pcs**

※ Assemble taking note of the inserted location of nuts .

Step 2 Right Wheel : 2 sets

※ Assemble 2 sets using **ID 1 motor** and **ID 3 motor**

※ Insert nuts **N1 : 4pcs**

※ Attach nut stickers :
Make sure nuts do not come off.
N1 : 4pcs
Sticker : 2pcs

ID 1 motor **ID 3 motor**

F3 **S1 : 4pcs** **F13** **F14** **S2 : 4pcs**

※ Assemble taking note of the inserted location of nuts .

Step 3 Joint

N1 : 4pcs **F3 : 2pcs**

S1 : 4pcs

Step 4 Head

※ Insert nuts **N1 : 8pcs**

※ Attach nut stickers :
Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

S1 : 8pcs

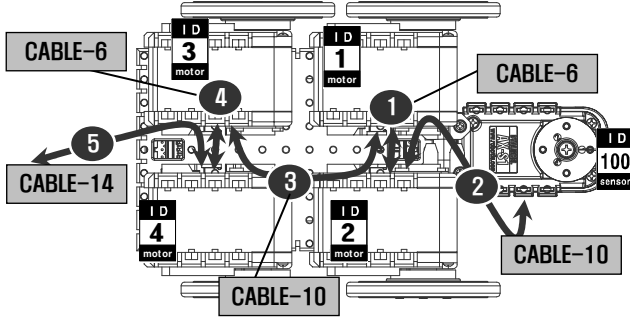
ADAPTOR-CM5

ID 100 sensor

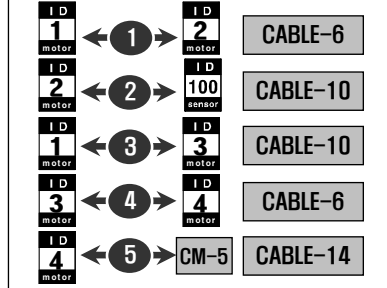
Step 3

Step 5 Wiring and Whole Body Assembly

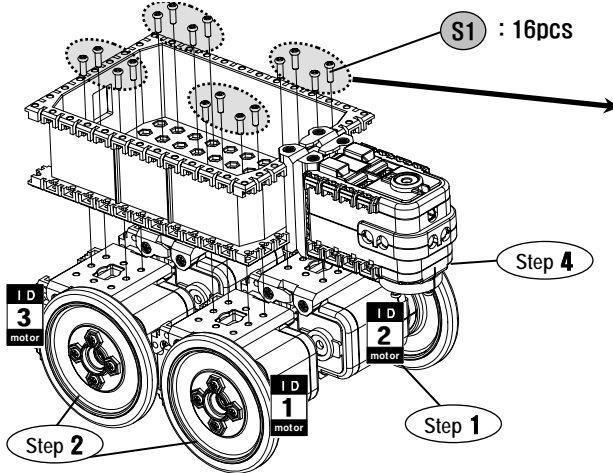
※ Bottom view



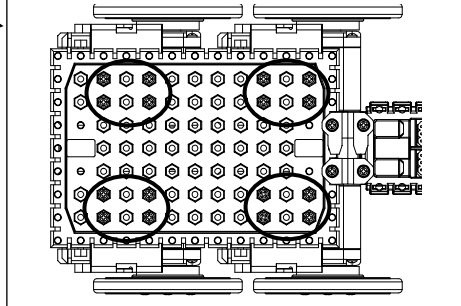
※ Wiring



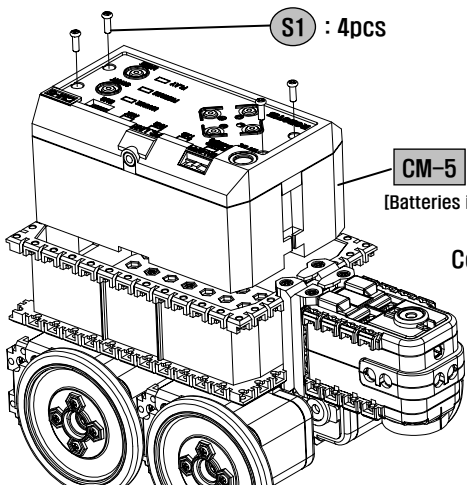
※ Assemble after wiring is finished.



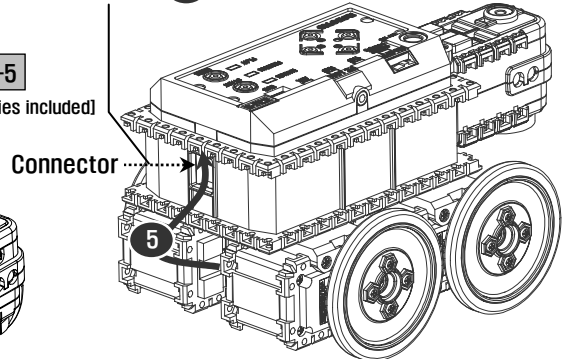
※ Top view : Check screw assembly point



Step 6 Completion



※ Using side connector of **CM-5**, connect **5** cable.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Obstacle Detection Car\CheckAssembly\(Obstacle Detection Car\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11c]

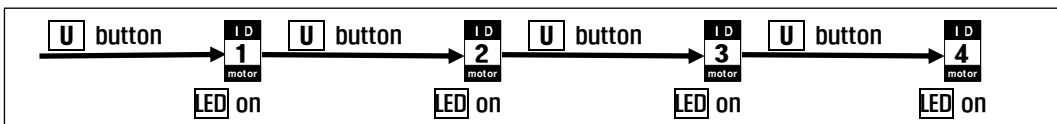
<>PC:57142 BPS, <>Dynamixel:1000000 BPS

ID:001 002 003 004 100
005(0X05) Dynamixels Found.

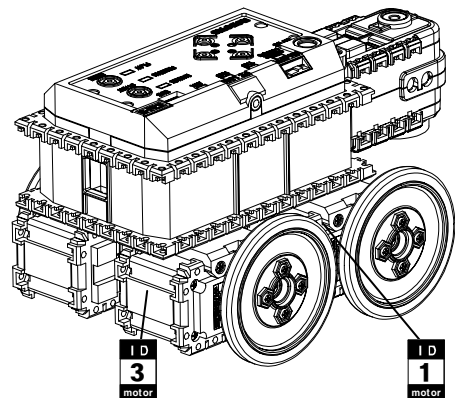
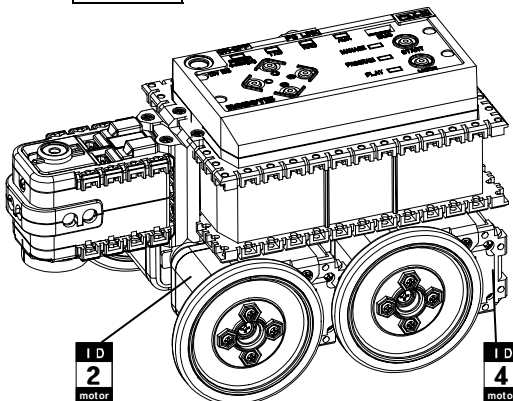
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.



※For ID of **Dynamixel** refer to the figure below.



Step 5 Close the CM-5 online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\ Obstacle Detection Car\DemoExample\(Obstacle Detection Car\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

– Robot continues to move forward and when it meets an obstacle, it will avoid it.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\ Obstacle Detection Car\DemoExample\(Obstacle Detection Car\).wmv](#))

2-2-1 0. Greeting Penguin

Let's build a penguin robot that greets when it detects an object in front and that raises hand when detecting an object on side.



(1) Necessary parts

	ID 1 motor	ID 2 motor	ID 3 motor	ID 4 motor		ID 100 sensor		
AX-12 × 4				AX-S1 × 1		CM-5 × 1		ADAPTOR-CM5 × 1
F1 × 2	F2 × 2	F3 × 9	F9 × 2	F12 × 2	BU × 4	WA × 4		

***Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.**

	N1 × 70		CABLE-6 × 1
	S1 × 90		CABLE-10 × 2
	S-B × 4		CABLE-14 × 2

(2) Assembling

Step 1 Shoulder : 2 sets

※ Assemble 2 sets in a same style.

S1 : 4pcs N1 : 4pcs

F1 F3

Step 2 Hand : 2 sets

※ Assemble 2 sets in a same style.

N1 : 4pcs S1 : 4pcs

F9 F3

Step 3 Head

ID 100 sensor

F3 S1 : 4pcs

Step 4 Upper Part of Body Assembly

※ Insert nuts

N1 : 12pcs

ID 1 motor ID 2 motor

N1 : 8pcs

※ Check assembly point

Step 3

Step 1

Step 1

Step 2

Step 2

S1 : 28pcs ID 1 motor

WA : 2pcs

BU : 2pcs S-B : 2pcs ID 2 motor

Step 5 Leg : 2 sets

※ Assemble 2 sets in a same style.

N1 : 4pcs
F3
S1 : 4pcs
F2

Step 6 Foot : 2 sets

※ Assemble 2 sets in a same style.

N1 : 3pcs
F3
S1 : 3pcs

Step 7 Lower Part of Body Assembly

※ Insert nuts N1 : 8pcs

Step 4

※ Check assembly point

Step 5

S1 : 24pcs

S-B : 2pcs

BU : 2pcs

WA : 2pcs

ID 3 motor

ID 4 motor

Step 6

Step 6

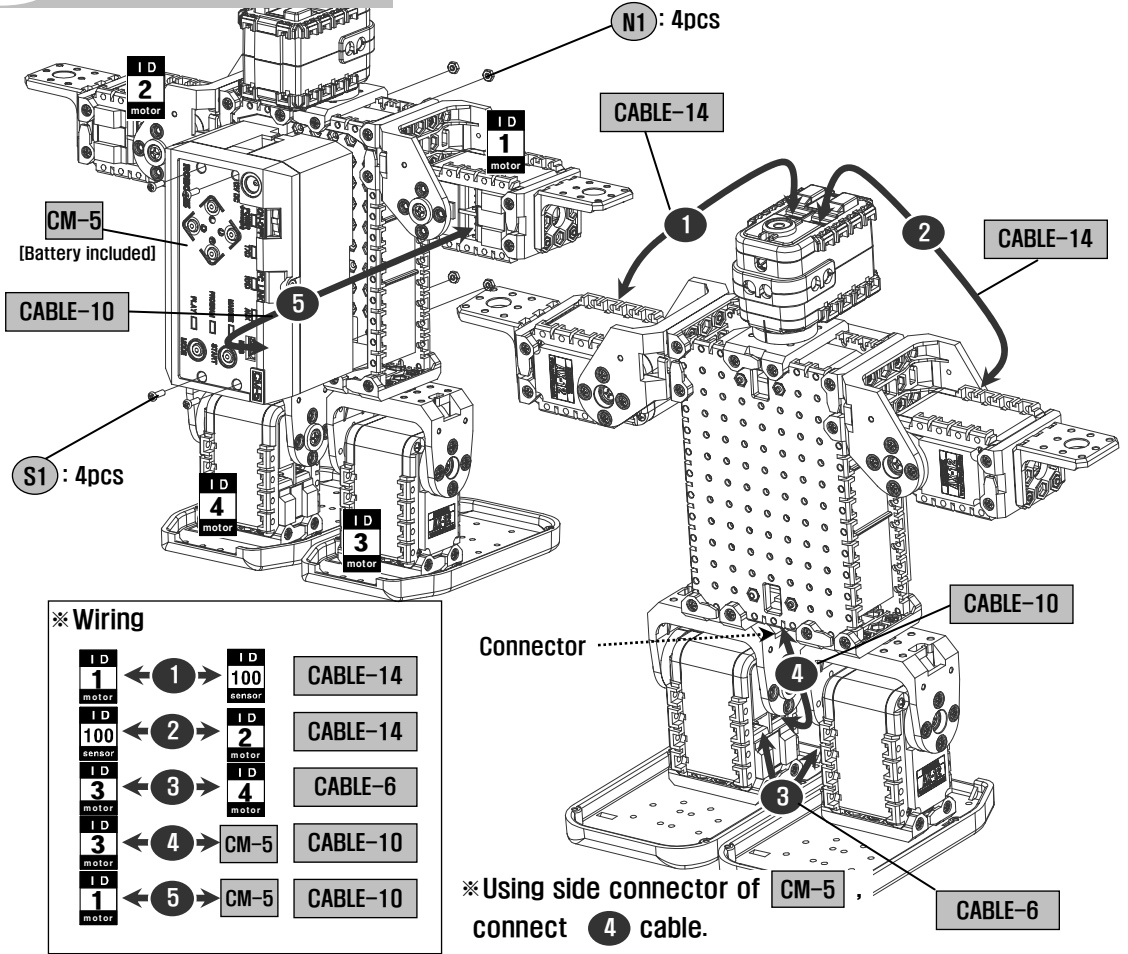
※ Check assembly point

※ Insert nuts N1 : 8pcs

ID 3 motor

ID 4 motor

Step 8 CM-5 Assembly and Wiring



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
 (In CD, [Applied Robots\Beginner\Greeting Penguin\CheckAssembly\(Greeting Penguin\).bpg](#))
 ※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.
 ※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11c]

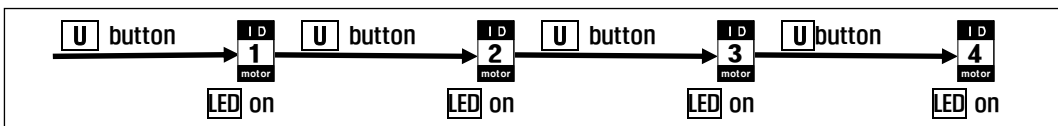
↔PC:57142 BPS, ↔Dynamixel:1000000 BPS

ID:001 002 003 004 100
 005[0X05] Dynamixels Found.

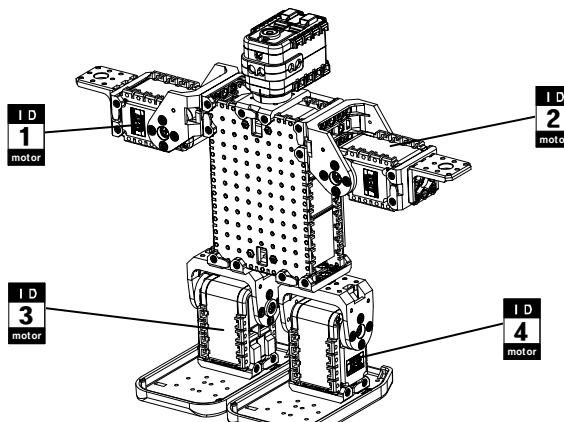
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.



※For ID of **Dynamixel** refer to the figure below.



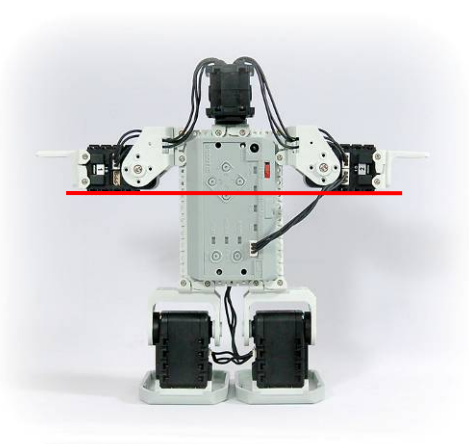
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram

※ Side View



Two legs are perpendicular to the surface.

※ Back View



Two arms are wide open.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Greeting Penguin\DemoExample\(Greeting Penguin\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

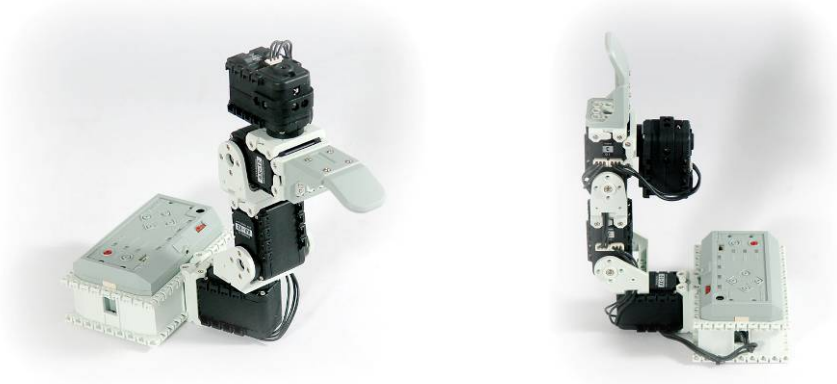
- When you place a hand on the front of a head, it greets..
- when you place a hand on the right side of a head, it raises right hand
- When you place a hand on the left side of a head, it raises left hand.

Step 4 Compare with the provided video clip

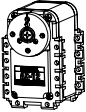


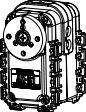
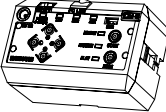
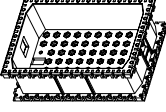
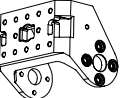

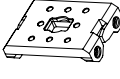

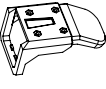


(In CD, [Applied Robots\Beginner\Greeting Penguin\DemoExample\(Greeting Penguin\).wmv](#))

2-2-1 1. Attacking Duck


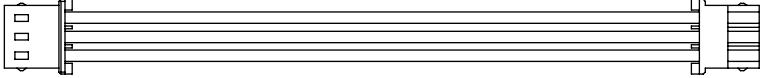


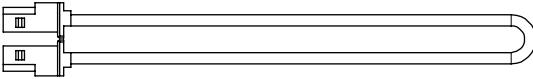
Let's build a duck robot that attack with a beak when the sensor detects an object.



(1) Necessary parts

 ID 1 motor	 ID 2 motor	 ID 3 motor	 ID 100 SENSOR	 CM-5	 ADAPTOR-CM5	
AX-12 × 3			AX-S1 × 1	× 1	× 1	
 F1 × 1	 F2 × 1	 F3 × 5	 F9 × 1	 F11 × 1	 BU × 2	 WA × 2

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

 N1 × 40	 CABLE-10 × 2
 S1 × 56	
 S-B × 2	 CABLE-14 × 2

(2) Assembling

Step 1 CM-5

ADAPTOR-CM5

CM-5
[Battery included]

S1 : 4pcs

N1 : 4pcs

Step 2 Joint 1

F3 : 2pcs

S1 : 4pcs

N1 : 4pcs

Step 3 Joint 2

※ Check assembly point

S1 : 4pcs

F1

ID 1 motor

Step 4 Joint 3

N1 : 4pcs

S1 : 4pcs

F2

Step 5 Hand

F3

F9

N1 : 8pcs

S1 : 8pcs

F11

Step 6 Whole Body Assembly

※ Insert nuts N1 : 12pcs

N1 : 12pcs

ID 3 motor

S1 : 24pcs

WA : 2pcs

S-B : 2pcs

BU : 2pcs

Step 1

Step 2

Step 3

Step 4

Step 5

※ Check assembly point

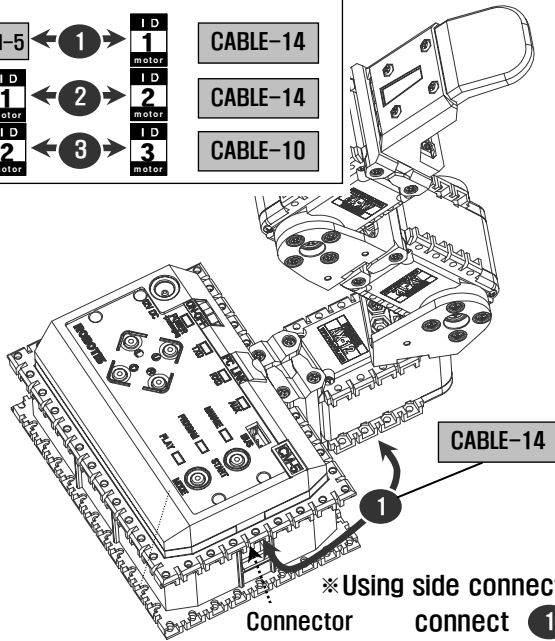
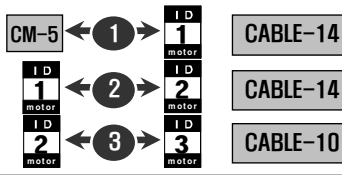
※ Insert nuts N1 : 4pcs

N1 : 4pcs

※ Check assembly point

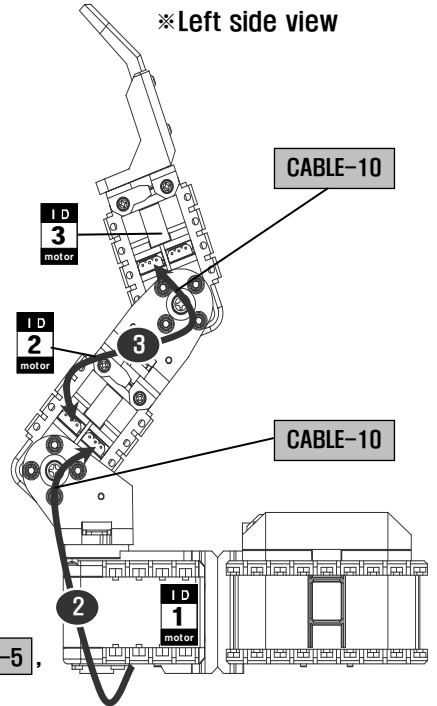
Step 7 Wiring

※ Wiring



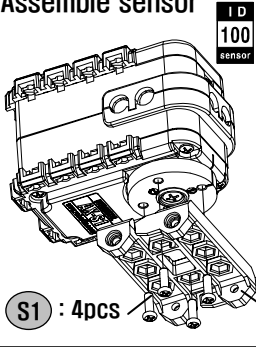
※ Using side connector of CM-5, Connector connect ① cable.

※ Left side view



Step 8 Assemble Sensor and Completion

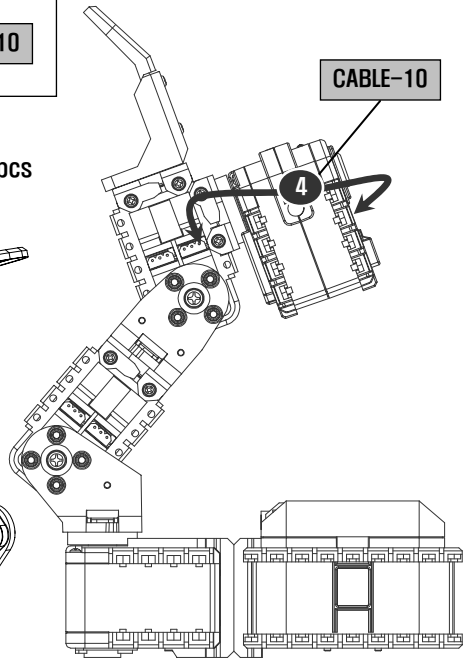
※ Assemble sensor



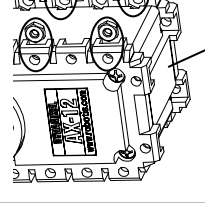
※ Wiring



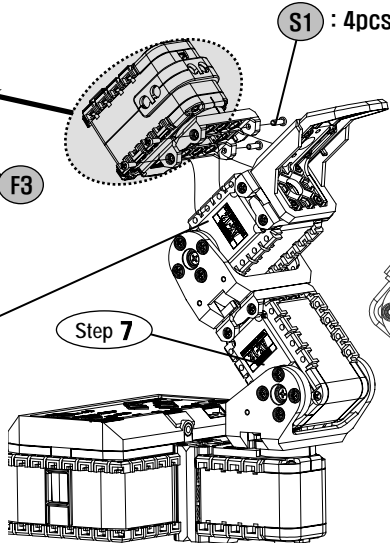
※ Left side view



※ Insert nut



Step 7



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Attacking Duck\CheckAssembly\Attacking Duck.bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.06]

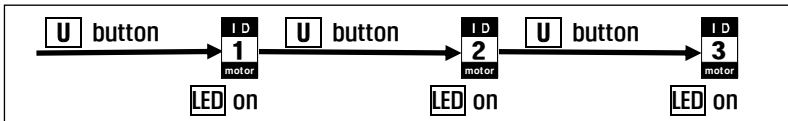
<->PC:57142 BPS <->Dynamixel:1000000 BPS

ID:001 002 003 100
004[0X04] Dynamixels Found.

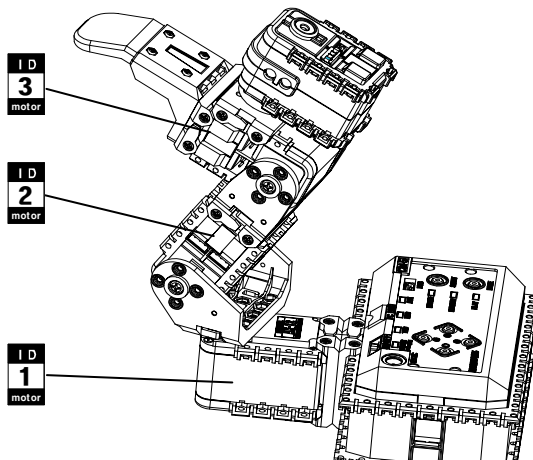
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever **U** button is pressed **LED** is on in the order shown below.



For ID of **Dynamixel** refer to the figure below.



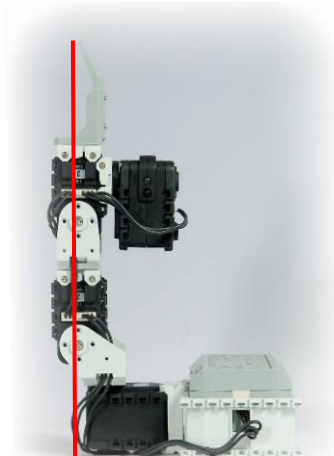
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Front View



The palm of the hand is facing the front.

※Side View



The Robot Arm is perpendicular to **CM-5** .

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Attacking Duck \DemoExample\(Attacking Duck\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you place a hand on the front of the head, the duck attacks with a beak.
- When you place a hand on the right side of the head, the head turns to the right.
- When you place a hand on the left side of the head, it turns to the left

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\ Attacking Duck \DemoExample\(Attacking Duck\).wmv](#))

2-2-1 2. Cliff Detection Car

Let's build a car that detects and avoids cliff and obstacle automatically by a sensor.



(1) Necessary parts

	ID 1 ID 2 ID 3 ID 4 motor motor motor motor		ID 100 sensor		CM-5		ADAPTOR-CM5
AX-12 × 4		AX-S1 × 1		× 1		× 1	
F3 × 6	F13 × 4		F14 × 4		Sticker × 10		
<p>※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.</p>							
	N1 × 48			CABLE-6 × 2			
	S1 × 48			CABLE-10 × 2			
	S2 × 16			CABLE-14 × 1			

(2) Assembling

Step 1 Left Wheel : 2 sets

※ Assemble 2 sets using **ID 2** motor and **ID 4** motor

※ Insert nuts **N1** : 4pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

ID 2 motor **ID 4** motor

F3 : 2pcs

S1 : 4pcs

F13 : 2pcs

F14 : 2pcs

S2 : 4pcs

※ Assemble taking note of the inserted location of nuts .

Step 2 Right Wheel : 2 sets

※ Assemble 2 sets using **ID 1** motor and **ID 3** motor

※ Insert nuts **N1** : 4pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

ID 1 motor **ID 3** motor

F3 : 2pcs

S1 : 4pcs

F13 : 2pcs

F14 : 2pcs

S2 : 4pcs

※ Assemble taking note of the inserted location of nuts .

Step 3 Joint

F3 : 2pcs

N1 : 4pcs

S1 : 4pcs

Step 4 Head

※ Insert nuts **N1** : 4pcs

※ Attach nut stickers : Make sure nuts do not come off.
Sticker : 2pcs

N1 : 4pcs

ID 100 sensor

S1 : 8pcs

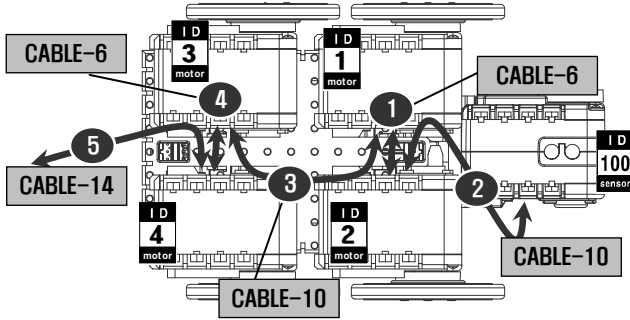
ADAPTOR-CM5

ID 100 sensor

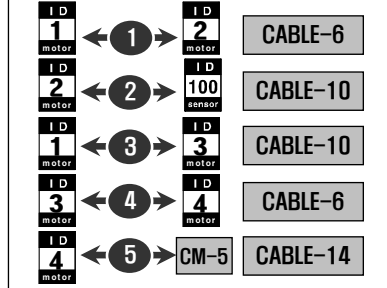
Step 3

Step 5 Whole Body Assembly and Wiring

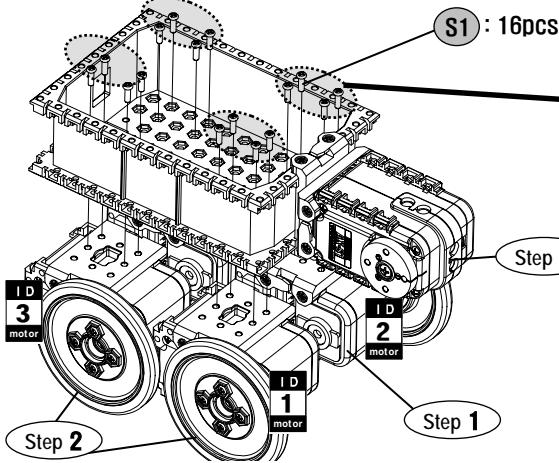
※ Bottom view



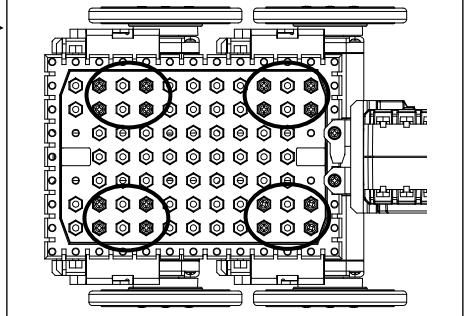
※ Wiring



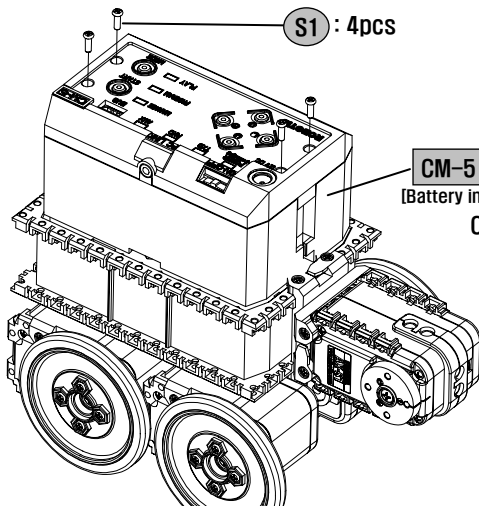
※ Assemble after wiring is finished



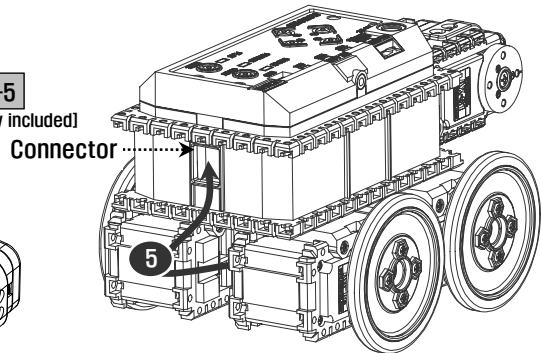
※ Top view : Check screw assembly point



Step 6 Completion



※ Using side connector of CM-5 , connect 5 cable.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
 (In CD, [Applied Robots\Beginner\Cliff Detection Car\CheckAssembly\(Cliff Detection Car\).bpg](#))
 ※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.
 ※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11c]

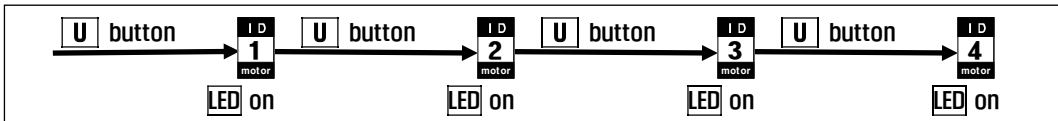
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 100
 005(0X05) Dynamixels Found.

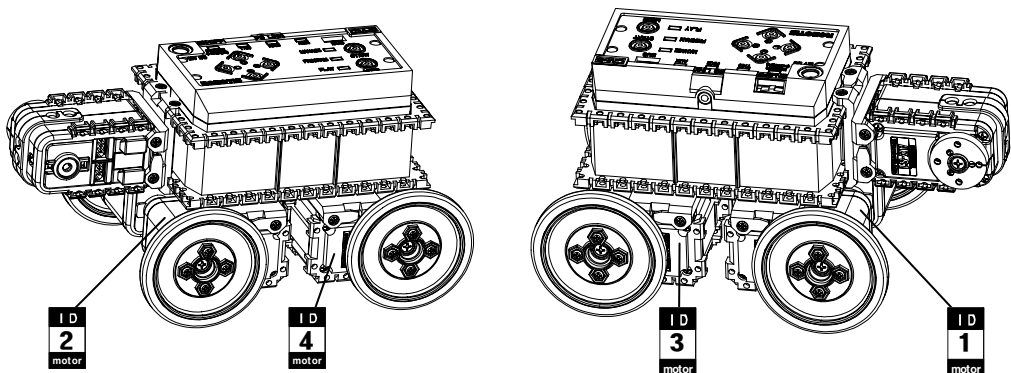
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever **U** button is pressed **LED** is on in the order shown below.



※ For ID of **Dynamixel** refer to the figure below.



Step 5 Close the CM-5 online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Cliff Detection Car \DemoExample\(Cliff Detection Car\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- The car moves forward and it avoids when it meets a cliff.
- The car moves forward and it avoids when it meets an obstacle.

Step 4 Compare with the provided video clip

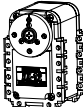




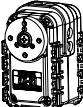


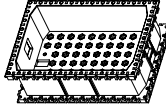
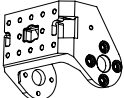

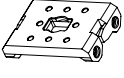

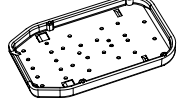


(In CD, [Applied Robots\Beginner\Cliff Detection Car \DemoExample\(Cliff Detection Car\).wmv](#))

2-2-1 3. Clapping Penguin


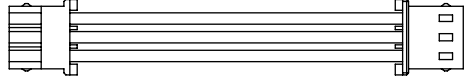

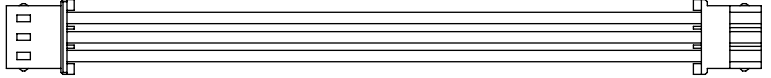

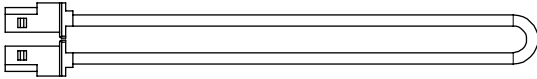
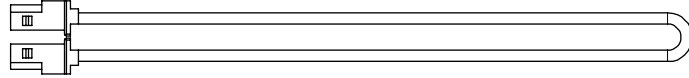
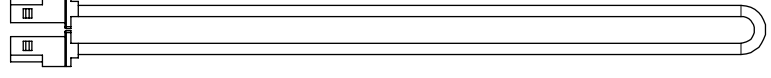
Let's build a penguin robot that greets when it meets an object in front and that imitates the handclap action



(1) Necessary parts

	 ID 1 motor	 ID 2 motor	 ID 3 motor	 ID 4 motor		 ID 100 sensor		CM-5 × 1		ADAPTOR-CM5 × 1
										
F1 × 2	F2 × 2	F3 × 9	F9 × 2	F12 × 2	BU × 4	WA × 4				

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 70		CABLE-6 × 1
	S1 × 90		CABLE-10 × 1
	S-B × 4		CABLE-14 × 1
			CABLE-18 × 1
			CABLE-20 × 1

(2) Assembling

Step 1 Shoulder : 2 sets
 ※ Assemble 2 sets in a same style.
 S1 : 4pcs
 N1 : 4pcs
 F3
 F1

Step 2 Hand : 2 sets
 ※ Assemble 2 sets in a same style.
 N1 : 4pcs
 S1 : 4pcs
 F9
 F3

Step 3 Head
 I.D 100 sensor
 F3
 S1 : 4pcs

Step 4 Upper Part of Body Assembly
 ※ Insert nuts
 N1 : 12pcs
 I.D 1 motor
 N1 : 8pcs
 I.D 2 motor
 S1 : 28pcs
 Step 1
 Step 2
 Step 3
 Step 1
 Step 2
 WA : 2pcs
 S-B : 2pcs
 BU : 2pcs
 ※ Check assembly point

Step 5 Leg : 2 sets

※ Assemble 2sets in a same style.

N1 : 4pcs
F3
S1 : 4pcs
F2

Step 6 Foot : 2 sets

※ Assemble 2sets in a same style.

N1 : 3pcs
F3
F12
S1 : 3pcs

Step 7 Lower Part of Body Assembly

※ Insert nuts N1 : 8pcs

※ Check assembly point

※ Insert nuts N1 : 8pcs

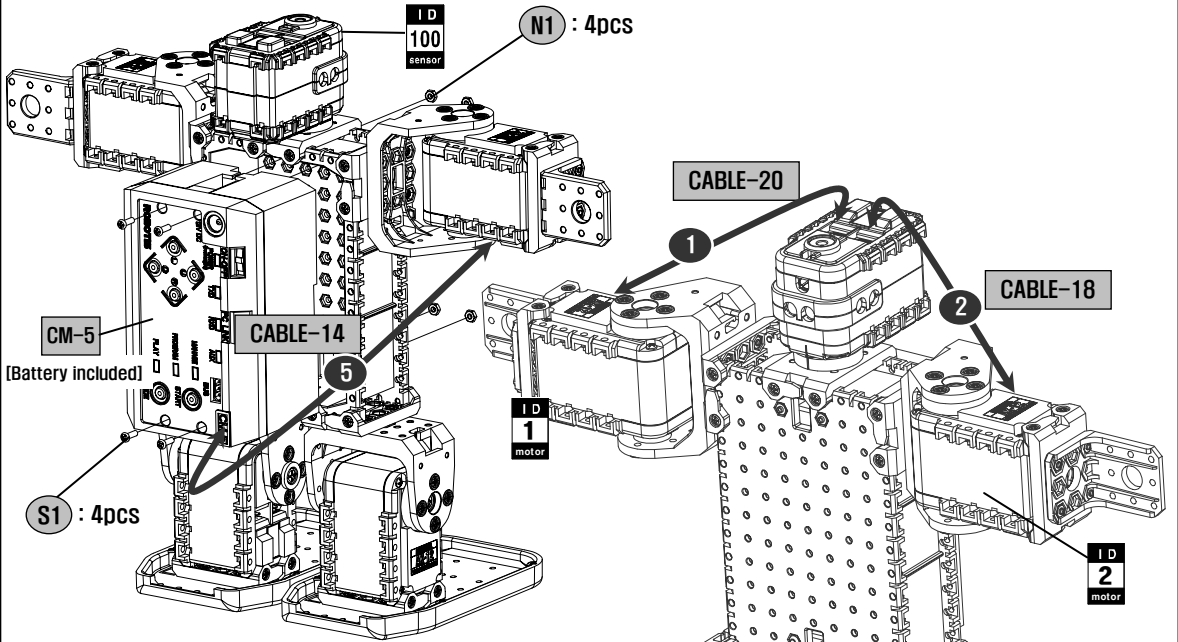
※ Check assembly point

Step 4
Step 5
Step 5
Step 6

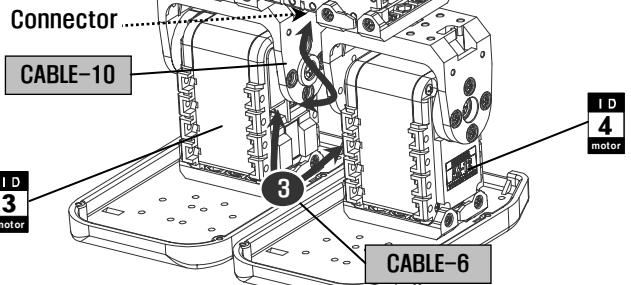
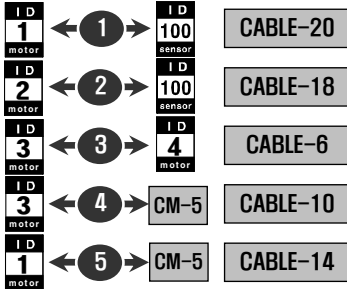
S-B : 2pcs
S1 : 24pcs
BU : 2pcs
WA : 2pcs

I D 3 motor
I D 4 motor

Step 8 CM-5 Assembly and Wiring



※ Wiring



※ Using side connector of CM-5, connect ④ cable.

