Contents

1. Starting Bioloid ................................................................. 4
   1-1. What is Bioloid? ......................................................... 5
   1-2. Parts of Bioloid ......................................................... 6
   1-3. Installing Bioloid Software ......................................... 8
      1-3-1. The Contents of Bioloid’s CD ................................. 8
      1-3-2. Installing Software .............................................. 8
   1-4. How to Use Bioloid .................................................... 9

2. Assembling Bioloid ............................................................. 11
   2-1. Robot Assembling Orders ........................................... 12
      2-1-1. Assembling the Robots ....................................... 12
      2-1-2. Downloading Robot Programs ................................. 13
      2-1-3. Operating the Robots ......................................... 17
   2-2. Examples of Beginner Level ....................................... 19
      2-2-1. Crossing Gate .................................................. 20
      2-2-2. Universal Gauge ............................................... 25
      2-2-3. Sound-Level Meter ............................................ 29
      2-2-4. Crocodile Mouth ............................................... 33
      2-2-5. Pan Tilt .......................................................... 38
      2-2-6. Parking Gate ................................................... 43
      2-2-7. Melody Car ...................................................... 48
      2-2-8. Robot Arm ........................................................ 53
      2-2-9. Obstacle Detection Car ....................................... 58
      2-2-10. Greeting Penguin ............................................. 63
      2-2-11. Attacking Duck ................................................ 69
      2-2-12. Cliff Detection Car ......................................... 74
      2-2-13. Clapping Penguin ............................................. 79
      2-2-14. Walking Droid ............................................... 85
   2-3. Examples of intermediate Level .................................... 91
      2-3-1. Probing Robot .................................................. 92
      2-3-2. Excavator ....................................................... 99
      2-3-3. Robot Flower ................................................... 105
      2-3-4. Fawn ............................................................. 111
      2-3-5. Turtle ............................................................. 118
      2-3-6. Spider ............................................................ 124
      2-3-7. Gerwalk ........................................................... 132
      2-3-8. Battle Droid .................................................... 139
### 2. Advanced Level Examples

<table>
<thead>
<tr>
<th>Example</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dinosaur</td>
<td>147</td>
</tr>
<tr>
<td>Puppy</td>
<td>158</td>
</tr>
<tr>
<td>King Spider</td>
<td>169</td>
</tr>
<tr>
<td>Humanoid</td>
<td>177</td>
</tr>
</tbody>
</table>

### 3. Bioloid Operation and Maintenance

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finding the Serial COM Port Number of the PC</td>
<td>193</td>
</tr>
<tr>
<td>Charging CM-5</td>
<td>194</td>
</tr>
<tr>
<td>Changing DYNAMIXEL’s ID</td>
<td>195</td>
</tr>
<tr>
<td>Exchanging Fuse</td>
<td>196</td>
</tr>
<tr>
<td>Comprehensive kit’s parts</td>
<td>197</td>
</tr>
</tbody>
</table>
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.

QuickStart book explains how to assemble various robots step by step. Take apart and assemble various robots of your choosing.

Users can easily assemble various robots as it consists of many blocks of different shapes.
1 - 2. Parts of Bioloid

◎ Main Parts of Bioloid

- **Main Controller CM-5**
  The main controller of Bioloid robot. Using parts, you can set up the robots by connecting Dynamixel (actuator module, sensor module) to a CM-5.

- **Robot Exclusive Actuator, Dynamixel AX-12**
  Actuator module that functions as joint of robot. It is a two-way (Bilateral) communication servo driven by network and has endless turn mode.

- **Robot Exclusive Sensor Module: Dynamixel AX-S1**
  Dynamixel sensor module AX-S1 consists of three pairs of sensors that detect distance, brightness and heat. It also has many other functions such as sounds detector, remocon transceiver and sound buzzer as well.

- **Assembly Parts**
  Various frames, cables and bolts that connect CM-5, AX-12 and AX-S1 to assemble robot.
◎ Names of each part of AX-12 (Actuator)

- LED
- Connector
- ID

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

- Sensor
- Connector
- ID

◎ Names of each part of CM-5

- POWER
- POWER JACK
- ON-OFF
- Serial Cable Jack
- START button
- MODE button
- U button
- L button
- D button
- R button
1–3. Installing Bioloid Software

1–3–1. The Contents of Bioloid’s CD

Many helpful materials and instruction are included in the CD.

- Programs that needs to be installed in PC in order to operate Bioloid robot.
- QuickStart, User’s Guide and manuals for the Dynamixel (AX-12, AX-S1).
- Various programs and video clips for Bioloid robots.
- Robot program sources that are explained in the User’s Guide.
- 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.
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

- **Beginner Level Robots**: Robots with 4 and less joints that can be assembled with Beginner kit.

- **Intermediate Level Robots**: Robots with 8 and less joints that can be assembled with Comprehensive kit. If you want to assemble intermediate level robots with a Beginner kit, you need to purchase four Dynamixels (AX-12) additionally.

- **Advanced Level Robots**: Robot with 18 and less joints that can be assembled with Comprehensive kit. If you want to assemble advanced level robots with Beginner kit, you need to purchase a frame set and Dynamixels (AX-12) additionally.

- 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.

Step 1: Assembling the Robots
Step 2: Downloading Robot Programs
Step 3: Operating the Robots

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.”

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.

※ 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.
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.

1. Connect PC and CM-5
2. Turn on Power of CM-5.
3. Go to File (F) => Select Open(o) menu and open the behavior control program you want.
4. Execute Behavior Control Programmer (it doesn’t need when a program already executed)
5. Select Program(P) => Download(D).menu
6. Click “Download” button.
7. Close the download dialog box.
8. 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”.

14
How to download Motion Data

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

Connect PC and CM-5

Serial Cable

Turn on Power of CM-5.

ON

OFF

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

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

Execute Behavior Control Programmer

(If it has done previously, not necessary)

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”.
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. Bioloid 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.

- Disconnect Serial Cable from CM-5
- Press MODE button to make PLAY LED flash on and off
- 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.

1. Connect PC and CM-5
2. Turn on Power of CM-5.
3. Serial Cable
4. Select Program(P)=> Download (D) menu
5. Execute Behavior Control Programmer (If it has done previously, not necessary)
6. Click "Play" to start to program.
7. Click the "stop" to finish the program.
8. You can check the output message from download robot program.
9. Click "Close" to 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".
2.2. Examples of Beginner Level

1. Crossing Gate
2. Universal Gauge
3. Sound-Level Meter
4. Crocodile Mouth
5. Pan Tilt
6. Parking Gate
7. Melody Car
8. Robot Arm
9. Cliff Detection Car
10. Greeting Penguin
11. Attacking Duck
12. Obstacle Detection Car
13. Clapping Penguin
14. Waking Droid
2 - 2 - 1. Crossing Gate
Let’s build a crossing gate that opens and closes with a button.

[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** CM5

- CM-5 (Battery included)
  - S1: 4pcs
  - N1: 4pcs

**Step 2** Joint

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

**Step 3** Bar

- F2
- S2: 8pcs
- N1: 8pcs
- F3: 3pcs

**Step 4** Whole Body Assembly

- Insert nuts
- S-B
- BU
- WA

- N1: 8pcs
- S1: 12pcs

※Check assembly point

[Battery included]
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.

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

※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.

<table>
<thead>
<tr>
<th>CM-5</th>
<th>ADAPTOR-CM5</th>
<th>F3</th>
<th>F6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AX-12</th>
<th>N1</th>
<th>S1</th>
<th>S2</th>
<th>CABLE-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16</td>
<td>18</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
(2) Assembling

**Step 1** CM-5

- **CM-5** (Battery included)
- **S1**: 4pcs
- **N1**: 4pcs

**Step 2** Bar

- **F6**: 2pcs
- **N1**: 2pcs
- **S2**: 2pcs

**Step 3** Joint

- **S1**: 2pcs
- **N1**: 2pcs
- **F3**: 2pcs

**Step 4** Whole Body Assembly

- **N1**: 8pcs
- **S1**: 12pcs

- **Check assembly point**

**Step 5** Wiring and Completion

- **Wiring**
  - CM-5 → CABLE-14

- **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\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.

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

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

- **AX-12** × 1
- **AX-S1** × 1
- **CM-5** × 1
- **ADAPTOR-CM5** × 1
- **F3** × 5
- **F6** × 1
- **N1** × 28
- **S1** × 30
- **S2** × 2
- **CABLE-14** × 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.
(2) Assembling

Step 1  CM-5

- ADAPTOR-CM5
- CM-5 (Battery included)
- S1 : 4pcs
- N1 : 4pcs

Step 2  Joint 1

- S1 : 2pcs
- N1 : 2PCS
- F3 : 2pcs

Step 3  Joint 2

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

Step 4  Bar

- F6 : 2pcs
- S2 : 2pcs
- N1 : 2pcs
- F3

Step 5  Whole Body Assembly

- *Insert Nuts
- *Check assembly point

Step 5  Wiring and Completion

- CABLE-14
- Connector
- *Using side connector of CM-5.
- Connect 1 cable.

*Wiring

CM-5 → CABLE-14
[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:57600 BPS, <>Dynamixel:1000000 BPS
ID:001 100
002(0X02) Dynamixels Found.