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Clapping Penguin\CheckAssembly\(Clapping Penguin\).bpg](#))
*Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.
*Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

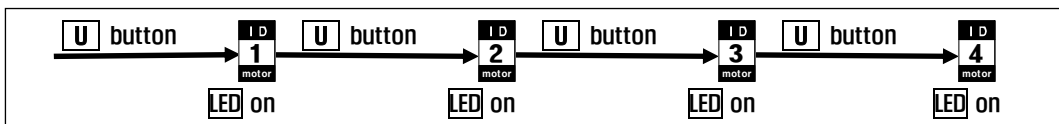
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.11c]
(<>PC:57142 BPS, <>)Dynamixel:1000000 BPS
ID:001 002 003 004 100
005(0X05) Dynamixels Found.
```

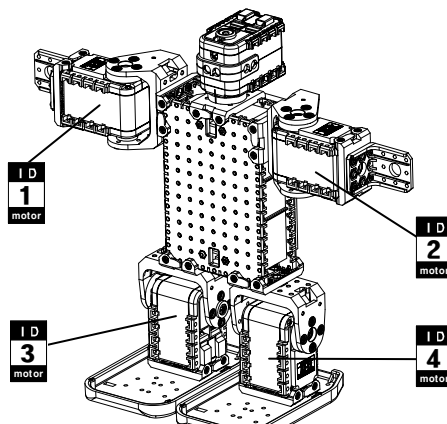
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

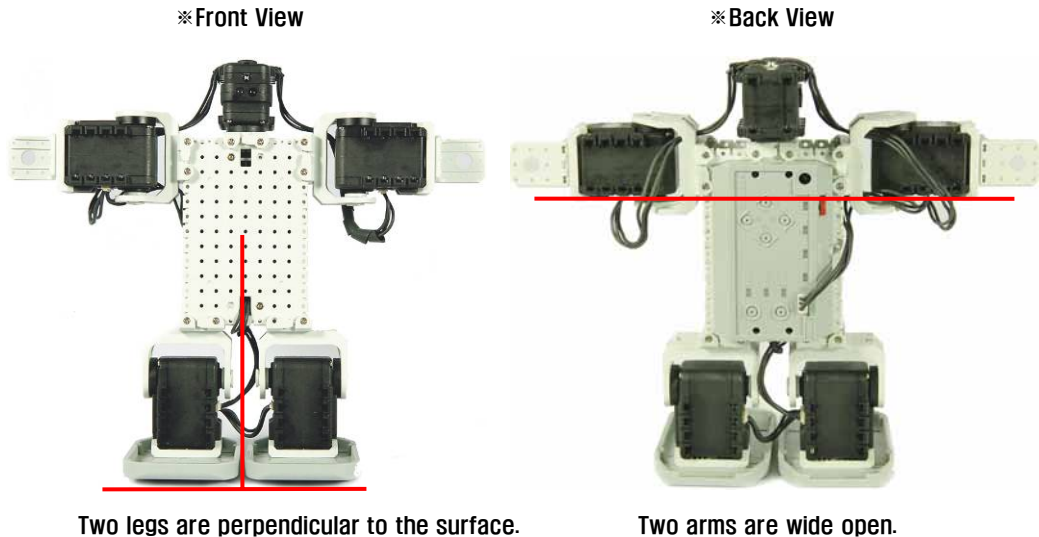
*Whenever **U** button is pressed **LED** is on in the order shown below.



*For ID of **Dynamixel** refer to the figure below.



Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.



Step 6 Close the online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner\Clapping Penguin \DemoExample\(Clapping Penguin\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When you place a hand on the front of a head, the penguin robot greets.
- When you handclap, the penguin robot claps same number of times.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\Beginner \Clapping Penguin \DemoExample\(Clapping Penguin\).wmv](#))

2-2-1 4. Walking Droid

Let's build 2-legged walking robot, Droid. This robot continues to move forward, and when it meets an obstacle, it will avoid it.



(1) Necessary parts

ID 1 motor				ID 2 motor	ID 3 motor	ID 4 motor	ID 100 sensor	CM-5	ADAPTOR-CM5
AX-12 × 4				AX-S1 × 1		× 1	× 1		
F1 × 2	F3 × 2	F8 × 2	F12 × 2	BU × 2	WA × 2	Sticker × 3			

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 50		CABLE-10 × 3
	S1 × 64		
	S2 × 2		CABLE-14 × 2
	S-B × 2		

(2) Assembling

Step 1 Right Leg 1

※ Check assembly

ID 1 motor

F3

S1 : 4pcs

Step 2 Right Leg 2

N1 : 4pcs

F1

F12

S1 : 4pcs

Step 4 Left Leg 1

※ Check assembly point

ID 2 motor

F3

S1 : 4pcs

Step 5 Left Leg 2

N1 : 4pcs

F1

F12

S1 : 4pcs

Step 3 Right Leg 3

※ Insert nuts N1 : 4pcs

S1 : 8pcs

Step 1

ID 3 motor

WA

S-B

BU

Step 2

※ Check assembly point

Step 6 Left Leg 3

※ insert nuts N1 : 4pcs

S1 : 8pcs

Step 4

ID 4 motor

WA

BU

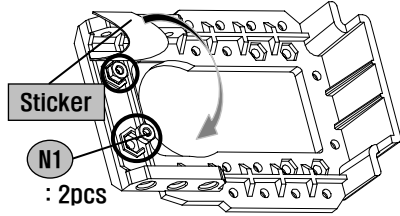
S-B

Step 5

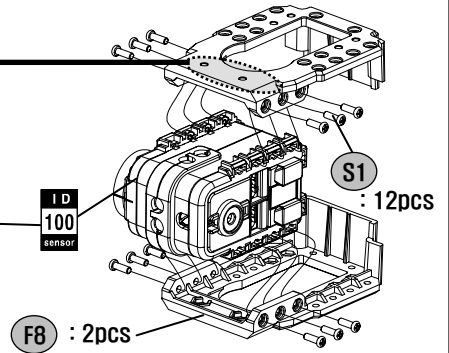
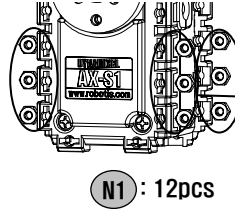
※ Check assembly point

Step 7 Waist

※ Attach nut stickers:
make sure nuts do not come off

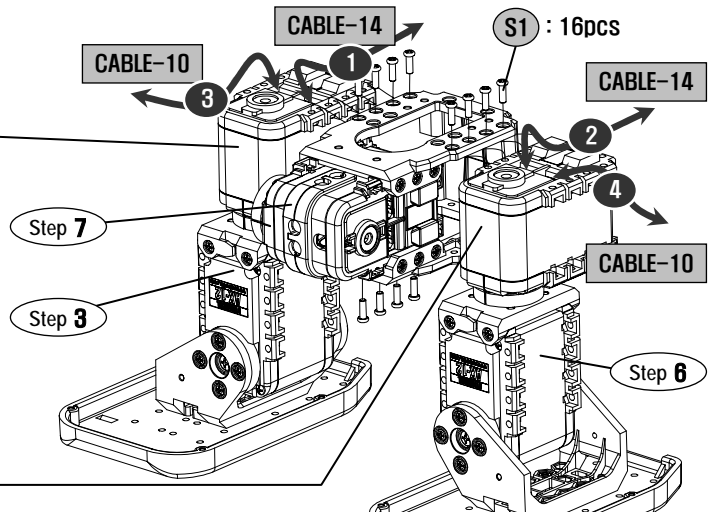
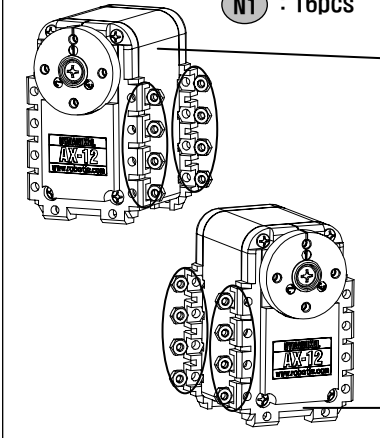


※ Insert nuts



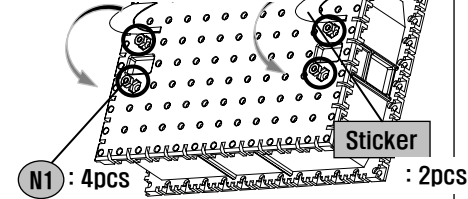
Step 8 Lower Part of Body

※ Insert nuts

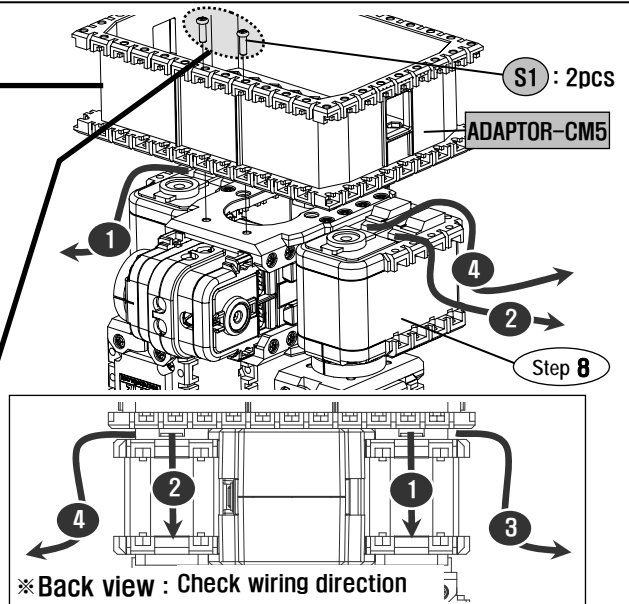
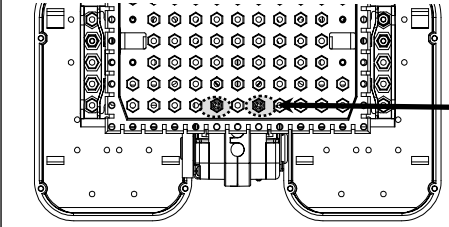


Step 9 ADAPTOR-CM5 Assembly

※ Attach nut stickers:
make sure do not come off.

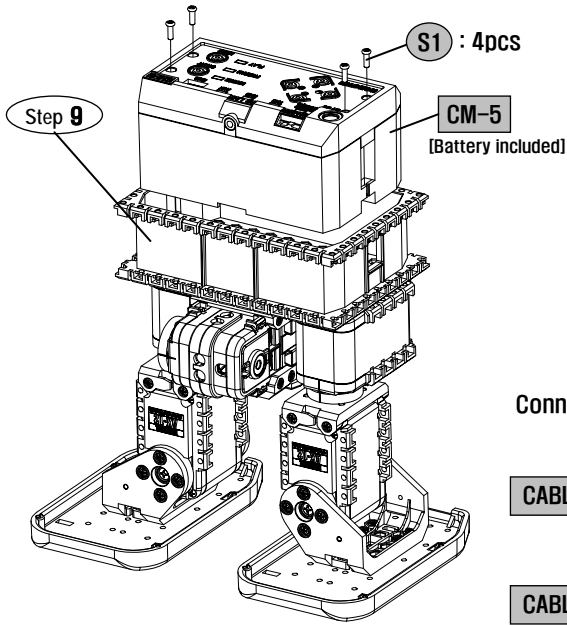


※ Top view : check screw assembly point

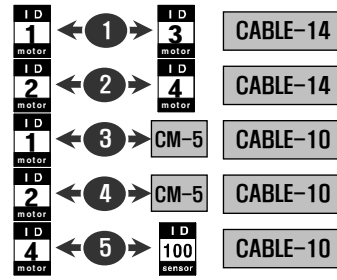


※ Back view : Check wiring direction

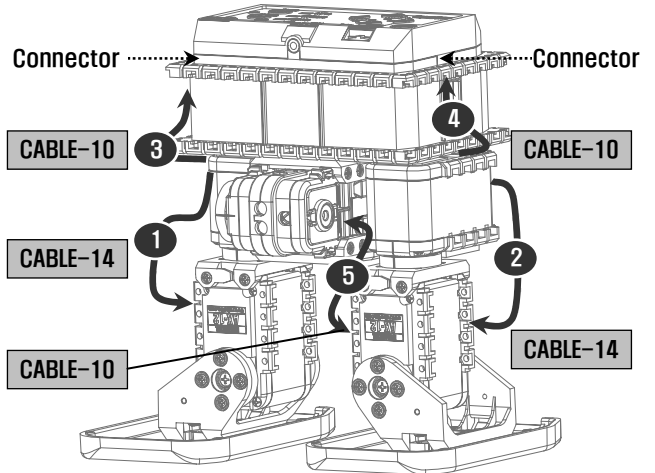
Step 10 Complete Assembly and Wiring



※ Wiring



※ Using both side connectors of CM-5, Connect 3 4 cables.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Beginner\Walking Droid\CheckAssembly\(Walking Droid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11c]

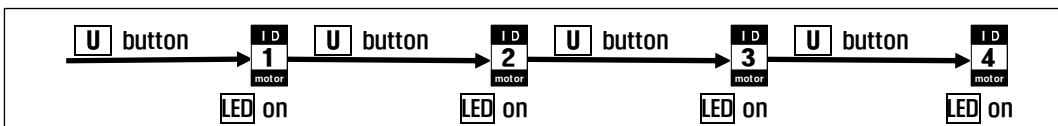
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 100
005(0X05) Dynamixels Found.

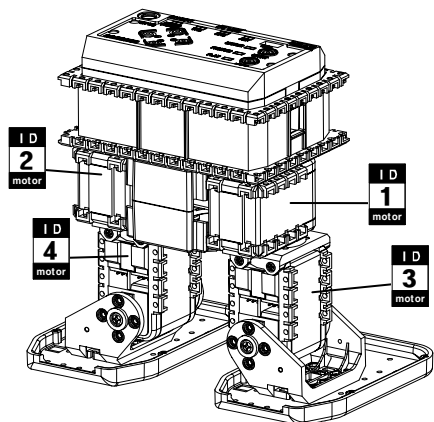
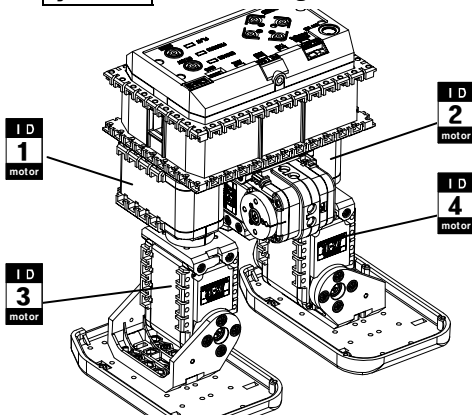
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.

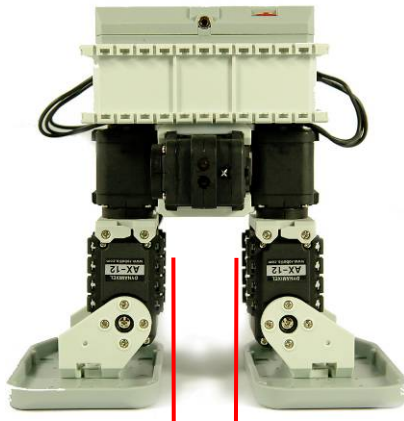


※For ID of **Dynamixel** refer to the figure below.



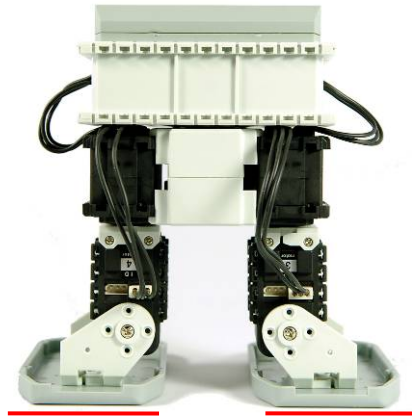
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Front View



The legs are parallel facing the front.

※Back View



Both feet are flat on the surface.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Beginner \Walking Droid \DemoExample\(Walking Droid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Beginner\Walking Droid \DemoExample\(Walking Droid\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

– Robot continues to move forward and when it meets an obstacle, it will avoid it.

Step 5 Compare with the provided video clip

(In CD, [Applied Robots\Beginner\Walking Droid \DemoExample\(Walking Droid\).wmv](#))

2 – 3. Examples of intermediate Level



1. Probing Robot



2. Excavator



3. Robot Flower



4. Fawn



5. Turtle



6. Spider



7. Gerwalk



8. Battle Droid

2-3-1. Probing Robot

Let's build a probing robot that picks up an object in front and that moves it aside.



(1) Necessary parts

	ID 1 motor	~	ID 7 motor	AX-12 × 7		ID 100 sensor	AX-S1 × 1		CM-5 × 1		ADAPTOR-CM5 × 1		
	F1 × 2		F2 × 1		F3 × 12		F9 × 2		F11 × 2		F13 × 4		F14 × 4
	BU × 3		WA × 3		Sticker × 10								

※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 84		CABLE-6 × 2
	S1 × 100		CABLE-10 × 3
	S2 × 16		CABLE-14 × 2
	S-B × 3		CABLE-18 × 1

(2) Assembling

Step 1 Sensor Assembly

S1 : 4pcs
F3 : 2pcs
N1 : 4pcs

S1 : 8pcs

※ Insert nuts N1 : 8pcs

ID 5 motor
ID 100 sensor

Step 2 Joint

Step 1

F2
WA
BU
F3 : 2pcs
S-B
S1 : 8pcs

ID 5 motor
ID 100 sensor

※ Check assembly point

Step 3 Claw Assembly

Step 2

※ Insert nuts N1 : 4pcs

ID 6 motor

※ Check assembly point

WA : 2pcs
S1 : 16pcs
BU : 2pcs
S-B : 2pcs

ID 7 motor

※ Insert nuts N1 : 4pcs

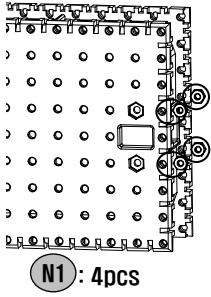
F1
F9
F11
S1 : 8pcs
N1 : 8pcs

※ Assemble 2 sets in a same style.

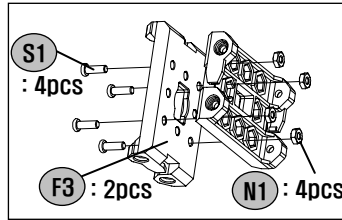
※ Check assembly point

Step 4 Body

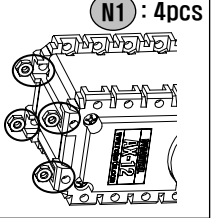
※Insert nuts



ADAPTOR-CM5



※Insert nuts



S1 : 8pcs

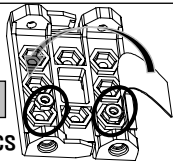
Step 3

Step 5 Right Wheel

※Attach nut stickers :

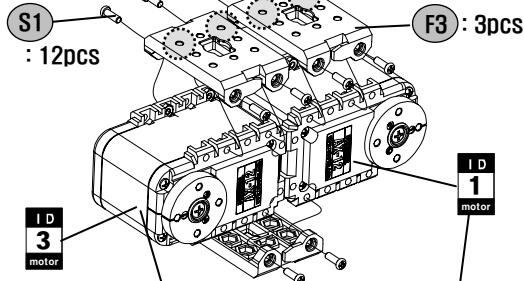
Make sure nuts do not come off.

Sticker

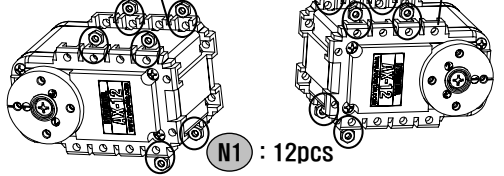


※Assemble 2 sets. N1 : 2pcs

※Assemble taking note of the inserted location of nuts .



※Insert nuts

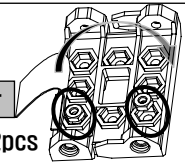


Step 6 Left Wheel

※Attach nut stickers :

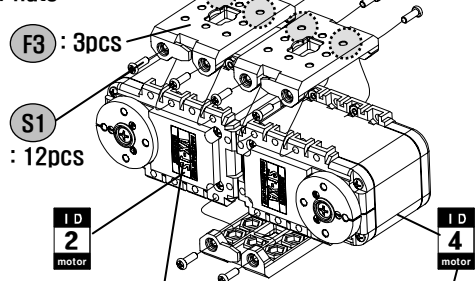
Make sure nuts do not come off.

Sticker

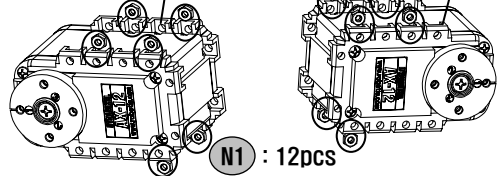


※Assemble 2 sets. N1 : 2pcs

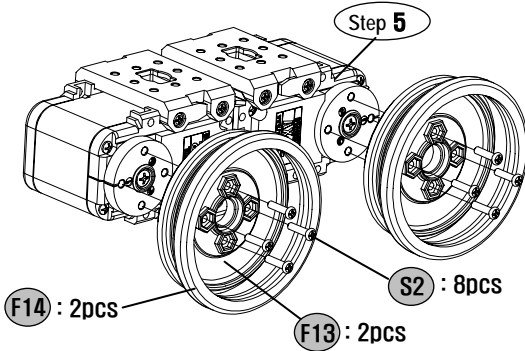
※Assemble taking note of the inserted location of nuts .



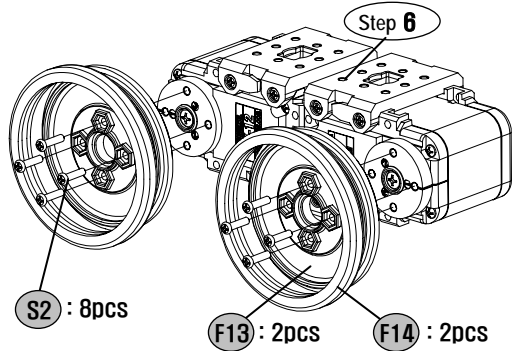
※Insert nuts



Step 7 Tire Assembly 1

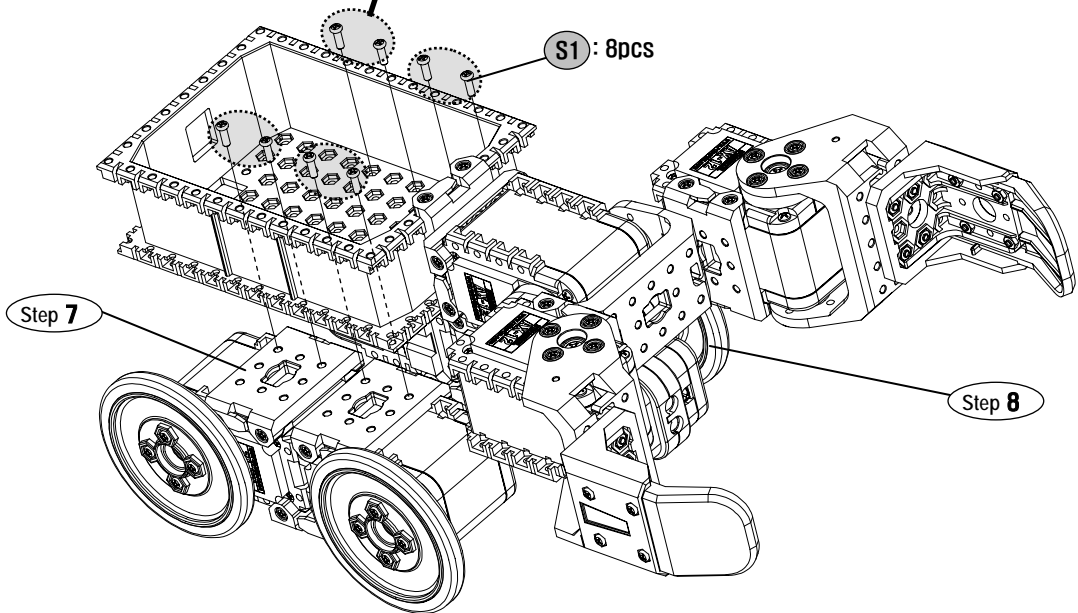
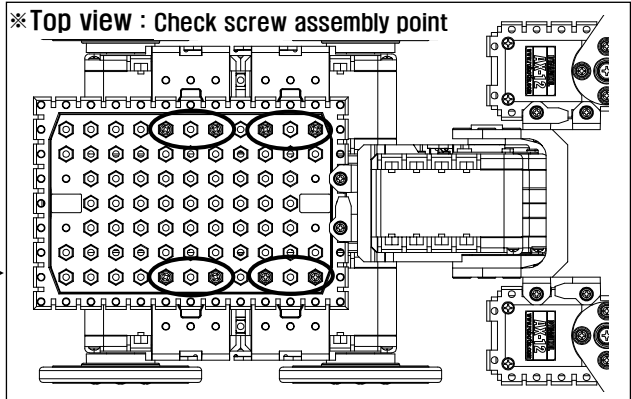
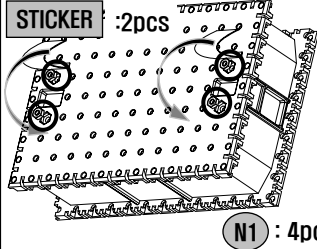


Step 8 Tire Assembly 2

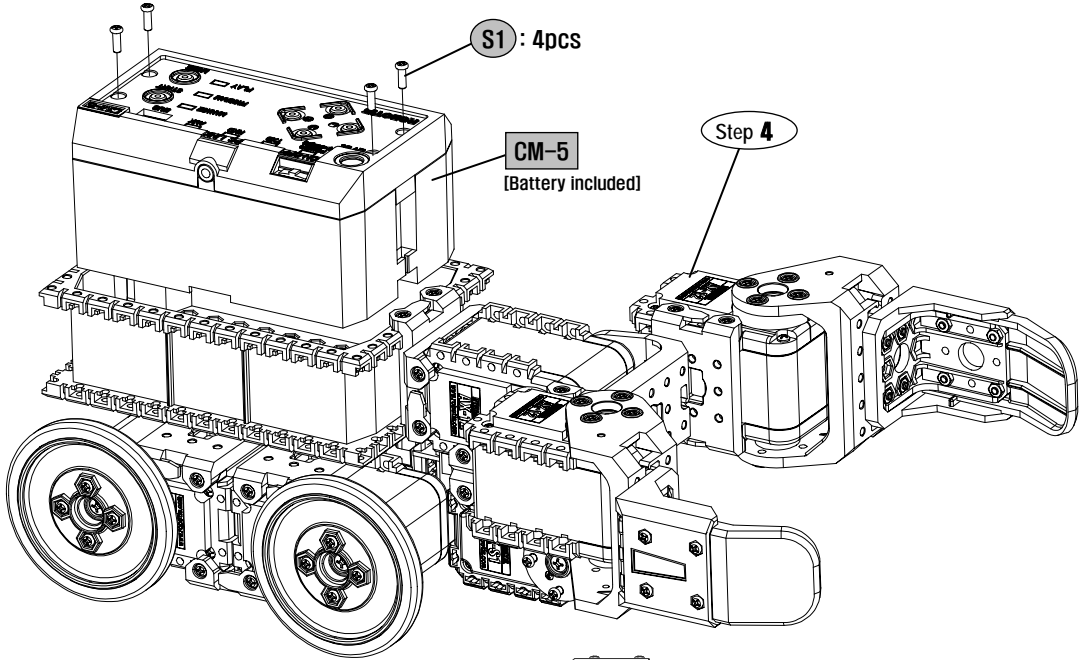


Step 9 Whole Body Assembly

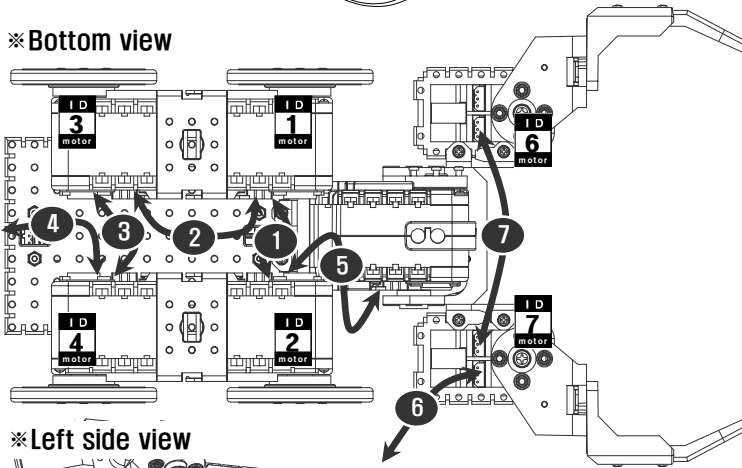
※ Attach nut stickers :
Make sure nuts do not come off.



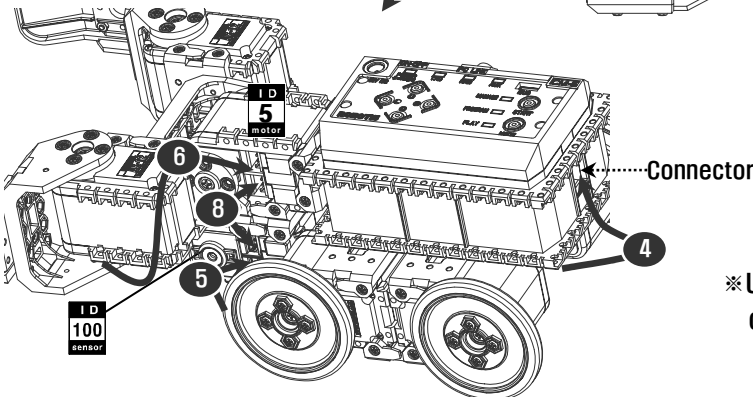
Step 10 Wiring and Completion



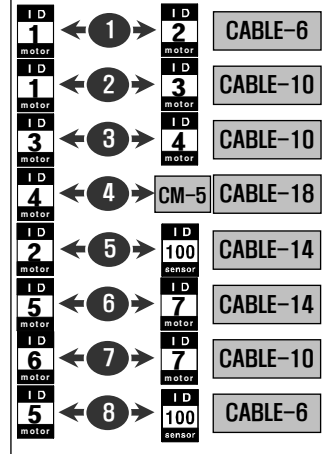
※ Bottom view



※ Left side view



※ Wiring



※ Using side connector of **CM-5**, connect **4** cable.

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Probing Robot\CheckAssembly\(Probing Robot\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

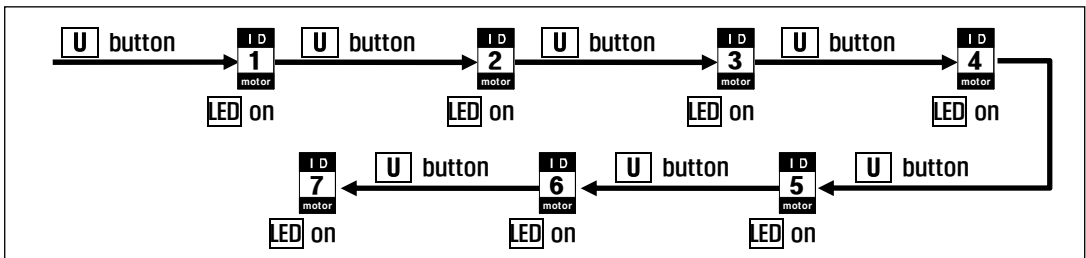
Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