**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

※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** CM-5

- ADAPTOR-CM5
- CM-5 (Battery included)
- S1: 4pcs
- N1: 4pcs

**Step 2** Head

- N1: 2pcs
- F8
- S2: 6pcs
- F10

**Step 3** Mouth 1

- *Insert nuts*
- S1: 6pcs
- N1: 6pcs

**Step 4** Mouth 2

- F1
- F3
- F10
- N1: 8pcs
- S3: 4pcs
- S2: 4pcs
- F8

**Step 5** Whole Body Assembly

- *Insert nuts*
- N1: 4pcs
- S1: 8pcs
- S-B
- BU
- WA

※ Check assembly point
Step 6  Wiring and Completion

1. Wiring


1. Motor

2. Motor

3. Motor
[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: 57600 BPS, <-- Dynamixel: 1000000 BPS
ID: 003 100
002[0x02] Dynamixels Found.
```

**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.

![Diagram](image)

※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

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX-12</td>
<td>× 2</td>
</tr>
<tr>
<td>CM-5</td>
<td>× 1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>× 1</td>
</tr>
<tr>
<td>F2</td>
<td>× 1</td>
</tr>
<tr>
<td>F3</td>
<td>× 3</td>
</tr>
<tr>
<td>N1</td>
<td>× 20</td>
</tr>
<tr>
<td>S1</td>
<td>× 28</td>
</tr>
<tr>
<td>S-B</td>
<td>× 1</td>
</tr>
<tr>
<td>BU</td>
<td>× 1</td>
</tr>
<tr>
<td>WA</td>
<td>× 1</td>
</tr>
<tr>
<td>CABLE-14</td>
<td>× 2</td>
</tr>
</tbody>
</table>

*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 **CM-5**

- CM-5 (Battery included)
- S1: 4pcs
- N1: 4pcs

Step 2 **Joint 1**

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

Step 3 **Joint 2**

- F3: 4pcs

Step 4 **Joint 3**

- S1: 4pcs
- F2: 4pcs
- WA: 4pcs
- S-B: 4pcs
- BU: 4pcs

Step 5 **Whole Body Assembly**

- Insert nuts N1: 4pcs
- N1: 8pcs
- S1: 12pcs
Step 6  Wiring and Completion

※ Using side connector of CM-5.

1. Connect cable.

※ Wiring

CM-5 3 4 CABLE-14
[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.

**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

※Side View

The Pan Tilt is perpendicular to CM-5.

The Pan Tilt is parallel 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

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX-12</td>
<td>× 2</td>
</tr>
<tr>
<td>AX-S1</td>
<td>× 1</td>
</tr>
<tr>
<td>CM-5</td>
<td>× 1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>× 1</td>
</tr>
<tr>
<td>F3</td>
<td>× 8</td>
</tr>
<tr>
<td>F6</td>
<td>× 1</td>
</tr>
<tr>
<td>CABLE-14</td>
<td>× 1</td>
</tr>
<tr>
<td>CABLE-10</td>
<td>× 2</td>
</tr>
</tbody>
</table>

※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 CM-5

Step 2 Joint

Step 3 Bar

Step 4 Joint 1

Step 5 Joint 2

Step 6 Whole Body Assembly

[Detailed instructions and diagrams for assembling the robot, with parts listed and steps outlined.]
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.

![Image](image_url)

**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.

![LED on]

※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](Image)

The bar is perpendicular to CM-5.

![Side View](Image)

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

※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** Left Wheel: 2 sets

- Assemble 2 sets using F12 and F14.
- 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 F13 and F14.
- 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

- Insert nuts **N1**: 8pcs
- Attach nut stickers: Make sure nuts do not come off.
- Sticker: 2pcs

**Step 4** Head Assembly

- Insert nuts **N1**: 4pcs
- Assemble using ADAPTOR-CM5
- **S1**: 8pcs
- **S1**: 4pcs
- **F3**: 2pcs
- **S2**: 4pcs
- **S2**: 4pcs
- **F13**: 4pcs
- **F14**: 4pcs
Step 5: Wiring and Whole Body Assembly

※ Bottom view

※ Assemble after wiring is finished

S1: 16pcs

※ Wiring

※ Top view: Check screw assembly point

Step 6: Completion

※ Using side connector of connect 5 cable.

[S1]: 4pcs

CM-5

[Battery Included]
[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:57600 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.
Comprehensive Kit Robot Series

[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.”

※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

※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** CM-5

- CM-5 (Battery included)
- S1: 4pcs
- N1: 4pcs

**Step 2** Joint 1

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

**Step 3** Joint 2

- S1: 4pcs

※Check assembly point

**Step 4** Joint 3

- N1: 4pcs
- S1: 4pcs

**Step 5** Hand

- F3
- F9
- S1: 8pcs
- N1: 8pcs

**Step 6** Whole Body Assembly

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

※Insert nuts

- N1: 12pcs
- N1: 4pcs

※Check assembly point
Step 7  Complete Wiring and Assembly

※Wiring

CM-5
[ ]
[ ]
[ ]

CABLE-14

CABLE-14

CABLE-10

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

※Left side view

CABLE-10

CABLE-14
[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.

**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

※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  Left Wheel : 2 sets

※ Assemble 2 sets using  and  motor

※ Insert nuts : 4pcs

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

※ Assemble taking note of the inserted location of nuts.

Step 2  Right Wheel : 2 sets

※ Assemble 2 sets using  and  motor

※ Insert nuts : 4pcs

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

※ Assemble taking note of the inserted location of nuts.

Step 3  Joint

※ Insert nuts : 8pcs

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

※ Assemble taking note of the inserted location of nuts.

Step 4  Head

※ Insert nuts : 8pcs

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

※ Assemble taking note of the inserted location of nuts.
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 connect 5 cable.

60
[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.

**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. 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

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-5</td>
<td>1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>1</td>
</tr>
<tr>
<td>AX-12</td>
<td>4</td>
</tr>
<tr>
<td>AX-S1</td>
<td>1</td>
</tr>
<tr>
<td>F1</td>
<td>2</td>
</tr>
<tr>
<td>F2</td>
<td>2</td>
</tr>
<tr>
<td>F3</td>
<td>9</td>
</tr>
<tr>
<td>F9</td>
<td>2</td>
</tr>
<tr>
<td>F12</td>
<td>2</td>
</tr>
<tr>
<td>BU</td>
<td>4</td>
</tr>
<tr>
<td>WA</td>
<td>4</td>
</tr>
<tr>
<td>N1</td>
<td>70</td>
</tr>
<tr>
<td>S1</td>
<td>90</td>
</tr>
<tr>
<td>S-B</td>
<td>4</td>
</tr>
<tr>
<td>CABLE-6</td>
<td>1</td>
</tr>
<tr>
<td>CABLE-10</td>
<td>2</td>
</tr>
<tr>
<td>CABLE-14</td>
<td>2</td>
</tr>
</tbody>
</table>

※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** Shoulder : 2 sets
- Assemble 2 sets in a same style.
  - S1 : 4pcs
  - N1 : 4pcs

**Step 2** Hand : 2 sets
- Assemble 2 sets in a same style.
  - S1 : 4pcs
  - N1 : 4pcs

**Step 3** Head
  - F3 : 4pcs

**Step 4** Upper Part of Body Assembly
- Insert nuts
  - N1 : 12pcs

- Check assembly point
  - S1 : 28pcs
  - WA : 2pcs
  - BU : 2pcs
  - S-B : 2pcs
**Comprehensive Kit Robot Series**

**Step 5**  
Leg: 2 sets  
※Assemble 2 sets in a same style.  
- N1: 4pcs  
- F3: 2pcs  
- S1: 4pcs  
- F2: 2pcs

**Step 6**  
Foot: 2 sets  
※Assemble 2 sets in a same style.  
- N1: 3pcs  
- F3: 2pcs  
- F12: 1pcs  
- S1: 3pcs

**Step 7**  
Lower Part of Body Assembly  
※Insert nuts  
- N1: 8pcs

※Check assembly point
- S1: 24pcs

※Insert nuts  
- N1: 8pcs

※Check assembly point
- S-B: 2pcs
- BU: 2pcs
- WA: 2pcs
- ID 3 motor
- ID 4 motor
- ID 5 motor
Step 8 CM-5 Assembly and Wiring

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

※ Wiring

1 → CABLE-14
2 → CABLE-14
3 → CABLE-6
4 → CM-5
5 → CM-5
[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.

**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.

<table>
<thead>
<tr>
<th>U button</th>
<th>ID 1</th>
<th>U button</th>
<th>ID 2</th>
<th>U button</th>
<th>ID 3</th>
<th>U button</th>
<th>ID 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LED on</td>
<td></td>
<td>LED on</td>
<td></td>
<td>LED on</td>
<td></td>
<td>LED on</td>
</tr>
</tbody>
</table>

※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

※Back View

Two legs are perpendicular to the surface.

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 Attacking Duck
Let’s build a duck robot that attacks with a beak 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** CM-5
- **CM-5** (Battery included)
- **S1**: 4pcs
- **N1**: 4pcs

**Step 2** Joint 1
- **F3**: 2pcs
- **S1**: 4pcs
- **N1**: 4pcs

**Step 3** Joint 2
- **S1**: 4pcs
- **F1**: Insert nuts

**Step 4** Joint 3
- **N1**: 4pcs

**Step 5** Hand
- **F3**: 2pcs
- **F9**: Insert nuts
- **F11**: Insert nuts

**Step 6** Whole Body Assembly
- **S1**: 24pcs
- **WA**: 2pcs
- **SB**: 2pcs
- **BU**: 2pcs
- **N1**: 24pcs

**Check assembly point**

- **Step 3** Insert nuts
- **Step 4** Insert nuts
- **Step 5** Insert nuts
**Step 7** Wiring

* Using side connector of Connector connect cable.

* Assemble sensor and completion

* Assemble sensor

* Wiring

- CM-5
- CABLE-14
- CABLE-14
- CABLE-10

**Step 8** Assemble Sensor and Completion

* Assemble sensor

- S1: 4pcs
- F3

* Insert nut

- N1: 4pcs

* Wiring

- CABLE-14
- CABLE-10

* Left side 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\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.

**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
※Side View

The palm of the hand is facing the front.
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

- **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.**

- **CM-5** × 1
- **AX-12 × 4**
- **AX-S1 × 1**
- **ADAPTOR-CM5 × 1**
- **N1 × 48**
- **S1 × 48**
- **S2 × 16**
- **CABLE-6 × 2**
- **CABLE-10 × 2**
- **CABLE-14 × 1**
- **Sticker × 10**
Comprehensive Kit Robot Series

(2) Assembling

**Step 1** Left Wheel : 2 sets

* Assemble 2 sets using F13 and F14

* 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 F13 and F14

* Insert nuts

- N1 : 4pcs

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

- N1 : 4pcs

- Sticker : 2pcs

* Assemble taking note of the inserted location of nuts.

**Step 3** Joint

* Insert nuts

- N1 : 4pcs

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

- N1 : 4pcs

- N1 : 4pcs

- S1 : 8pcs

**Step 4** Head

* Insert nuts

- S1 : 8pcs

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

- S1 : 8pcs

- S1 : 8pcs

ADAPTOR-CM5
Step 5  Whole Body Assembly and Wiring

※Bottom view

※Assemble after wiring is finished

※Wiring

※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:57600 BPS, <>Dynamixel:1000000 BPS
ID:001 002 003 004 100
005(0x05) Dynamixels Found.

**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.