```
[CM-5 Version 1.11dd]
<->PC:57142 BPS, <->Dynamixel:1000000 BPS
ID:001 002 003 004 005 006 007 100
008[0X08] Dynamixels Found.
```

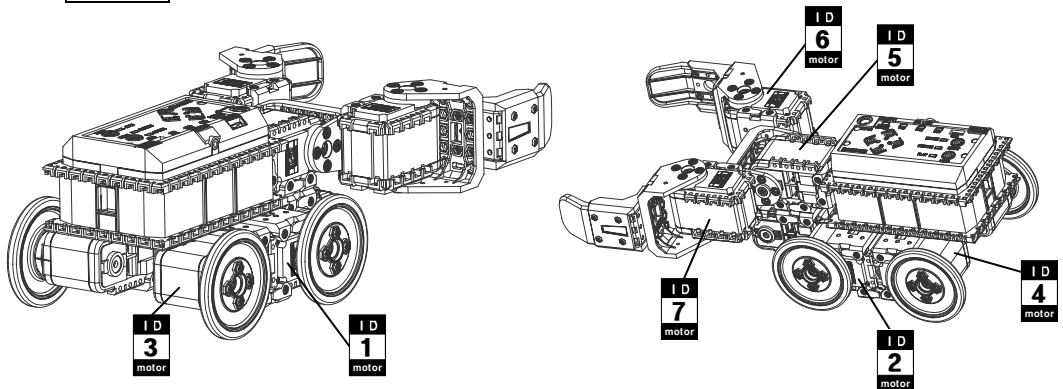
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever **U** button is pressed **LED** is on in the order shown below.

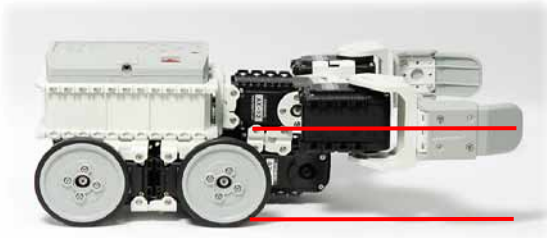


※For ID of **Dynamixel** refer to the figure below.



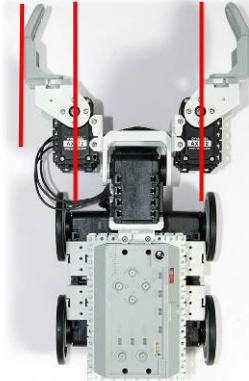
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



Claw is horizontal to the surface.

※Top View



Claws are balanced with each other.

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate\Probing Robot\DemoExample\(Probing Robot\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate offline robot.

※ Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

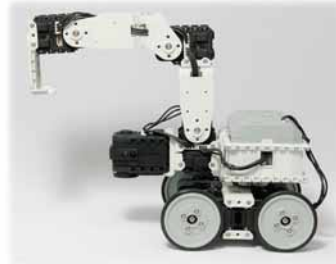
– When the sensor detects an object in front, the Probing Robot will examine the width of an object. If the width is manageable size, it will pick up an object and move it aside. If not, it will go around without moving it aside.

Step 4 Compare with the provided video clip

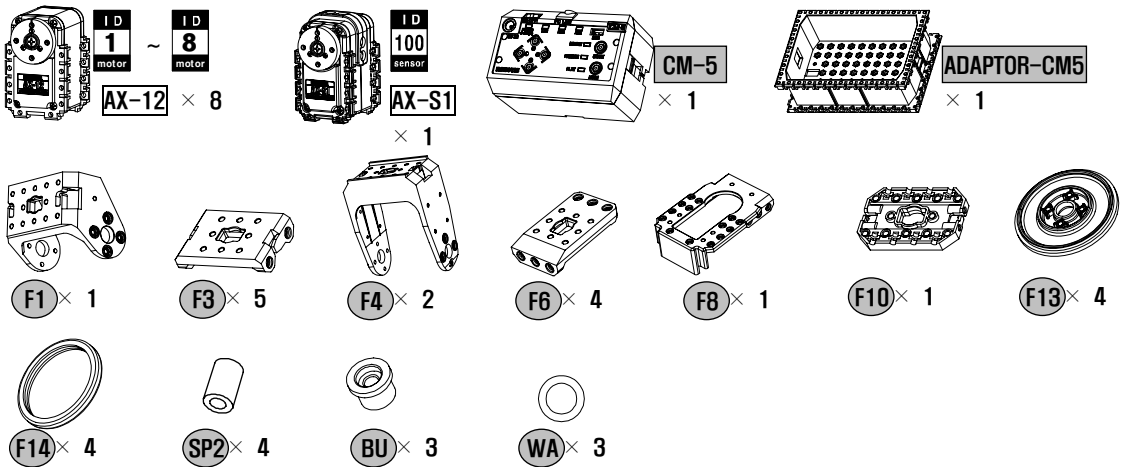
(In CD, [Applied Robots\Intermediate\Probing Robot\DemoExample\(Probing Robot\).wmv](#))

2-3-2. Excavator

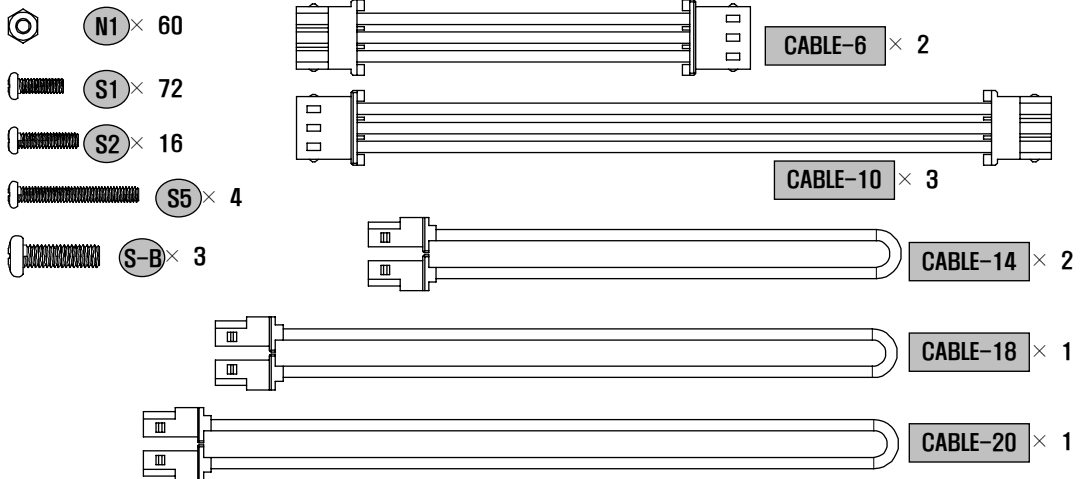
Let's build an excavator that performs excavation works with its robot arm when the sensor detects an object.



(1) Necessary parts



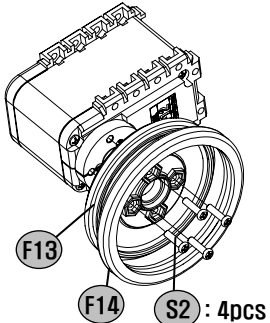
※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.



(2) Assembling

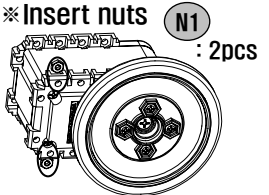
Step 1 Wheel : 4 sets

※ Using **ID 1 motor**, **ID 2 motor**, **ID 3 motor** and **ID 4 motor**, assemble 4sets.



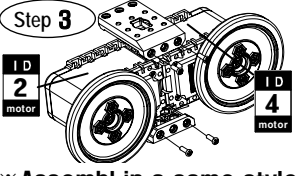
Step 2 ~ Step 3 Drive 1

※ Insert nuts **N1** : 2pcs



Step 3

※ Assemble in a same style.



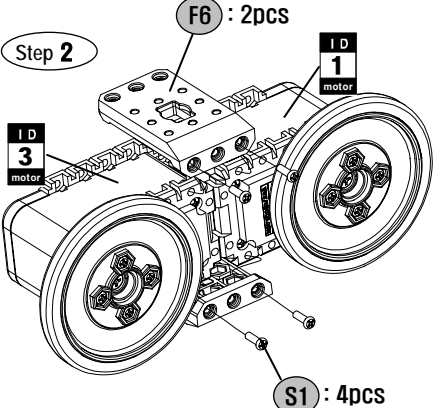
Step 2

F6 : 2pcs

ID 1 motor

ID 3 motor

S1 : 4pcs



Step 4 Drive Assembly

※ Assemble after wiring is finished.

※ Bottom view

※ Insert nuts **N1** : 8pcs

CABLE-10

CABLE-6

CABLE-20

ID 2 motor

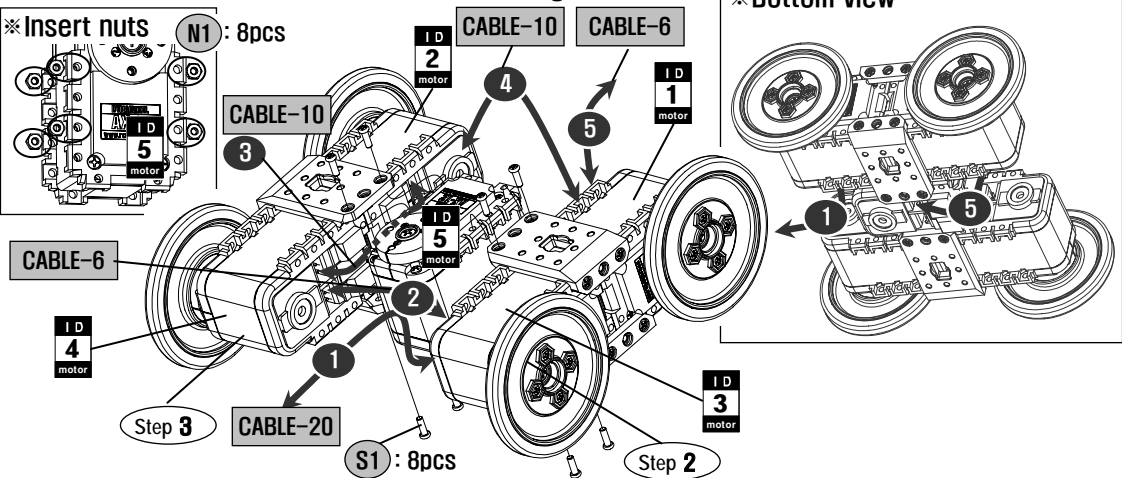
ID 1 motor

ID 5 motor

ID 4 motor

ID 3 motor

S1 : 8pcs



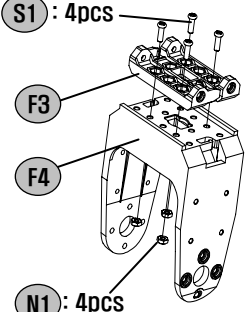
Step 5 Joint 1

S1 : 4pcs

F3

F4

N1 : 4pcs



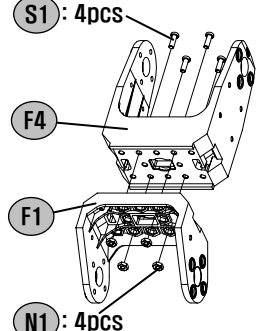
Step 6 Joint 2

S1 : 4pcs

F4

F1

N1 : 4pcs



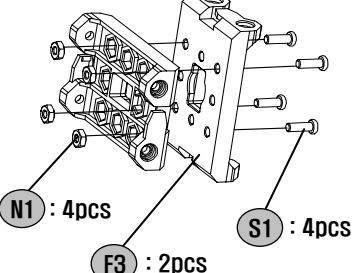
Step 7 Joint 3 : 2 sets

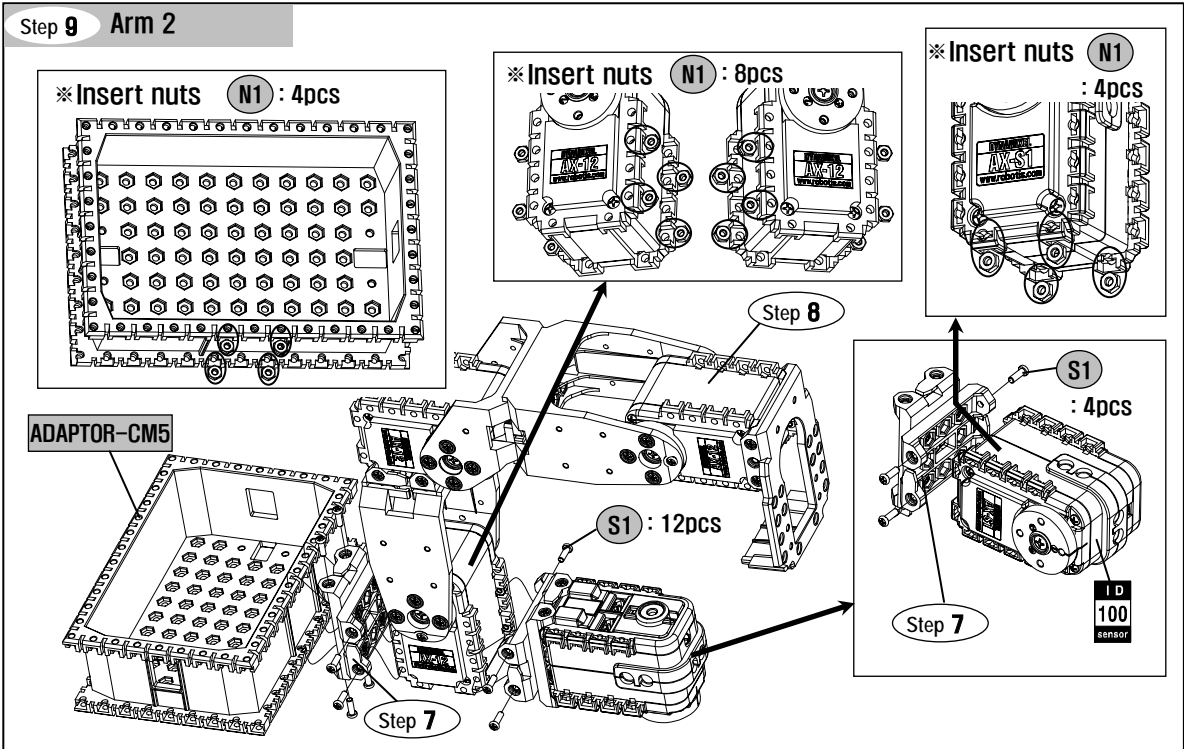
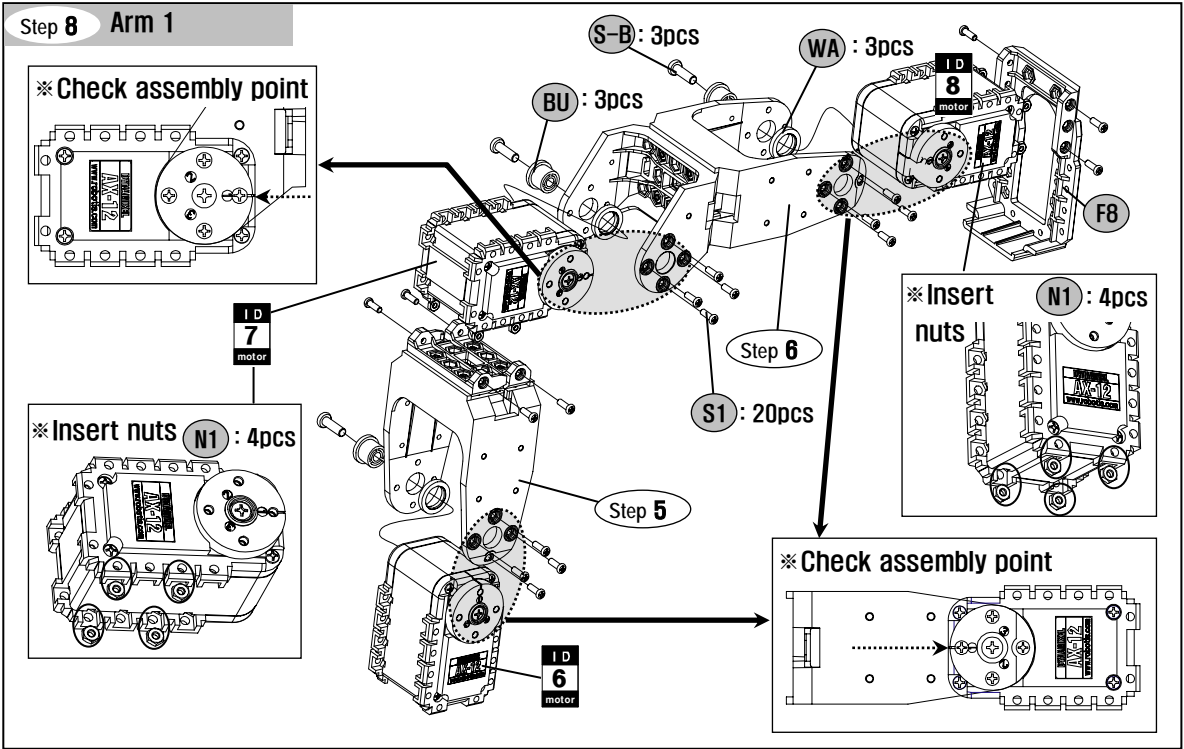
※ Assemble 2 sets in a same style.

N1 : 4pcs

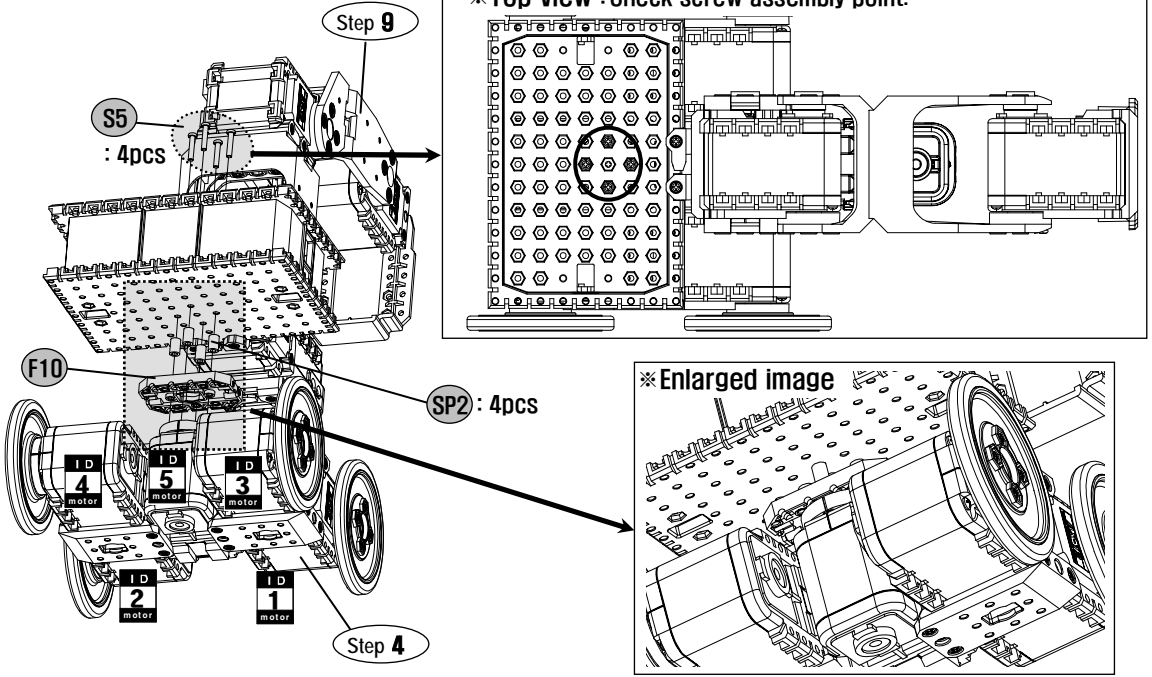
S1 : 4pcs

F3 : 2pcs

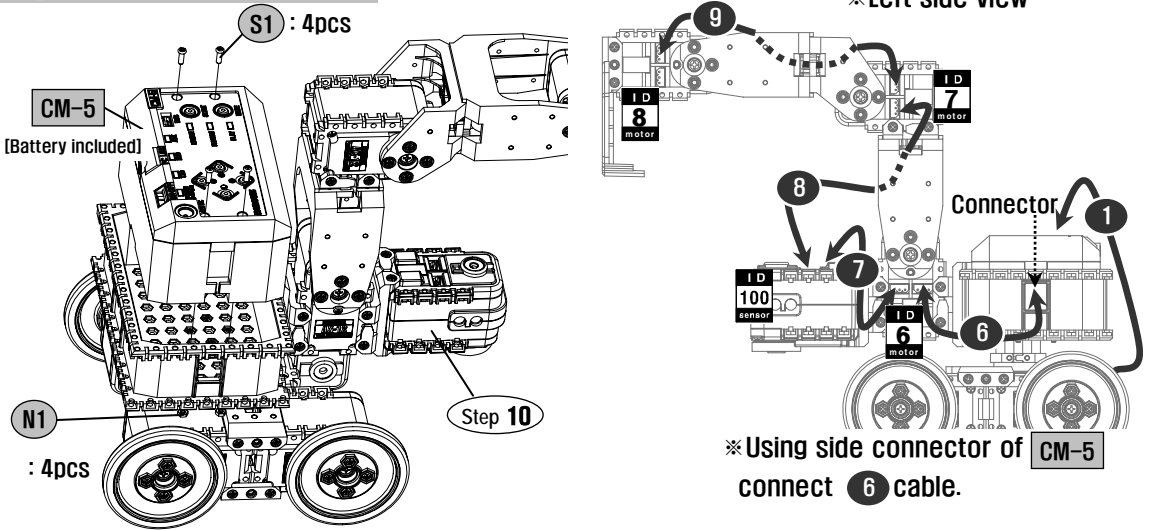




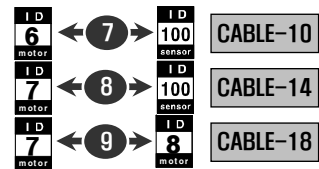
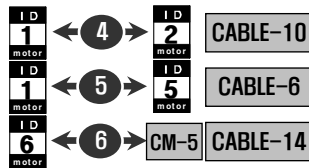
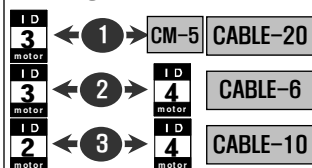
Step 10 Whole Body Assembly



Step 11 Wiring and Completion



※ Wiring



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Excavator\CheckAssembly\(Excavator\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

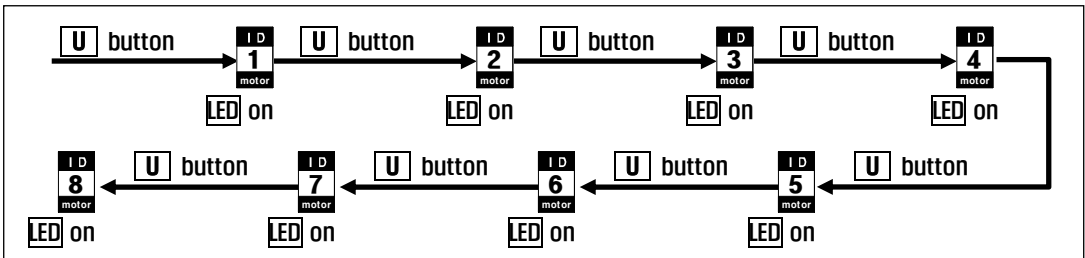
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 100
009[OX09] Dynamixels Found.

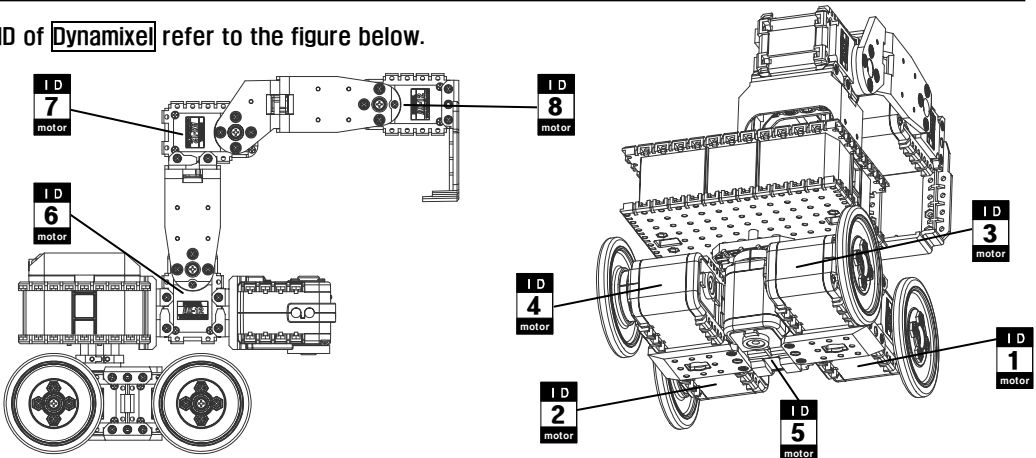
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever **U** button is pressed **LED** is on in the order shown below.

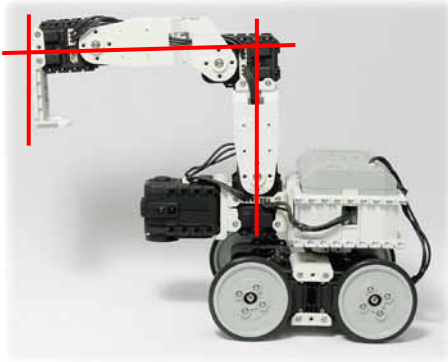


※ For ID of **Dynamixel** refer to the figure below.



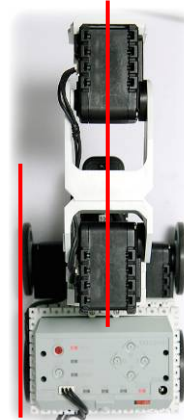
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



Each joint of robot arm forms the right angle.

※Top View



The robot arm and wheels are parallel.

Step 6 Close the CM-5 online robot activation

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate\ Excavator \DemoExample\[Excavator\].bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Operation of the robot

- When the sensor detects an object in front, its robot arm will perform the excavation works.
- When the sensor detects an object on side, it will turn to the side where the object is and will perform the excavation works.

Step 4 Compare with the provided video clip

(In CD, [Applied Robots\ Intermediate \ Excavator \DemoExample\[Excavator\].wmv](#))

2-3-3. Robot Flower

Let's build a robot that blooms a flower when the light is shone and that moves petals when there is a sound.



(1) Necessary parts

	ID 1 motor	~	ID 6 motor		ID 100 sensor		CM-5		ADAPTOR-CM5
AX-12 × 6				AX-S1 × 1		× 1		× 1	
	F1 × 3		F2 × 3		F3 × 9		F9 × 3		BU × 6
									WA × 6

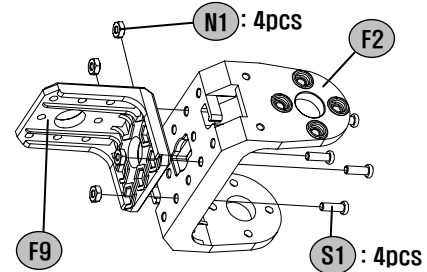
※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 68		CABLE-6 × 1
	S1 × 92		CABLE-10 × 3
	S-B × 6		CABLE-20 × 3

(2) Assembling

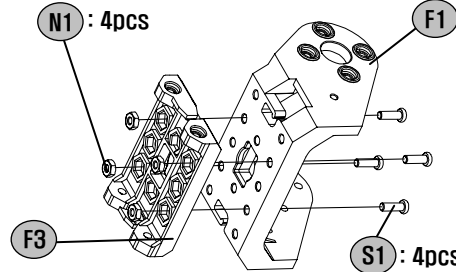
Step 1 Joint 1 : 3 sets

※ Assemble 3 sets in a same style.



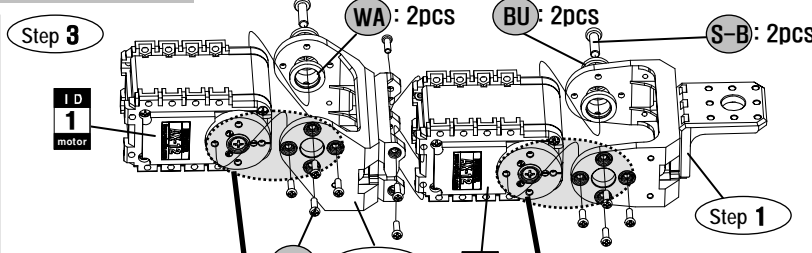
Step 2 Joint 2 : 3 sets

※ Assemble 3 sets in a same style.

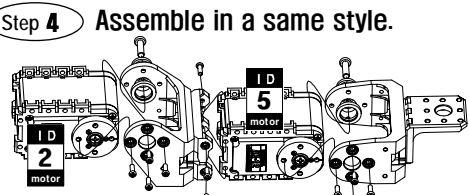


Step 3 ~ Step 4 Petal (TYPE 1) : 2 sets

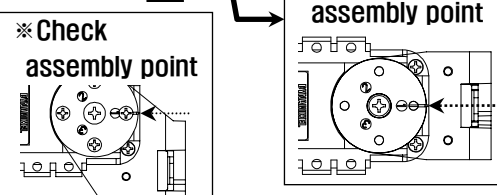
※ Insert nuts
N1 : 4pcs



Step 4 Assemble in a same style.

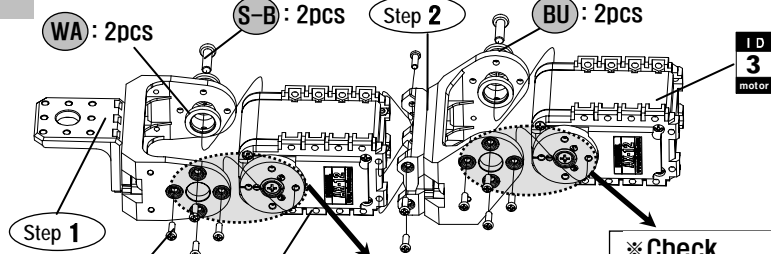


※ Check assembly point

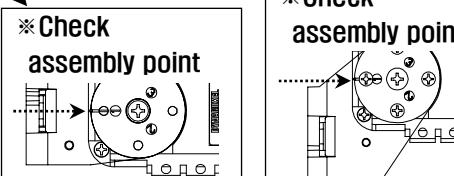


Step 5 Petal (TYPE 2)

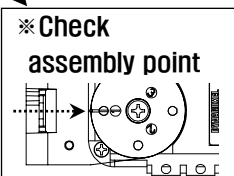
※ Insert nuts
N1 : 4pcs



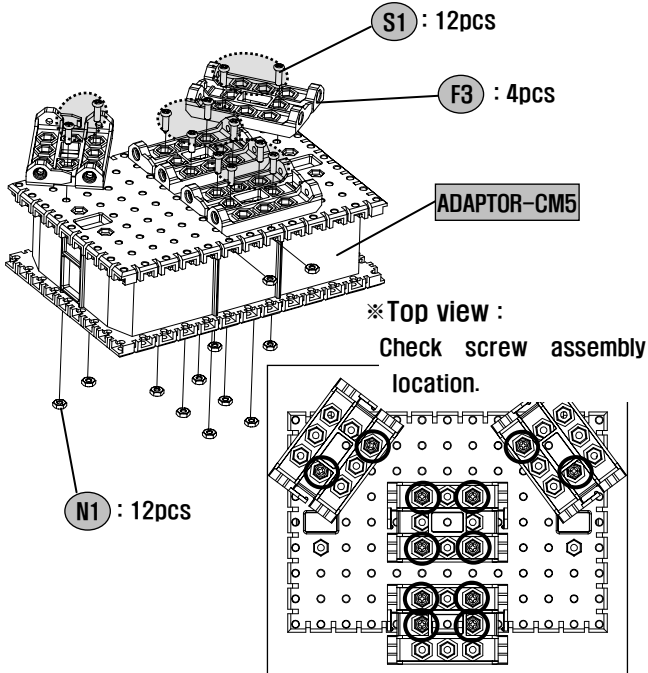
Step 2



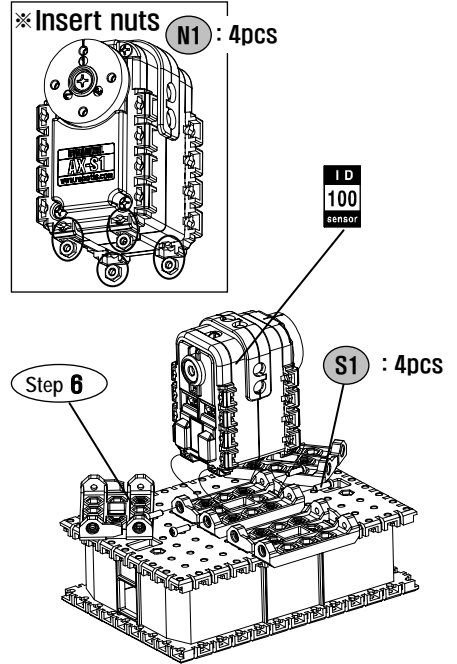
※ Check assembly point



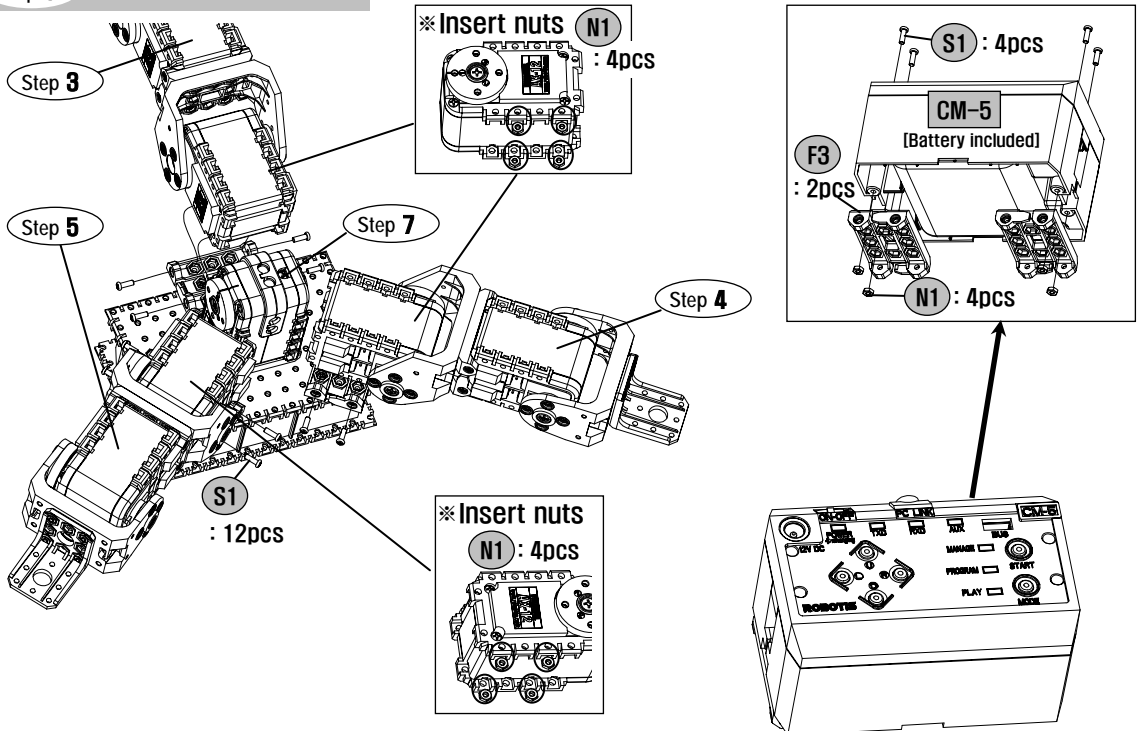
Step 6 Support



Step 7 Sensor Assembly



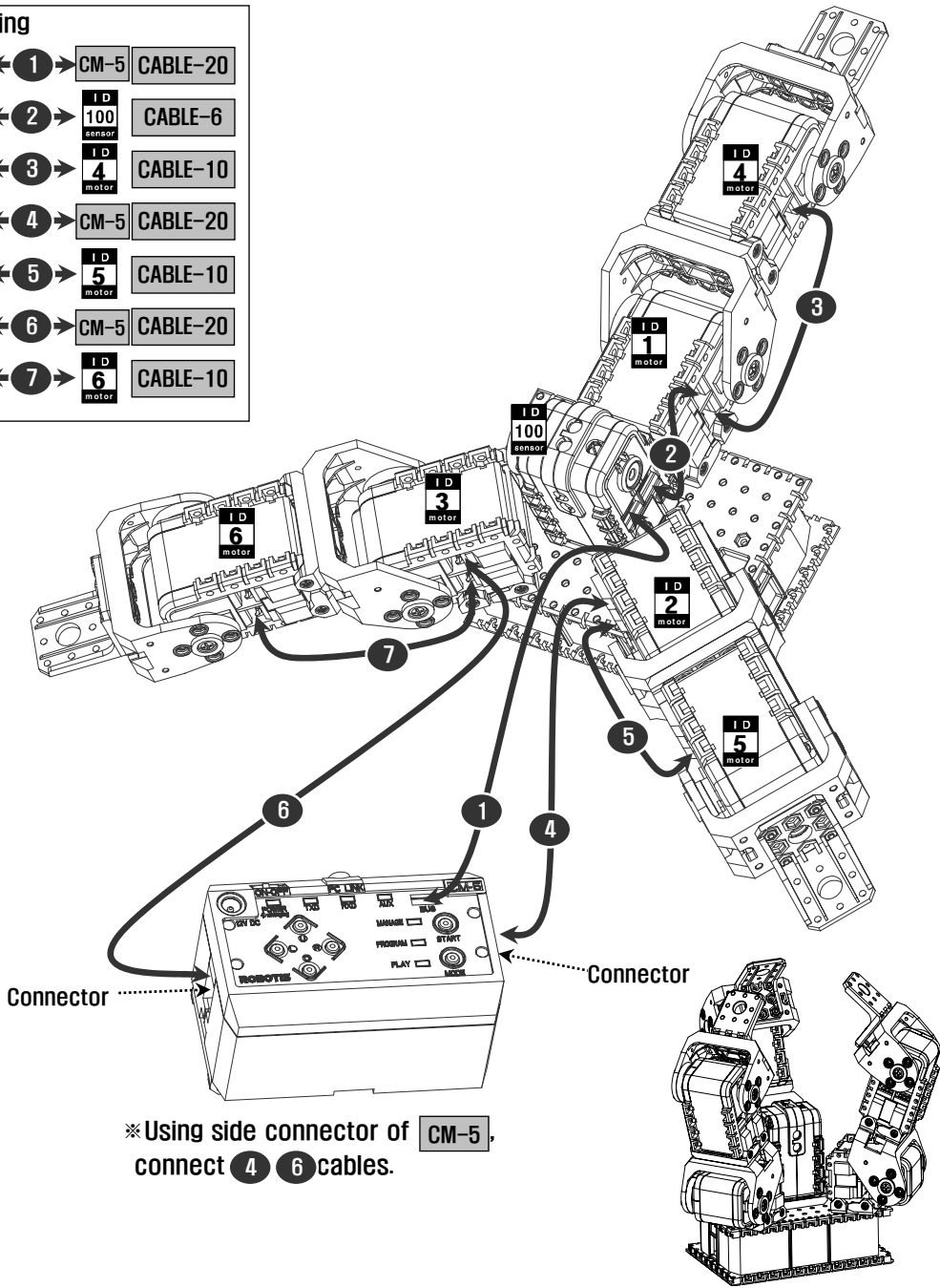
Step 8 Assemble Completion



Step 9 Wiring

※ Wiring

ID 100 sensor	← 1 →	CM-5	CABLE-20
ID 1 motor	← 2 →	ID 100 sensor	CABLE-6
ID 1 motor	← 3 →	ID 4 motor	CABLE-10
ID 2 motor	← 4 →	CM-5	CABLE-20
ID 2 motor	← 5 →	ID 5 motor	CABLE-10
ID 3 motor	← 6 →	CM-5	CABLE-20
ID 3 motor	← 7 →	ID 6 motor	CABLE-10



※ Using side connector of CM-5, connect 4 6 cables.

※ Completed

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Robot Flower\CheckAssembly\(Robot Flower\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11f]

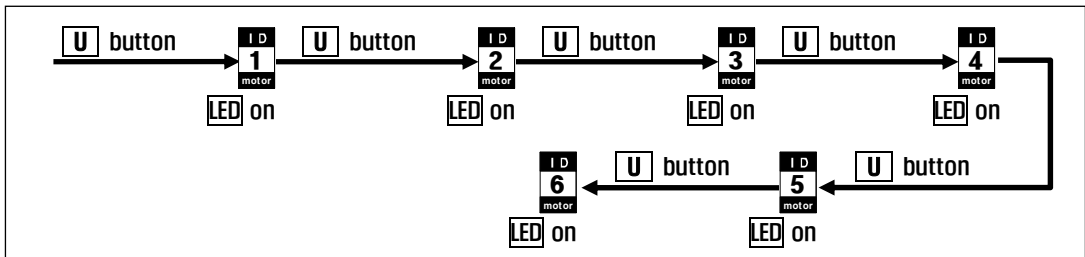
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 100
007[0X07] Dynamixels Found.

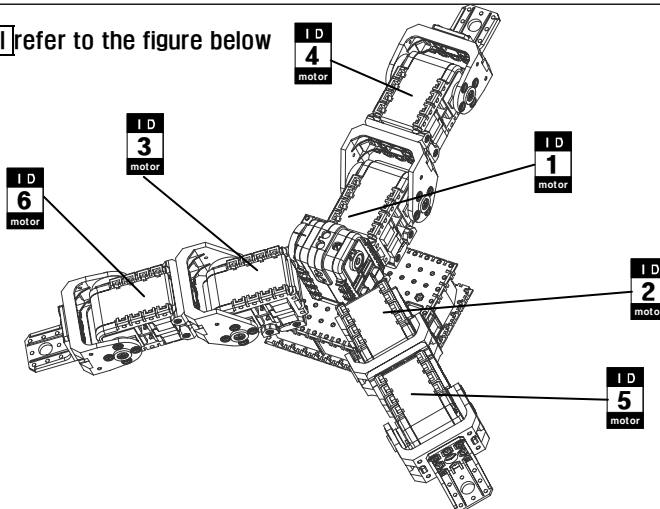
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever **U** button is pressed **LED** is on in the order shown below.

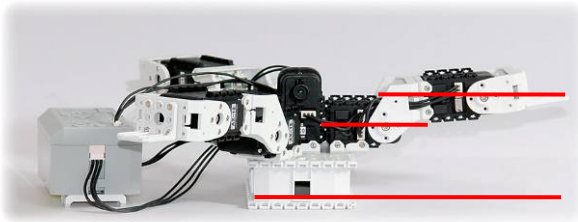


※ For ID of **Dynamixel** refer to the figure below



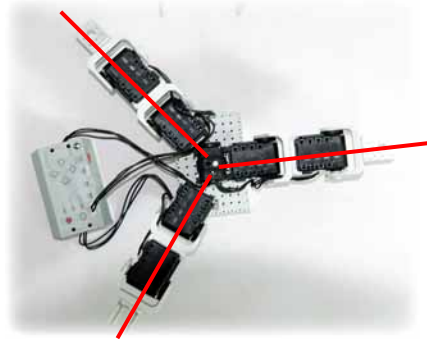
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



Each joint petal is perpendicular to the surface.

※Top View



Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate \Robot Flower \DemoExample\(Robot Flower\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\ Intermediate \ Robot Flower \DemoExample\(Robot Flower\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

- When a flashlight is shone, the robot will open the top, just like a flower.
- The robot will move its petal-like joints corresponding to the number of claps.

Step 5 Compare with the provided video clip

(In CD, [Applied Robots\ Intermediate \ Robot Flower \DemoExample\(Robot Flower\).wmv](#))

2-3-4. Fawn

Let's build a fawn that sits and looks around when nothing is detected but that follows an object when it detects an object.



(1) Necessary parts

	ID 1 motor	~	ID 7 motor	AX-12 × 7		ID 100 sensor	AX-S1 × 1		CM-5 × 1		ADAPTOR-CM5 × 1		
	F1 × 3		F2 × 2		F3 × 15		F4 × 2		F9 × 1		BU × 6		WA × 6

※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 100		CABLE-6 × 1
	S1 × 128		CABLE-10 × 2
	S-B × 6		CABLE-14 × 2
			CABLE-18 × 1
			CABLE-20 × 2

(2) Assembling

Step 1 ~ Step 4 Assemble frame

Step 1 Assemble 4 sets.
 S1 : 4pcs
 N1 : 4pcs
 F3 : 2pcs

Step 2 Assemble 2 sets.
 S1 : 4pcs
 F2 : 1pc
 F1 : 1pc
 N1 : 4pcs

Step 3
 S1 : 4pcs
 F3 : 2pcs

Step 4
 N1 : 4pcs
 F1 : 1pc
 F3 : 2pcs
 S1 : 4pcs

Step 5 Right Foreleg

※ Insert nuts
 N1 : 8pcs

Step 1
 S-B : 2pcs
 BU : 2pcs
 WA : 2pcs
 F3 : 1pc
 S1 : 16pcs

Step 2

※ Check assembly point

ID 2 motor
 ID 4 motor

Step 6 Left Foreleg

※ Insert nuts
 N1 : 8pcs

Step 1
 S-B : 2pcs
 BU : 2pcs
 WA : 2pcs
 F3 : 1pc
 S1 : 16pcs

Step 2

※ Check assembly point

ID 3 motor
 ID 5 motor

Step 7 Right Hindleg

※ Check assembly point

Step 1

S-B
BU
WA
I D 6 motor
S1 : 4pcs
F4

※ Insert nuts
N1 : 4pcs

Step 8 Left Hindleg

※ Check assembly point

Step 1

I D 7 motor
S-B
BU
WA
S1 : 4pcs
F4

※ Insert nuts
N1 : 4pcs

Step 9 CM-5

CABLE-18
CM-5 (Battery included)

※ Draw out the cable through the rear hole of ADAPTOR-CM5.

S1 : 4pcs
ADAPTOR-CM5
N1 : 4pcs

Step 10 Head 1

※ Check assembly point

S1 : 4pcs
F3
I D 1 motor

Step 11 Head 2

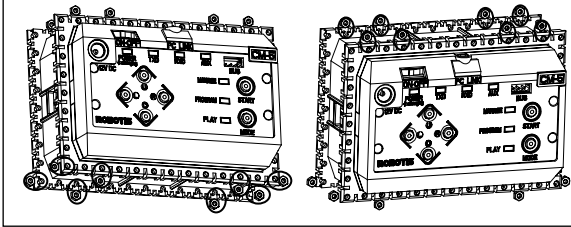
※ Insert nuts

N1 : 8pcs
S1 : 12pcs
I D 100 sensor
N1 : 4pcs

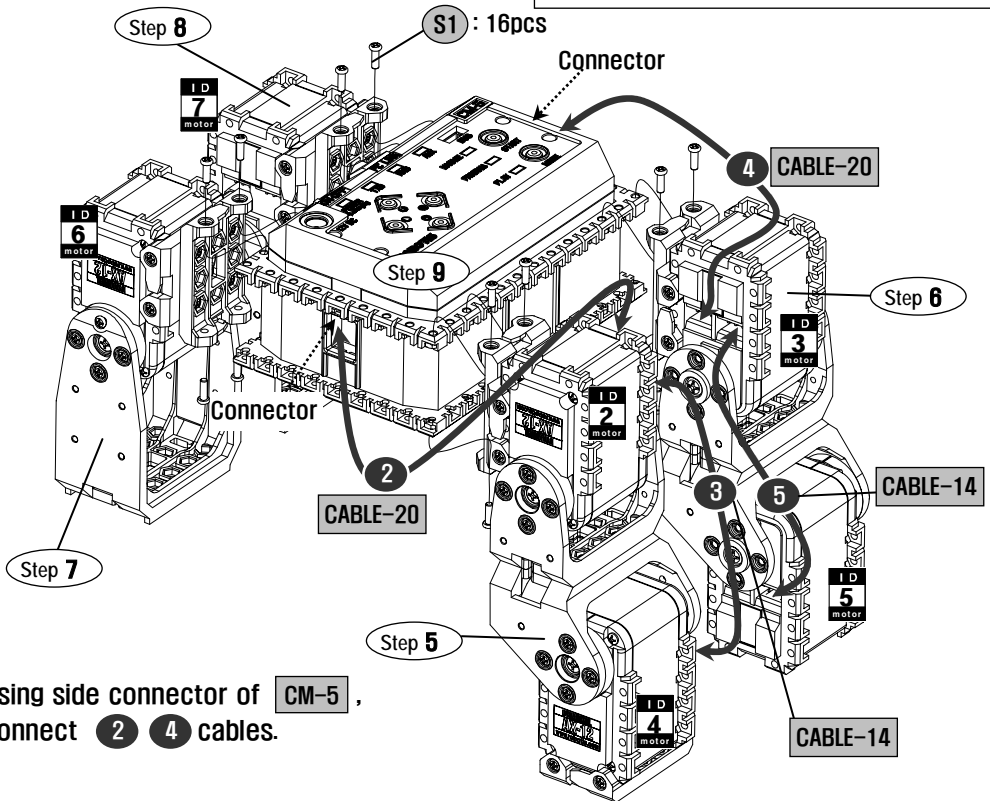
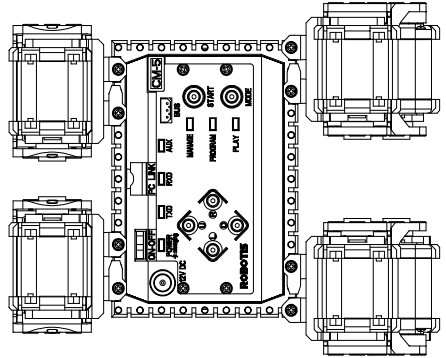
Step 4
Step 3
Step 10

Step 12 Body Assembly

※ Insert nuts **(N1)** : 16pcs



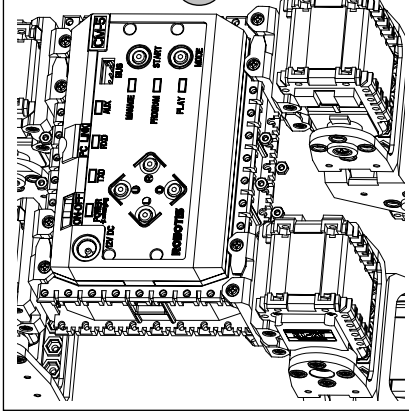
※ Top view



Step 13 Whole Body Assembly and Completion

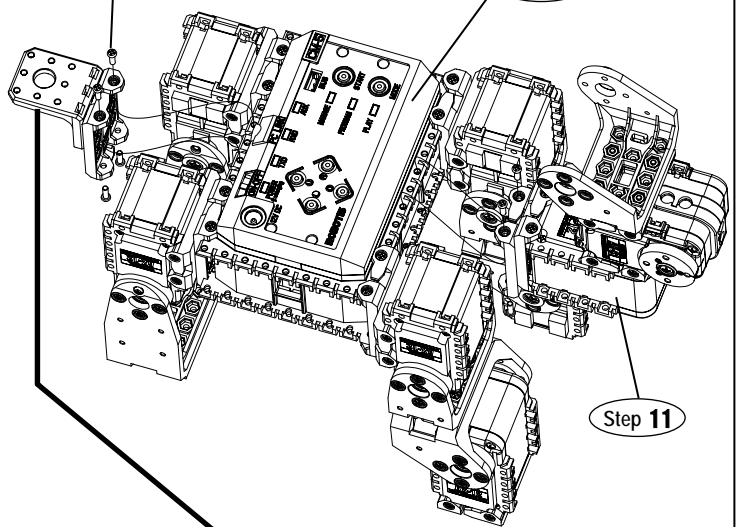
※ Insert nuts

N1 : 8pcs



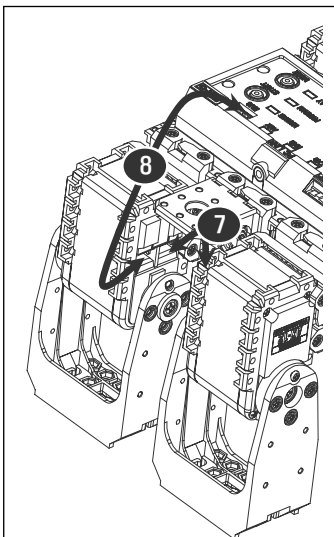
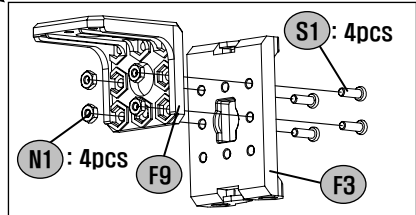
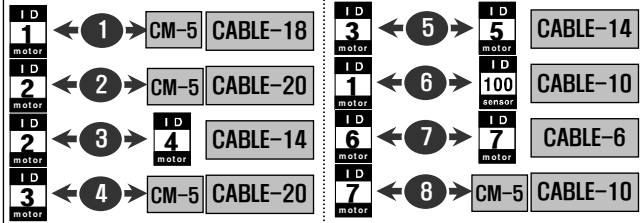
S1 : 8pcs

Step 10

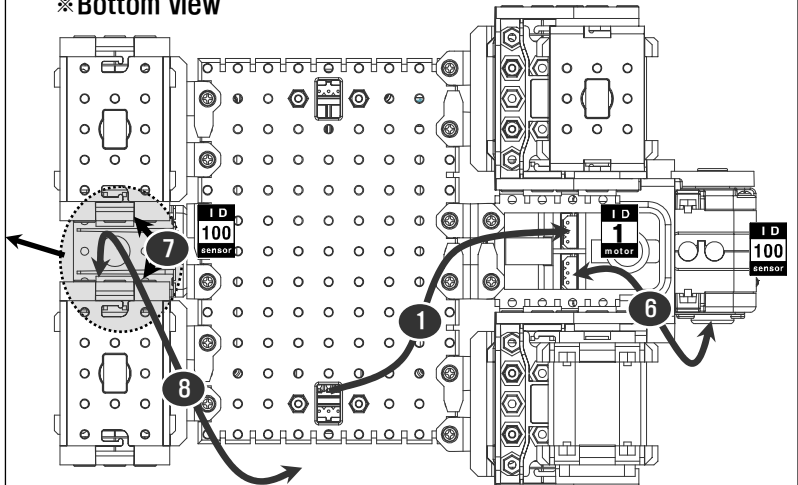


Step 11

※ Wiring



※ Bottom view