```
U button  LED on
1 motor
U button  LED on
2 motor
U button  LED on
3 motor
U button  LED on
4 motor
```

※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

- AX-12 × 4
- AX-S1 × 1
- CM-5 × 1
- ADAPTOR-CM5 × 1
- N1 × 70
- S1 × 90
- S-B × 4
- CABLE-6 × 1
- CABLE-10 × 1
- CABLE-14 × 1
- CABLE-18 × 1
- CABLE-20 × 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.
(2) Assembling

Step 1  Shoulder : 2 sets
※ Assemble 2 sets in a same style.

Step 2  Hand : 2 sets
※ Assemble 2 sets in a same style.

Step 3  Head

Step 4  Upper Part of Body Assembly
※ Insert nuts

※ Check assembly point
**Comprehensive Kit Robot Series**

**Step 5** Leg: 2 sets
- Assemble 2 sets in the same style.
  - N1: 4 pcs
  - S1: 4 pcs

**Step 6** Foot: 2 sets
- Assemble 2 sets in the same style.
  - N1: 3 pcs

**Step 7** Lower Part of Body Assembly
- Insert nuts
  - N1: 8 pcs

- Check assembly point

- Insert nuts
  - N1: 8 pcs
Step 8 CM-5 Assembly and Wiring

Wiring:

1. 100 N1: 4pcs
2. 100 CABLE-18
3. 4 CABLE-6
4. CM-5 CABLE-10
5. CM-5 CABLE-14

*Using side connector of connect 4 cable.

[Diagram showing CM-5 assembly and wiring connections, with labels for connectors and cables like CM-5, N1, S1, and CABLE-10, 18, 20, 6, 14.]

[Battery included: CM-5: 4pcs N1: 4pcs S1: 4pcs]
(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:57600 BPS, \->Dynamixel:1000000 BPS
ID:001 002 003 004 100 005(0x05) Dynamixels Found.
```

**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.

```
<table>
<thead>
<tr>
<th>U button</th>
<th>ID 1 button</th>
<th>U button</th>
<th>ID 2 button</th>
<th>U button</th>
<th>ID 3 button</th>
<th>U button</th>
<th>ID 4 button</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

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

※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: Right Leg 1

- Check assembly
- Insert nuts (N1): 4pcs
- Step 1: 4pcs
- S1: 4pcs

Step 2: Right Leg 2

- N1: 4pcs
- F1
- F12
- S1: 4pcs

Step 3: Right Leg 3

- Insert nuts (N1): 4pcs
- S1: 8pcs
- Step 1: 4pcs

Step 4: Left Leg 1

- Check assembly point
- F3
- S1: 4pcs

Step 5: Left Leg 2

- N1: 4pcs
- F1
- F12
- S1: 4pcs

Step 6: Left Leg 3

- Insert nuts (N1): 4pcs
- S1: 8pcs
- Step 4: 4pcs
- F3

※ Check assembly point

Step 5: Left Leg 2

- N1: 4pcs
- F1
- F12
- S1: 4pcs
**Step 7** Waist

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

![Waist diagram](image)

**Step 8** Lower Part of Body

*Insert nuts*

![Lower part of body diagram](image)

**Step 9** ADAPTOR-CM5 Assembly

*Attach nut stickers: make sure do not come off*

![ADAPTOR-CM5 assembly diagram](image)

*Top view: check screw assembly point*

*Back view: Check wiring direction*
Step 10  Complete Assembly and Wiring

※ Wiring

Irregular numbers (6, 8, 10, 12, 14) indicate cables.

1  CABLE-14
2  CABLE-14
3  CM-5  CABLE-10
4  CM-5  CABLE-10
5  CM-5  CABLE-10

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

Step 9

CM-5 (Battery included)

S1 : 4pcs
[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.

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 the 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

※Back View

The legs are parallel facing the front.

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

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: Sensor Assembly**
- **Insert nuts**: N1: 8pcs
- **Check assembly point**

**Step 2: Joint**
- **Insert nuts**: N1: 8pcs
- **Check assembly point**
- **Check assembly point**

**Step 3: Claw Assembly**
- **Insert nuts**: N1: 4pcs
- **Check assembly point**

- **Check assembly point**
- **Assemble 2 sets in a same style.**

[Diagram showing assembly steps with parts labeled and numbers indicating quantities]
Step 4  Body

※ Insert nuts
  N1 : 4pcs

※ Insert nuts
  N1 : 4pcs

Step 3

ADAPTOR-CM5

N1 : 4pcs
F3 : 2pcs
S1 : 8pcs

Step 5  Right Wheel

※ Attach nut stickers :
  Make sure nuts do not come off.
※ Assemble 2 sets.
※ Assemble taking note of the inserted location of nuts.
  S1 : 12pcs
  F3 : 3pcs

Step 6  Left Wheel

※ Attach nut stickers :
  Make sure nuts do not come off.
※ Assemble 2 sets.
※ Assemble taking note of the inserted location of nuts.
  S1 : 12pcs
  F3 : 3pcs
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.

STICKER 2pcs

N1 4pcs

Top view: Check screw assembly point

S1 8pcs

F14 2pcs
F13 2pcs
S2 8pcs
S2 8pcs
F13 2pcs
F14 2pcs

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BIOLOID QUICKSTART

ROBOTIS

95
Comprehensive Kit Robot Series

Step 10  Wiring and Completion

≥ Bottom view

≥ Left side view

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

[Image of a robot with labels and wiring connections]

*S1: 4pcs

CM-5 [Battery included]

※Bottom view

※Left side view

※Wiring

1  CABLE-6

2  CABLE-10

3  CABLE-10

4  CM-5 CABLE-18

5  CABLE-14

6  CABLE-14

7  CABLE-10

8  CABLE-6

Connector
[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.

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

※Top View

Claw is horizontal to the surface.

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.
Comprehensive Kit Robot Series

(2) Assembling

Step 1  Wheel : 4 sets

※ Using 1, 2, 3 and 4, assemble 4 sets.

Step 2  ~  Step 3  Drive 1

※ Insert nuts

Step 2

※ Assemble in a same style.

Step 3

Step 4  Drive Assembly

※ Assemble after wiring is finished.

※ Bottom view

Step 5  Joint 1

 ※ Assemble 2 sets in a same style.

Step 6  Joint 2

Step 7  Joint 3 : 2 sets

※ Using 1, 2, 3 and 4, assemble 4 sets.

Step 3

Step 4

Step 5

Step 6

100
**Comprehensive Kit Robot Series**

**Step 8** Arm 1

- Check assembly point
- Insert nuts (N1: 4pcs)

**Step 9** Arm 2

- Insert nuts (N1: 4pcs)
- Insert nuts (N1: 8pcs)
- Insert nuts (N1: 4pcs)

**Check assembly point**

- ADAPTOR-CM5
- S1: 12pcs
- S1: 4pcs
- S1: 20pcs

**Check assembly point**

- Motor 8
- Motor 6
- Motor 7

- N1: 4pcs
- WA: 3pcs
- BU: 3pcs
- S-B: 3pcs

- Check assembly point

- Insert nuts
**Comprehensive Kit Robot Series**

**Step 10  Whole Body Assembly**

*Top view: Check screw assembly point.*

**Step 11  Wiring and Completion**

*Left side view*

*Using side connector of connect cable.*

**Wiring**

1. **CM-5**
2. **CABLE-20**
3. **CABLE-6**
4. **CABLE-10**
5. **CABLE-6**
6. **CM-5**
7. **CABLE-10**
8. **CABLE-14**
9. **CABLE-18**

**Battery included**
[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[0X09] Dynamixels Found.

**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.

![Comparison Diagram]

※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

Each joint of robot arm forms the right angle.