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Fawn\CheckAssembly\(Fawn\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11dd]

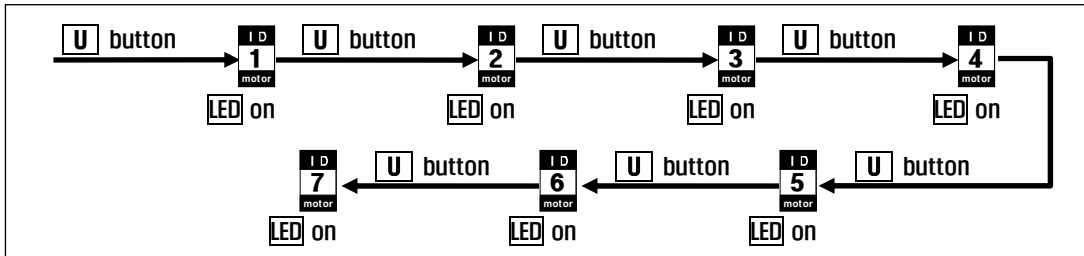
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 100
008[0X08] Dynamixels Found.

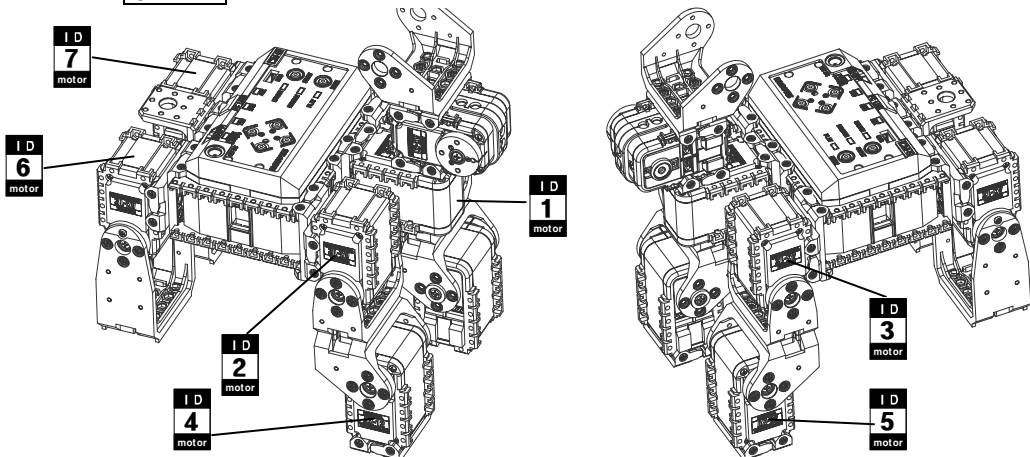
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever the **U** button is pressed, **LED** is on in the order shown below.

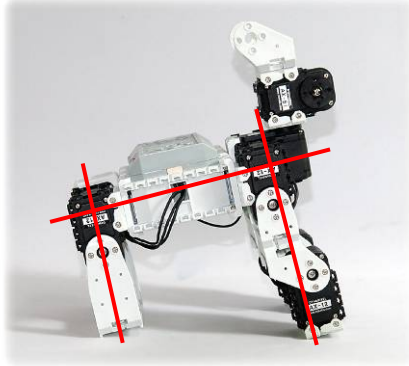


※ For the ID of **Dynamixel**, refer to the figure below.



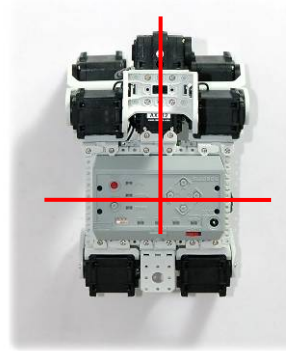
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



Each leg opens perpendicular to the body

※Top View



Fawn' s head directly faces front.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate\Fawn \DemoExample\(Fawn\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Intermediate\Fawn \DemoExample\(Fawn\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

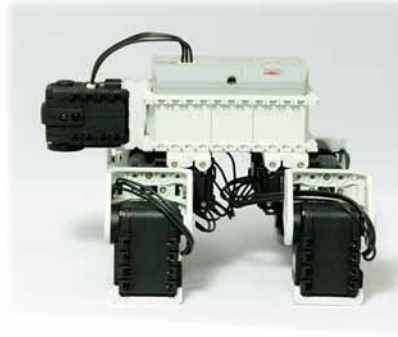
- When there is no changes, the fawn sits and looks around.
- When an object appears in front, the fawn will follow the object.
- When handclapped twice, the fawn will stand, make melodic sound and will sit back again.

Step 5 Compare with the provided video clip.

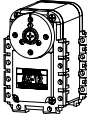
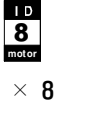
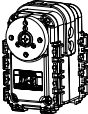
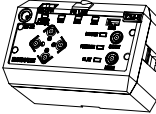
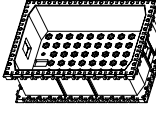
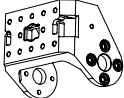




(In CD, [Applied Robots\Intermediate\Fawn \DemoExample\(Fawn\).wmv](#))

2-3-5. Turtle



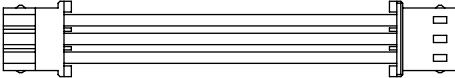

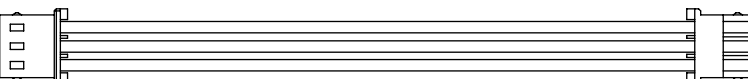
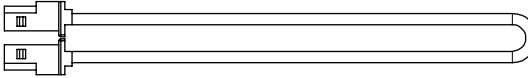
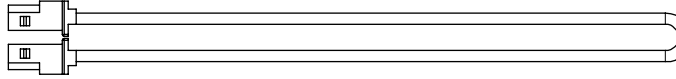
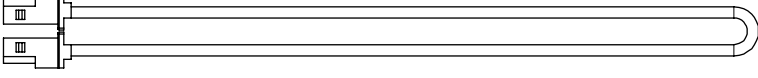
Let's build a turtle that senses and avoids an obstacle.



(1) Necessary parts

 ID 1 motor	~	 ID 8 motor	 ID 100 sensor	 CM-5	 ADAPTOR-CM5
AX-12 × 8		AX-S1 × 1		× 1	
					
F1 × 4	F3 × 10	BU × 4	WA × 4	Sticker × 8	

※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

 N1 × 64	 S1 × 96		CABLE-6 × 2
			CABLE-10 × 1
S-B × 4			CABLE-14 × 2
			CABLE-18 × 1
			CABLE-20 × 3

(2) Assembling

Step 1 Leg 1 : 2 sets

※ Using **ID 1 motor** and **ID 6 motor**, assemble 2 sets.

※ Assemble taking note of the inserted location of nuts.

※ Insert nuts
N1 : 4pcs

※ Attach nut stickers :
Make sure nuts do not come off
Sticker : 2pcs
N1 : 4pcs

※ Check assembly point

S1 : 8pcs

F3

F1

Step 2 Leg 2 : 2 sets

※ Using **ID 2 motor** and **ID 5 motor**, assemble 2sets.

※ Assemble taking note of the inserted location of nuts.

※ Insert nuts
N1 : 4pcs

※ Attach nut stickers :
Make sure nuts do not come off
Sticker : 2pcs
N1 : 4pcs

※ Check assembly point

S1 : 8pcs

F3

F1

ID 2 motor

ID 5 motor

Step 3 Right Foreleg

Step 1 **ID 1 motor**

※ Insert nuts
N1 : 4pcs

※ Check assembly point

S-B

BU

WA

F3

S1 : 8pcs

ID 3 motor

Step 4 Left Foreleg

Step 2 **ID 2 motor**

※ Insert nuts
N1 : 4pcs

※ Check assembly point

S-B

BU

WA

F3

S1 : 8pcs

ID 4 motor

Step 5 Right Hind Leg

Step 2

ID 5 motor

※ Insert nuts

ID 7 motor

N1 : 4pcs

※ Check assembly point

ID 7 motor

F3

S1 : 8pcs

Step 6 Left Hind Leg

Step 1

ID 6 motor

※ Insert nuts

ID 8 motor

N1 : 4pcs

※ Check assembly point

ID 8 motor

F3 : 8pcs

Step 7 Body

※ Insert nuts N1 : 8pcs

※ Attach nut stickers : Making sure nuts do not come off.

Sticker : 2pcs

N1 : 4pcs

N1 : 4pcs

S1 : 4pcs

F3 : 2pcs

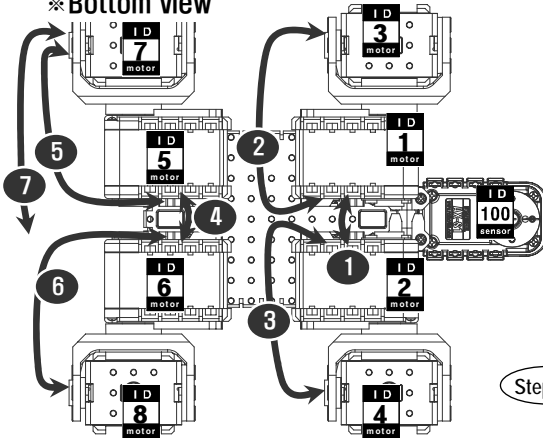
ADAPTOR-CM5

ID 100 sensor

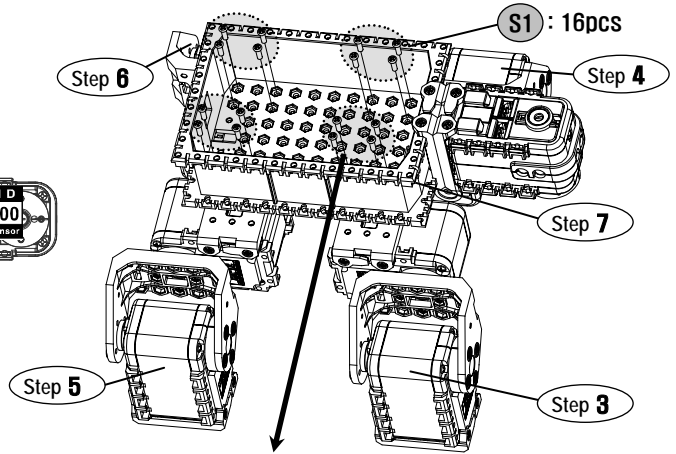
S1 : 8pcs

Step 8 Wiring and Whole Body Assembly

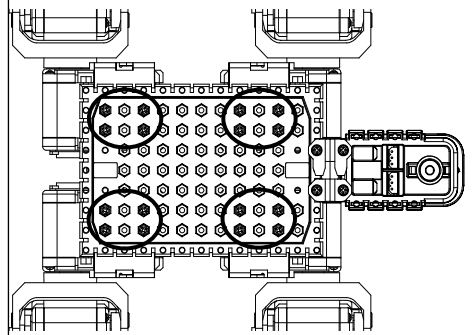
※ Bottom view



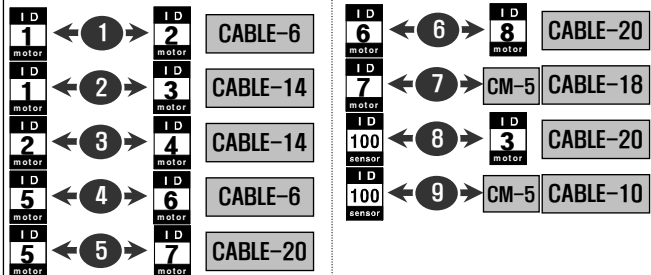
※ Assemble after wiring is finished.



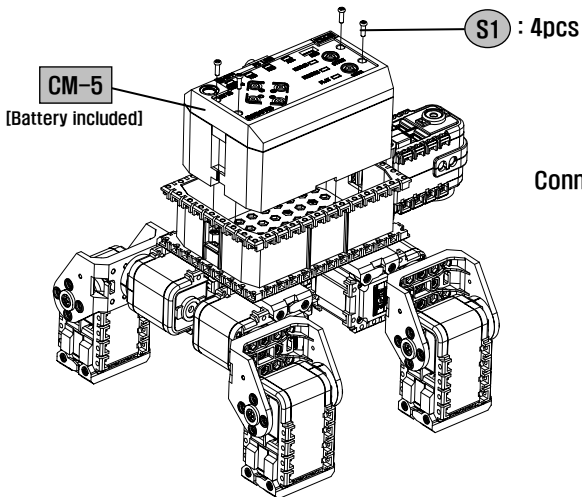
※ Top view : Check screw assembly point



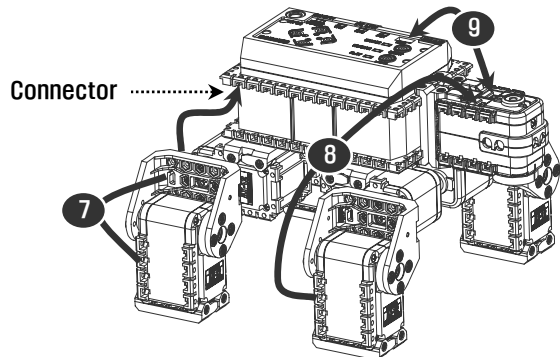
※ Wiring



Step 9 Completion



※ Using side connector of CM-5, connect 8 cable.



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Turtle\CheckAssembly\(Turtle\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

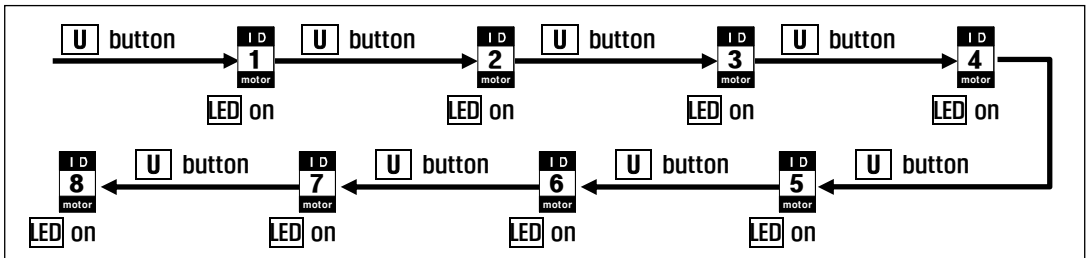
<->PC:57142 BPS. <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 100
009(0X09) Dynamixels Found.

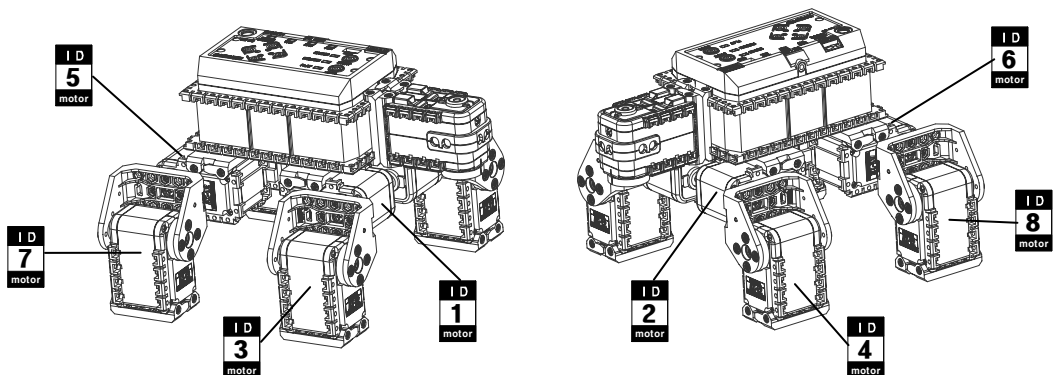
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever the **U** button is pressed, **LED** is on in the order shown below.

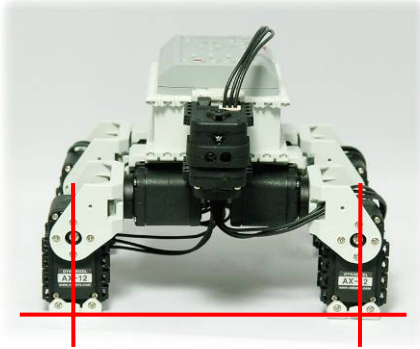


※ For the ID of **Dynamixel**, refer to the figure below.



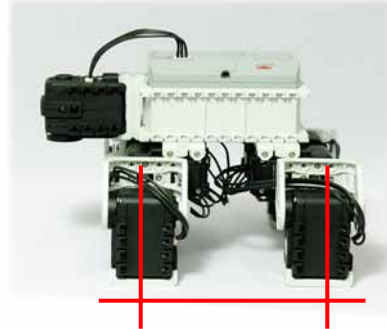
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Front View



All legs are perpendicular to the surface.

※Side View



All legs are perpendicular to the surface.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate \Turtle \DemoExample\(Turtle\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Intermediate\Turtle \DemoExample\(Turtle\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

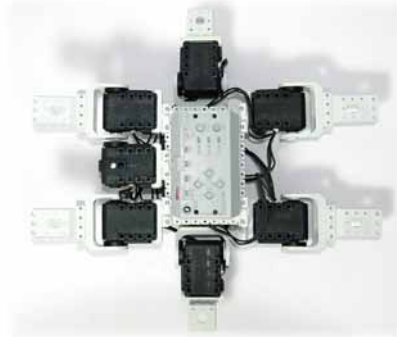
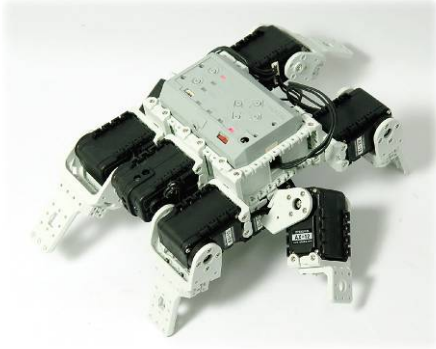
- The turtle robot continues to move forward and when it meets an obstacle, it will avoid it.

Step 5 Compare with the provided video clip

(In CD, [Applied Robots\ Intermediate \ Turtle \DemoExample\(Turtle\).wmv](#))

2-3-6. Spider

Let's build a spider that attacks when it meets an object.



(1) Necessary parts

	ID 1 motor	~	ID 8 motor	AX-12 × 8		ID 100 sensor	AX-S1 × 1		CM-5 × 1		ADAPTOR-CM5 × 1				
	F1 × 2		F2 × 4		F3 × 14		F6 × 4		F9 × 2		F10 × 8		BU × 6		WA × 6
	Sticker × 6														

※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

	N1 × 102		S1 × 118		CABLE-6 × 1
	S4 × 8				CABLE-14 × 2
	S5 × 8				CABLE-18 × 1
	S-B × 6				CABLE-20 × 5

(2) Assembling

Step 1 ~ Step 4 Assemble frame

Step 1 Assemble 2 sets

F3 : 2pcs
S1 : 2pcs
N1 : 2pcs

※ Completed

Step 2 Assemble 2 sets

F3 : 2pcs
N1 : 2pcs
S1 : 2pcs

※ Completed

Step 3 Assemble 2 sets

F9 : 1pc
F3 : 1pc
S1 : 4pcs
N1 : 4pcs

Step 4 Assemble 4 sets

F2 : 1pc
F6 : 1pc
F10 : 2pcs
S4 : 2pcs
S5 : 2pcs
N1 : 4pcs

Step 5 ~ Step 6 Leg (TYPE 1) : 2 sets

※ Using **ID 1 motor** and **ID 8 motor**, assemble 2 sets.

※ Insets nuts

N1 : 4pcs

※ Check assembly point

Step 5

S-B : 1pc
BU : 1pc
WA : 1pc
S1 : 8pcs

Step 6

※ Assemble in a same style.

Step 7 ~ Step 8 Leg (TYPE 2) : 2 sets

※ Using **ID 2 motor** and **ID 7 motor**, assemble 2 sets.

※ **Insert nuts N1 : 4pcs**

※ **Check assembly point**

Step 4

Step 8

※ **Assemble in a same style.**

S1 : 8pcs

ID 2 motor

ID 7 motor

S-B

BU

WA

Step 2

Step 9 Head

※ **Insert nuts N1 : 4pcs**

ID 100 sensor

S1 : 4pcs

N1 : 4pcs

F3 : 2pcs

Step 10 Body

ADAPTOR-CM5

Step 6

ID 8 motor

Step 7

ID 2 motor

Step 8

ID 7 motor

Step 9

Step 5

ID 1 motor

S1 : 20pcs

※ **Insert nuts N1 : 20pcs**

※ **Top view**

Step 11 Right Leg 1 *** Assemble taking note of the inserted location of nuts .**

*** Insert nuts**

N1 : 4pcs

*** Attach nut stickers :**
Make sure nuts do not come off

Sticker : 2pcs

N1 : 3pcs

Step 12 Right Leg 2

*** Insert nuts**

N1 : 4pcs

Step 13 Left leg 1 *** Assemble taking note of the inserted location of nuts .**

*** Insert nuts**

N1 : 4pcs

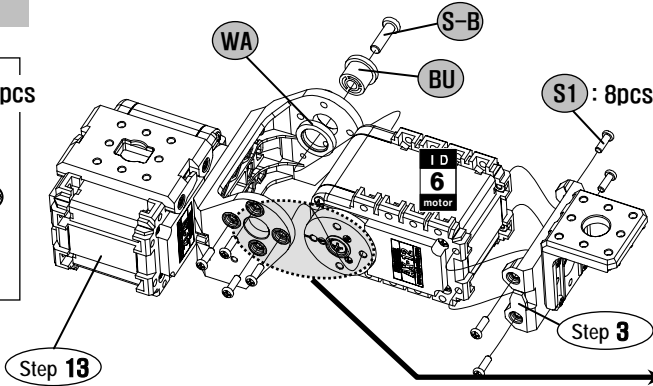
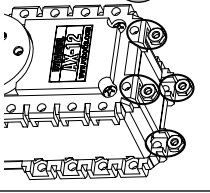
*** Attach nut stickers :**
Make sure nuts do not come off

Sticker : 2pcs

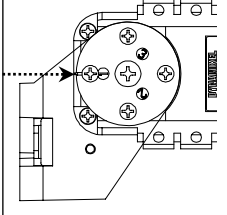
N1 : 3pcs

Step 14 Left Leg 2

※ Insert nuts **N1** : 4pcs

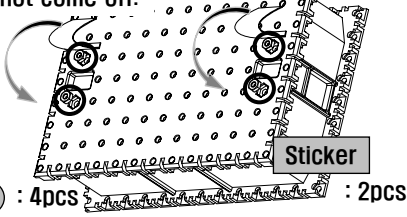


※ Check assembly point

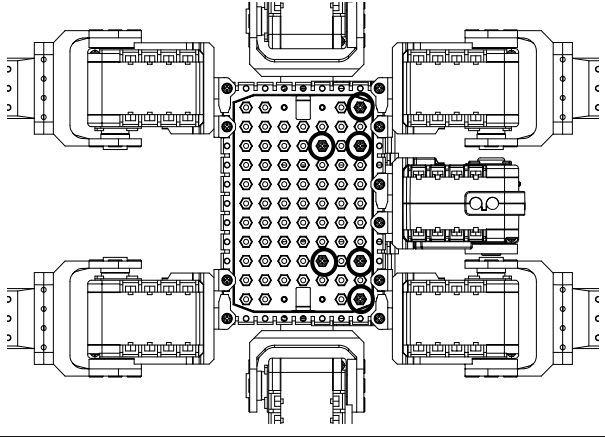


Step 15 Whole Body Assembly

※ Attach nut stickers : Make sure nuts do not come off.



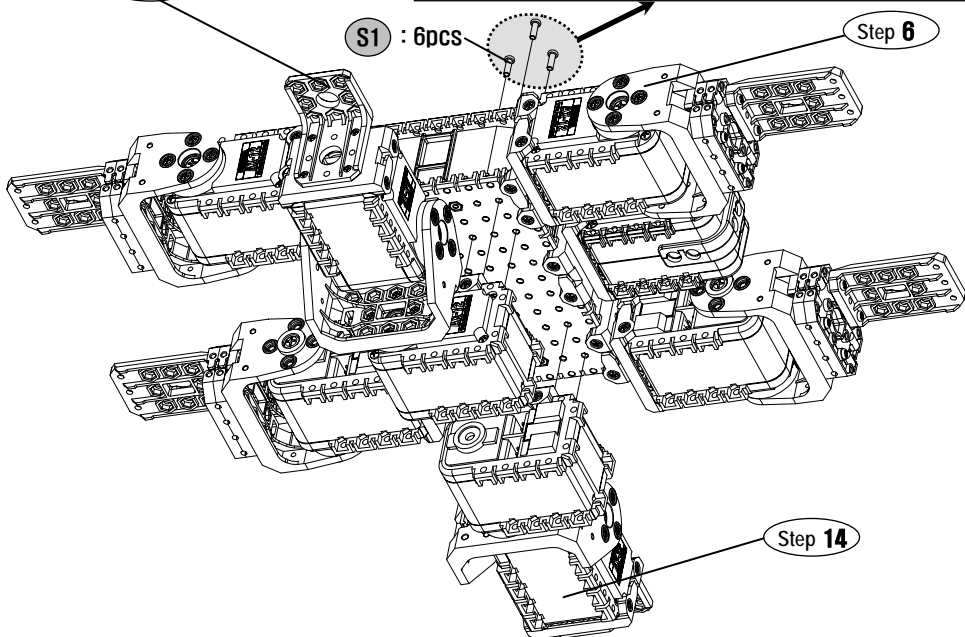
※ Top view : Check screw assembly point



Step 12

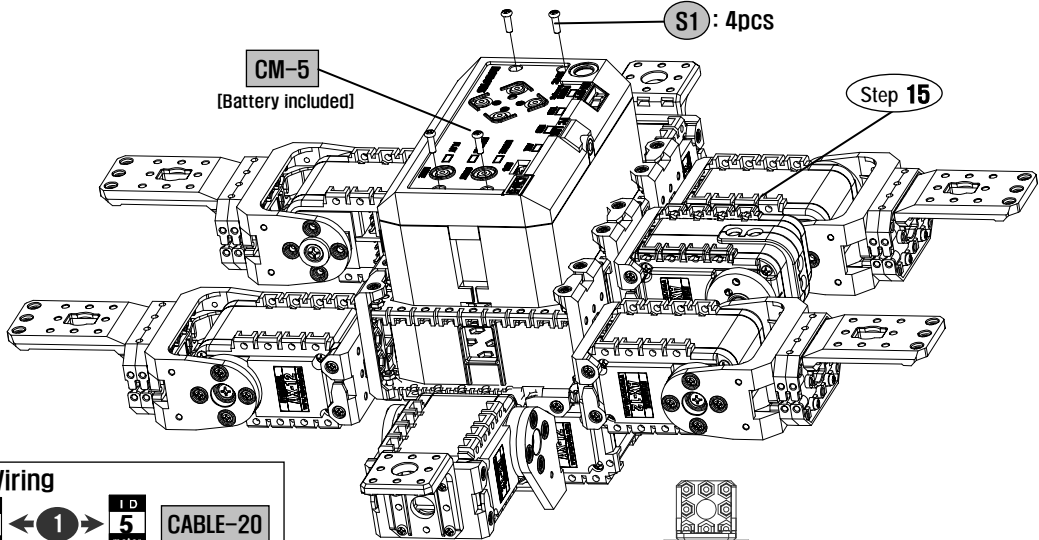
S1 : 6pcs

Step 6



Step 14

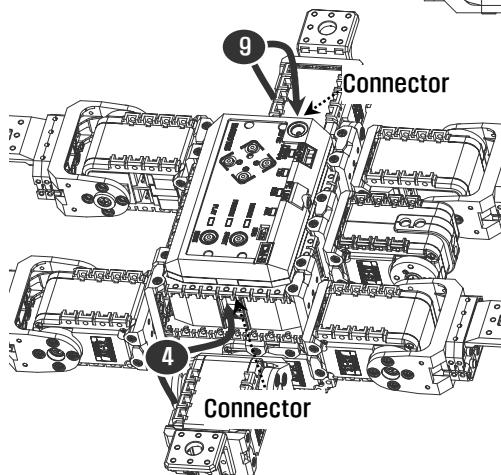
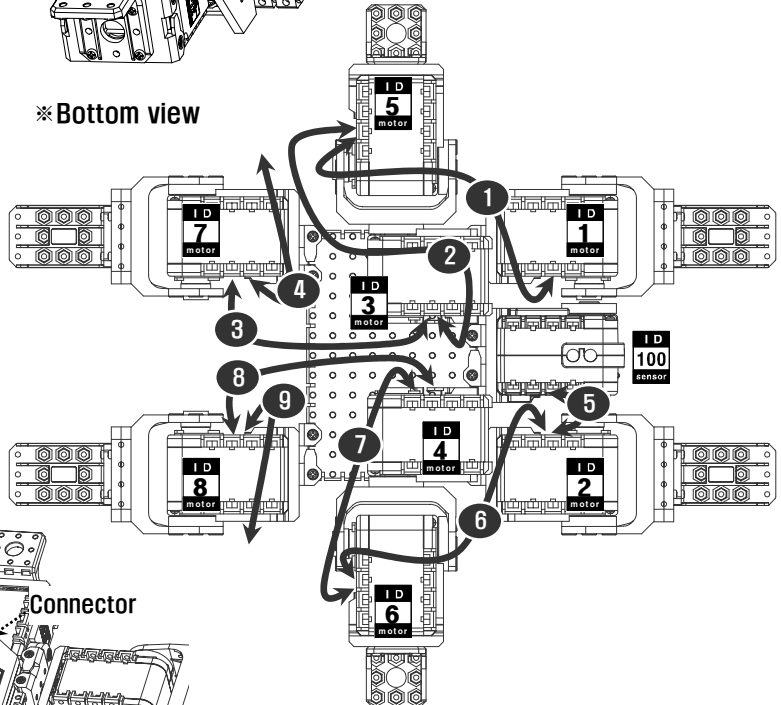
Step 16 Wiring and Completion



※ Wiring

ID 1 motor	← 1 →	ID 5 motor	CABLE-20
ID 3 motor	← 2 →	ID 5 motor	CABLE-20
ID 3 motor	← 3 →	ID 7 motor	CABLE-20
ID 7 motor	← 4 →	CM-5	CABLE-14
ID 2 motor	← 5 →	ID 100 sensor	CABLE-6
ID 2 motor	← 6 →	ID 6 motor	CABLE-20
ID 4 motor	← 7 →	ID 6 motor	CABLE-20
ID 4 motor	← 8 →	ID 8 motor	CABLE-18
ID 8 motor	← 9 →	CM-5	CABLE-14

※ Bottom view



※ Using side connector of **CM-5**, connect **4** **9** cable.

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Spider\CheckAssembly\(Spider\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

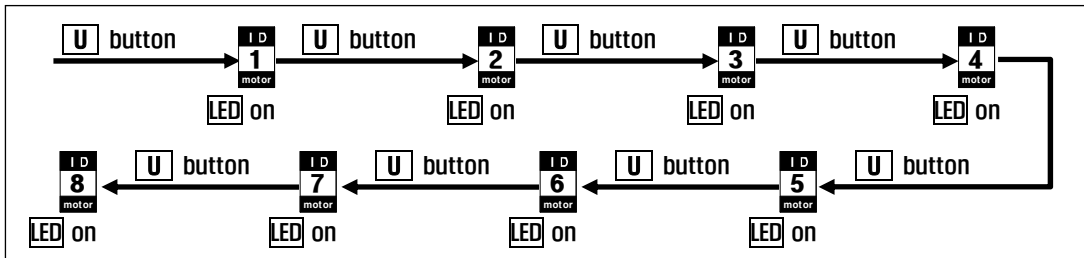
<->PC:57142 BPS. <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 100
009[0X09] Dynamixels Found.

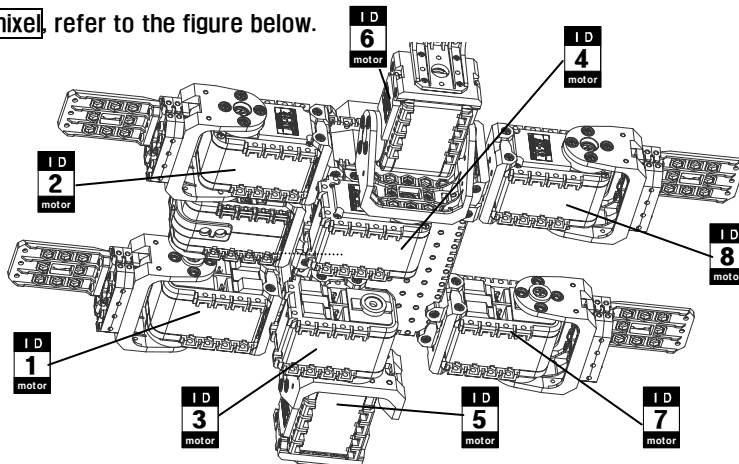
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever the **U** button is pressed, **LED** is on in the order shown below.

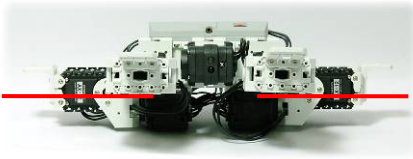


※ For the ID of **Dynamixel**, refer to the figure below.

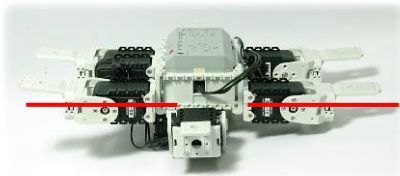


Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

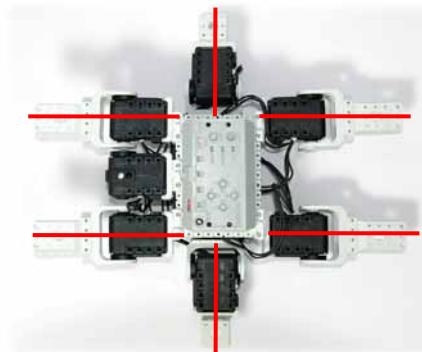
※Front View



※Side View



※Top View



All legs are parallel to the surface.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate \Spider \DemoExample\(Spider\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Intermediate\Spider \DemoExample\(Spider\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.”