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**)

104
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

※ 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: Joint 1: 3 sets
- Assemble 3 sets in a same style.
- Insert nuts:
  - N1: 4pcs

Step 2: Joint 2: 3 sets
- Assemble 3 sets in a same style.
- Insert nuts:
  - N1: 4pcs

Step 3 ~ Step 4: Petal (TYPE 1): 2 sets
- Assemble in a same style.
- Insert nuts:
  - N1: 4pcs

Step 5: Petal (TYPE 2)
- Insert nuts:
  - N1: 4pcs
**Step 6** Support

- **S1**: 12pcs
- **F3**: 4pcs

*Top view: Check screw assembly location.*

- **N1**: 12pcs

**Step 7** Sensor Assembly

*Insert nuts*  
- **N1**: 4pcs

**Step 8** Assemble Completion

- **S1**: 4pcs
- **N1**: 4pcs
- **F3**: 4pcs
- **CM-5**: Battery included
- **N1**: 4pcs

- **S1**: 12pcs
- **N1**: 4pcs
Using side connector of CM-5, connect 4 and 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.

![Comparison part of the diagram](image)

**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.

![Diagram of Dynamixel LED order](image)

※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

Each joint petal is 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 \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)
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

- AX-12 x 7
- AX-S1 x 1
- F1 x 3
- F2 x 2
- F3 x 15
- F4 x 2
- F9 x 1
- BU x 6
- WA x 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 x 100
- S1 x 128
- S-B x 6
- CABLE-6 x 1
- CABLE-10 x 2
- CABLE-14 x 2
- CABLE-18 x 1
- CABLE-20 x 2
(2) Assembling

**Step 1 ~ Step 4  Assemble frame**

- **Step 1**  Assemble 4 sets.
  - N1: 4pcs
  - F3: 2pcs
- **Step 2**  Assemble 2 sets.
  - N1: 4pcs
  - F3: 2pcs
- **Step 3**  Assemble 2 sets.
  - N1: 4pcs
- **Step 4**  Assemble 2 sets.
  - N1: 4pcs

**Step 5  Right Foreleg**

- **Step 1**
  - Insert nuts
  - N1: 8pcs
  - Step 2
  - S-B: 2pcs
  - BU: 2pcs
  - WA: 2pcs
  - S1: 16pcs

**Step 6  Left Foreleg**

- **Step 1**
  - Insert nuts
  - N1: 8pcs
  - Step 2
  - S-B: 2pcs
  - BU: 2pcs
  - WA: 2pcs
  - S1: 16pcs
Comprehensive Kit Robot Series

**Step 7** Right Hindleg

- **Check assembly point**
  - S-B: 4pcs
  - BU: 3d
  - WA: 6
  - F4: 1

- **Insert nuts**
  - N1: 4pcs

**Step 8** Left Hindleg

- **Check assembly point**
  - S1: 4pcs

- **Insert nuts**
  - N1: 4pcs

**Step 9** CM-5

- **CABLE-18**
  - CM-5 (Battery included)
  - ADAPTOR-CM5
  - S1: 4pcs
  - N1: 4pcs

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

**Step 10** Head 1

- **Check assembly point**
  - S1: 4pcs

**Step 11** Head 2

- **Insert nuts**
  - N1: 8pcs

- **Check assembly point**
  - N1: 4pcs

- **Step 3**
  - N1: 12pcs

- **Step 4**
  - N1: 4pcs
Step 12 Body Assembly

* Insert nuts  N1 : 16pcs

* Top view

* Using side connector of CM-5, connect 2 4 cables.
Step 13 Whole Body Assembly and Completion

*Insert nuts N1: 8pcs

*Wiring

1. CM-5 CABLE-18
2. CM-5 CABLE-20
3. CABLE-14
4. CM-5 CABLE-20
5. CABLE-14
6. CABLE-10
7. CABLE-6
8. CM-5 CABLE-10

*Bottom view

1. N1: 4pcs
2. S1: 4pcs
3. F9
4. F3

※S1: 8pcs
[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.

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.
Comprehensive Kit Robot Series

**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

Each leg opens perpendicular to the body

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-5</td>
<td>1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>1</td>
</tr>
<tr>
<td>AX-12 × 8</td>
<td></td>
</tr>
<tr>
<td>AX-S1 × 1</td>
<td></td>
</tr>
<tr>
<td>F1 × 4</td>
<td></td>
</tr>
<tr>
<td>F3 × 10</td>
<td></td>
</tr>
<tr>
<td>BU × 4</td>
<td></td>
</tr>
<tr>
<td>WA × 4</td>
<td></td>
</tr>
<tr>
<td>Sticker × 8</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1 × 64</td>
<td></td>
</tr>
<tr>
<td>S1 × 96</td>
<td></td>
</tr>
<tr>
<td>S-B × 4</td>
<td></td>
</tr>
<tr>
<td>CABLE-6 × 2</td>
<td></td>
</tr>
<tr>
<td>CABLE-10 × 1</td>
<td></td>
</tr>
<tr>
<td>CABLE-14 × 2</td>
<td></td>
</tr>
<tr>
<td>CABLE-18 × 1</td>
<td></td>
</tr>
<tr>
<td>CABLE-20 × 3</td>
<td></td>
</tr>
</tbody>
</table>
[2] Assembling

**Step 1**  **Leg 1 : 2 sets**


※ Insert nuts
N1 : 4pcs

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

※ Assemble taking note of the inserted location of nuts.

**Step 2**  **Leg 2 : 2 sets**


※ Insert nuts
N1 : 4pcs

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

※ Assemble taking note of the inserted location of nuts.

**Step 3**  **Right Foreleg**

※ Insert nuts
N1 : 4pcs

※ Check assembly point
S1 : 8pcs

**Step 4**  **Left Foreleg**

※ Insert nuts
N1 : 4pcs

※ Check assembly point
S1 : 8pcs

※ Assembling
Step 5 Right Hind Leg

- S-B
- BU
- WA
- F3
- N1: 8pcs

Step 2
- Insert nuts
- N1: 4pcs

※ Check assembly point

Step 6 Left Hind Leg

- S-B
- BU
- WA
- F3
- N1: 8pcs

Step 1
- Insert nuts
- N1: 4pcs

※ Check assembly point

Step 7 Body

- Insert nuts
- N1: 8pcs

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

- Sticker: 2pcs
- N1: 4pcs
- F3: 2pcs
- S1: 4pcs

ADAPTOR-CM5

S1: 8pcs

Body
Step 8  Wiring and Whole Body Assembly

※Bottom view

※Assemble after wiring is finished.

※Top view: Check screw assembly point

Step 9  Completion

※Using side connector of CM-5

(connect 8 cable.)
Comprehensive Kit Robot Series

[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.

**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

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

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

**Step 4** Assemble 4 sets
- F2: 2pcs
- F6: 2pcs
- S5: 2pcs
- S4: 2pcs
- F10: 2pcs
- N1: 4pcs

**Step 2** Assemble 2 sets
- F3: 2pcs
- S1: 2pcs
- N1: 2pcs

**Step 3** Assemble 2 sets
- F3: 2pcs
- S1: 4pcs
- N1: 4pcs

- Completed

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

**Step 5**
- Using 1D and 8D assemble 2 sets.
- Inserts nuts:
  - N1: 4pcs

**Step 6**
- Assemble in a same style.
- S-B: 2sets
- BU: 2sets
- WA: 2sets

**Check assembly point**
Comprehensive Kit Robot Series

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

* Using 10 and 10, assemble 2 sets.

**Insert nuts**
- N1 : 4pcs

**Check assembly point**

**Step 8**
- S1 : 8pcs

*Assemble in a same style.

**Step 9** Head

* Insert nuts
- N1 : 4pcs

**Step 10** Body

* 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

* Check assembly point:

- S1: 8pcs
- F3

Step 12 Right Leg 2

* Insert nuts

- N1: 4pcs

* Assemble taking note of the inserted location of nuts.

* Attach nut stickers:
  - Make sure nuts do not come off
  - Sticker: 2pcs
  - N1: 3pcs

* Check assembly point:

- S1: 8pcs
- F3

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

* Check assembly point:

- S1: 8pcs
- F3

- F1

- S1
Step 14 Left Leg 2

- Insert nuts:
  - N1: 4pcs
- Check assembly point:
  - S1: 8pcs

Step 15 Whole Body Assembly

- Attach nut stickers:
  - Make sure nuts do not come off.
  - N1: 4pcs
- Top view:
  - Check screw assembly point:
  - S1: 6pcs
**Wiring**

1. CABLE-20
2. CABLE-20
3. CABLE-20
4. CM-5
5. CABLE-14
6. CABLE-6
7. CABLE-20
8. CABLE-20
9. CM-5

**Bottom view**

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

---

**Step 16  Wiring and Completion**

[S1: 4pcs]

- CM-5
  - [Battery included]
[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.

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.
Comprehensive Kit Robot Series

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

※Top View

※Side 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).bp)
※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).bp)
※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

<table>
<thead>
<tr>
<th>Parts</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-5</td>
<td>1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>1</td>
</tr>
<tr>
<td>motor AX-12</td>
<td>7</td>
</tr>
<tr>
<td>motor AX-S1</td>
<td>1</td>
</tr>
<tr>
<td>F1 × 4</td>
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</tr>
<tr>
<td>F2 × 1</td>
<td></td>
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<tr>
<td>F3 × 10</td>
<td></td>
</tr>
<tr>
<td>F12 × 2</td>
<td></td>
</tr>
<tr>
<td>BU × 5</td>
<td></td>
</tr>
<tr>
<td>WA × 5</td>
<td></td>
</tr>
<tr>
<td>CABLE-10</td>
<td>3</td>
</tr>
<tr>
<td>CABLE-14</td>
<td>2</td>
</tr>
<tr>
<td>CABLE-18</td>
<td>1</td>
</tr>
<tr>
<td>CABLE-20</td>
<td>2</td>
</tr>
</tbody>
</table>

※ 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

**Step 2** Assemble 2 sets
- N1: 4pcs
- S1: 4pcs

**Step 3** Assemble 2 sets
- N1: 3pcs
- F1: 2pcs
- S1: 3pcs

**Top view**
- Check screw location.

**Bottom view**
- Assemble in a same style.

**Step 4 ~ Step 5** Thigh

※ Using 2 and 3, assemble 2 sets.

**Step 4**
- Check assembly point
- S1: 4pcs
- ID 2 motor
- ID 3 motor

**Step 5**
- Assemble in a same style.

**Step 6** Right Leg

※ Insert nuts
- N1: 12pcs
- S-B: 2pcs
- BU: 2pcs
- S1: 20pcs

**Step 1**
- Check assembly point
- ID 2 motor
- ID 4 motor
- ID 6 motor

**Step 2**
- Check assembly point
- ID 2 motor
- ID 4 motor
- ID 6 motor

**Step 3**
- Assemble 2 sets
- WA: 2pcs
- ID 3 motor
**Step 7** Left Leg

- Insert nuts
  - N1: 12pcs

**Step 8** Body

- Insert nuts
  - N1: 8pcs

- Bottom view
  - Check nut location.
Step 9 Lower Part of Body

※ Insert nuts

N1: 8pcs

Step 10 Body

※ Check assembly point

S1: 4pcs

Step 11 Assembly Completion

※ Completed

S1: 4pcs

CM-5 [Battery included]
Step 12 Wiring

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

※ Completed

※ Wiring

1. CM-5 CABLE-20
2. CABLE-18
3. CABLE-14
4. CABLE-10
5. CM-5 CABLE-20
6. CABLE-14
7. CABLE-10
8. CM-5 CABLE-10
[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.

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](image1)

![Side View](image2)

- Waist is perpendicular to the CM-5.
- 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

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX-12</td>
<td>8</td>
</tr>
<tr>
<td>AX-S1</td>
<td>1</td>
</tr>
<tr>
<td>CM-5</td>
<td>1</td>
</tr>
<tr>
<td>ADAPTOR-CM5</td>
<td>1</td>
</tr>
<tr>
<td>F1</td>
<td>4</td>
</tr>
<tr>
<td>F3</td>
<td>4</td>
</tr>
<tr>
<td>F4</td>
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<td>F6</td>
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<td>WA</td>
<td>4</td>
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<td>Stick</td>
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<td>N1</td>