Step 4 Operation of the robot

- While moving forward, when an object is detected from the front of head, the Spider will attack an object.
- While moving forward, when an object is detected from the top of the head, the Spider will lie down.

Step 5 Compare with the provided video clip

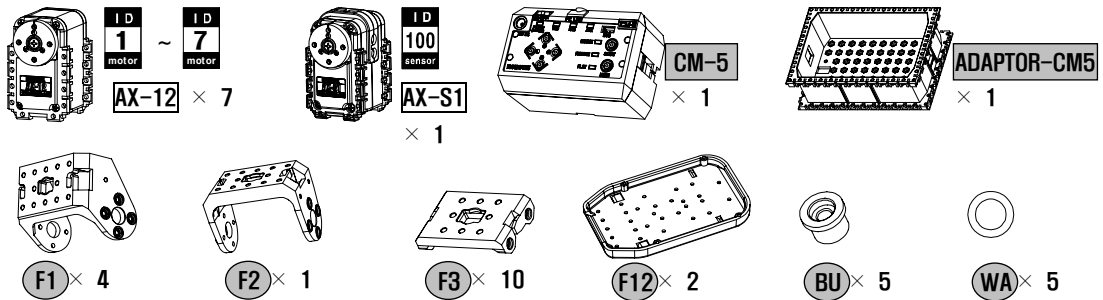
(In CD, [Applied Robots\ Intermediate \ Spider \DemoExample\(Spider\).wmv](#))

2-3-7. Gerwalk

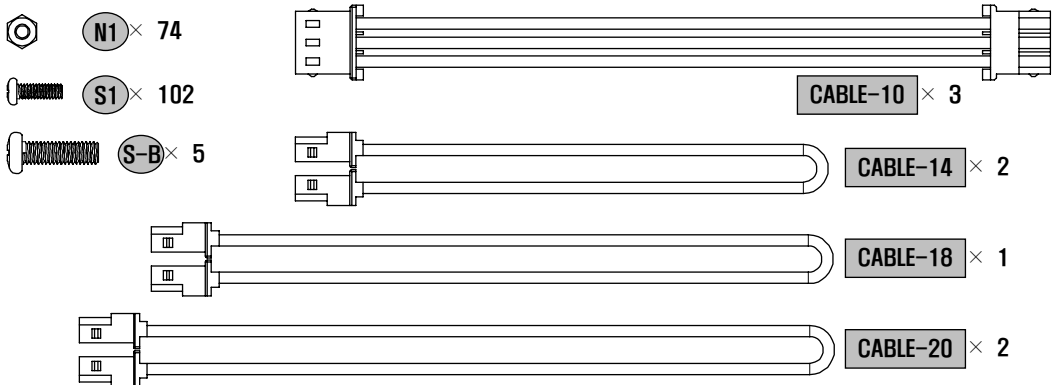
Let's build a two-legged Gerwalk robot that can walk. Gerwalk is a type of robot that has legs-like bird.



(1) Necessary parts



※ Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.



(2) Assembling

Step 1 ~ Step 3 Assemble Frame

Step 1 Assemble 2 sets S1 : 4pcs
F3 : 2pcs N1 : 4pcs

Step 2 Assemble 2 sets N1 : 4pcs
F1 : 1pc F3 : 1pc S1 : 4pcs

Step 3 Assemble 2 sets N1 : 3pcs
F1 : 1pc F12 : 1pc S1 : 3pcs

Top view
: Check screw location.

Bottom view

Step 4 ~ Step 5 Thigh

Check assembly point

Using ID 2 motor and ID 3 motor, assemble 2 sets.

Step 4 F3 : 1pc S1 : 4pcs ID 2 motor

Step 5 ID 3 motor
Assemble in a same style.

Step 6 Right Leg

Insert nuts N1 : 12pcs

Check assembly point

Check assembly point

Step 1 ID 2 motor

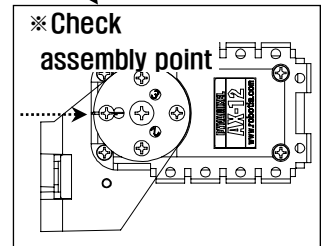
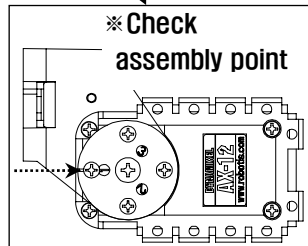
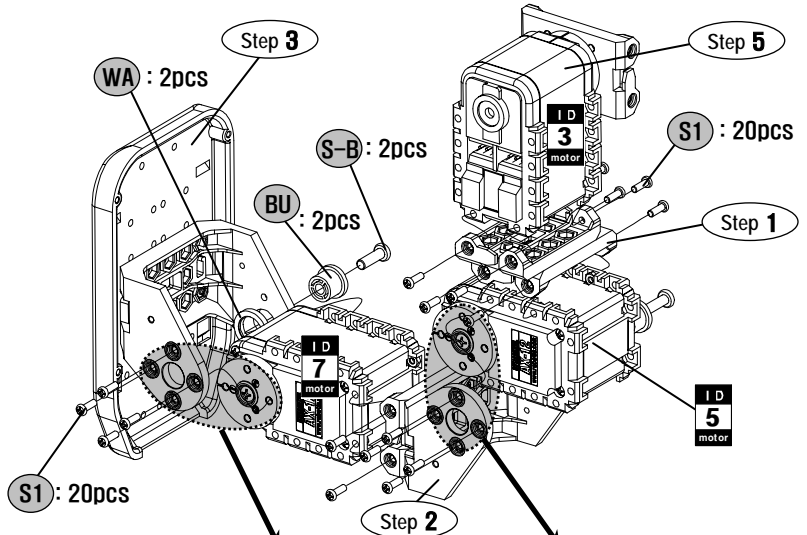
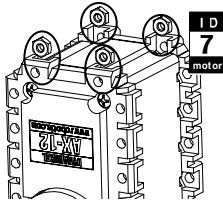
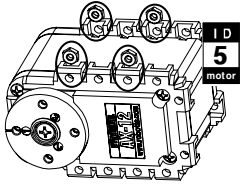
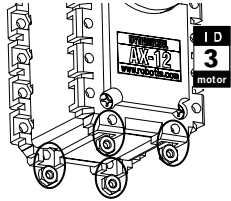
Step 2 S1 : 20pcs

Step 3 WA : 2pcs

Step 4 S-B : 2pcs BU : 2pcs ID 6 motor

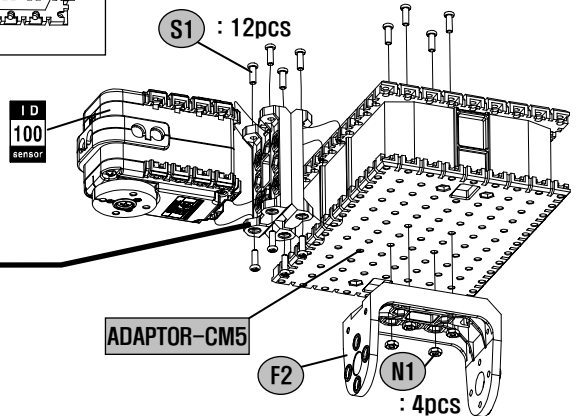
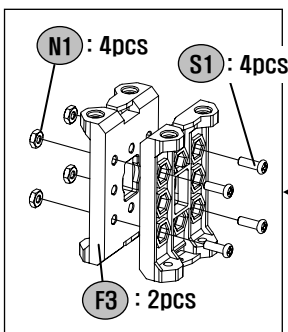
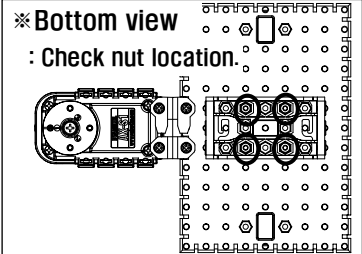
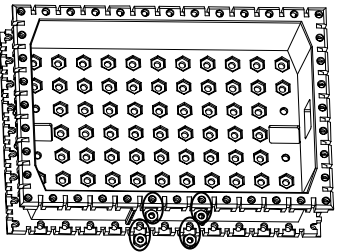
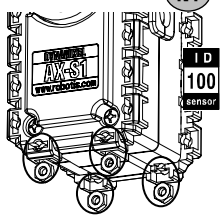
Step 7 Left Leg

※ Insert nuts **N1** : 12pcs



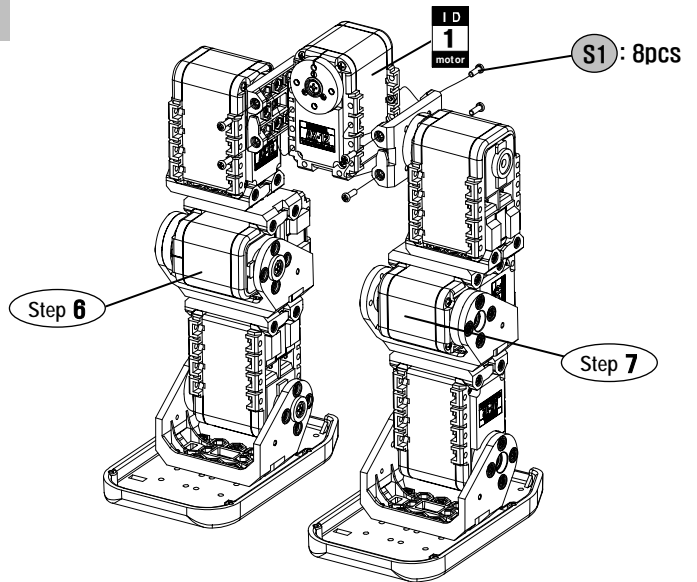
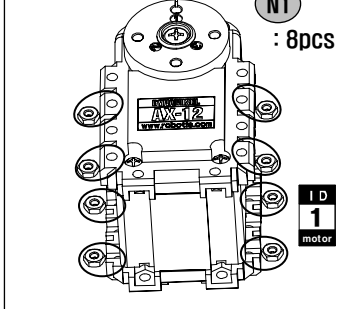
Step 8 Body

※ Insert nuts **N1** : 8pcs



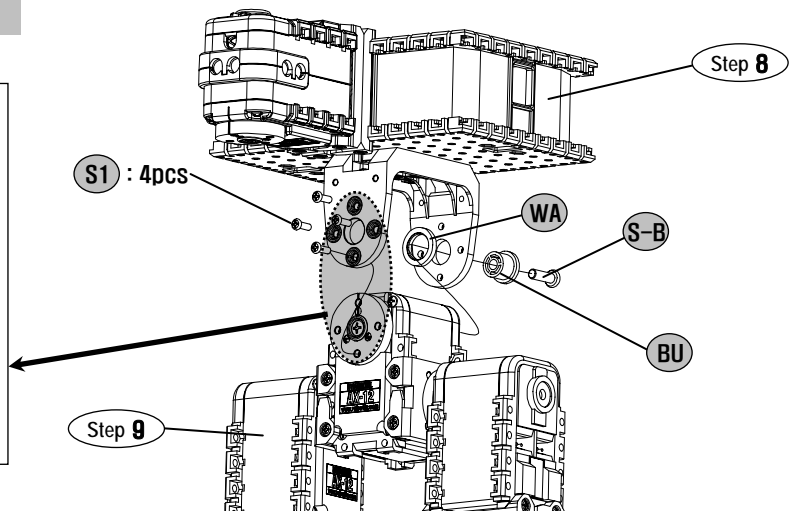
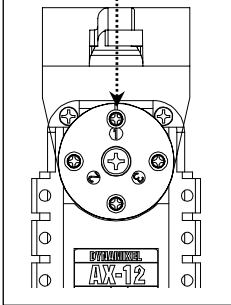
Step 9 Lower Part of Body

※ Insert nuts



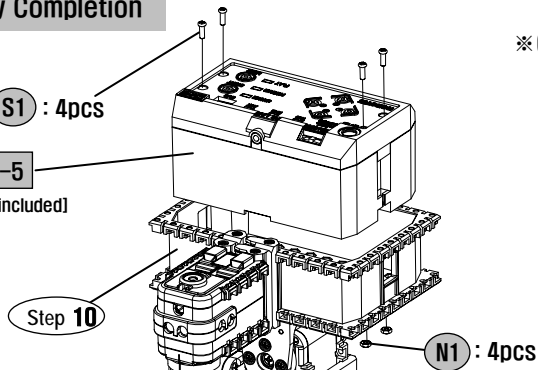
Step 10 Body

※ Check assembly point

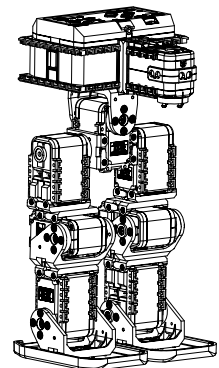


Step 11 Assembly Completion

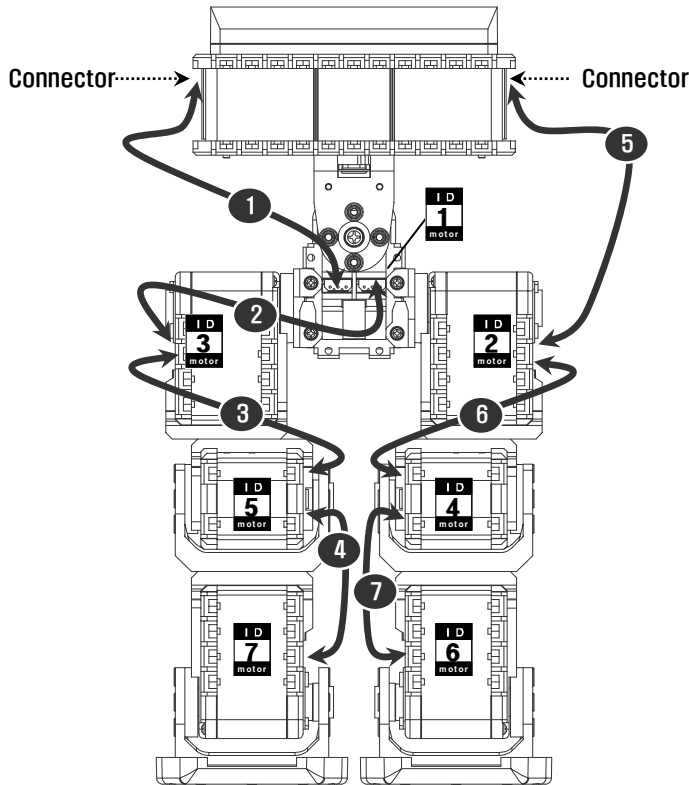
S1 : 4pcs
CM-5
[Battery included]



※ Completed



Step 12 Wiring

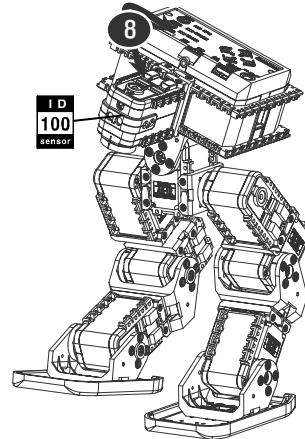


※ Using side connector of **CM-5**, connect **1** **5** cables.

※ Wiring

ID 1 motor	← 1 →	CM-5	CABLE-20
ID 1 motor	← 2 →	ID 3 motor	CABLE-18
ID 3 motor	← 3 →	ID 5 motor	CABLE-14
ID 5 motor	← 4 →	ID 7 motor	CABLE-10
ID 2 motor	← 5 →	CM-5	CABLE-20
ID 2 motor	← 6 →	ID 4 motor	CABLE-14
ID 4 motor	← 7 →	ID 6 motor	CABLE-10
ID 100 sensor	← 8 →	CM-5	CABLE-10

※ Completed



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Gerwalk\CheckAssembly\(Gerwalk\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.11dd]

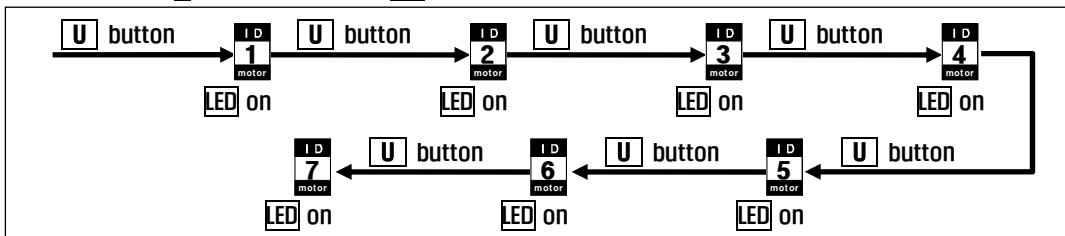
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 100
008[0X08] Dynamixels Found.

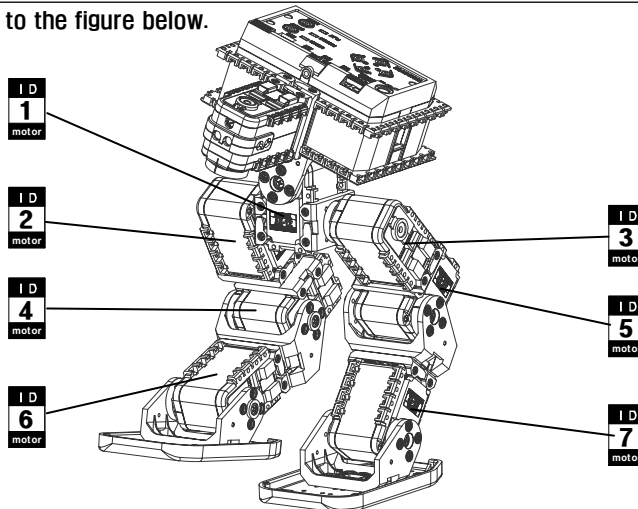
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※Whenever the **U** button is pressed, **LED** is on in the order shown below.

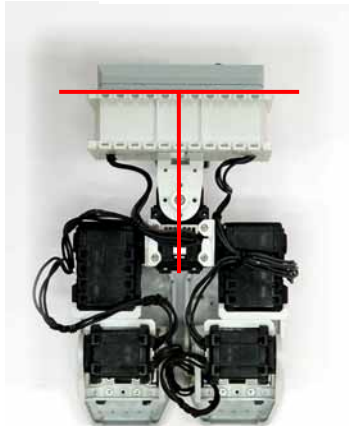


※For the ID of **Dynamixel**, refer to the figure below.



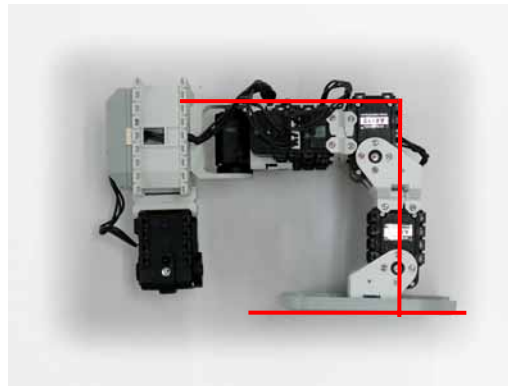
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Top View



Waist is perpendicular to the **CM-5**.

※Side View



Each joint is perpendicular .

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate \Gerwalk \DemoExample\(Gerwalk\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Intermediate \Gerwalk \DemoExample\(Gerwalk\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

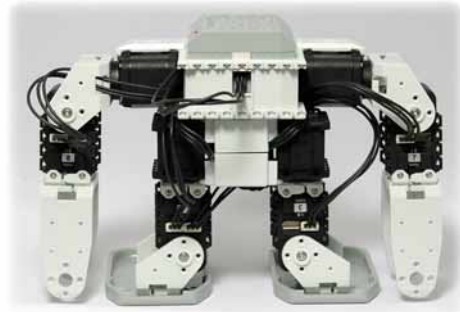
– The Gerwalk continues to move forward and when it meets an obstacle, it will avoid it.

Step 5 Compare with the provided video clip

(In CD, [Applied Robots\Intermediate \Gerwalk \DemoExample\(Gerwalk\).wmv](#))

2-3-8. Battle Droid

Let's build a Battle Droid that attacks with both hands and that gets up on its own when it is knocked down.



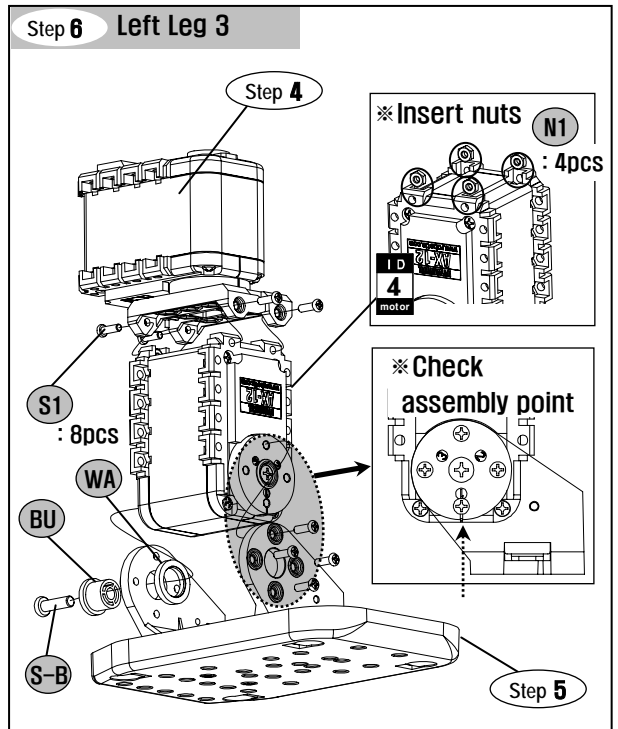
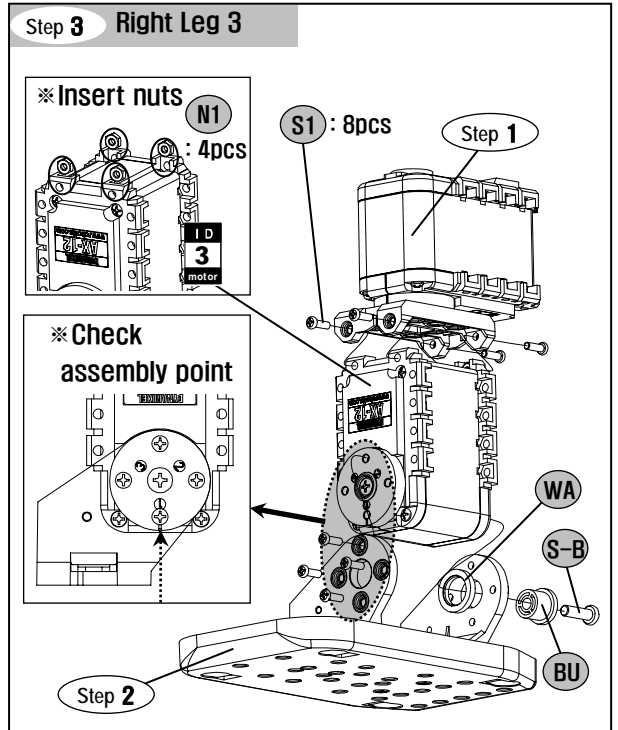
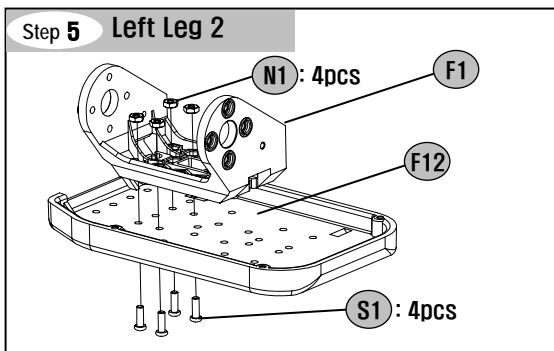
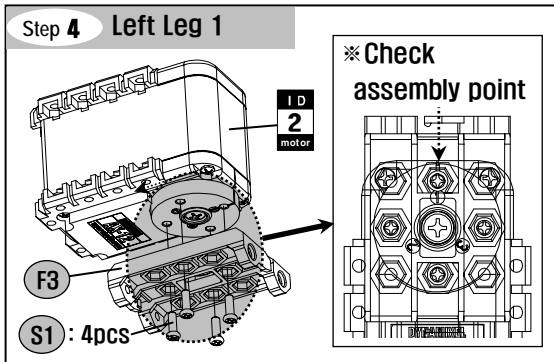
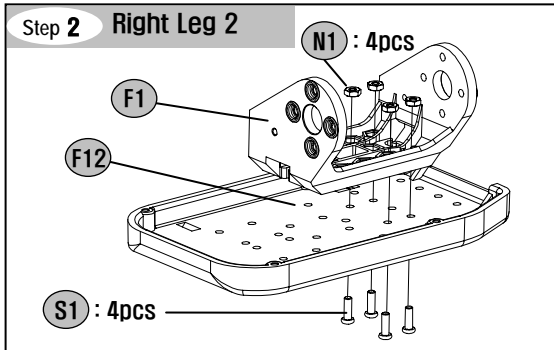
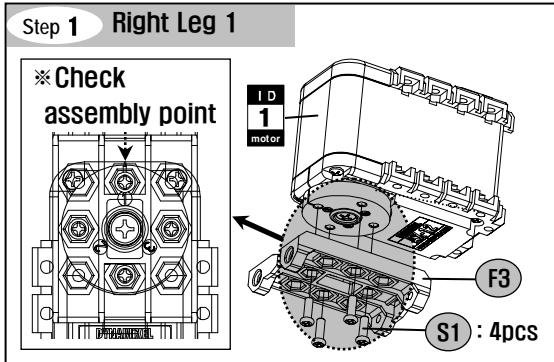
[1] Necessary parts

	ID 1 motor	~	ID 8 motor		ID 100 sensor		CM-5		ADAPTOR-CM5		
AX-12 × 8				AX-S1 × 1		× 1		× 1			
	F1 × 4		F3 × 4		F4 × 2		F6 × 4		F8 × 2		F12 × 2
	BU × 4		WA × 4			Sticker × 3					

※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

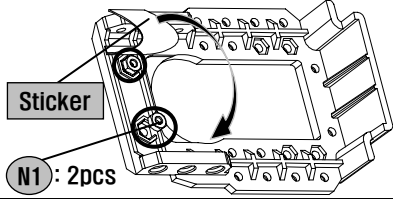
	N1 × 94		CABLE-10 × 2
	S1 × 114		
	S2 × 2		
	S-B × 4		

(2) Assembling

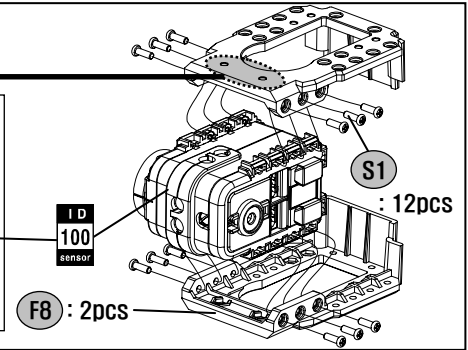
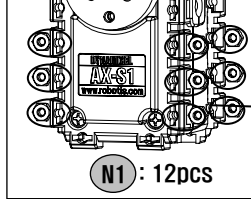


Step 7 Waist

※Attach nut stickers :
Make sure nuts do not come off.

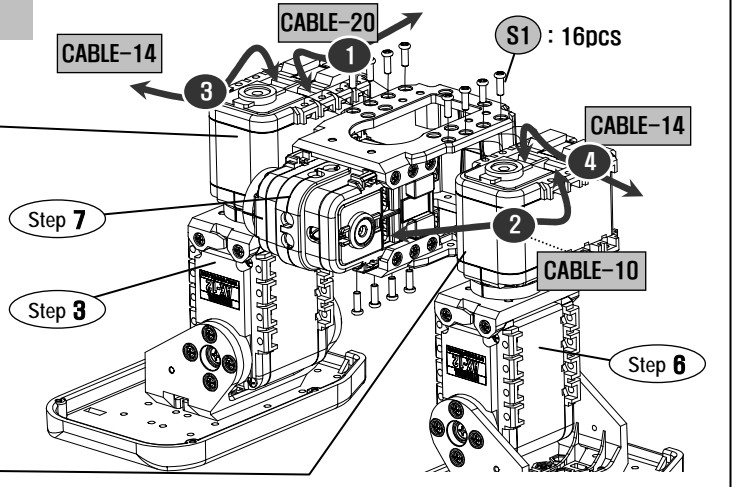
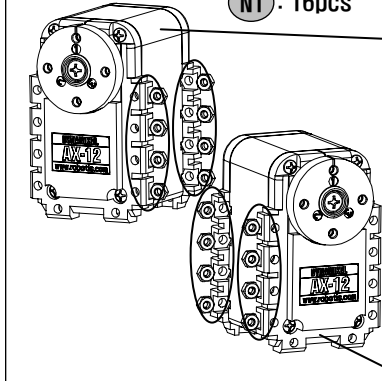


※Insert nuts



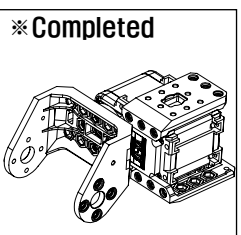
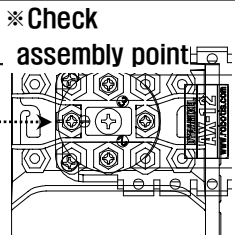
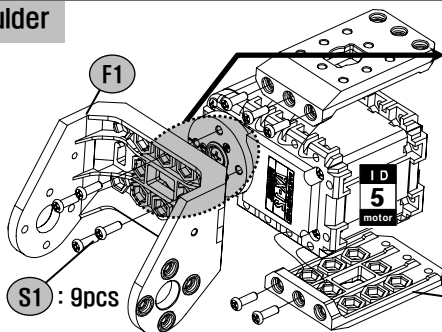
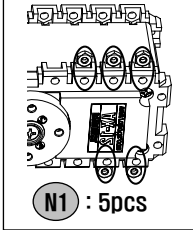
Step 8 Lower Part of Body Assembly

※Insert nuts



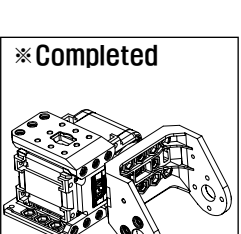
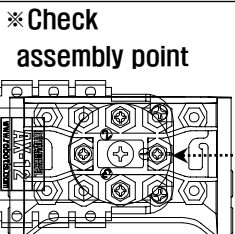
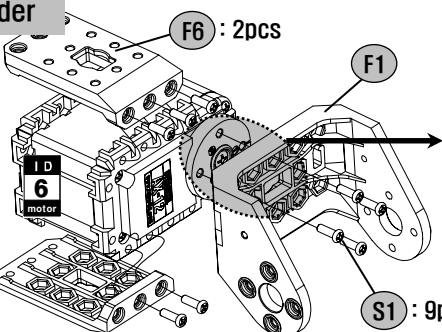
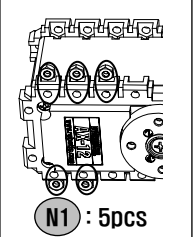
Step 9 Right Shoulder

※Insert nuts

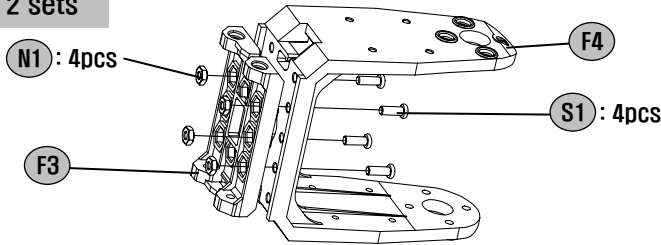


Step 10 Left Shoulder

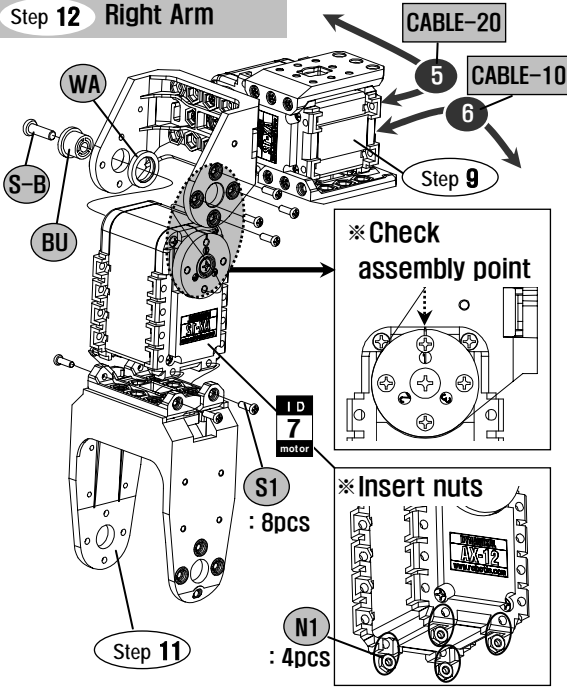
※Insert nuts



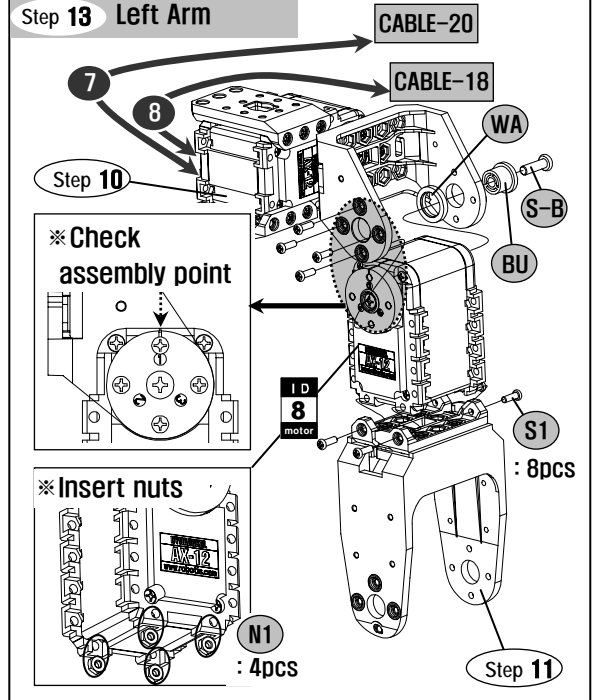
Step 11 Hand : 2 sets



Step 12 Right Arm

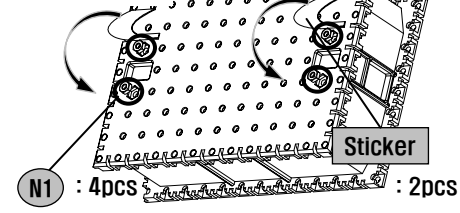


Step 13 Left Arm

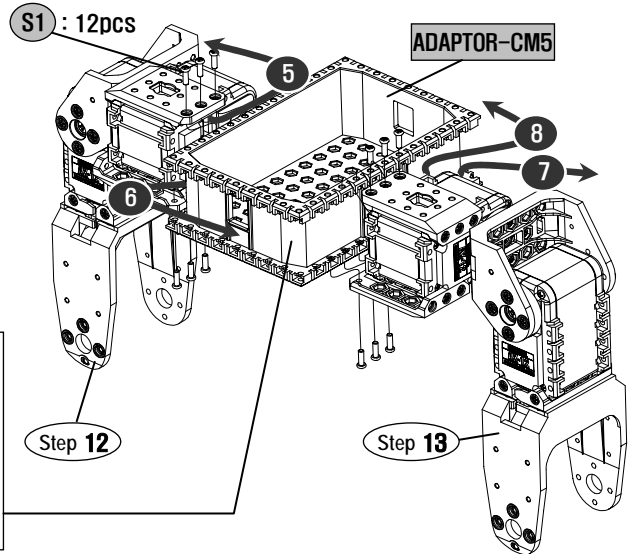
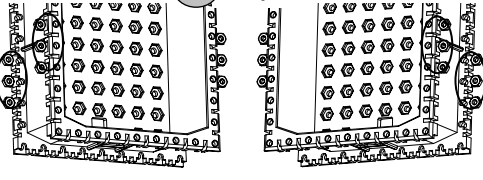


Step 14 Upper Part of Body Assembly

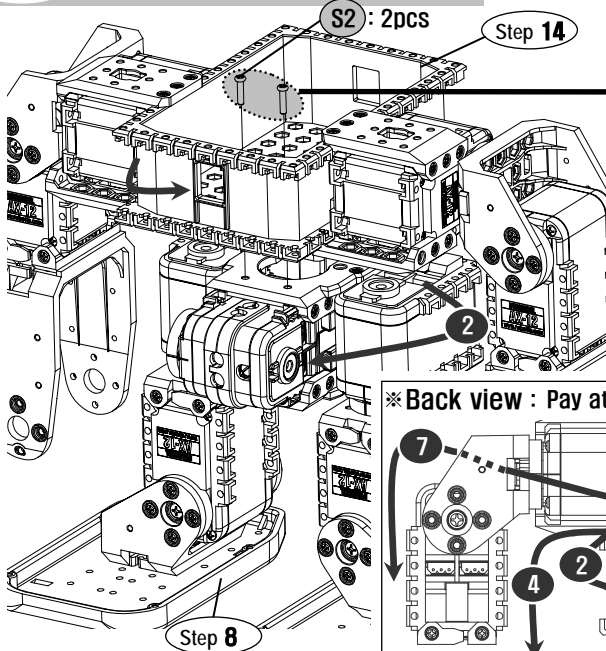
* Attach nut stickers : Make sure nuts do not come off.



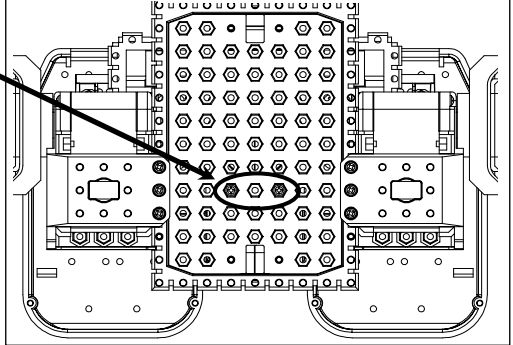
* Insert nuts N1 : 12pcs



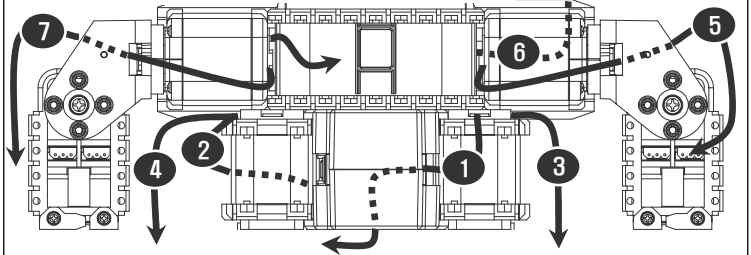
Step 15 Upper and Lower Body Assembly



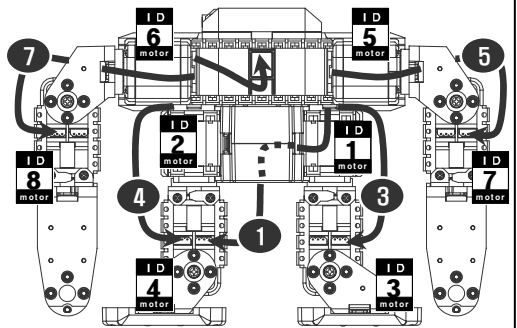
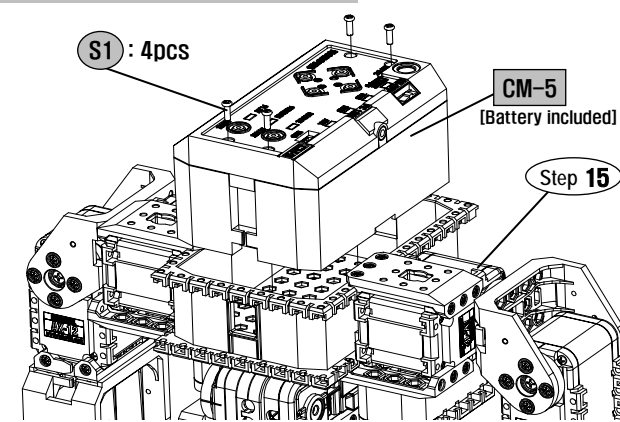
***Top view : Check screw assembly point.**



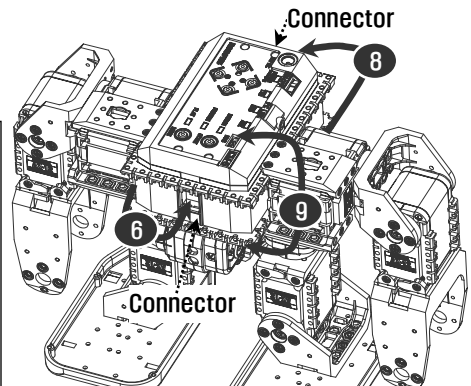
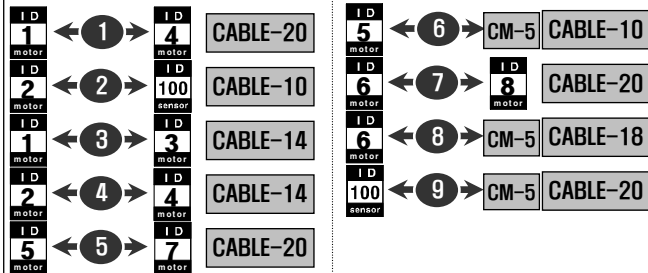
***Back view : Pay attention to wire direction.**



Step 16 Wiring and Completion



***Wiring**



***Using side connector of CM-5, connect 6 8 cables.**

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Intermediate\Battle Droid\CheckAssembly\(Battle Droid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

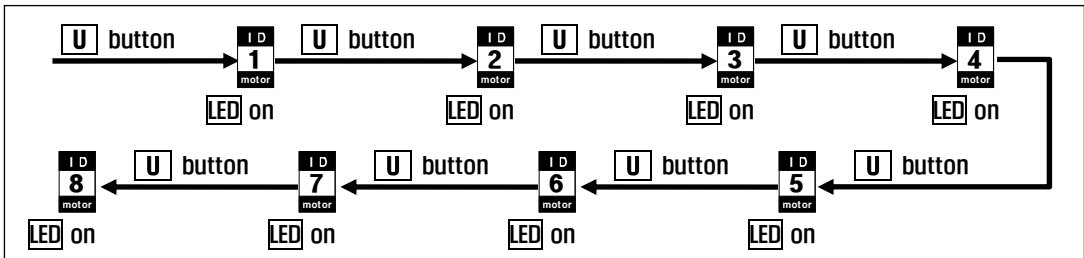
<->PC:57142 BPS. <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 100
009[0X09] Dynamixels Found.

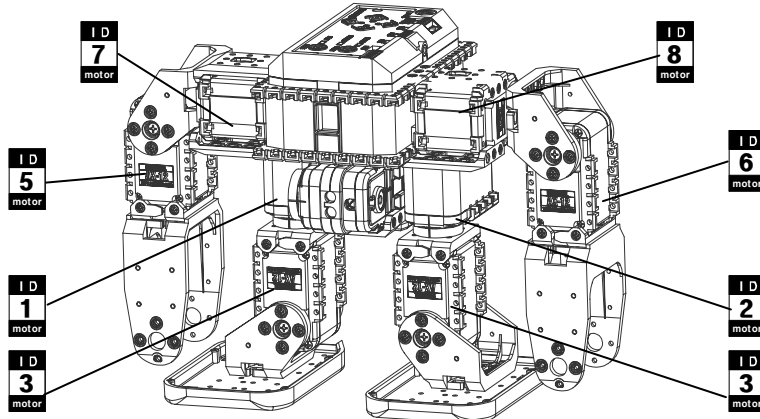
← comparison part

Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ Whenever the **U** button is pressed, **LED** is on in the order shown below.



※ For the ID of **Dynamixel**, refer to the figure below.

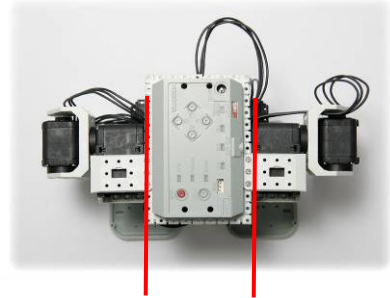
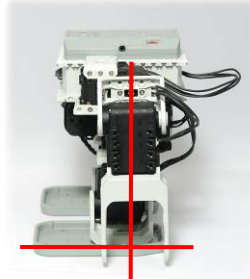
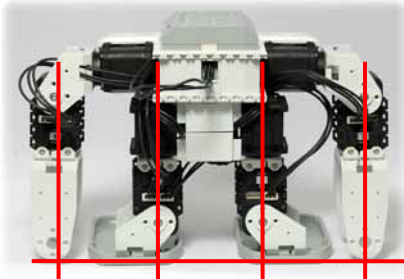


Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Back View

※Side View

※Top View



Two legs and arms are perpendicular to the surface.

Both tip of the toes are parallel.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Intermediate \Battle Droid \DemoExample\(Battle Droid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\ Intermediate \ Battle Droid \DemoExample\(Battle Droid\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

- When you press the **R** button of CM-5, the Battle Droid will walk forward.
- When you press the **L** button of CM-5, the Battle Droid will walk backward.
- When you press the **U** button of CM-5, the Battle Droid will turn toward right.
- When you press the **D** button of CM-5, the Battle Droid will turn toward left.
- When you press the **Start** button of CM-5, the Battle Droid will attack in various ways.
- When the Battle Droid falls down, it will get up when you handclap at least three times.

Step 5 Compare with the provided video clip

(In CD, [Applied Robots\Intermediate\ Battle Droid \DemoExample\(Battle Droid\).wmv](#))

2 – 4 . Examples of Advanced Level



1. Dinosaur



2. Puppy



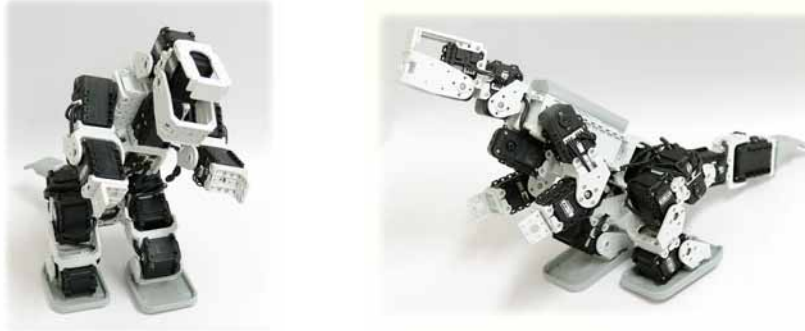
3. King Spider



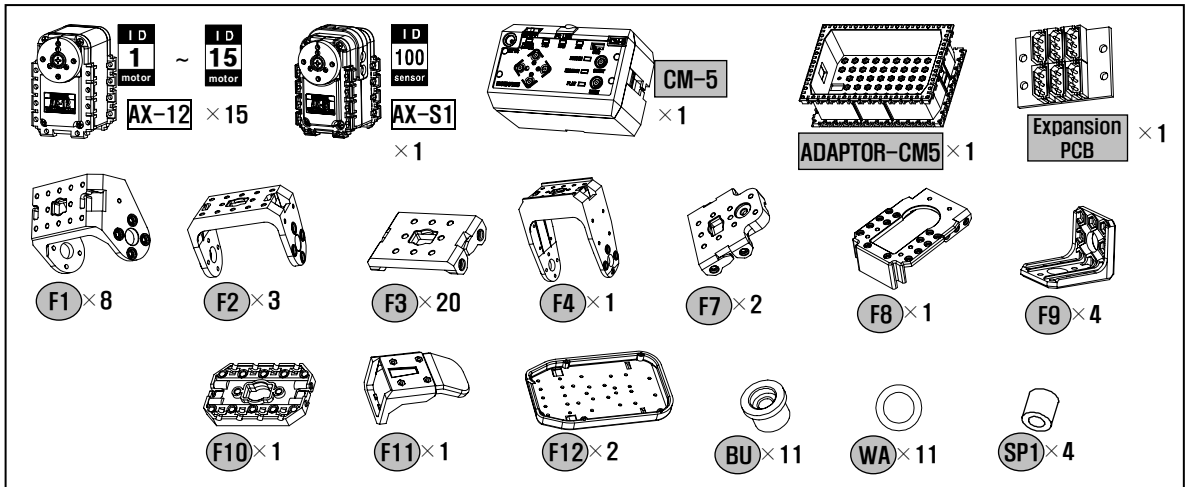
4. Humanoid

2-4-1. Dinosaur

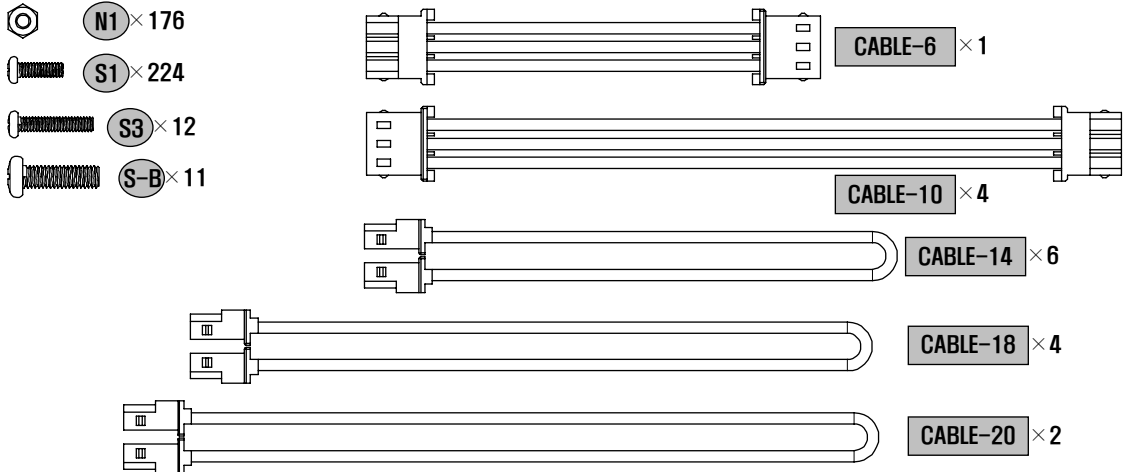
Let's build a dinosaur that ferociously attacks when it detects an object.



(1) Necessary parts



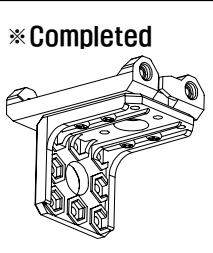
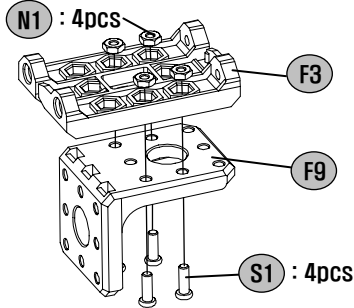
※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.



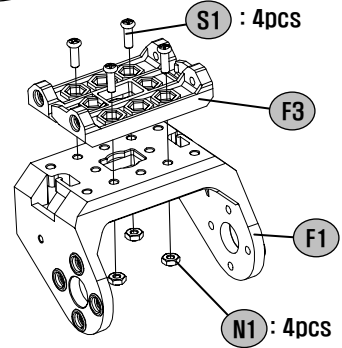
(2) Assembling

Step 1 ~ Step 4 Assemble Frame

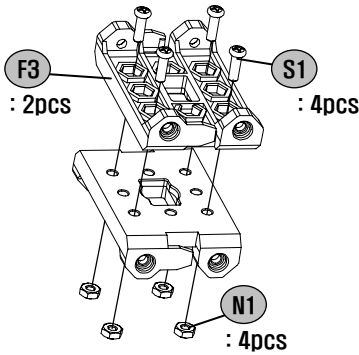
Step 1 Assemble 2 sets.



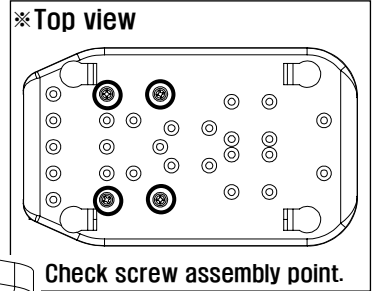
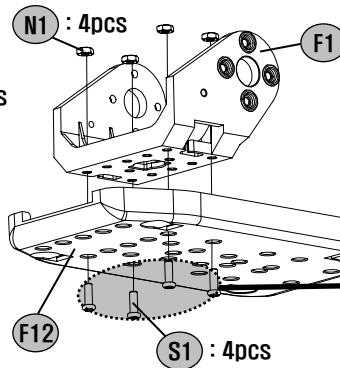
Step 2 Assemble 4 sets.



Step 3 Assemble 2 sets.

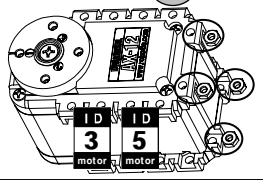


Step 4 Assemble 2 sets.

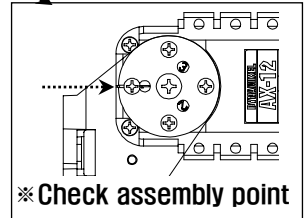
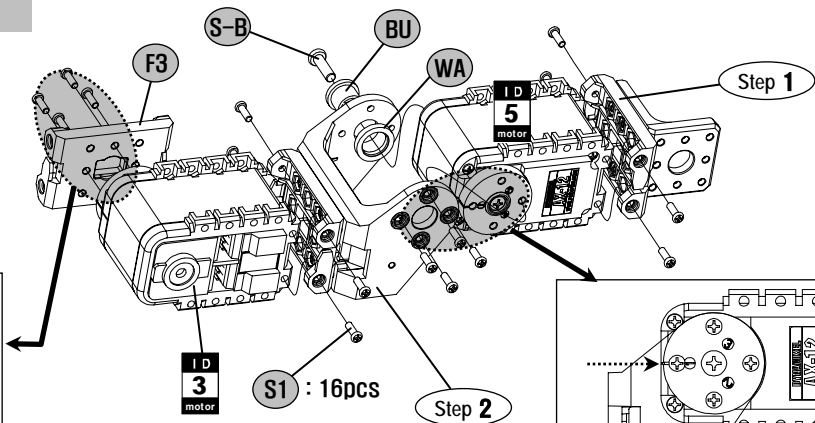
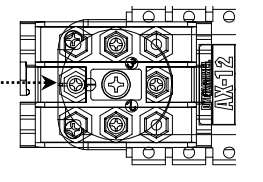


Step 5 Right Arm

※ Insert nuts N1 : 4 pcs

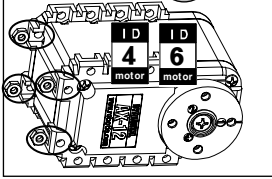


※ Check assembly point

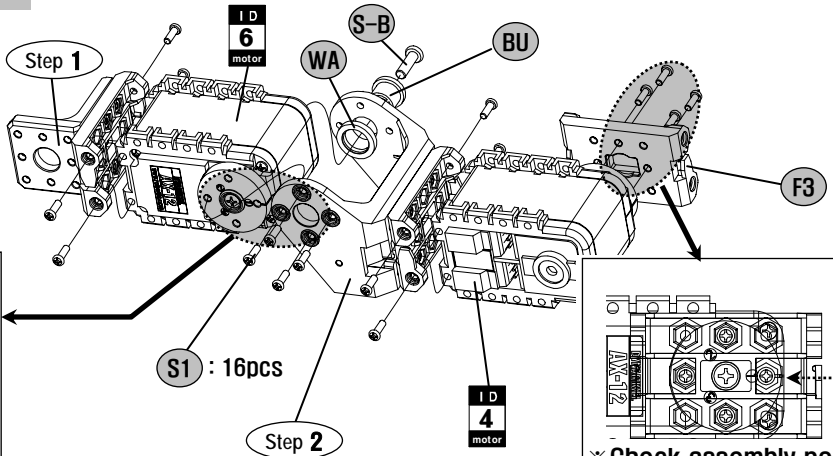
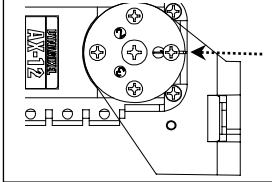


Step 6 Left Arm

※ Insert nuts **N1** : 4pcs



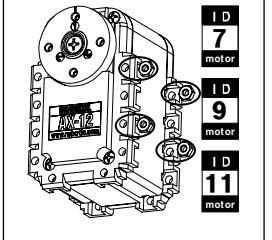
※ Check assembly point



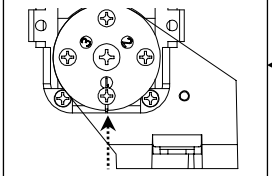
※ Check assembly point

Step 7 Right Leg

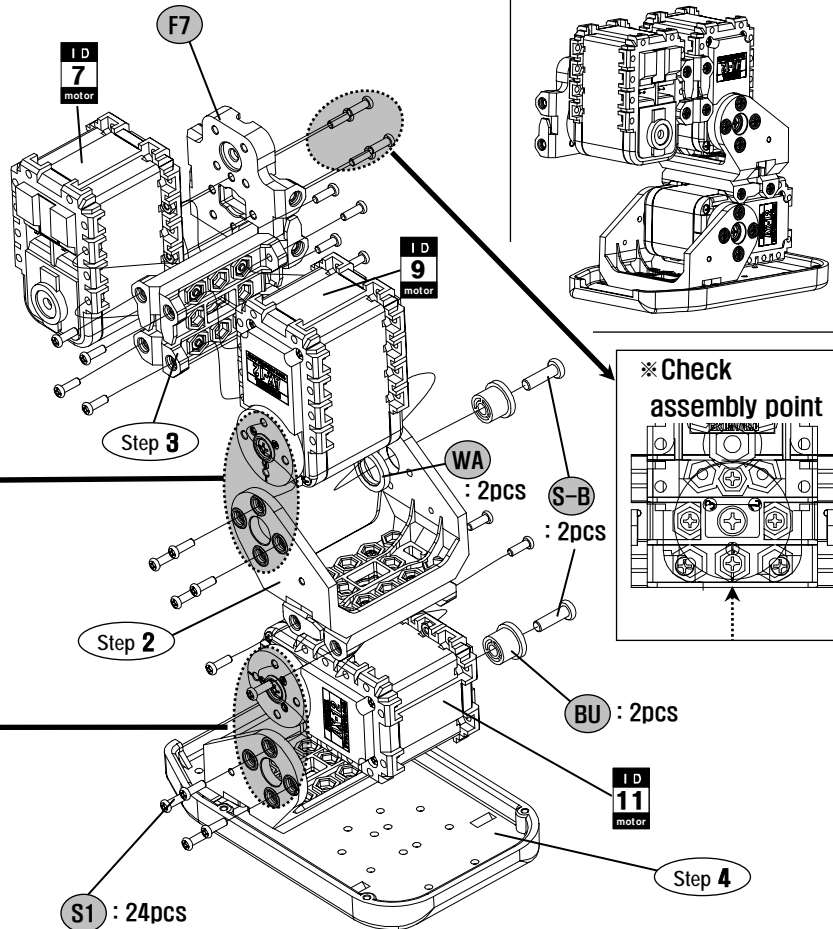
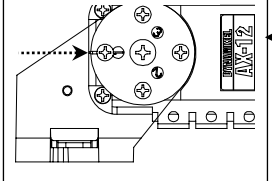
※ Insert nuts **N1** : 4pcs



※ Check assembly point



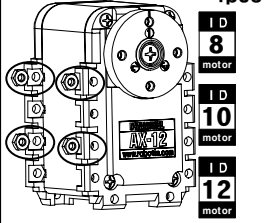
※ Check assembly point



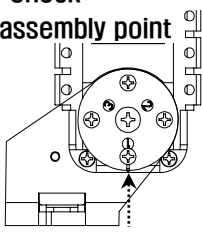
※ Check assembly point

Step 8 Left Leg

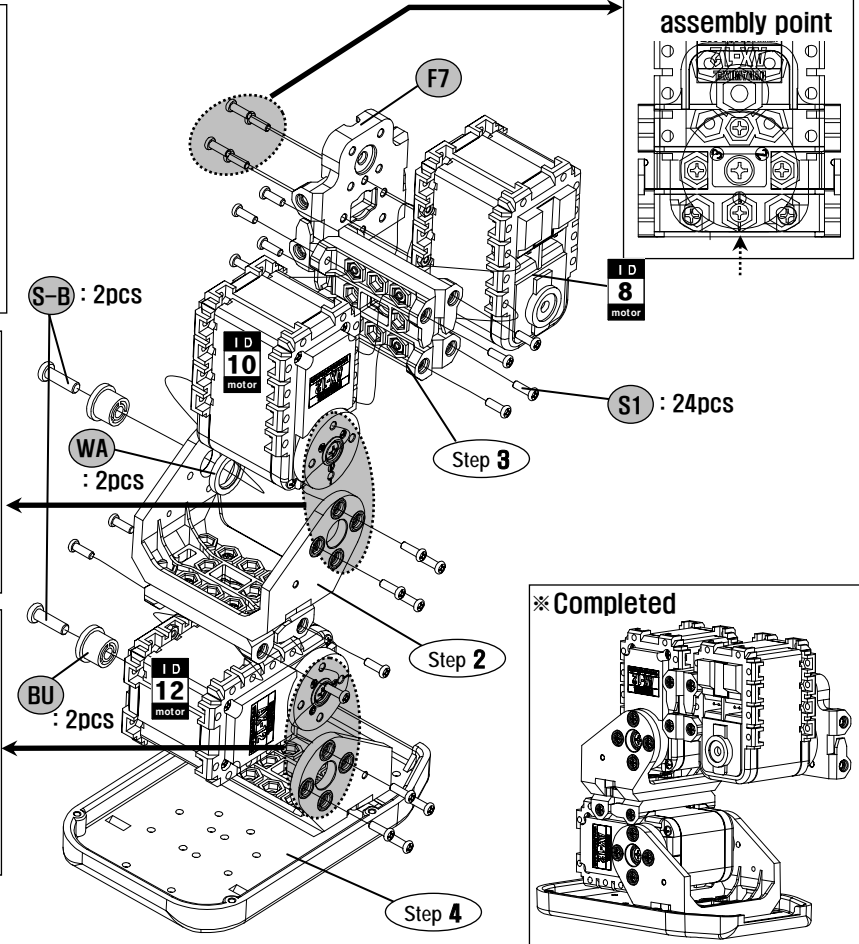
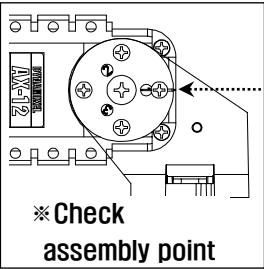
※Insert nuts **N1** : 4pcs



※Check assembly point

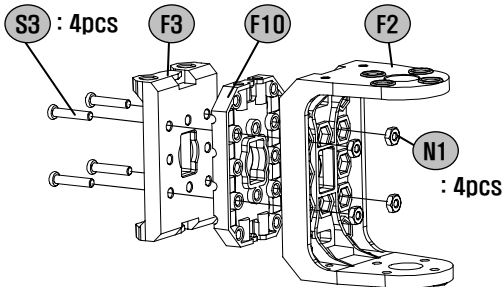


※Check assembly point

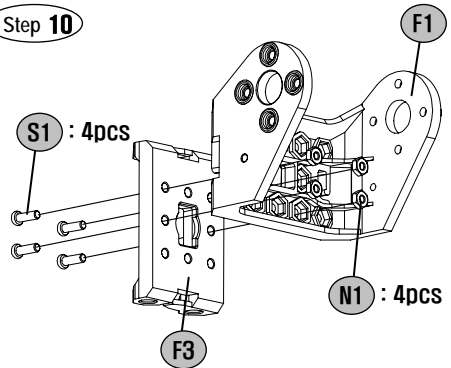


Step 9 ~ Step 10 Tail 1 : Frame Assembly

Step 9

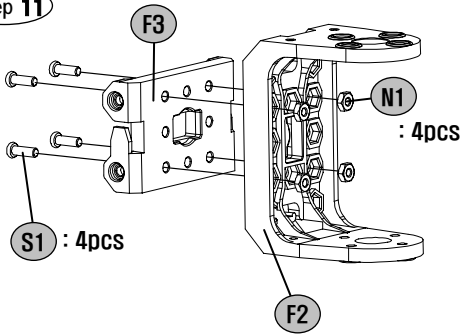


Step 10

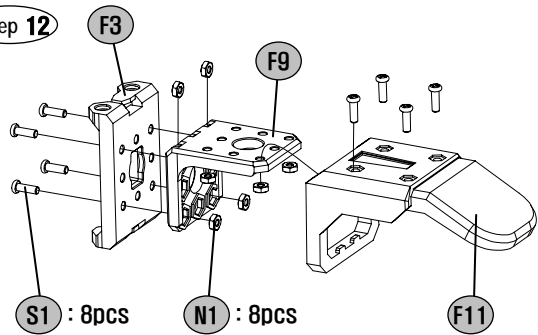


Step 11 ~ Step 12 Tail 2 : Frame Assembly

Step 11

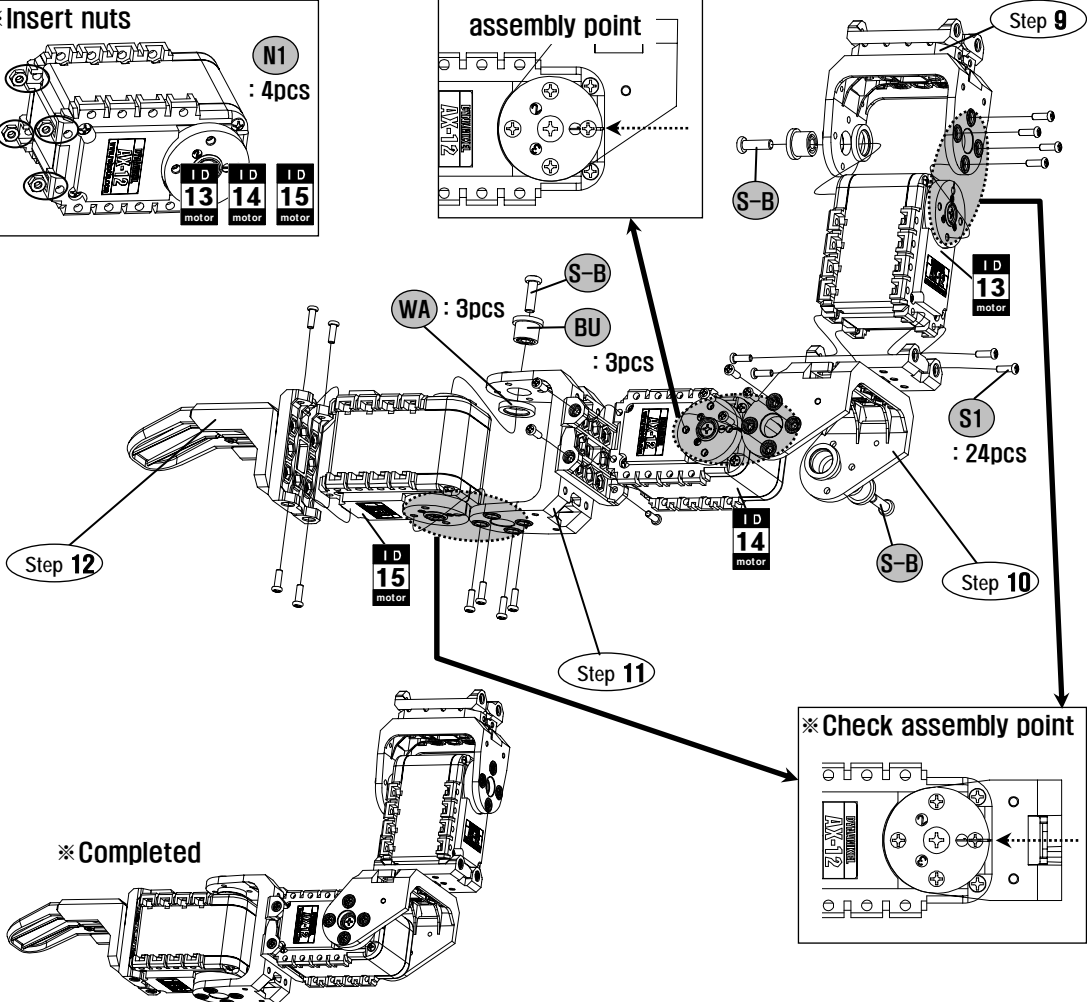
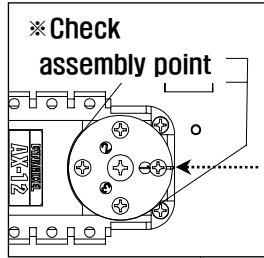
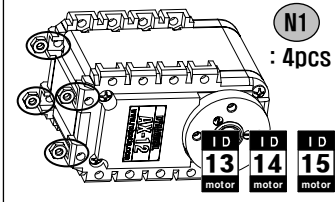


Step 12

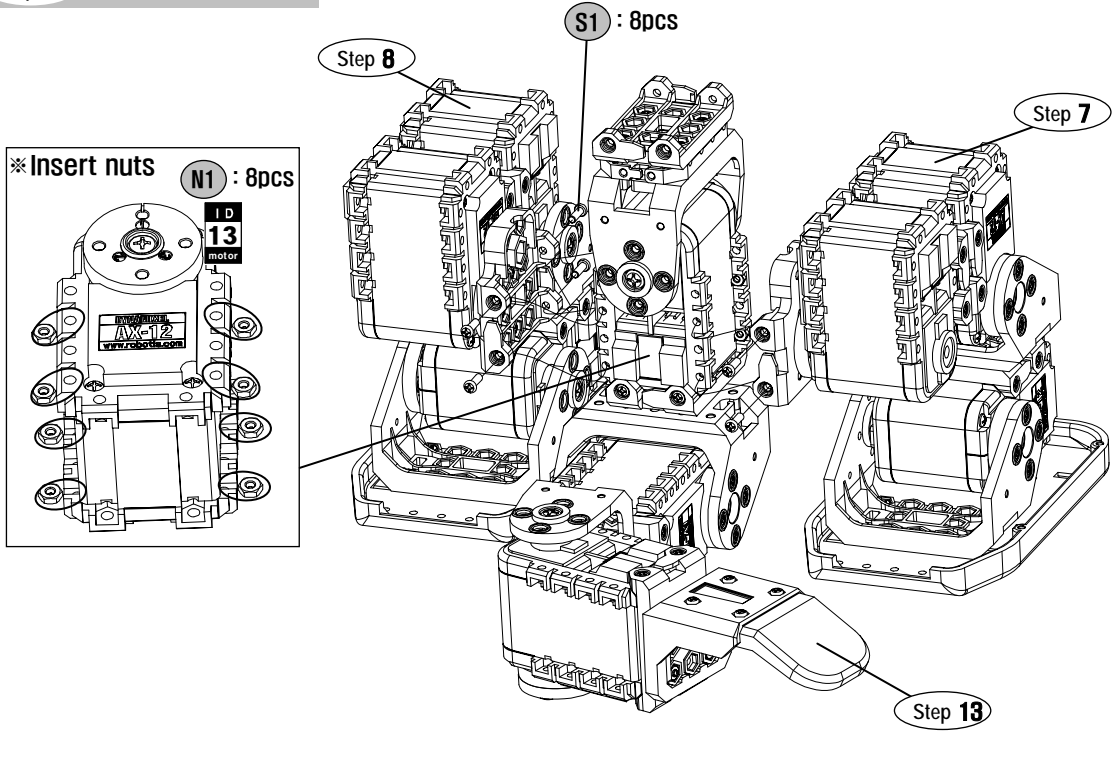


Step 13 Tail 3

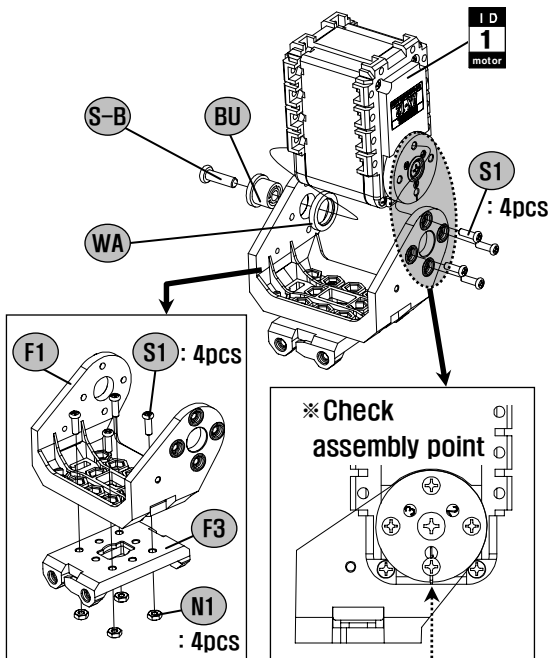
※Insert nuts



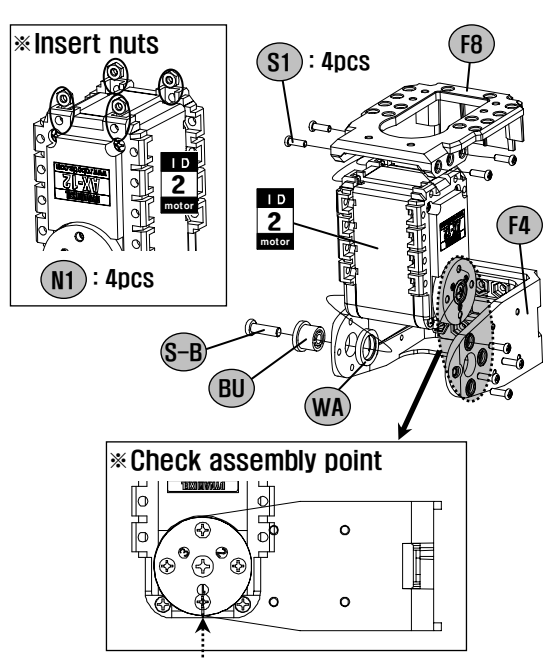
Step 14 Leg-Tail Assembly



Step 15 Head 1

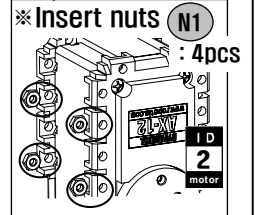
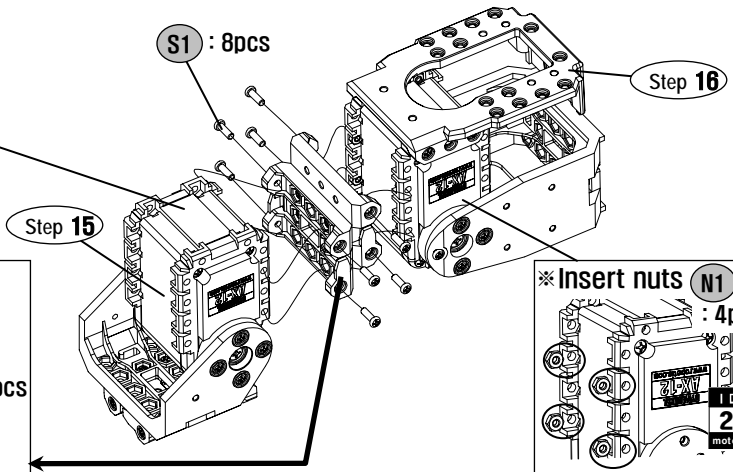
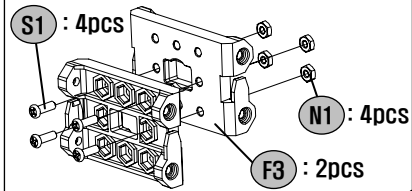
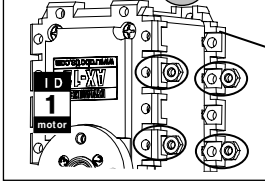


Step 16 Head 2

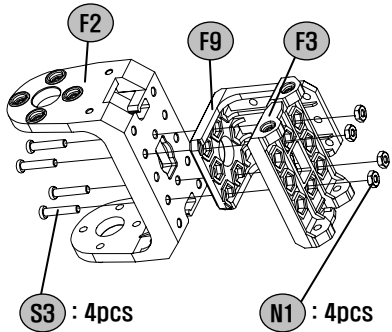


Step 17 Head 3

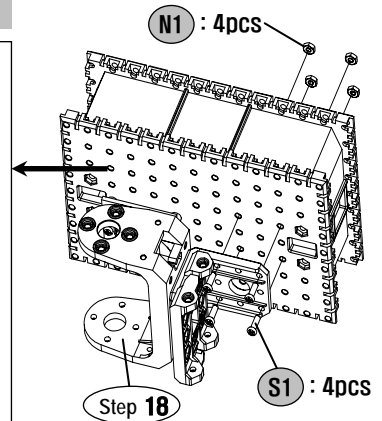
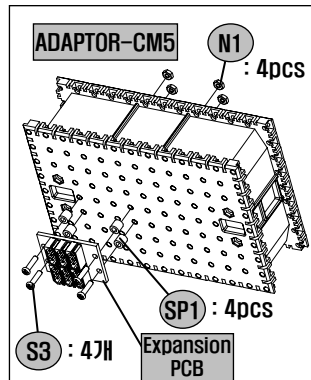
※ Insert nuts **N1** : 4pcs



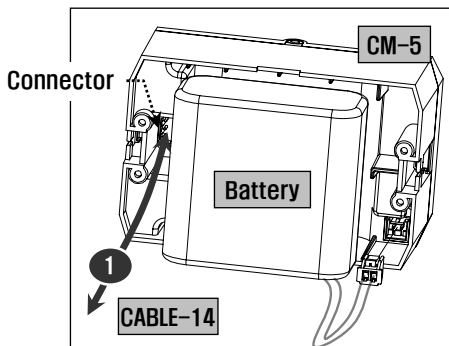
Step 18 Body 1



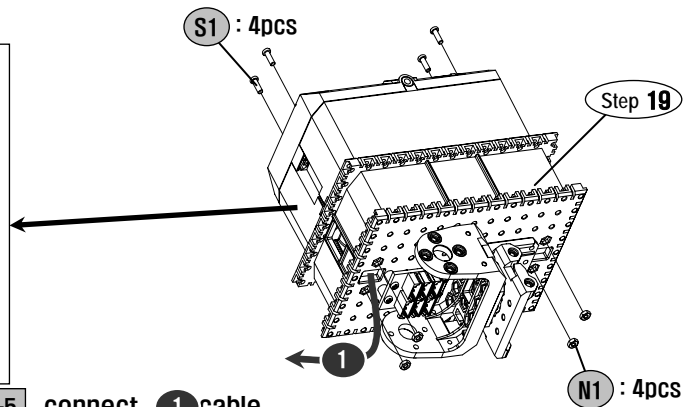
Step 19 Body 2



Step 20 Body 3

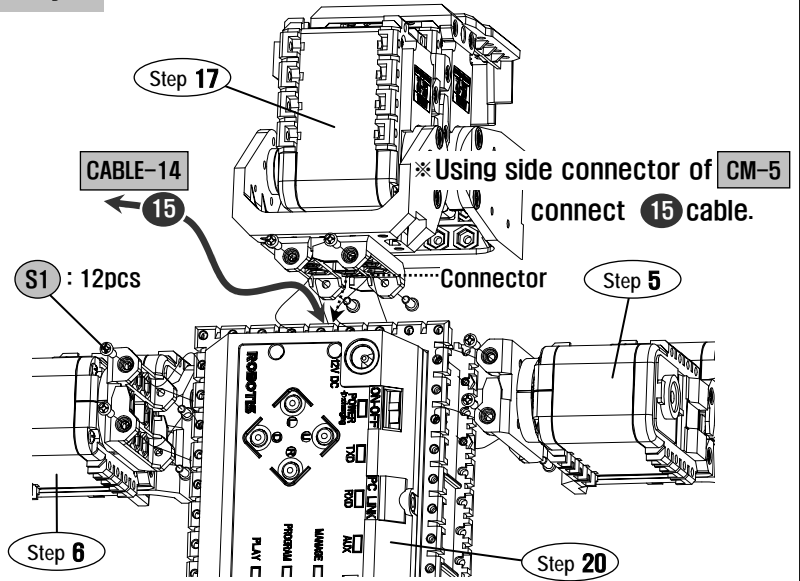
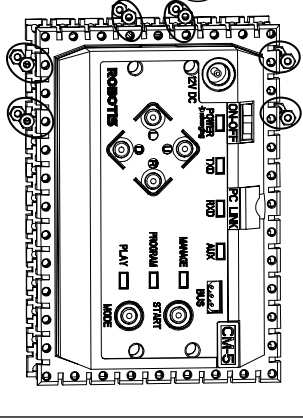


※ Using the connector inside of **CM-5**, connect **1** cable.



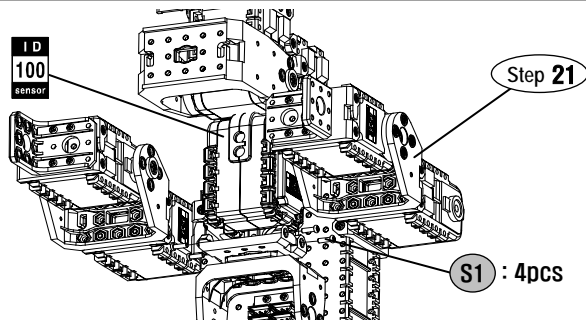
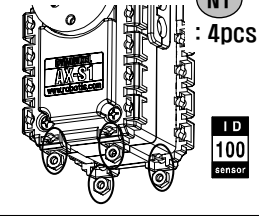
Step 21 Upper Part of Body Assembly

※ Insert nuts **N1** : 12pcs



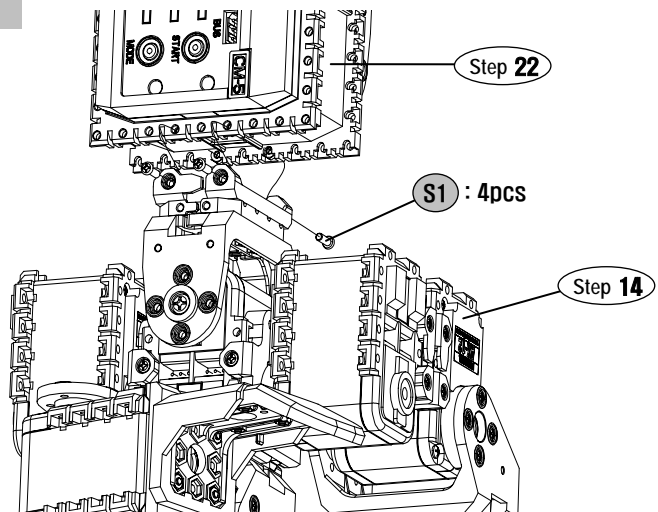
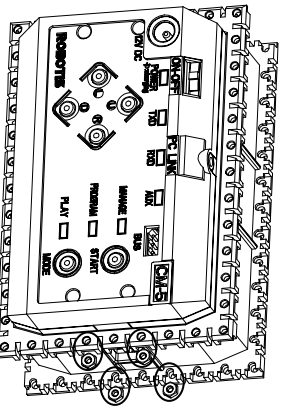
Step 22 Sensor Assembly

※ Insert nuts **N1** : 4pcs

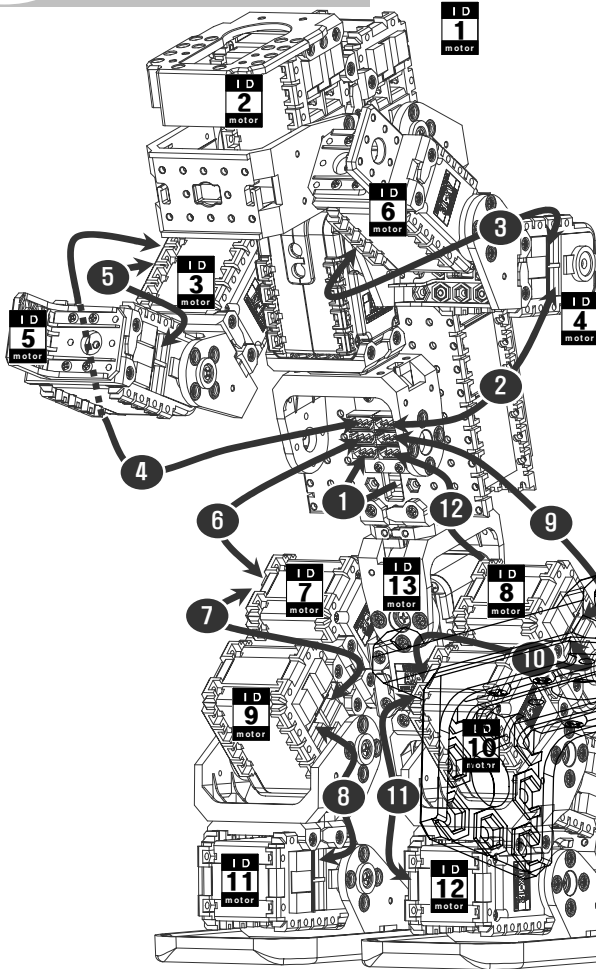


Step 23 Lower Part of Body Assembly

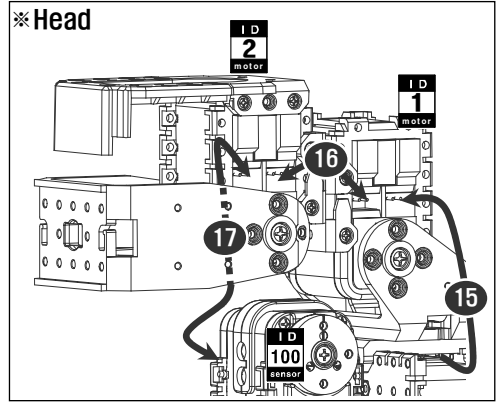
※ Insert nuts **N1** : 4pcs



Step 24 Wiring and Completion



※ Head

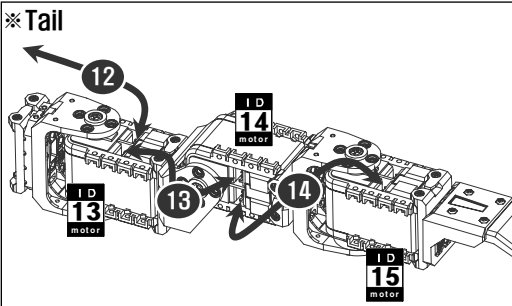


※ Wiring

CM-5	1	Expansion PCB	CABLE-14
I.D. 4 motor	2	Expansion PCB	CABLE-18
I.D. 4 motor	3	I.D. 6 motor	CABLE-14
I.D. 3 motor	4	Expansion PCB	CABLE-18
I.D. 3 motor	5	I.D. 5 motor	CABLE-14
I.D. 7 motor	6	Expansion PCB	CABLE-20

I.D. 7 motor	7	I.D. 9 motor	CABLE-10
I.D. 9 motor	8	I.D. 11 motor	CABLE-10
I.D. 8 motor	9	Expansion PCB	CABLE-20
I.D. 8 motor	10	I.D. 10 motor	CABLE-10
I.D. 10 motor	11	I.D. 12 motor	CABLE-10
I.D. 13 motor	12	Expansion PCB	CABLE-18
I.D. 13 motor	13	I.D. 14 motor	CABLE-14
I.D. 14 motor	14	I.D. 15 motor	CABLE-14
I.D. 1 motor	15	CM-5	CABLE-14
I.D. 1 motor	16	I.D. 2 motor	CABLE-6
I.D. 2 motor	17	I.D. 100 sensor	CABLE-18

※ Tail



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Advanced\Dinosaur\CheckAssembly\(Dinosaur\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

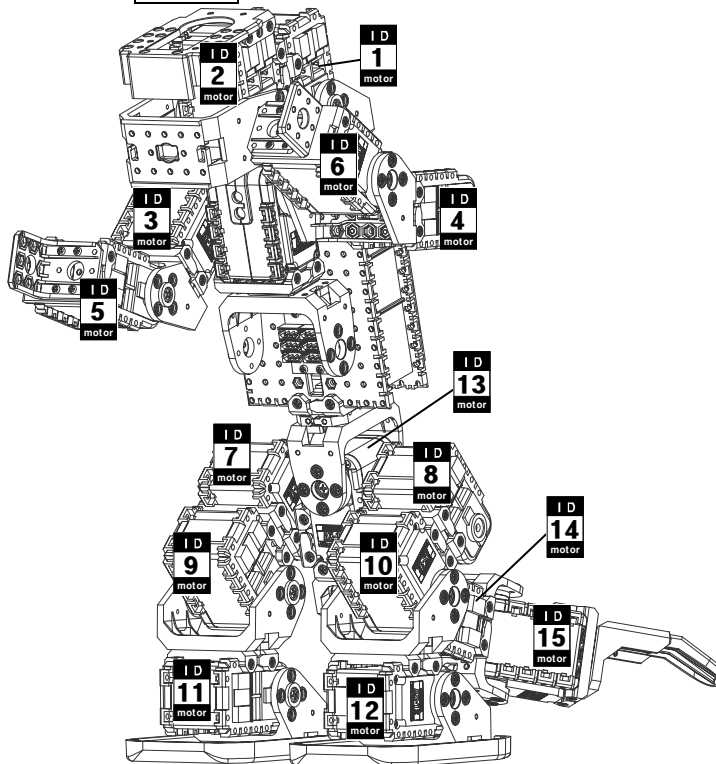
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:002 003 004 005 006 007 008 010 011 012 0
13 014 015 016 017 100
016[0X10] Dynamixels Found.

← comparison part

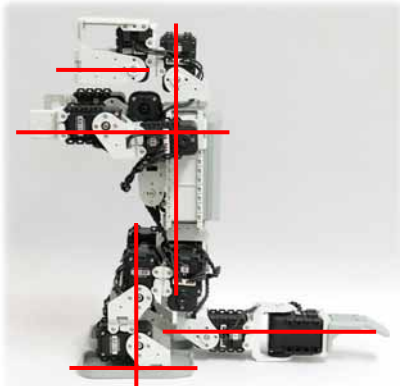
Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※For ID of **Dynamixel** refer to the figure below.

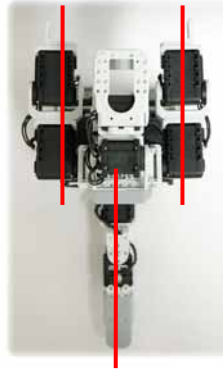


Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

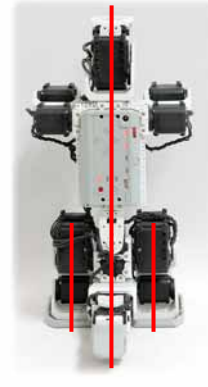
※Side View



※Top View



※Back View



Left and right are same as above pictures.

Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Advanced \Dinosaur \DemoExample\(Dinosaur\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Advanced \Dinosaur \DemoExample\(Dinosaur\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

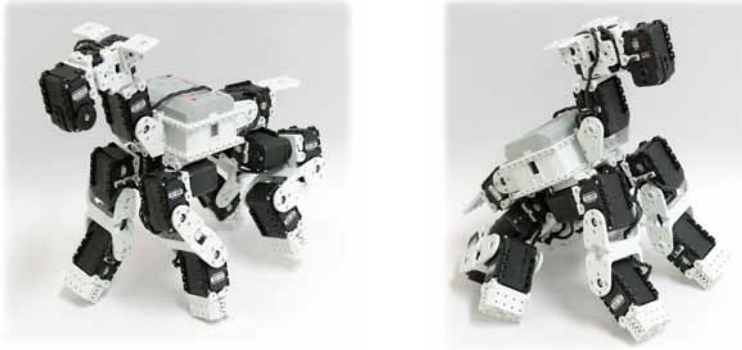
- Upon handclap, the dinosaur will awake from sleep and will keep a lookout.
- When it detects an object in front, it will attack ferociously.
- It will roar how corresponding to the number of handclaps.
- If there is no change in the surrounding for a certain amount of time, it will go to sleep

Step 5 Compare with the provided video clip

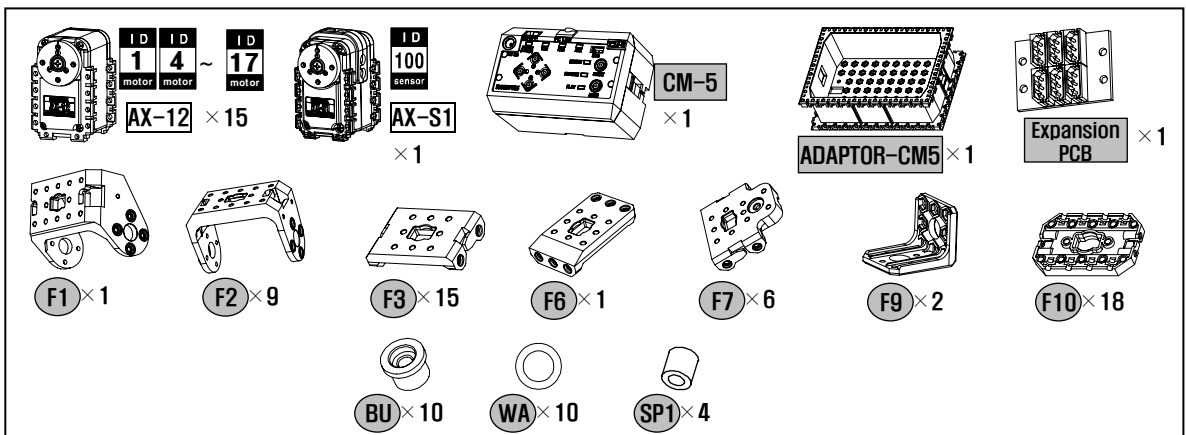
(In CD, [Applied Robots\Advanced \Dinosaur \DemoExample\(Dinosaur\).wmv](#))

2-4-2. Puppy

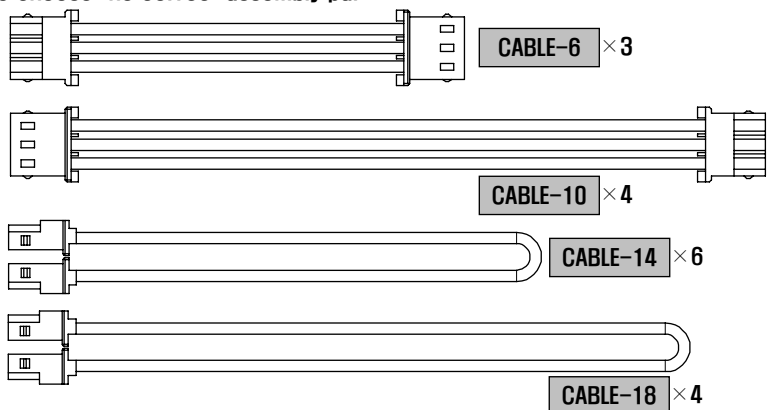
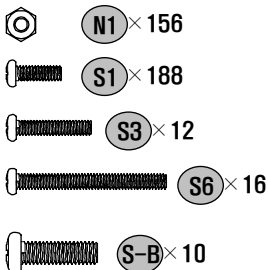
Let's build a puppy that performs various cute tricks.



(1) Necessary parts

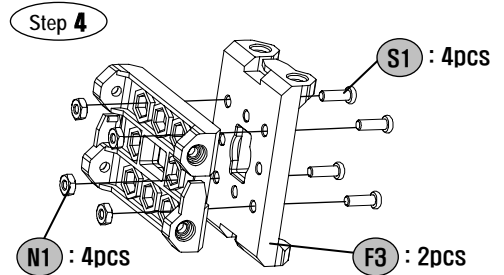
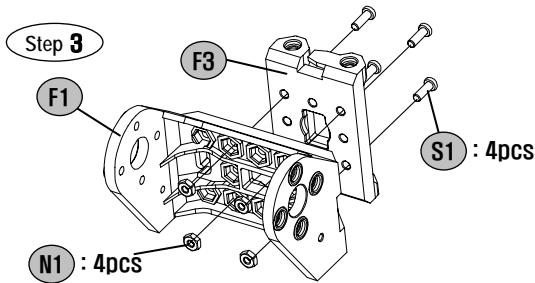
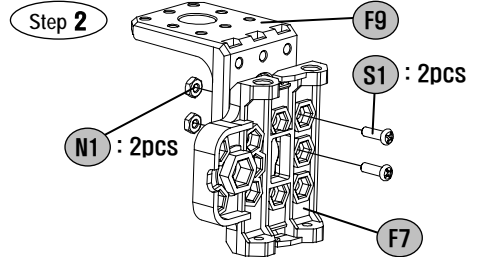
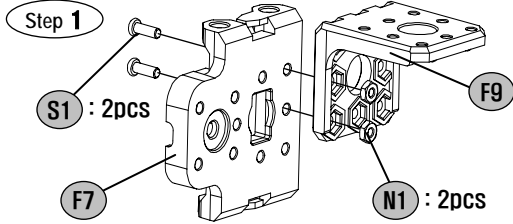


※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

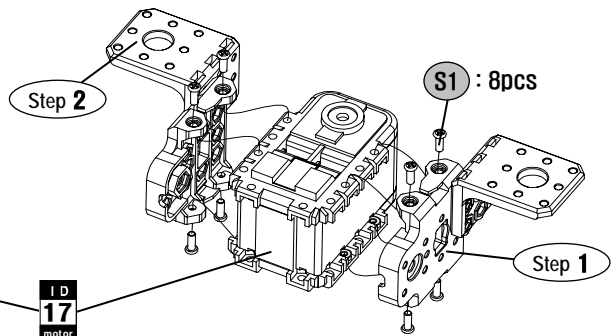
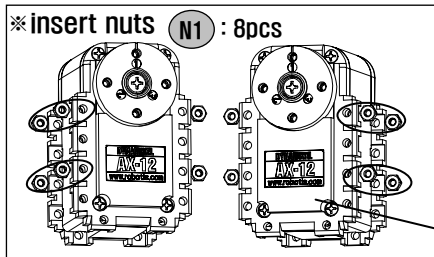


(2) Assembling

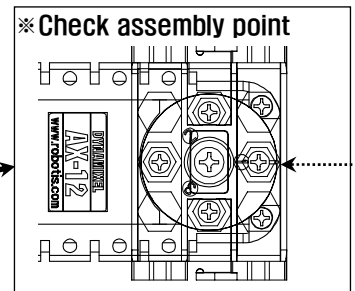
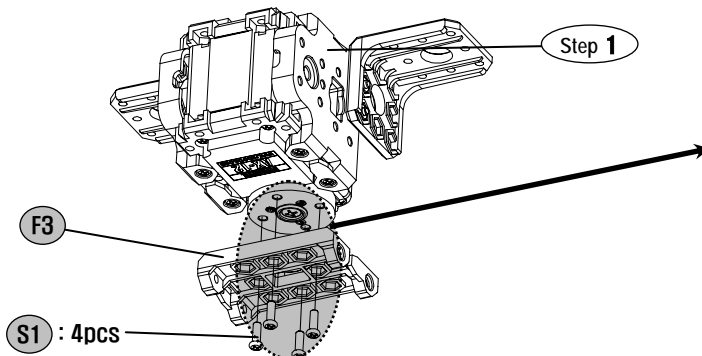
Step 1 ~ Step 4 Head 1 : Assemble Frame



Step 5 Head 2

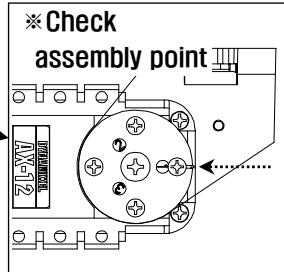
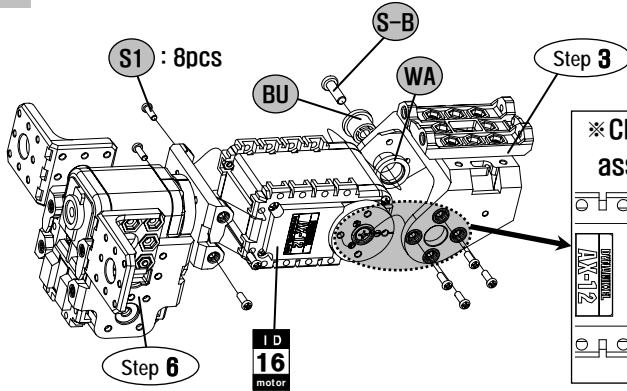
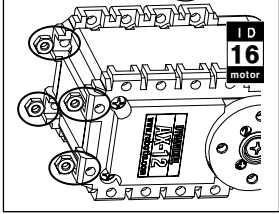


Step 6 Head 3



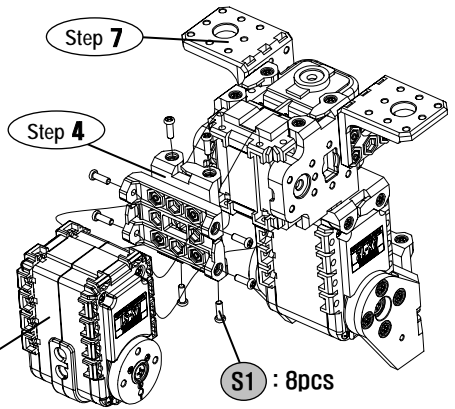
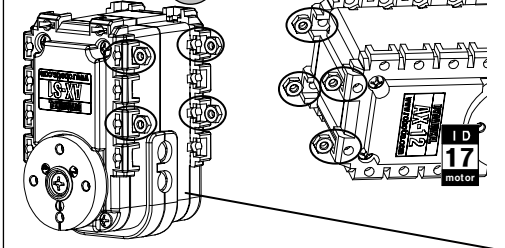
Step 7 Head 4

※ Insert nuts **N1** : 4pcs

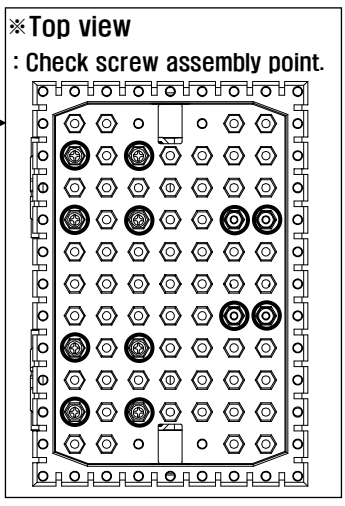
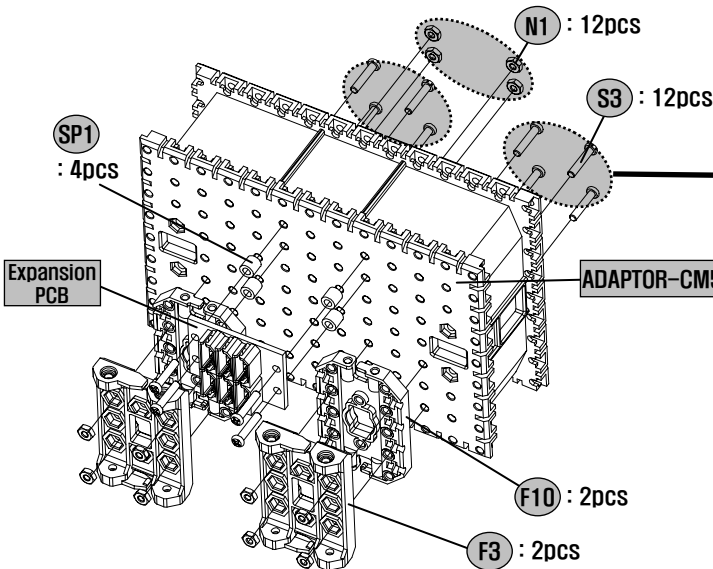


Step 8 Head 5

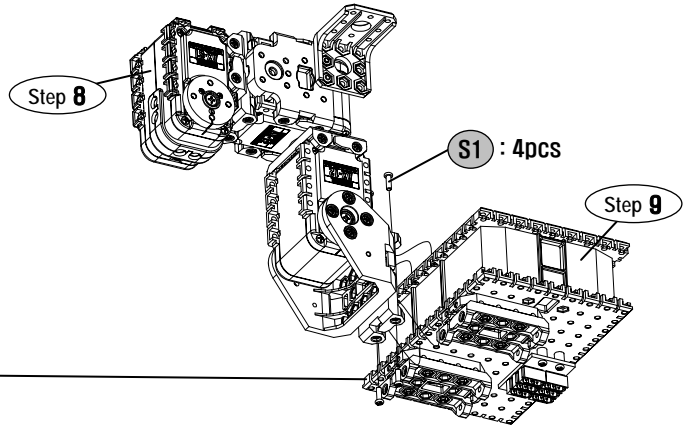
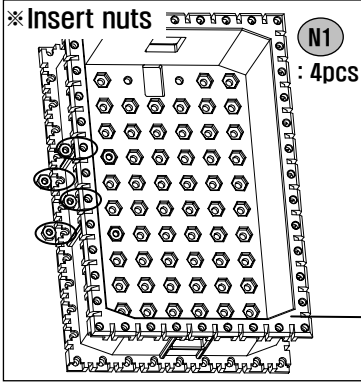
※ Insert nuts **N1** : 8pcs



Step 9 Body

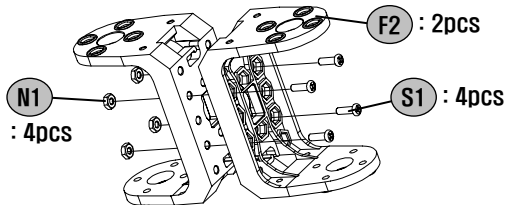


Step 10 Head-body Assembly

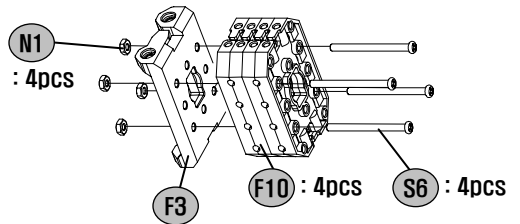


Step 11 ~ Step 12 Leg 1 : Assemble Frame (4 sets Each)

Step 11 Assemble 4 sets.

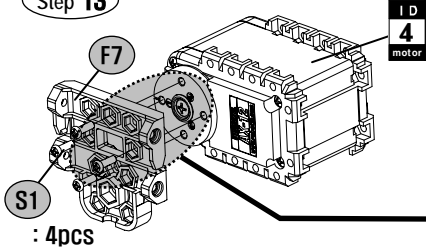


Step 12 Assemble 4 sets.

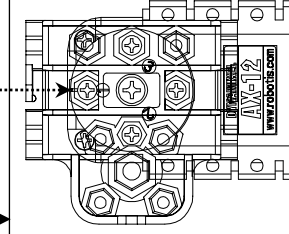


Step 13 ~ Step 14 Leg 2 : Assemble 2 sets

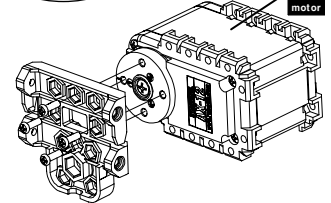
Step 13



※ Check assembly point



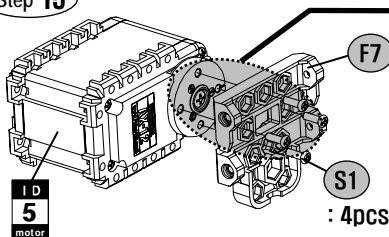
Step 14



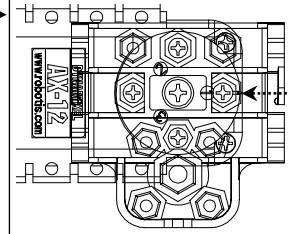
※ Assemble in a same manner.

Step 15 ~ Step 16 Leg 3 : Assemble 2 sets

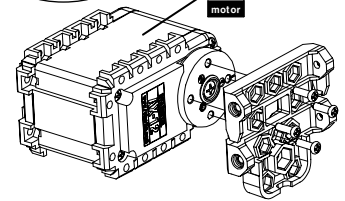
Step 15



※ Check assembly point



Step 16



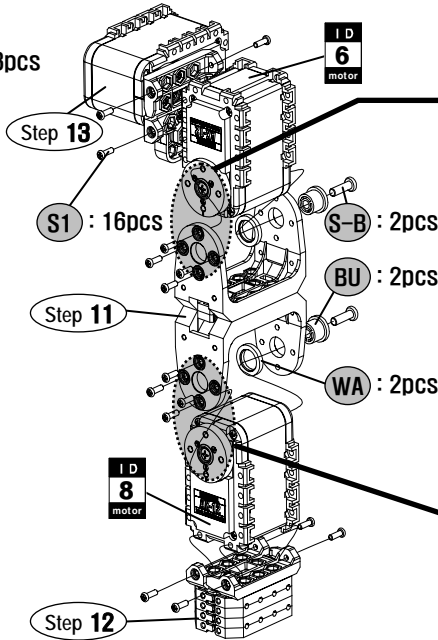
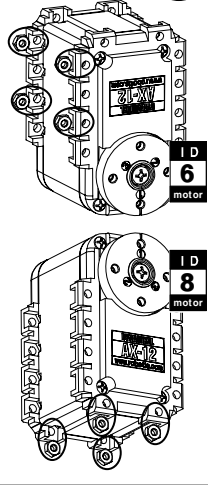
※ Assemble in a same manner.

Step 17 ~ Step 18 Leg 4 (Type 1) : Assemble 2 sets

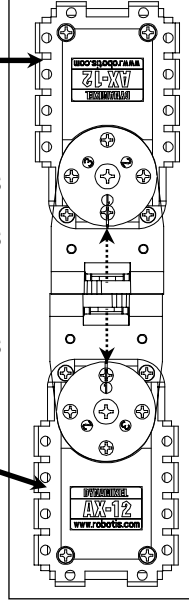
Step 17

※ Insert nuts

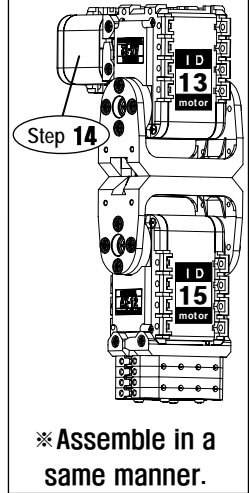
N1 : 8pcs



※ Check assembly point



Step 18



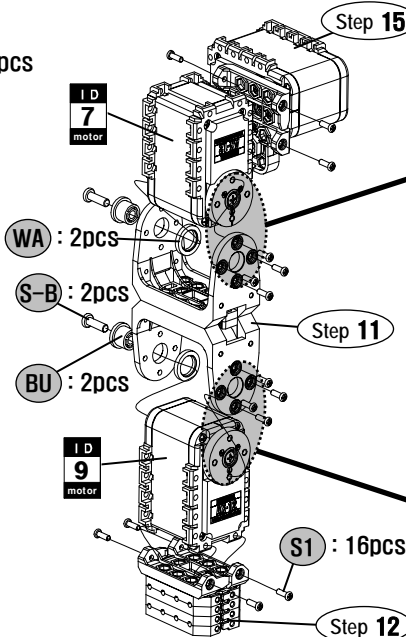
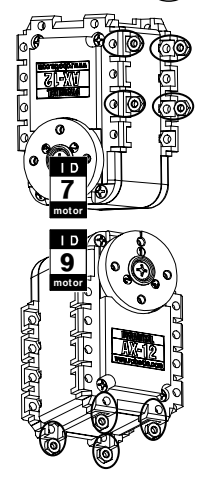
※ Assemble in a same manner.

Step 19 ~ Step 20 Leg 5 (Type 2) : Assemble 2 sets

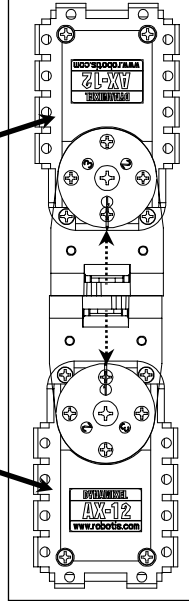
Step 19

※ Insert nuts

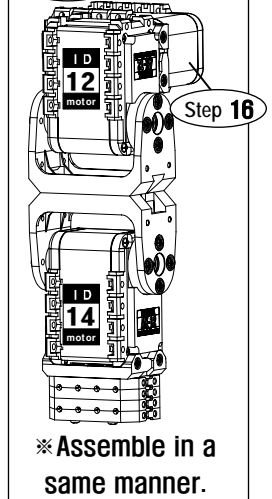
N1 : 8pcs



※ Check assembly point



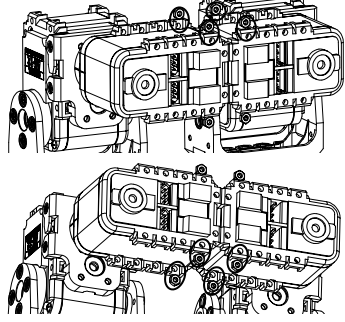
Step 20



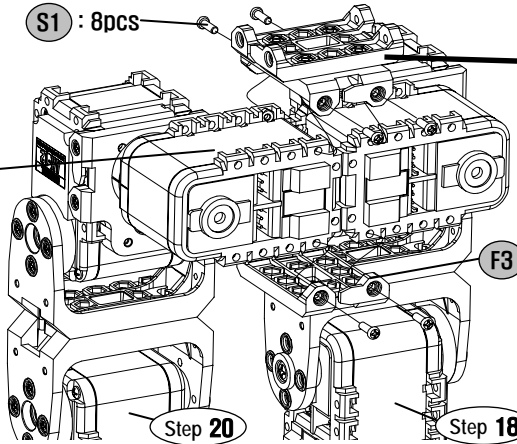
※ Assemble in a same manner.

Step 21 Hind Leg 1

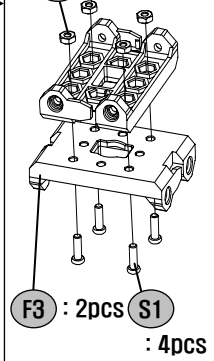
※ Insert nuts **N1 : 8pcs**



S1 : 8pcs

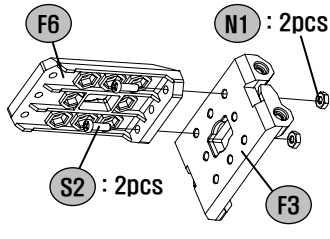


N1 : 4pcs

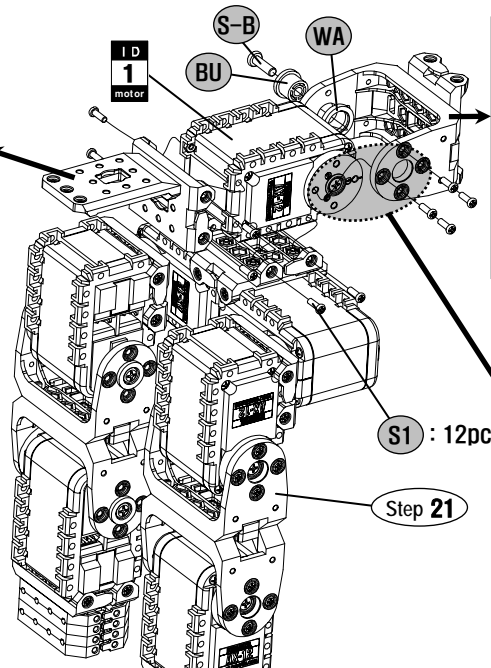
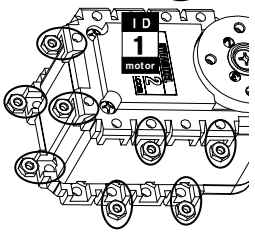


F3 : 2pcs S1 : 4pcs

Step 22 Hind Leg 2

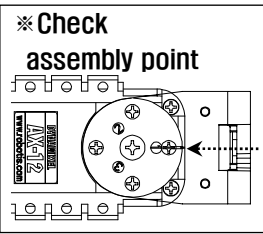
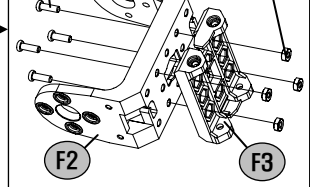


※ Insert nuts **N1 : 8pcs**



S1 : 4pcs

N1 : 4pcs



※ Check assembly point

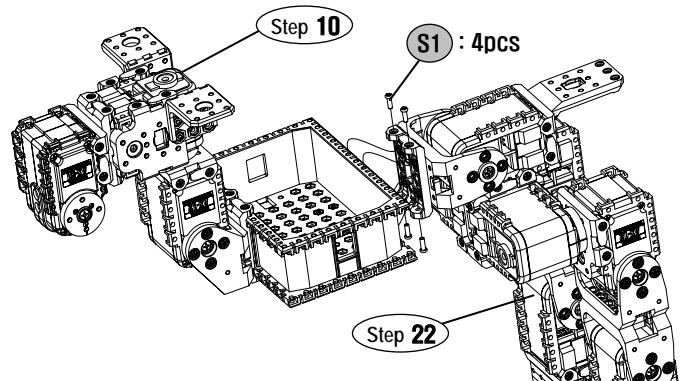
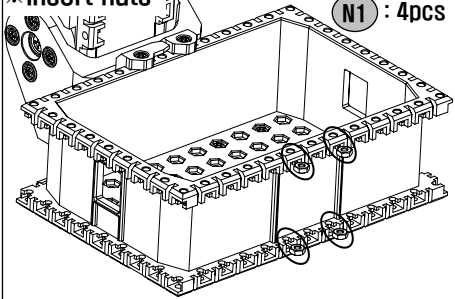
S1 : 12pcs

Step 21

Step 23 Body-Hind Leg Assembly

※ Insert nuts

N1 : 4pcs



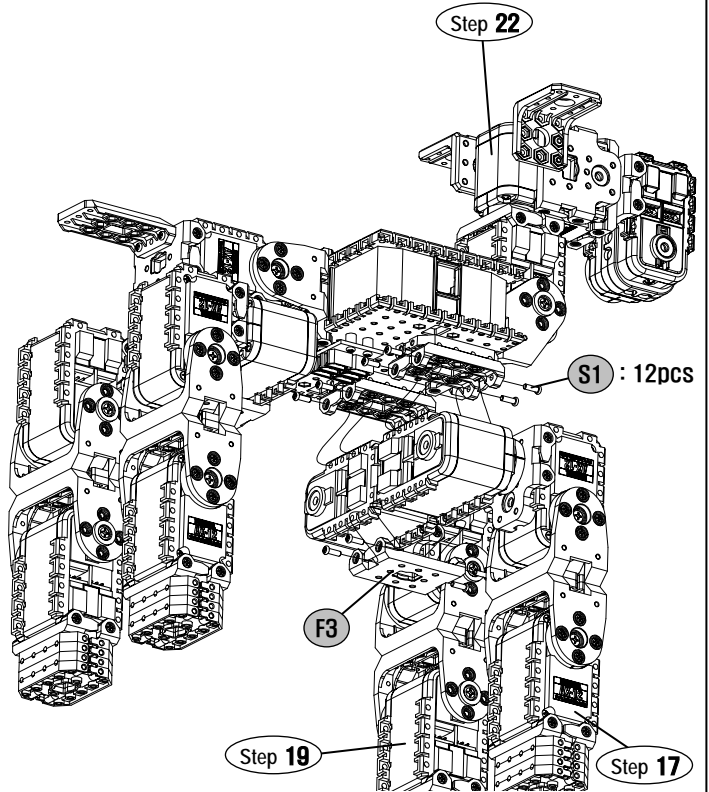
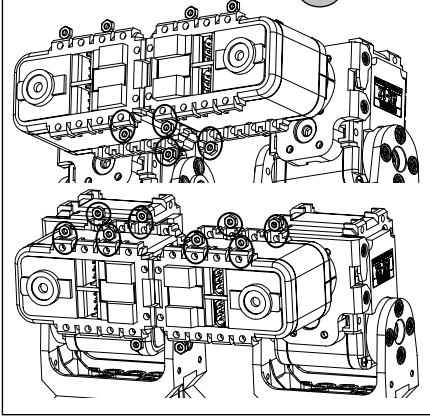
S1 : 4pcs

Step 22

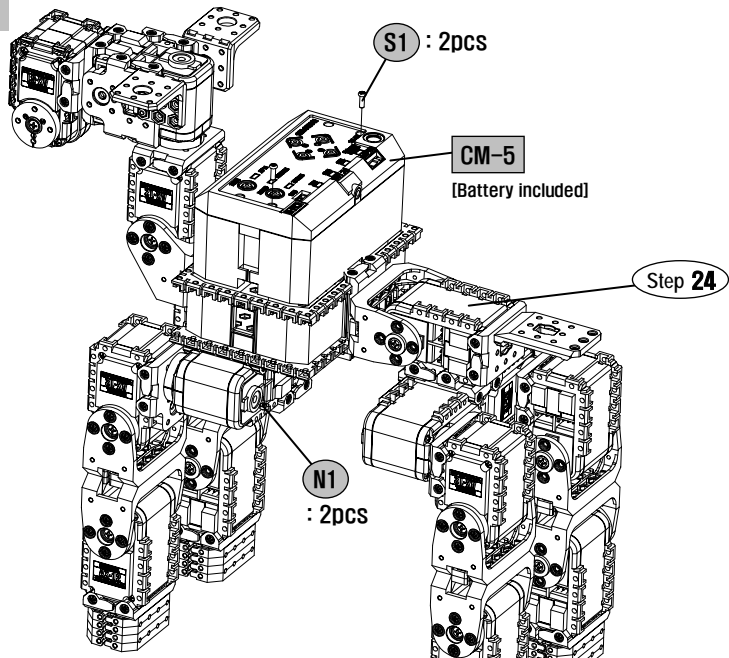
Step 24 Foreleg Assembly

※Insert nuts

N1 : 12pcs



Step 25 CM-5 Assembly

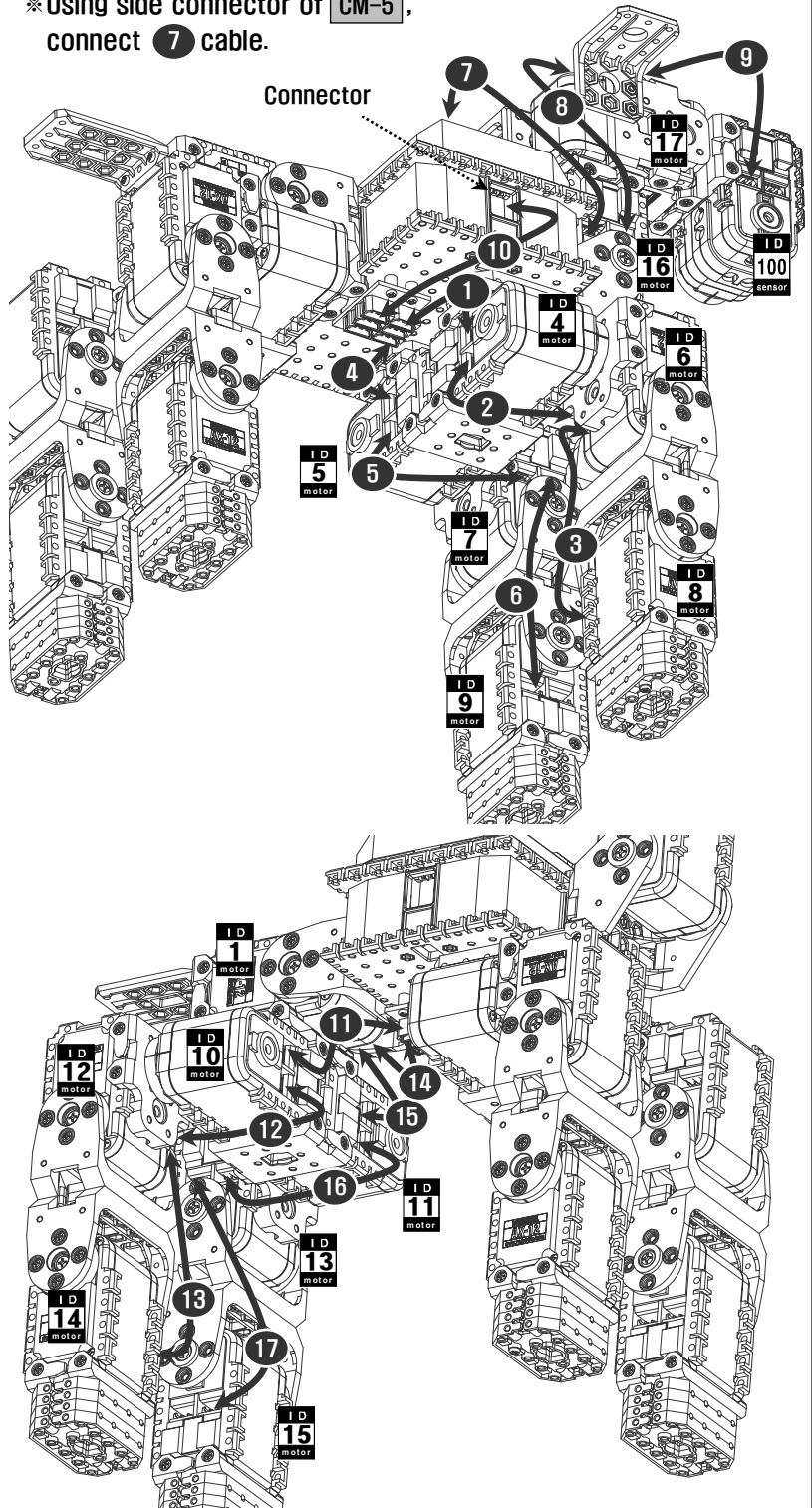


Step 26 Wiring 1

※Using side connector of CM-5, connect 7 cable.

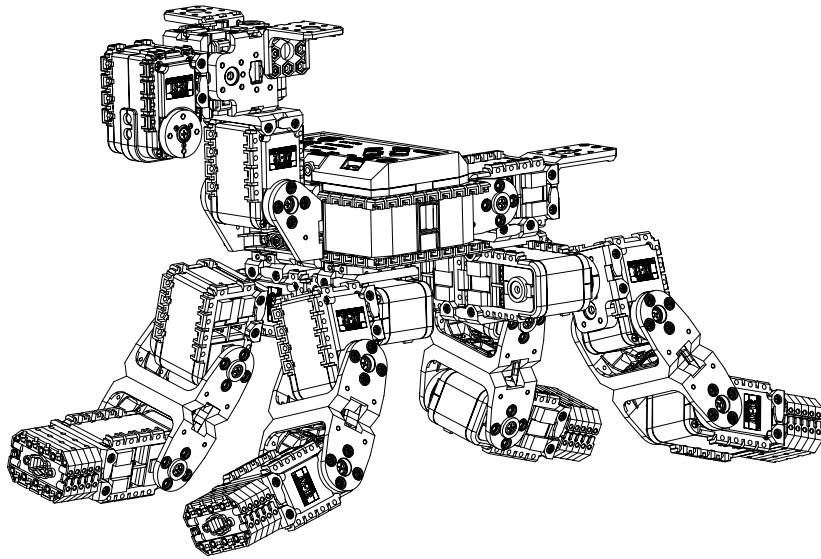
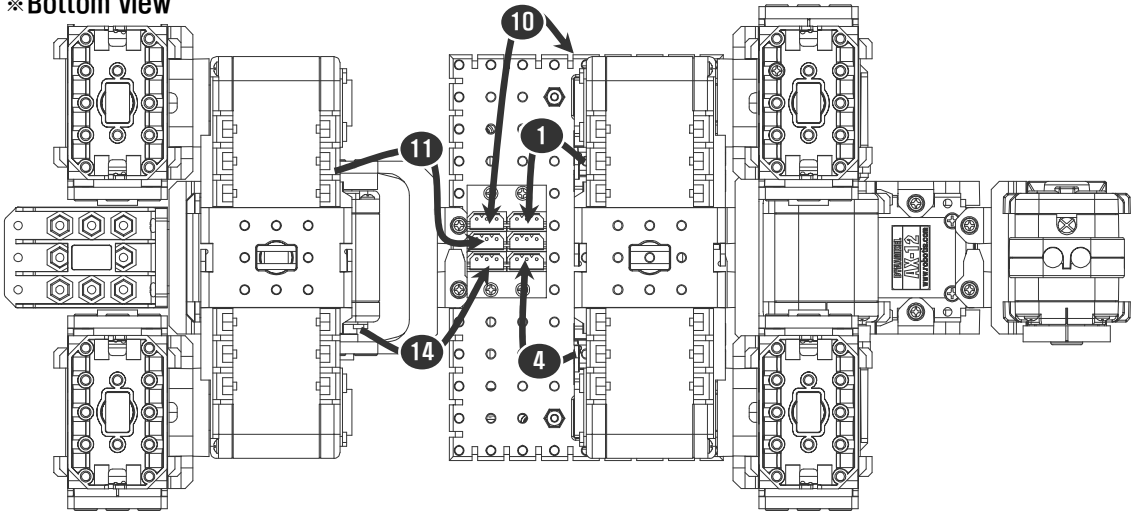
※Wiring

ID 4 motor	1	Expansion PCB	CABLE-6
ID 4 motor	2	ID 6 motor	CABLE-10
ID 6 motor	3	ID 8 motor	CABLE-14
ID 5 motor	4	Expansion PCB	CABLE-6
ID 5 motor	5	ID 7 motor	CABLE-10
ID 7 motor	6	ID 9 motor	CABLE-14
ID 16 motor	7	CM-5	CABLE-18
ID 16 motor	8	ID 17 motor	CABLE-18
ID 17 motor	9	ID 100 sensor	CABLE-14
CM-5	10	Expansion PCB	CABLE-14
ID 10 motor	11	Expansion PCB	CABLE-18
ID 10 motor	12	ID 12 motor	CABLE-10
ID 12 motor	13	ID 14 motor	CABLE-14
ID 1 motor	14	Expansion PCB	CABLE-18
ID 1 motor	15	ID 11 motor	CABLE-6
ID 11 motor	16	ID 13 motor	CABLE-10
ID 13 motor	17	ID 15 motor	CABLE-14



Step 26 Wiring 2 and Completion

※ Bottom view



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Advanced\Puppy\CheckAssembly\(Puppy\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

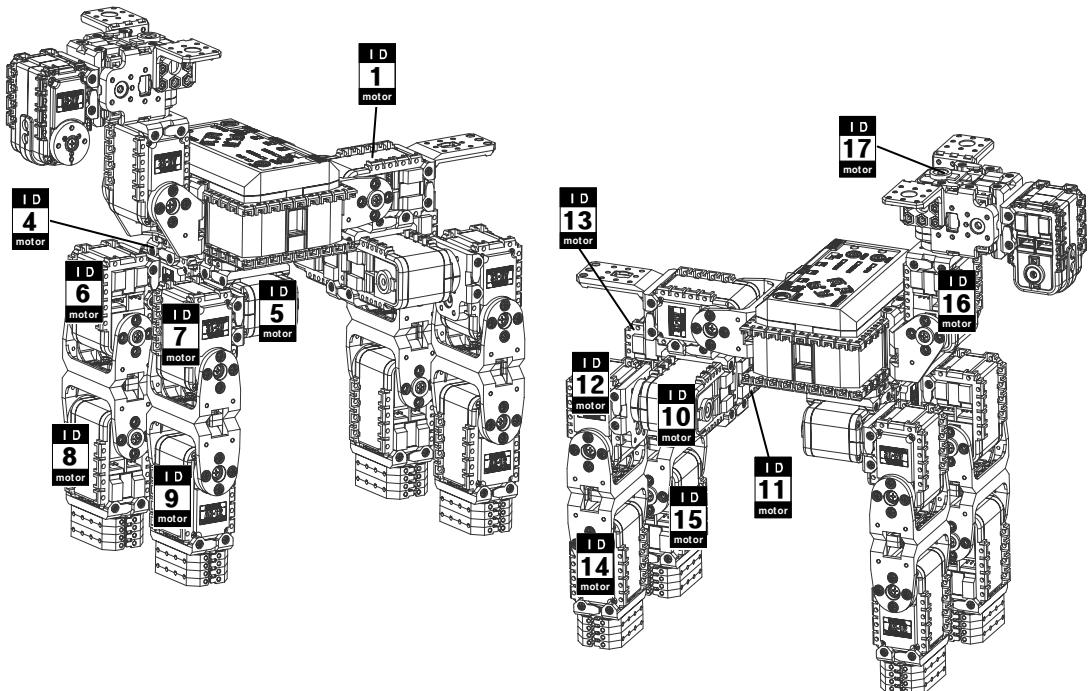
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 004 005 006 007 008 009 010 011 012 0
13 014 015 016 017 100
016[0X10] Dynamixels Found.

← comparison part

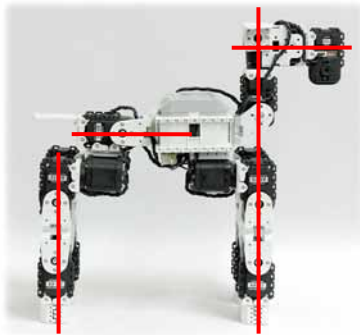
Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※For ID of **Dynamixel** refer to the figure below.



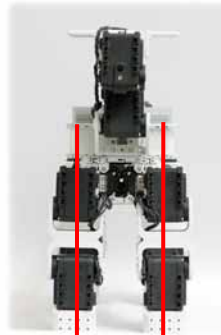
Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Side View



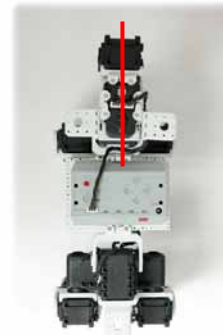
Left and right are identical.

※Front View



Front and back are identical.

※Top View



Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Advanced \Puppy \DemoExample\(Puppy\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.”

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Advanced \Puppy \DemoExample\(Puppy\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.”

Step 4 Operation of the robot

- Upon handclap, the puppy will awake from sleep and walk around.
- When it detects an object while walking around, it will either avoid it or will make a cute gesture
- When you touch puppy's mouth, it will get ready to make a cute gesture.
- If there is no change in the surrounding for a certain amount of time, it will sit and go to sleep.

Step 5 Compare with the provided video clip

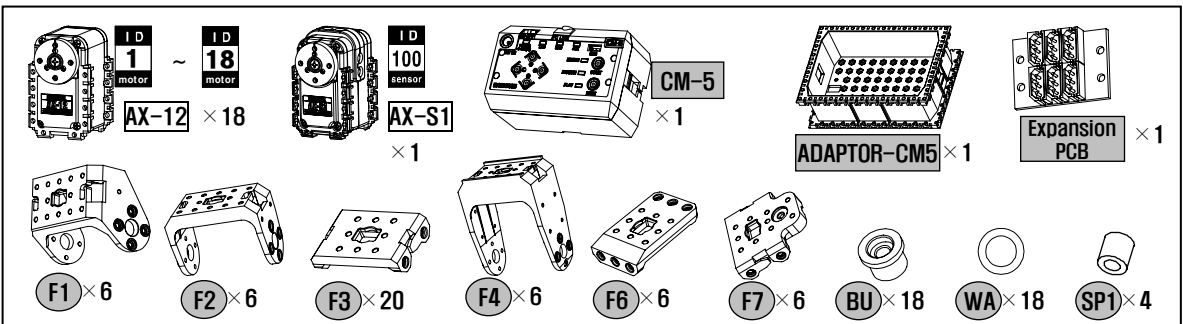
(In CD, [Applied Robots\Advanced \Puppy \DemoExample\(Puppy\).wmv](#))

2-4-3. King Spider

Let's build a king spider that moves around and attacks when it detects an object.



(1) Necessary parts



※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

N1 × 206

S1 × 256

S2 × 18

S3 × 4

S-B × 18

CABLE-6 × 6

CABLE-10 × 4

CABLE-14 × 6

CABLE-18 × 4

(2) Assembling

Step 1 ~ Step 4 Assemble Frame : Assemble 6 sets each

Step 1 Assemble 6 sets.

N1 : 4pcs
F3 : 2pcs
S1 : 4pcs

Step 2 Assemble 6 sets.

N1 : 4pcs
S1 : 4pcs
F1
F2

Step 3 Assemble 6 sets.

N1 : 4pcs
S1 : 4pcs
F3
F7

Step 4 Assemble 6 sets.

N1 : 3pcs
S2 : 3pcs
F4
F6

Step 5 Assemble Leg : Assemble 6 sets ※ Using **ID 1 motor**, **ID 2 motor**, **ID 7 motor**, **ID 8 motor**, **ID 13 motor** and **ID 14 motor**, assemble 6 sets.

※ Insert nuts N1 : 4pcs

S1 : 8pcs
WA
BU
S-B

※ Check assembly point

Step 1 Step 2

Step 6 Leg (TYPE 1) 1

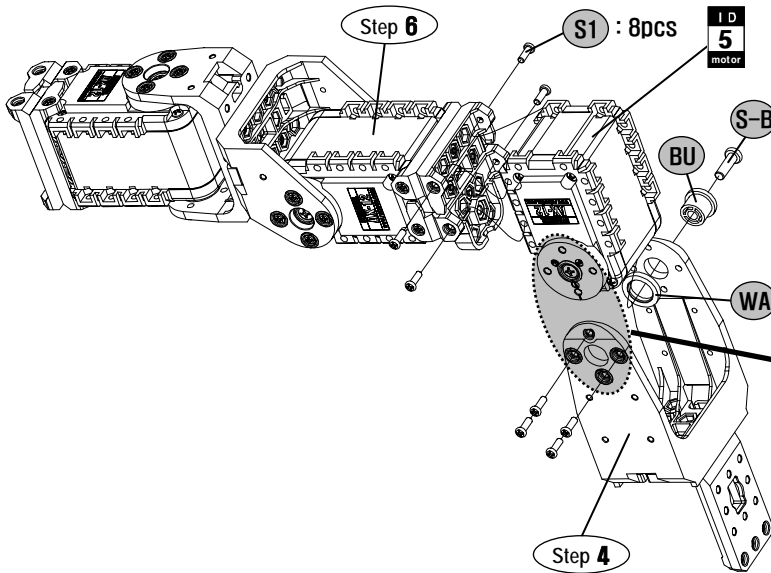
※ Insert nuts N1 : 4pcs

S1 : 8pcs
S-B
BU
WA

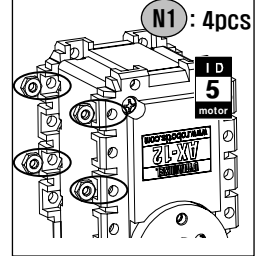
※ Check assembly point

Step 3

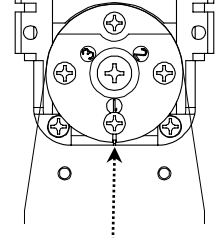
Step 7 Leg (TYPE 1) 2



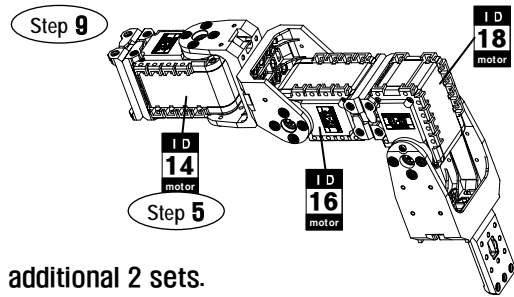
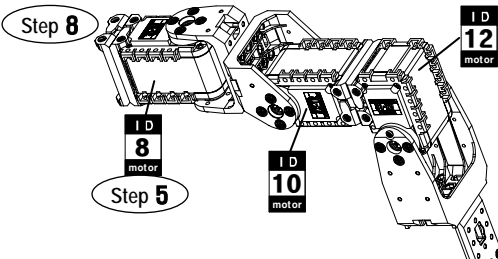
※Insert nuts



※Check assembly point

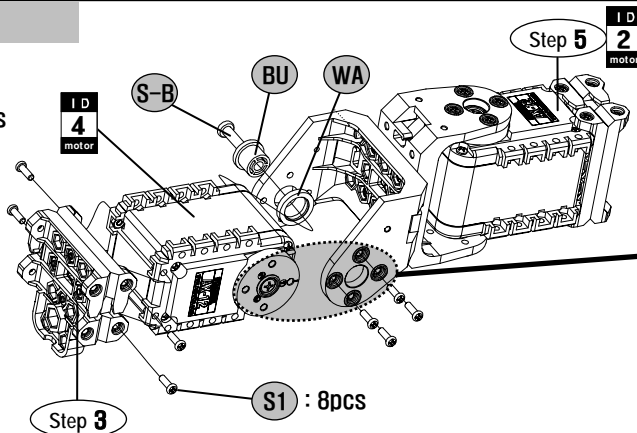
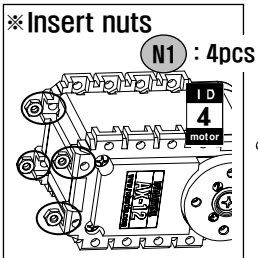


Step 8 ~ Step 9 Leg (TYPE 1) 3 : Assemble additional 2 sets

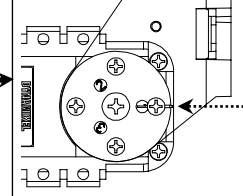


※Following Step 6, Step 7, assemble additional 2 sets.

Step 10 Leg (TYPE 2) 1



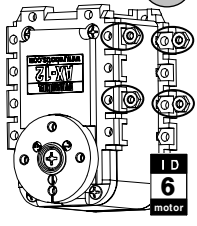
※Check assembly point



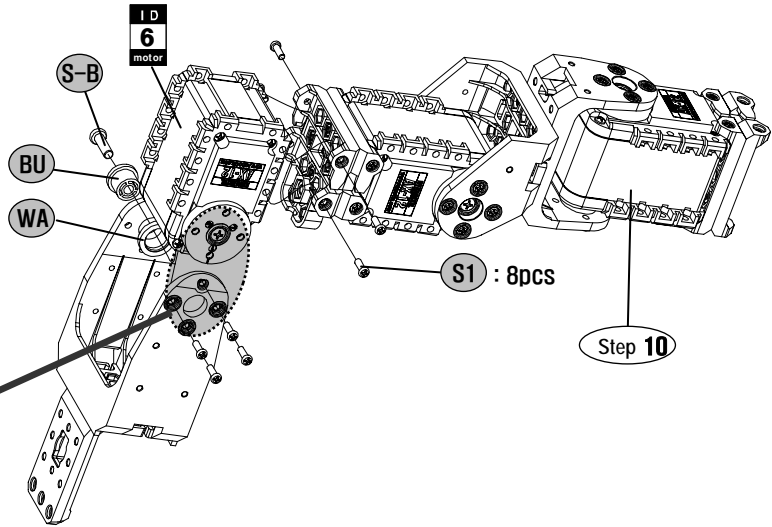
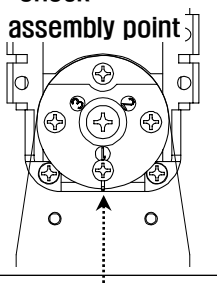
Step 11 Leg [TYPE 2] 2

※ Insert nuts

N1 : 4pcs



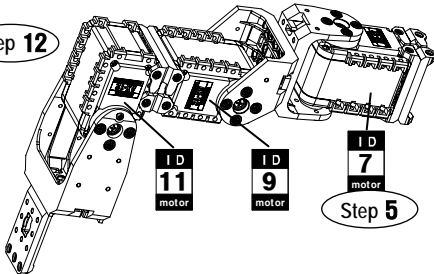
※ Check assembly point



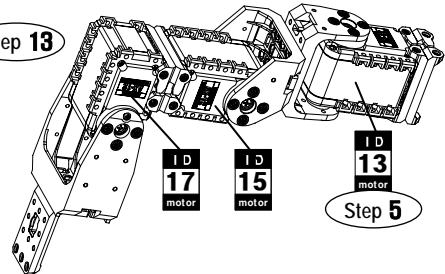
Step 10

Step 12 ~ Step 13 Leg [TYPE 1] 3 : Assemble additional 2 sets

Step 12



Step 13

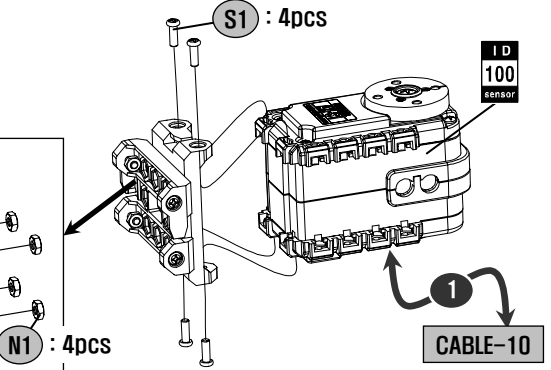
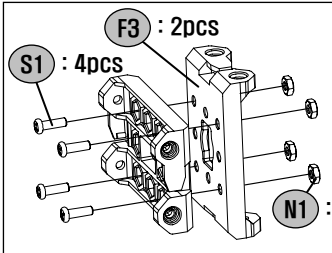
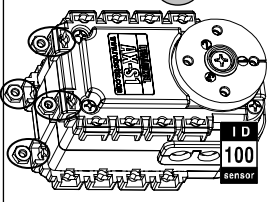


※ Following Step 10 ~ Step 11, assemble additional 2 sets.

Step 14 Sensor

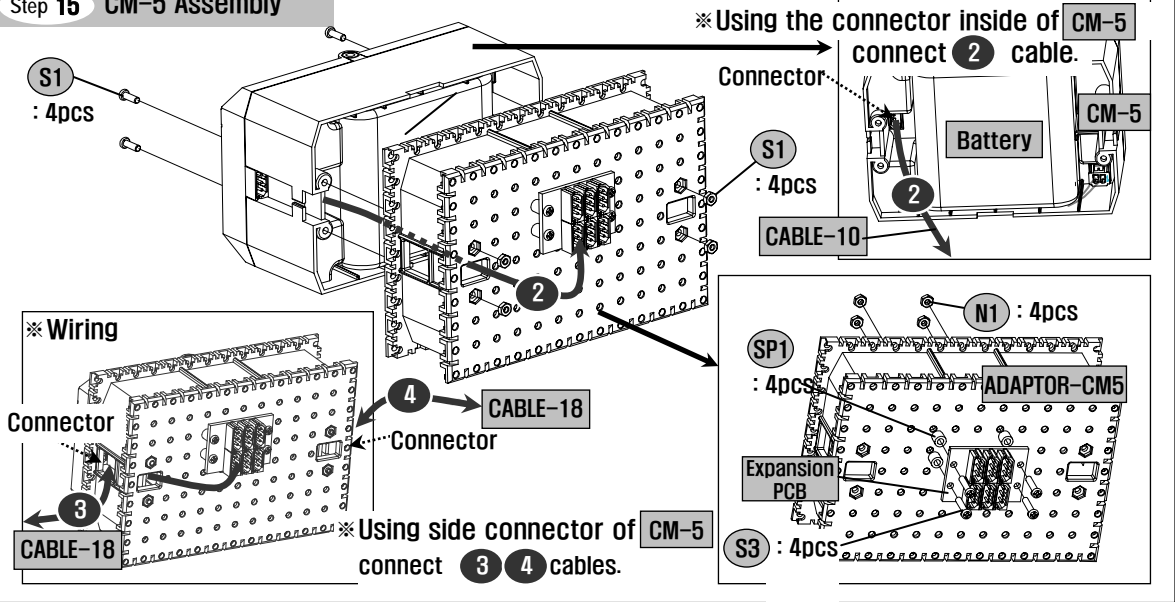
※ Insert nuts

N1 : 4pcs

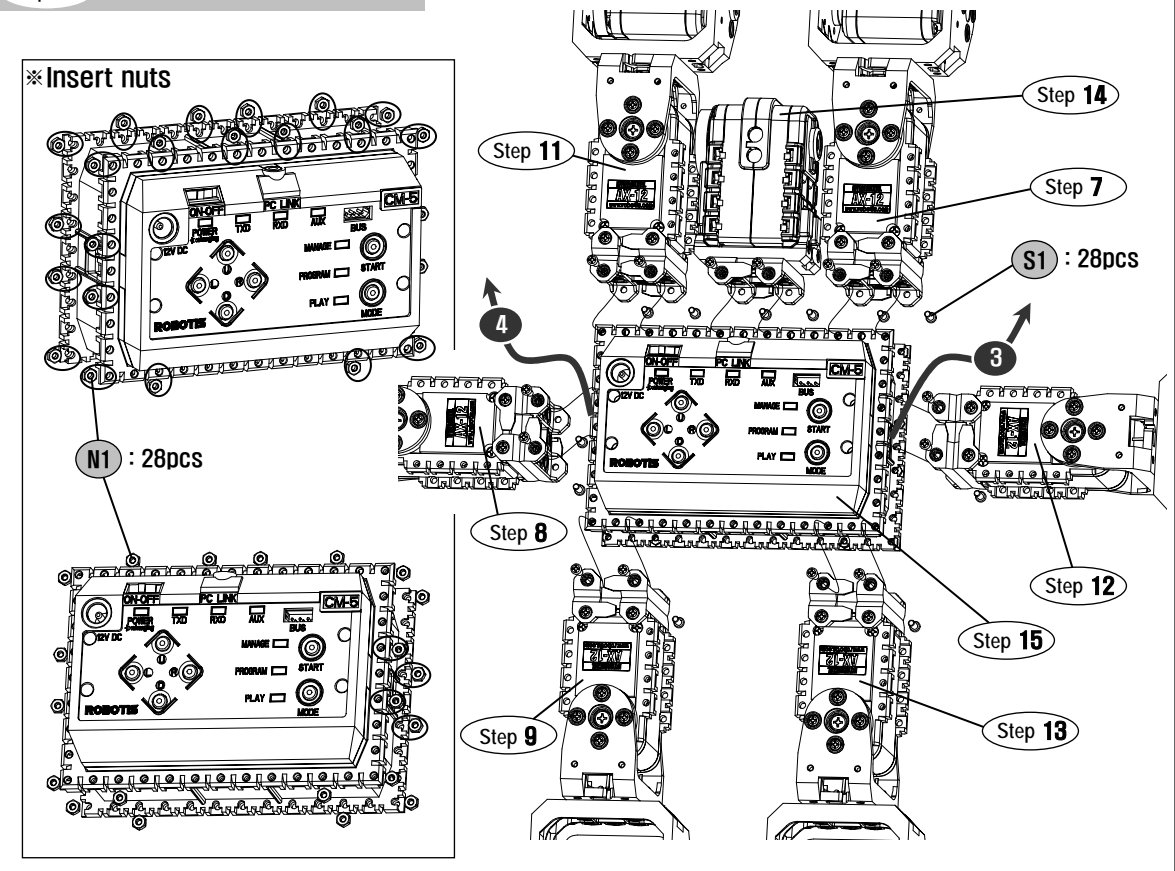


CABLE-10

Step 15 CM-5 Assembly

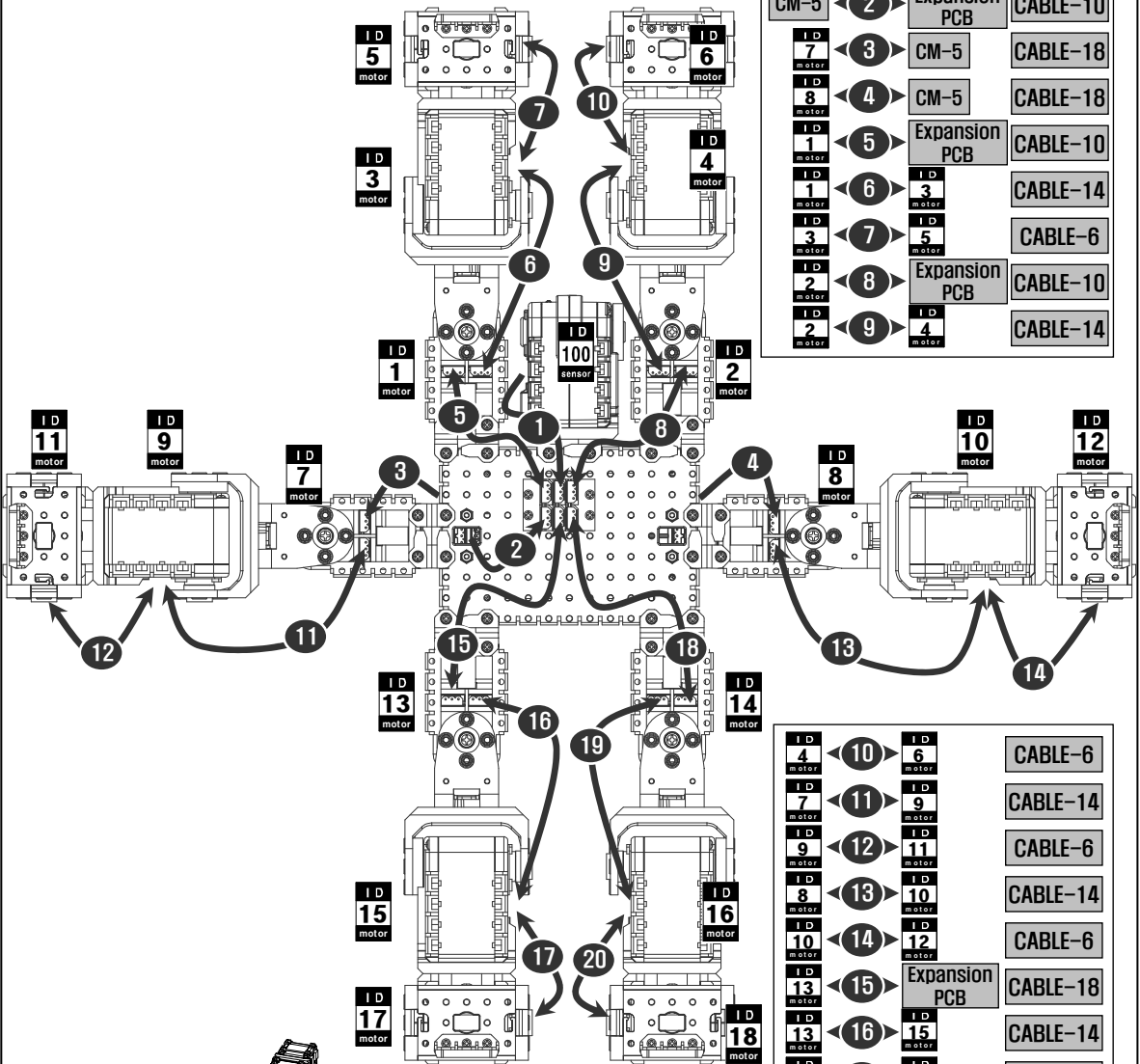


Step 16 Whole Body Assembly



Step 17 Wiring and Completion

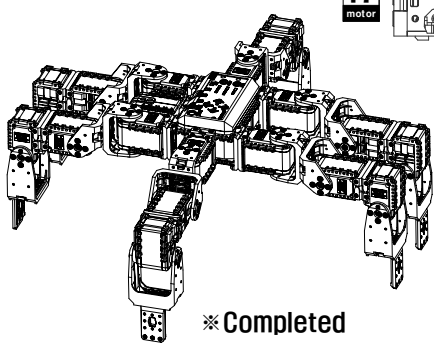
※ Bottom view



※ Wiring

ID 100 sensor	1	Expansion PCB	CABLE-10
CM-5	2	Expansion PCB	CABLE-10
ID 7 motor	3	CM-5	CABLE-18
ID 8 motor	4	CM-5	CABLE-18
ID 1 motor	5	Expansion PCB	CABLE-10
ID 1 motor	6	ID 3 motor	CABLE-14
ID 3 motor	7	ID 5 motor	CABLE-6
ID 2 motor	8	Expansion PCB	CABLE-10
ID 2 motor	9	ID 4 motor	CABLE-14

ID 4 motor	10	ID 6 motor	CABLE-6
ID 7 motor	11	ID 9 motor	CABLE-14
ID 9 motor	12	ID 11 motor	CABLE-6
ID 8 motor	13	ID 10 motor	CABLE-14
ID 10 motor	14	ID 12 motor	CABLE-6
ID 13 motor	15	Expansion PCB	CABLE-18
ID 13 motor	16	ID 15 motor	CABLE-14
ID 15 motor	17	ID 17 motor	CABLE-6
ID 14 motor	18	Expansion PCB	CABLE-18
ID 17 motor	19	ID 16 motor	CABLE-14
ID 16 motor	20	ID 18 motor	CABLE-6



※ Completed

(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Advanced\King Spider\CheckAssembly\(King Spider\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

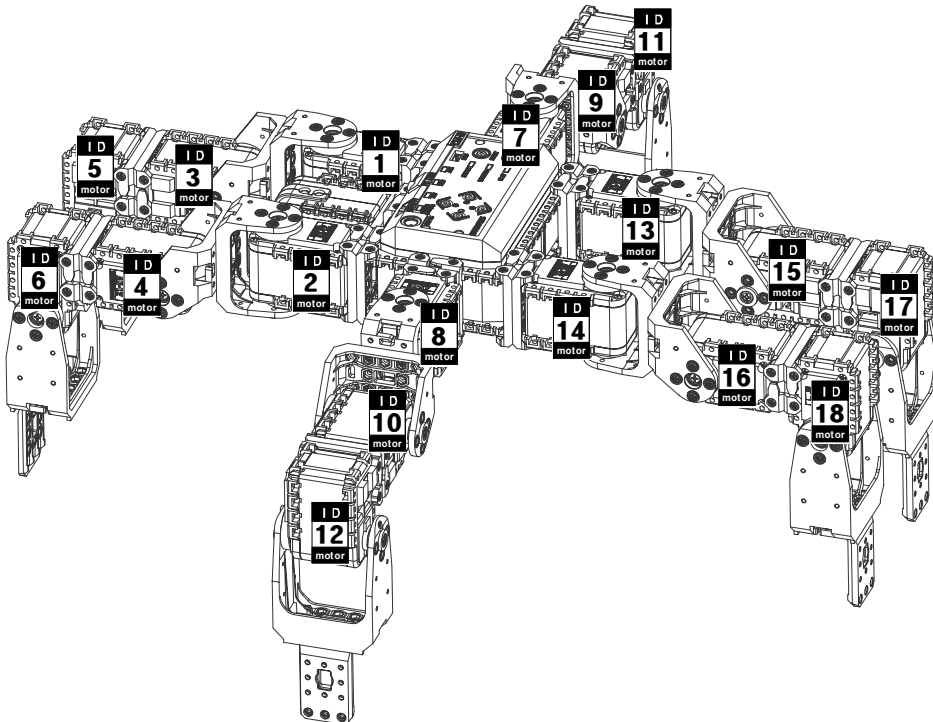
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 009 010 0
11 012 013 014 015 016 017 018 100
019[0X13] Dynamixels Found.

← comparison part

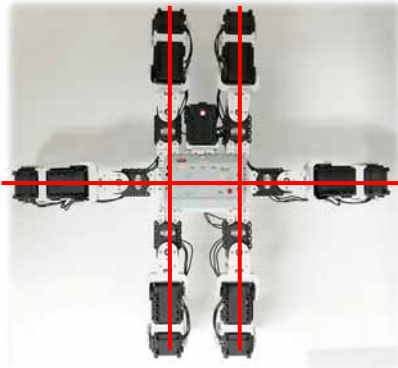
Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※For the ID of **Dynamixel**, refer to the figure below.

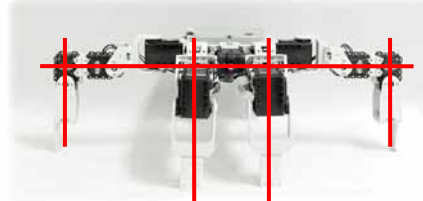


Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

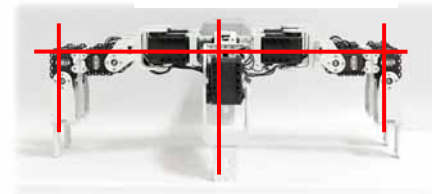
※Top View



※Front View



※Side View



Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Advanced \King Spider \DemoExample\(King Spider\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Advanced \King Spider \DemoExample\(King Spider\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

- Upon handclap, the king spider will awake from sleep and avoid obstacle while it moving around.
- If you put your hand close to sensor while it moving around, it will shrink back.
- It will attack ferociously if it detects an object when it shrank back and when a flashlight is beamed, it will tremble
- If there is no change in the surrounding for a certain amount of time, it will go to sleep.

Step 5 Compare with the provided video clip

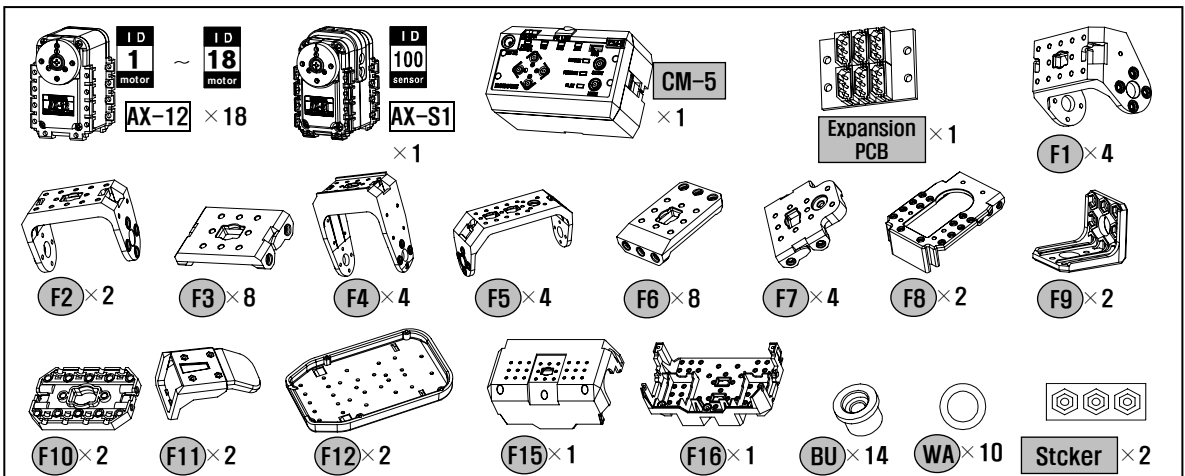
(In CD, [Applied Robots\Advanced \King Spider \DemoExample\(King Spider\).wmv](#))

2-4-4. Humanoid

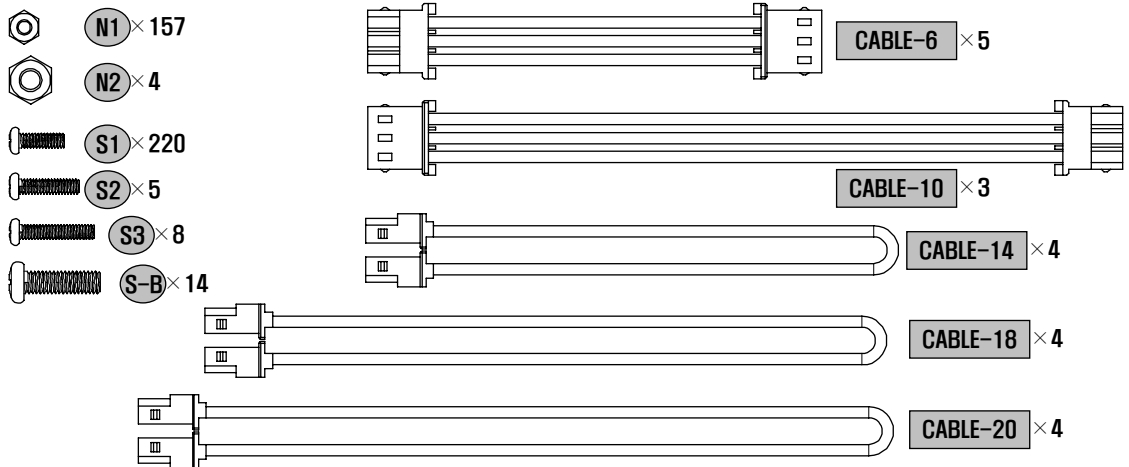
Let's build a humanoid robot that avoids an obstacle, walks on two legs and that can dance.



(1) Necessary parts



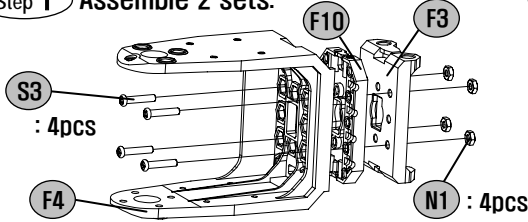
*Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.



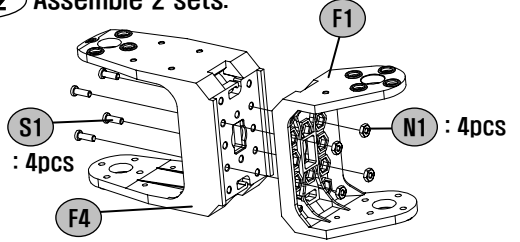
(2) Assembling

Step 1 ~ Step 4 Assemble frame

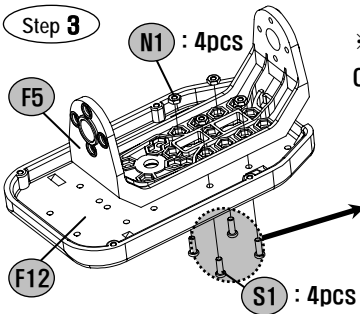
Step 1 Assemble 2 sets.



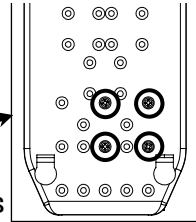
Step 2 Assemble 2 sets.



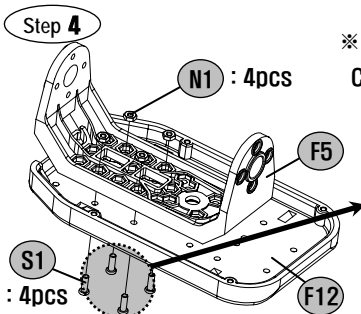
Step 3



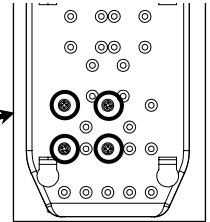
※ Bottom View :
Check screw location



Step 4

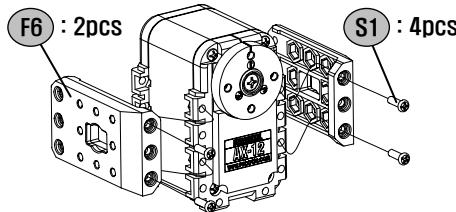
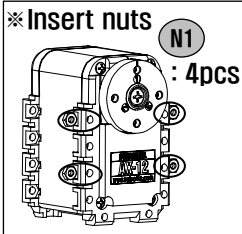


※ Botte View :
Check screw location

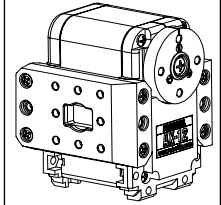


Step 5 Intersecting Joint : 4 sets

※ Assemble 4 sets using ID 9 motor, ID 10 motor, ID 17 motor and ID 18 motor.

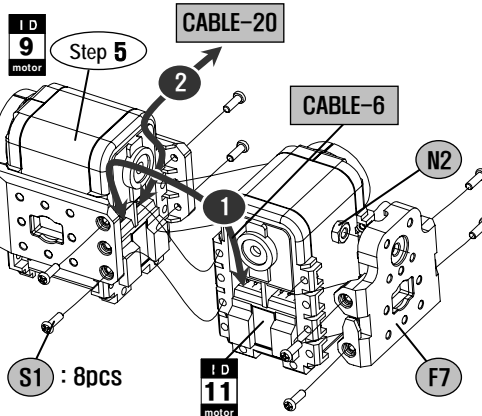
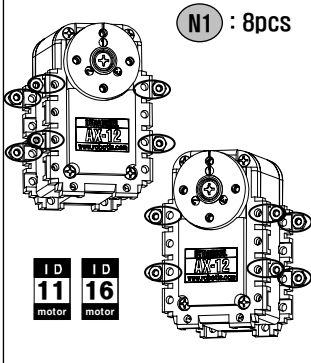


※ Completed

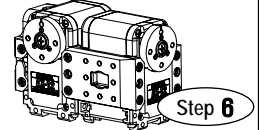


Step 6 ~ Step 7 Intersecting Joint (TYPE 1) : 2 sets

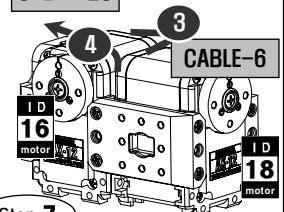
※ Insert Nuts N1 : 8 pcs



※ Completed



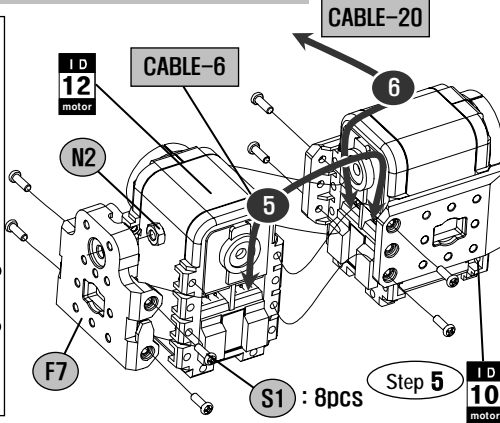
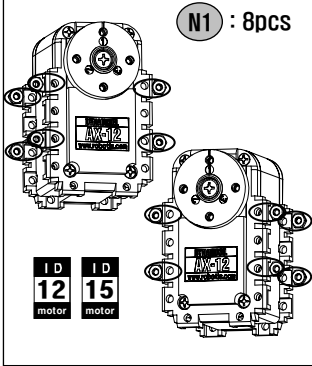
※ Assemble in a same manner.



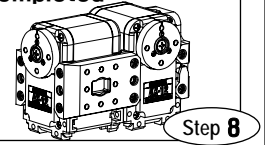
Step 7

Step 8 ~ Step 9 Intersecting Joint (TYPE 2) : 2 sets

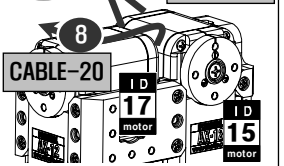
※ Insert nuts



※ Completed



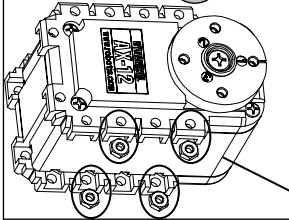
Step 9



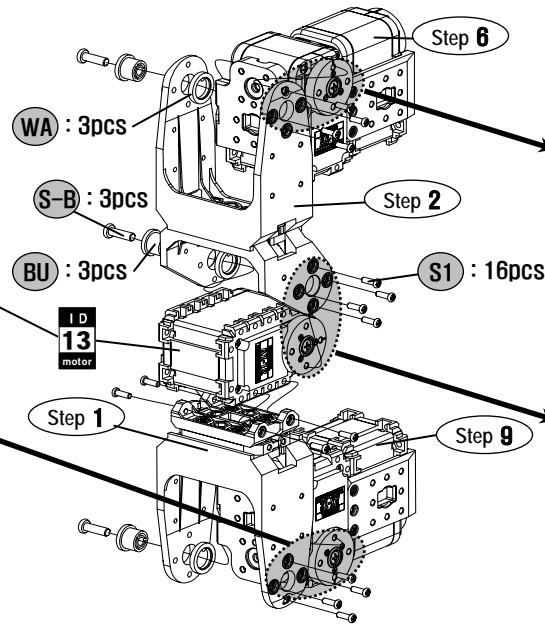
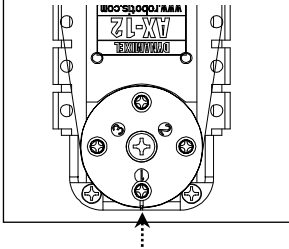
※ Assemble in a same manner.

Step 10 Right Leg 1

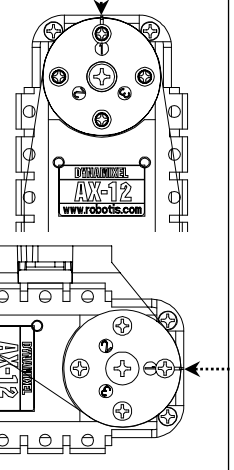
※ Insert nuts



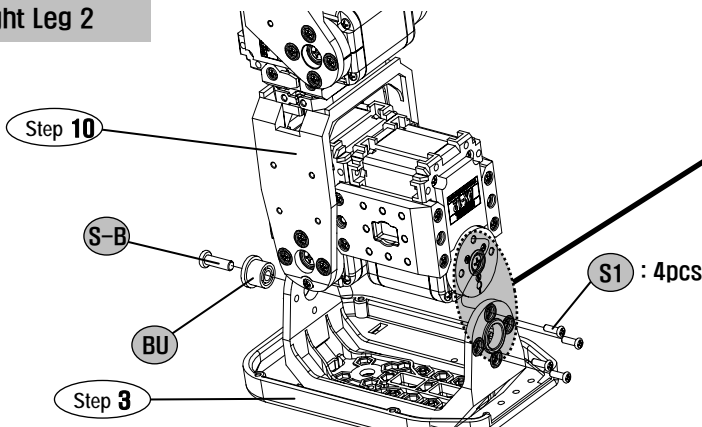
※ Check assembly point



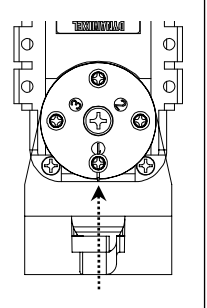
※ Check assembly point



Step 11 Right Leg 2



※ Check assembly point



Step 12 Left Leg 1

※ Insert nuts **N1 : 4pcs**

ID 14 motor

※ Check assembly point

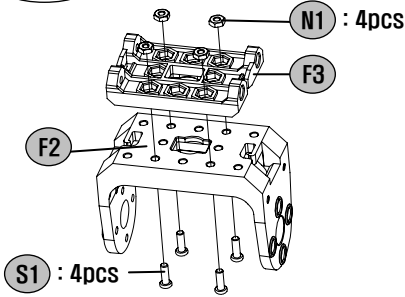
※ Check assembly point

Step 13 Left leg 2

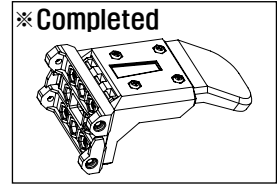
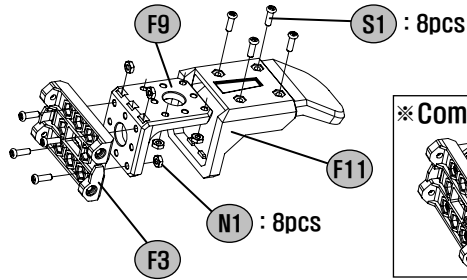
※ Check assembly point

Step 14 ~ Step 15 Assemble Frame

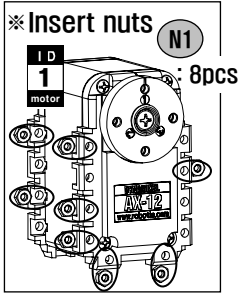
Step 14 Assemble 2 sets.



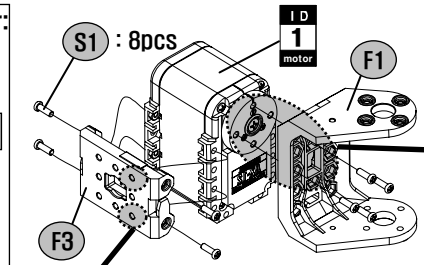
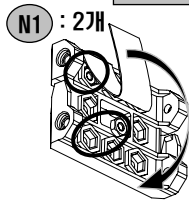
Step 15 Assemble 2 sets.



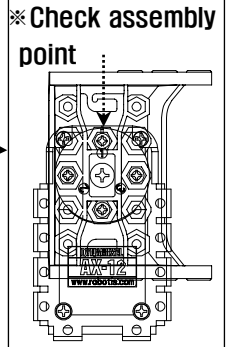
Step 16 Right Arm 1



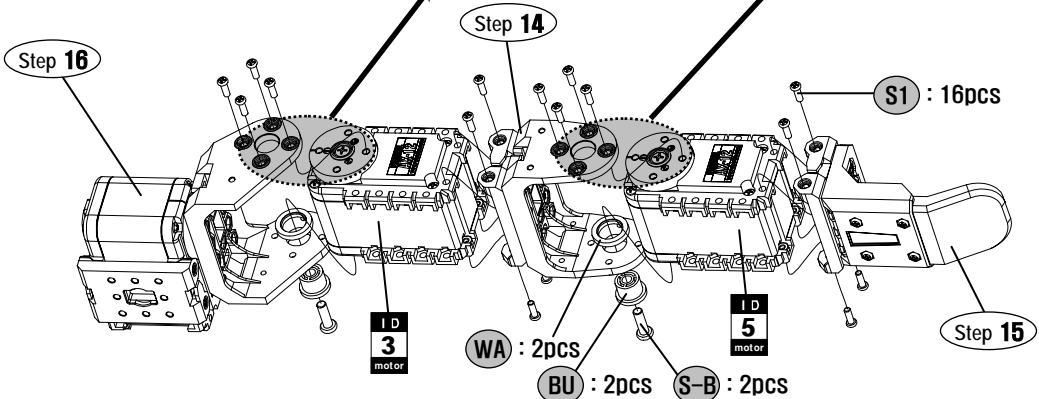
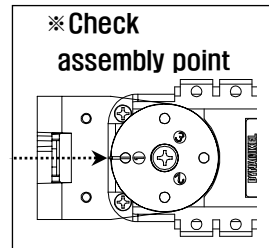
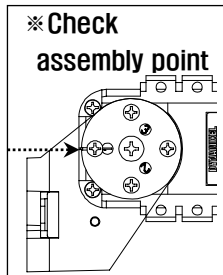
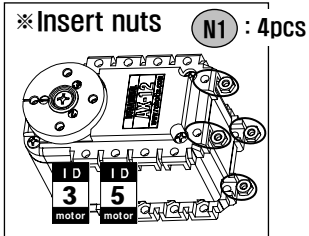
※ Attach nut sticker:
make sure do not
nuts come off.



※ Assemble taking note of the
inserted location of nuts.



Step 17 Right Arm 2



Step 18 Left Arm 1

※Insert nuts
N1 : 8pcs

※Attach nut sticker
Make sure nuts do not come off.

N1 : 2pcs

Sticker

※ Assemble taking note of the inserted location of nuts.

※Check assembly point

Step 19 Left Arm 2

※Insert nuts
N1 : 4pcs

※Check assembly point

※Check assembly point

Step 20 Body 1

※Insert nuts
N1 : 4pcs

※Insert nuts
N1 : 4pcs

Step 21 Body 2

※Front View :
Pay attention to wire direction.

※Bottom View :
Check the inserted nut location

Step 22 Body 3

Step 23 Body 4

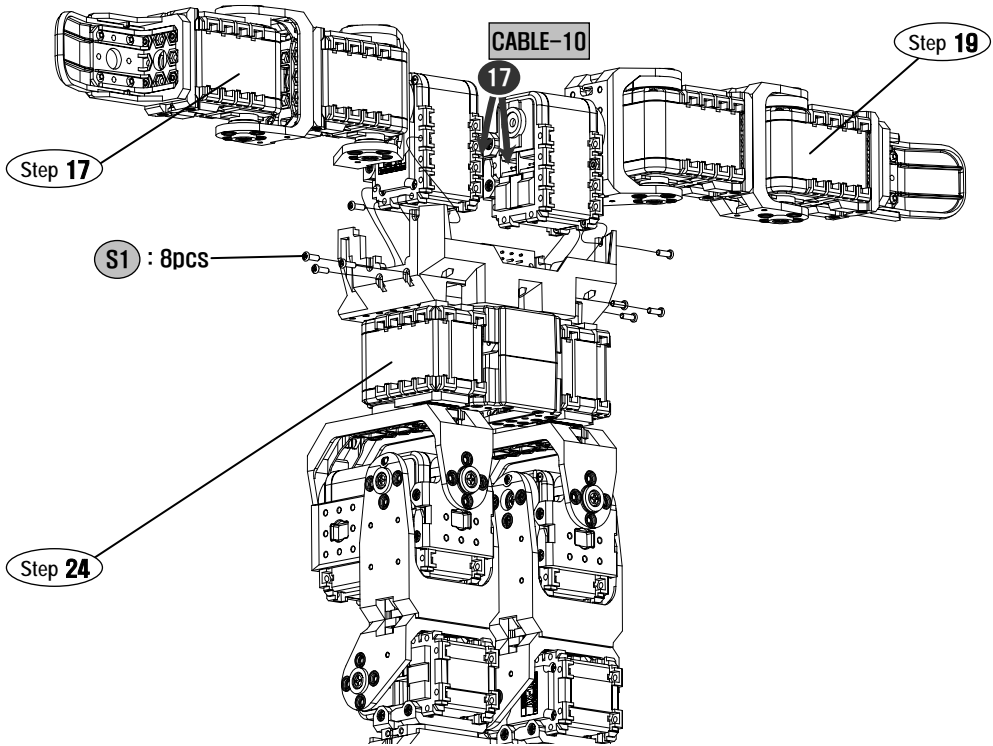
※Check assembly points.

※Check assembly point

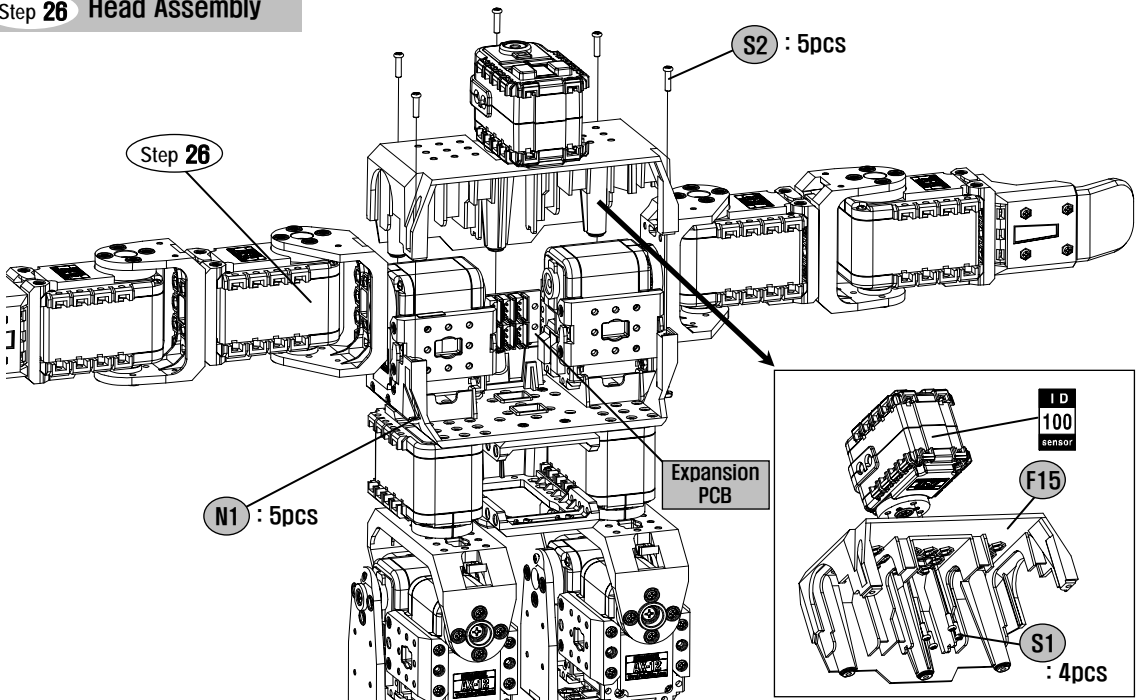
Step 24 Lower Part of Body Assembly

※Completed

Step 25 Arm Assembly

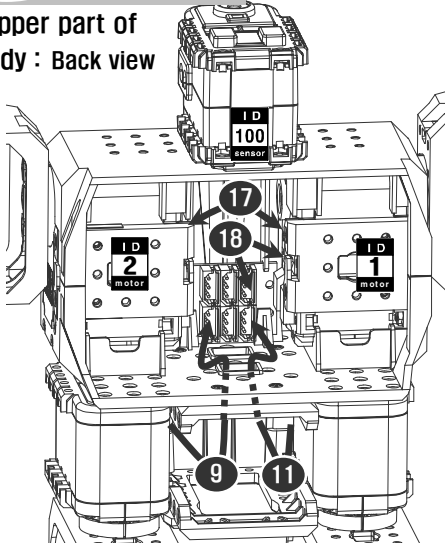


Step 26 Head Assembly



Step 27 Wiring

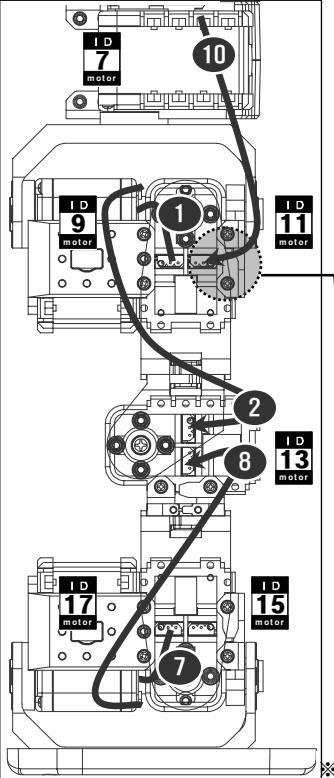
※ Upper part of body : Back view



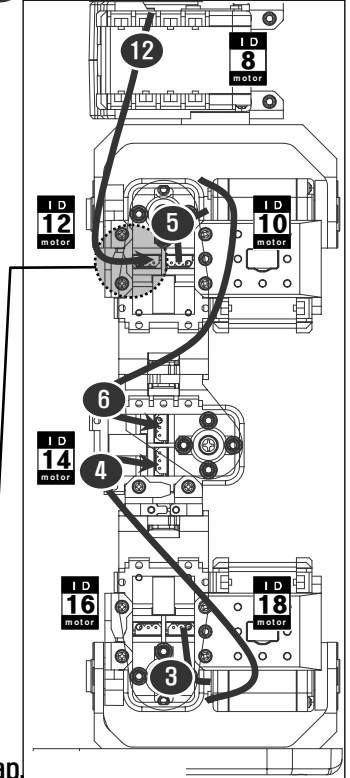
※ Wiring

ID 9 motor	1	ID 11 motor	CABLE-6	ID 8 motor	11	Expansion PCB	CABLE-18
ID 9 motor	2	ID 13 motor	CABLE-20	ID 8 motor	12	ID 12 motor	CABLE-18
ID 16 motor	3	ID 18 motor	CABLE-6	ID 3 motor	13	ID 5 motor	CABLE-10
ID 14 motor	4	ID 18 motor	CABLE-20	ID 4 motor	14	ID 6 motor	CABLE-10
ID 10 motor	5	ID 12 motor	CABLE-6	ID 3 motor	15	CM-5	CABLE-14
ID 10 motor	6	ID 14 motor	CABLE-20	ID 4 motor	16	CM-5	CABLE-14
ID 15 motor	7	ID 17 motor	CABLE-6	ID 1 motor	17	ID 2 motor	CABLE-10
ID 13 motor	8	ID 17 motor	CABLE-20	ID 1 motor	18	Expansion PCB	CABLE-6
ID 7 motor	9	Expansion PCB	CABLE-18	CM-5	19	Expansion PCB	CABLE-14
ID 7 motor	10	ID 11 motor	CABLE-18	ID 100 sensor	20	CM-5	CABLE-14

※ Right Leg

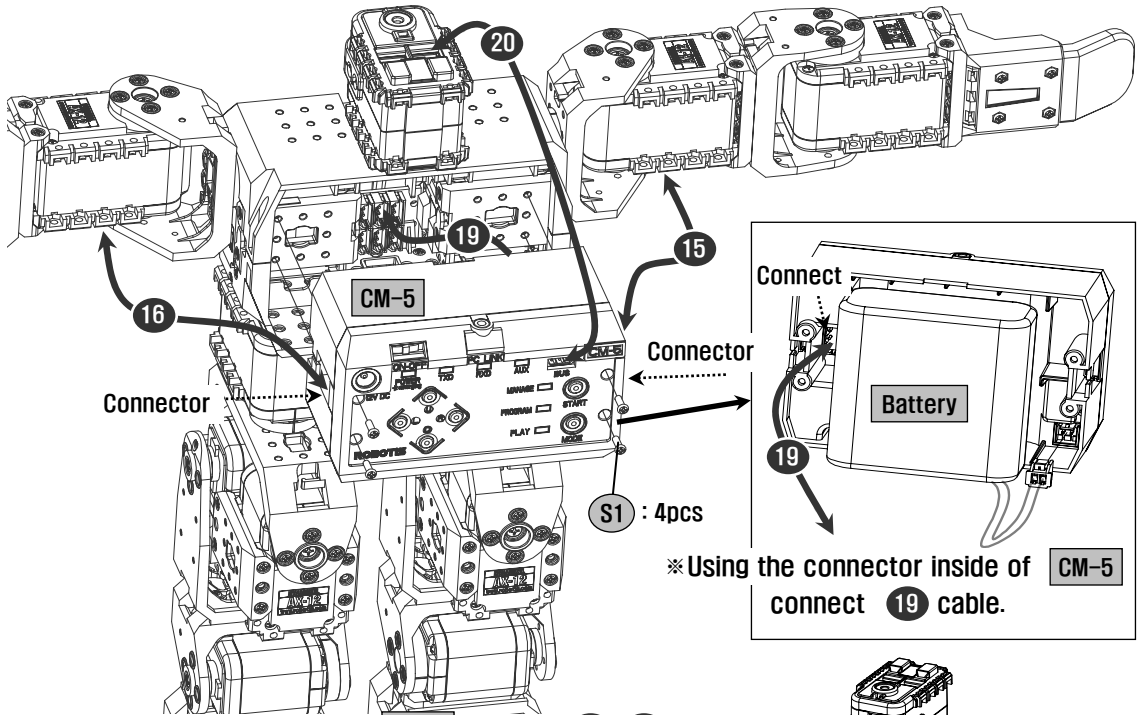


※ Left Leg



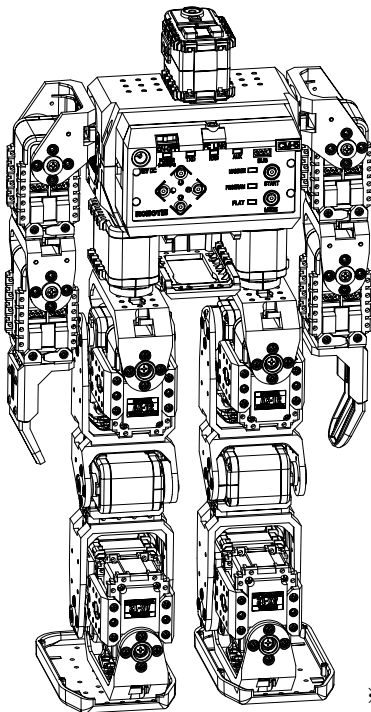
※ When wiring, insert 2 6 into the gap.

Step 28 Completion

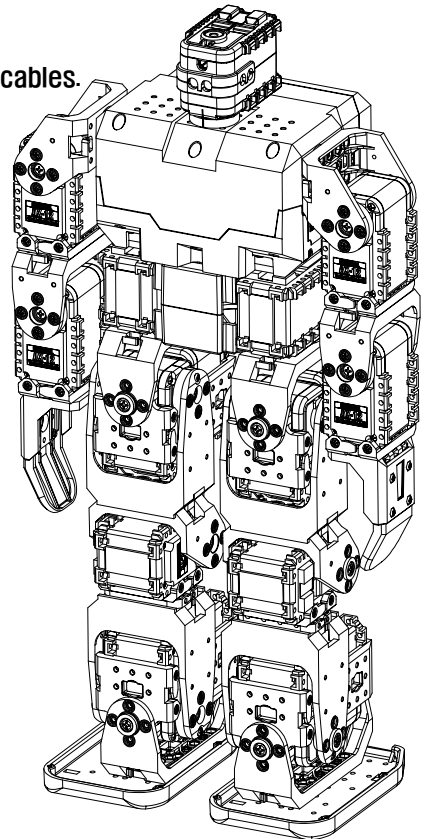


※ Using the connector inside of CM-5 connect 19 cable.

※ Using both side connectors of CM-5, connect 15 16 cables.



※ Completed



(3) Check Assembly

You should confirm whether assembled uprightly before operate.

Step 1 Download “Check Assembly” file which is behavior control program
(In CD, [Applied Robots\Advanced\Humanoid\CheckAssembly\(Humanoid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs”

Step 2 Operate online robot.

※Refer to “Online Robot Activation” from “2-1-3. Operating the Robots”

Step 3 Compare the execution screen with the image below. If different, check Dynamixel ID and cable wiring using the assembly diagram.

[CM-5 Version 1.12]

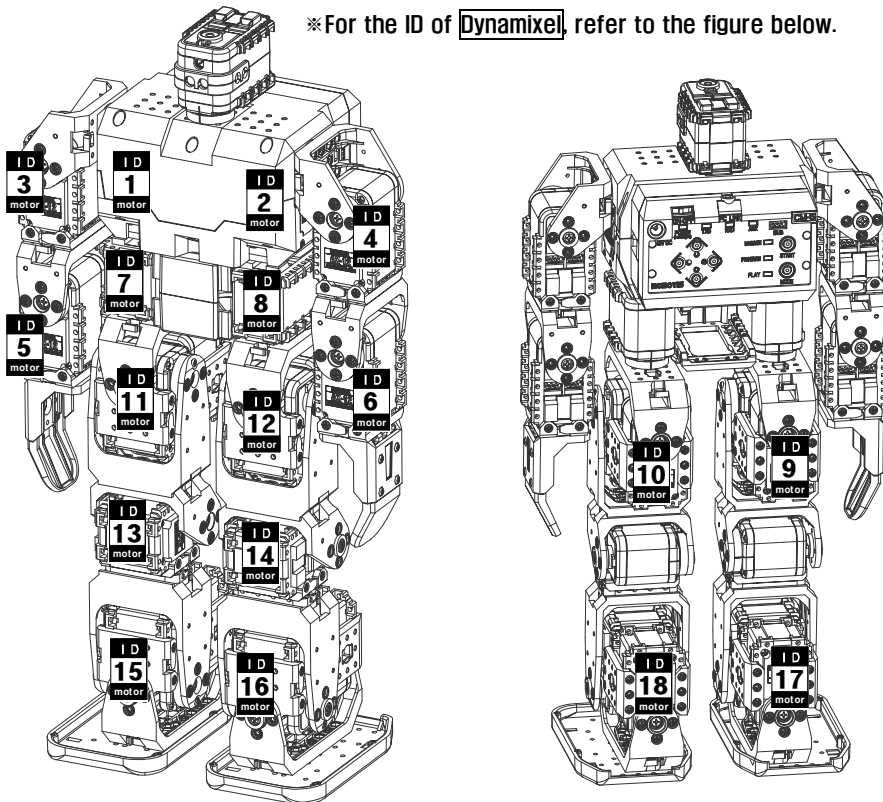
<->PC:57142 BPS, <->Dynamixel:1000000 BPS

ID:001 002 003 004 005 006 007 008 009 010 0
11 012 013 014 015 016 017 018 100
019[0X13] Dynamixels Found.

← comparison part

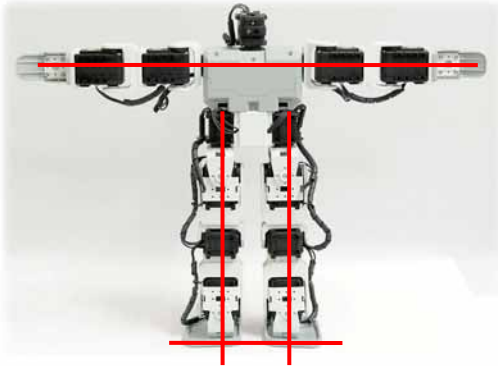
Step 4 Whenever **U** button of CM-5 is pressed, Dynamixel **LED** will be on in the order shown below. By pressing **U** button of CM-5 in order, compare the Dynamixel location of the robot with the figure.

※ For the ID of **Dynamixel**, refer to the figure below.

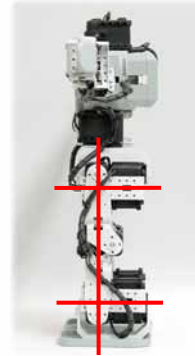


Step 5 When **START** button of CM-5 is pressed, the robot will look like the figures below. If different, check the assembly points of Dynamixel using the assembly diagram.

※Front View



※Side View



※Top View



Step 6 Close the online robot activation.

(4) Operating the Robot

Operate completed robot using demonstration(example)program.

Step 1 Download “Example” file which is behavior control program.

(In CD, [Applied Robots\Advanced \Humanoid \DemoExample\(Humanoid\).bpg](#))

※Refer to “How to download Behavior Control Program” from “2-1-2 Downloading Robot Programs.” .

Step 2 Download “Example” motion data.

(In CD, [Applied Robots\Advanced \Humanoid \DemoExample\(Humanoid\).bpg](#))

※Refer to “How to download Motion Data” from “2-1-2 Downloading Robot Programs.”

Step 3 Operate offline robot.

※Refer to “Offline Robot Activation” from “2-1-3. Operating the Robots.

Step 4 Operation of the robot

- When you press the **U** button of CM-5, it will clap corresponding to the number of handclaps and upon detection of object, it will execute a program that commands a robot to

give a greeting.

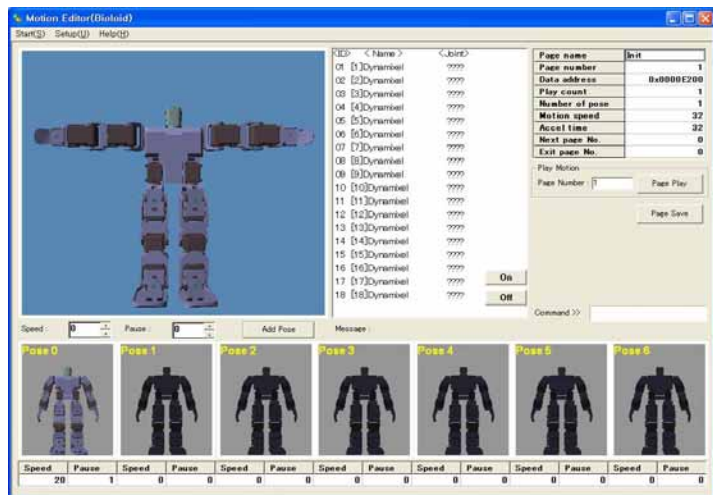
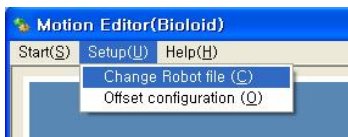
- When you press the **L** button of CM-5, it will be in a pre-attack position and upon detection of object, it will execute a program that commands a robot to attack.
- When you press the **R** button of CM-5 and upon three or more handclapping, it will execute a program that commands a robot to get up on its own.
- When you press the **D** button of CM-5, it will execute a program that avoids an obstacle by itself.
- When you press the **Start** button of CM-5, it will execute a program that commands a robot to dance.

Step 5 Compare with the provided video clip
(In CD, [Applied Robots\Advanced\Humanoid \DemoExample\(Humanoid\).wmv](#))

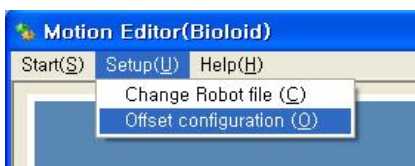
(5) Tuning of Joint Offset

If the assembled robot does not walk stable as shown in the video clips, you have to adjust the “joint offset” (the difference of joint value). To do so, be used to the Motion Editor referring to “Using the Motion Editor” in User’ s Guide.

Step 1 After executing the Motion Editor, select “**Setup(U) => Change Robot file(C)**” and change the robot profile (*.rbt file) to “Humanoid” .

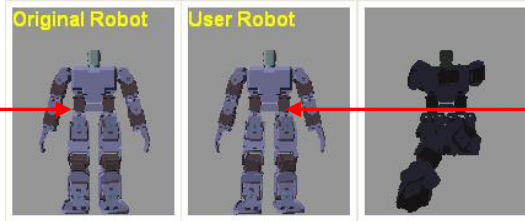


Step 2 Select “**Setup(U) => Offset Configuration(O)**” menu.



Step 3 When setting up the Joint Offset at the first time, double-click the “Original Robot.” If not, double-click the “User Robot” to tune the previous Joint Offset. (If the Motion Editor has been newly downloaded, double-click the “Original Robot”)

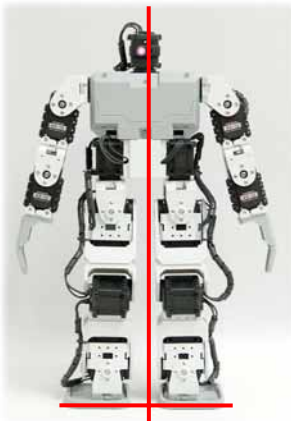
When setting up the Joint Offset at first time, double click this icon



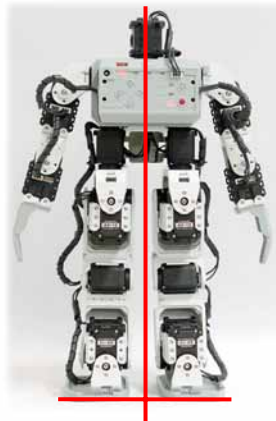
For adjusting the previous Joint Offset, double click this icon.

Step 4 Make sure that the robot is same as the following pictures. robot by adjusting the joint.

※Front View

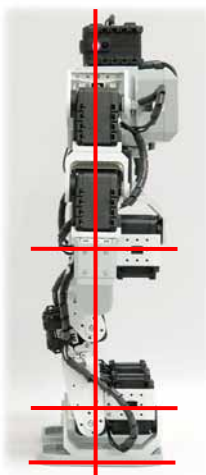


※Rear View

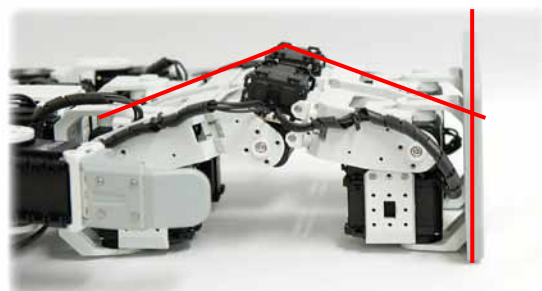


The robot must stand perpendicular to the surface as shown in the left picture

※Side View



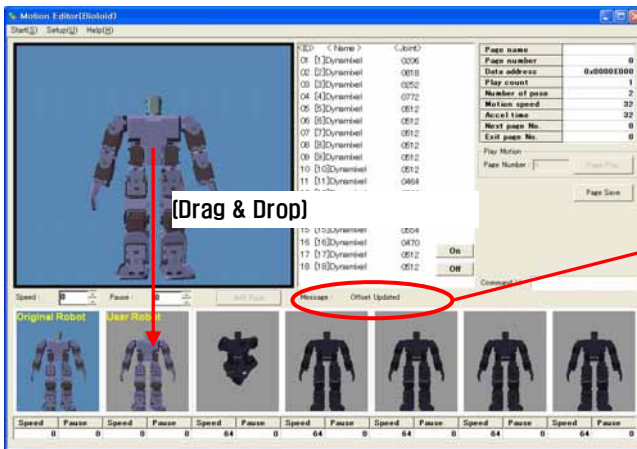
※Side View of Leg



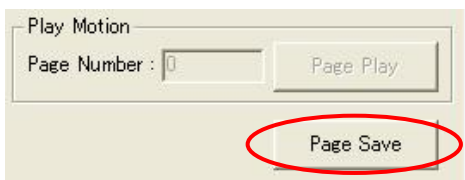
Left and right sides must be balanced when viewed from the side.

The robot must stand perpendicular to the surface and the hip and the ankle areas must be parallel.

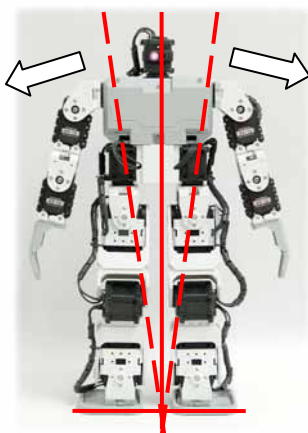
Step 5 After adjusting the Joint Offset, the revised robot's pose must be reflected on the robot's initial pose configuration.



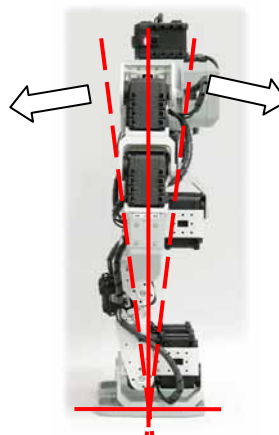
Step 6 Save the Joint Offset and close the Motion Editor.



Step 7 If the robot still walks unstable, refer to pictures below and start once again from **Step 1**.



If the robot is tilting side ways, adjust the Joint Offset by giving the counter values



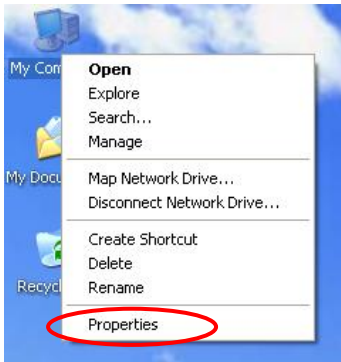
If the robot is slanting toward front and back, adjust the Joint Offset by giving the counter values

3 . Bioloid Operation and Maintenance

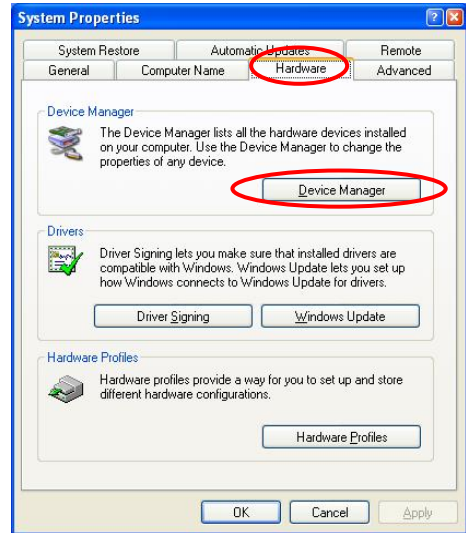
3 – 1 . Finding the Serial COM Port Number of the PC

To use the software of Bioloid, the users must know the CM-5 corresponding communication port number. To find out the port number, follow the next steps.

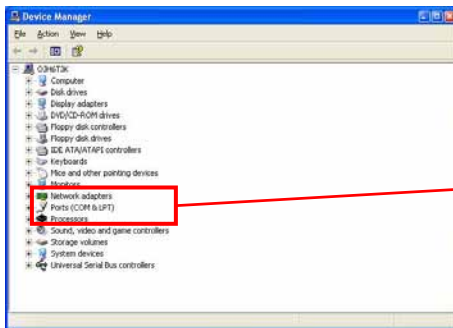
Right click the “My Computer” icon of Window desktop, and then select “Properties.”



“Select “Hardware” tab and select the “Device Manager”



Select Port (Com & LPT) from the list.



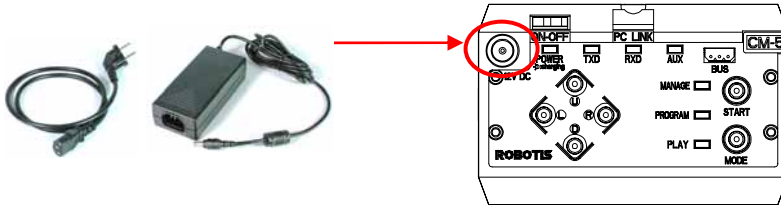
Serial COM Ports that can be connected to CM-5



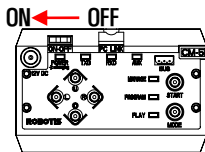
※ If your PC does not have Serial COM Port, install USB2Serial converter. USB2Serial converter is a device that converts USB port to Serial COM Port and can be easily found in PC accessory corners.

3 - 2 . Charging CM-5

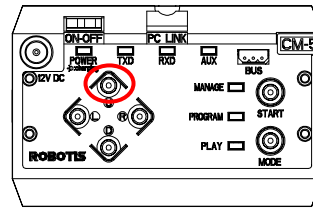
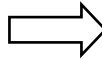
Connect SMPS to CM-5.



Turn on **POWER** of CM-5.



Click **U** button of CM-5.



LED light will blink when CM-5 is charging. The speed of LED blink indicates the charging level. The faster blinks signify the closer to full charge. When it is fully charged, it will blink every two seconds.

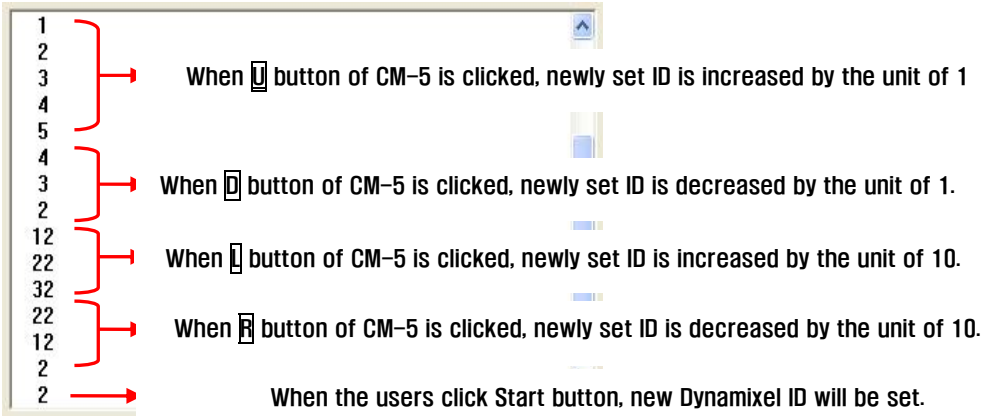
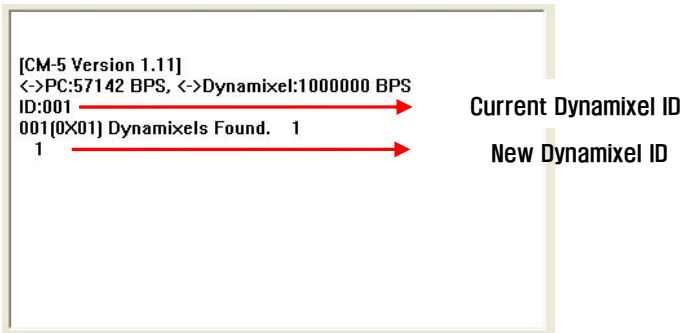
※ Refer to **“Help Files\Charging CM-5. wmv”** on the CD.

3-3. Changing DYNAMIXEL' s ID

- ▷ Connect only one Dynamixel that will change the ID to CM-5..
- ▷ Download behavior control program that can change Dynamixel' s ID.

(Use the **Examples\ID changing .bpg** file)

- ▷ After download, execute the program via online activation mode.
- ▷ Using CM-5 button, insert new ID.



- ▷ Close the program after you change the ID.

※ **Caution:** Check the chart below to make sure that the motor and sensor setup configuration is not out of ID' s ranges.

Dynamixel type	Available ID
AX-12	0~30
AX-S1	100~109

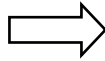
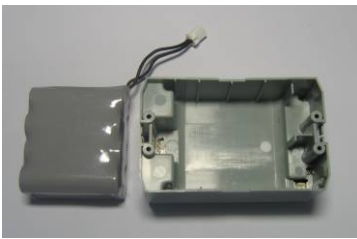
※ Refer to video clip of **"Help Files\ID changing. wmv"** on the CD.

3 – 4 . Exchanging Fuse

Inside the CM-5, there is a fuse that protects circuits from over-current. If CM-5 does not recharge or it does not power on with the battery only but the SMPS is powered on, it indicates the shorted fuse and thus should be replaced.

※ Fuse inside CM-5 can be easily purchased in local electric stores. [220V/5A]

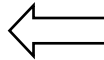
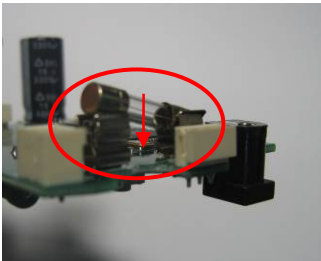
Separate the CM-5 and battery.



Separate the CM-5' s case.



Replace with new fuse.
[Direction of fuse does not matter]



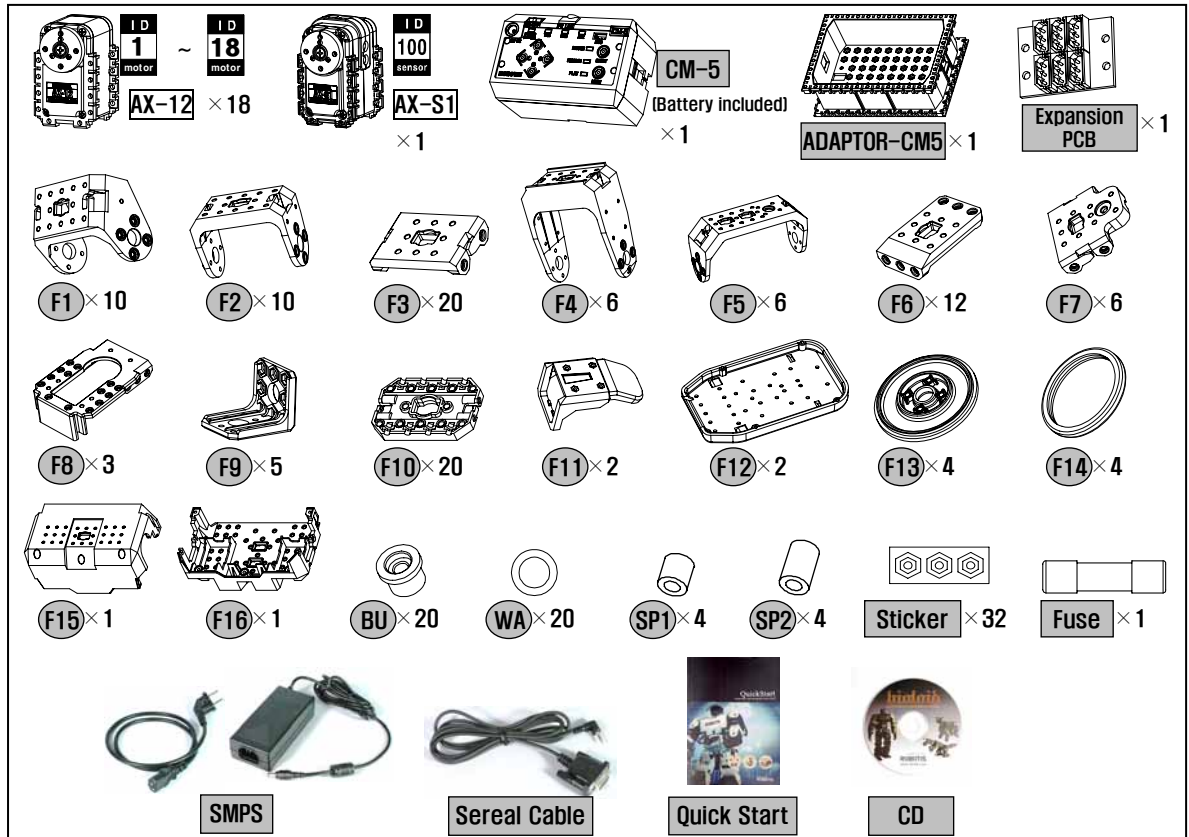
Take out the fuse from the circuit board.



Put back the CM-5 to original condition.

※ Refer to video clips of **“Help Files \Exchanging Fuse. wmv”** on the CD.

3-5. Comprehensive kit' s parts



※Nuts, screws, and cables shown below are the same as the actual size. Place and measure the parts against the below illustration to choose the correct assembly part.