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<td>S1</td>
<td>114</td>
</tr>
<tr>
<td>S2</td>
<td>2</td>
</tr>
<tr>
<td>S-B</td>
<td>4</td>
</tr>
</tbody>
</table>

※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** Right Leg 1

- Check assembly point
- **N1**: 4pcs
- **F1**: 4pcs
- **F12**: 4pcs
- **S1**: 4pcs

**Step 2** Right Leg 2

- **N1**: 4pcs
- **F1**: 4pcs
- **F12**: 4pcs
- **S1**: 4pcs

**Step 3** Right Leg 3

- Insert nuts
- **N1**: 4pcs
- **S1**: 8pcs

**Step 4** Left Leg 1

- Check assembly point

**Step 5** Left Leg 2

- **N1**: 4pcs
- **F1**: 4pcs
- **F12**: 4pcs
- **S1**: 4pcs

**Step 6** Left Leg 3

- Insert nuts
- **N1**: 4pcs
Step 7  Waist

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

Sticker

N1: 2pcs

*Insert nuts

N1: 12pcs

※Insert nuts

F8: 2pcs

Step 8  Lower Part of Body Assembly

*Insert nuts

N1: 16pcs

CABLE-14

CABLE-20

Step 7  Waist

Step 3

Step 6

Step 9  Right Shoulder

*Insert nuts

F1

N1: 5pcs

S1: 9pcs

※Check assembly point

※Completed

F6: 2pcs

Step 10 Left Shoulder

*Insert nuts

F6: 2pcs

F1

N1: 5pcs

S1: 9pcs

※Check assembly point

※Completed
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

※Check assembly point

※Insert nuts

※Check assembly point
**Step 15 Upper and Lower Body Assembly**

- **S1**: 4pcs
- **S2**: 2pcs
- **Connector**: 6
- **CM-5**: 5

- **Top view**: Check screw assembly point.
- **Back view**: Pay attention to wire direction.

- **Wiring**:
  - 1 → 4: CABLE-20
  - 2 → 6: CABLE-10
  - 3 → 7: CABLE-14
  - 4 → 8: CABLE-14
  - 5 → 9: CABLE-20

- **Notes**:
  - Using side connector of CM-5.
  - Connect 6 & 8 cables.

---

**Step 16 Wiring and Completion**

- **CM-5**: Battery included

---

143
[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).bgp)
※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.

**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.

<table>
<thead>
<tr>
<th>U button</th>
<th>1 Motor</th>
<th>2 Motor</th>
<th>3 Motor</th>
<th>4 Motor</th>
<th>5 Motor</th>
<th>6 Motor</th>
<th>7 Motor</th>
<th>8 Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
<td>LED on</td>
</tr>
</tbody>
</table>

※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](image1)

![Side View](image2)

![Top View](image3)

- **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 Battel 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

![Diagram of 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.

*Completed

Step 2  Assemble 4 sets.

Step 3  Assemble 2 sets.

Step 4  Assemble 2 sets.

*Top view

Check screw assembly point.

Step 5  Right Arm

*Insert nuts  N1 : 4pcs

*Check assembly point

*S-B  BU  WA
Step 6 Left Arm

- Insert nuts N1: 4pcs

- Check assembly point

Step 7 Right Leg

- Insert nuts N1: 4pcs

- Check assembly point

- Completed

- Check assembly point

Step 4

S1: 24pcs
Comprehensive Kit Robot Series

**Step 11 ~ Step 12: Tail 2: Frame Assembly**

- **Step 11**
  - F3: 4pcs
  - S1: 4pcs

- **Step 12**
  - F3: 4pcs
  - S1: 8pcs
  - N1: 8pcs

**Step 13: Tail 3**

- **Insert nuts**
  - N1: 4pcs

- **Check assembly point**
  - WA: 3pcs
  - BU: 3pcs
  - S1: 24pcs

- **Completed**
  - Step 11
  - Step 12
  - Step 13

Motor

- Motor 13
- Motor 14
- Motor 15

- *Check assembly point*
Step 14  Leg–Tail Assembly

- Insert nuts
  - N1: 8pcs

Step 8

S1: 8pcs

Step 7

Step 13

Step 15  Head 1

- Check assembly point
  - N1: 4pcs
  - S1: 4pcs
  - F1: 4pcs
  - F3: 4pcs

- Insert nuts
  - N1: 4pcs

Step 16  Head 2

- Insert nuts
  - S1: 4pcs
  - F8: 2pcs
  - F4: 2pcs

- Check assembly point
  - S-B: 2pcs
  - BU: 2pcs
  - WA: 2pcs
**Step 17  Head 3**

- *Insert nuts*: N1 : 4pcs
- S1 : 4pcs
- F3 : 2pcs

**Step 18  Body 1**

- F2
- F9
- F3
- S3 : 4pcs
- N1 : 4pcs

**Step 19  Body 2**

- ADAPTOR-CM5
- N1 : 4pcs
- S1 : 4pcs
- N1 : 4pcs
- S3 : 4pcs
- SP1 : 4pcs
- Expansion PCB

**Step 20  Body 3**

- Connector
- CM-5
- Battery
- CABLE-14

*Using the connector inside of CM-5, connect 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

※ Using side connector of CM-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\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:002 003 004 005 006 007 008 010 011 012 013 014 015 016 017 100 016[0X10] Dynamixels Found.
```

**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.
Comprehensive Kit Robot Series

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](image1)

![Top View](image2)

![Back View](image3)

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 1:  
- S1: 2pcs
- N1: 2pcs
- F7

Step 2:  
- S1: 2pcs
- N1: 2pcs
- F9

Step 3:  
- F3
- S1: 4pcs
- N1: 4pcs

Step 4:  
- S1: 4pcs
- N1: 4pcs
- F3: 2pcs

Step 5  Head 2

*insert nuts  
- N1: 8pcs

Step 1:  
- S1: 8pcs

Step 2:  
- N1: 8pcs

Step 6  Head 3

*Check assembly point

- S1: 4pcs
- F3
**Step 7** Head 4

※Insert nuts N1: 4pcs

※Check assembly point

**Step 8** Head 5

※Insert nuts N1: 8pcs

**Step 9** Body

※Top view: Check screw assembly point.
**Step 10**  Head–body Assembly

- **Step 8**
  - Insert nuts
  - N1: 4pcs

- **Step 9**
  - S1: 4pcs

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

- **Step 11**
  - Assemble 4 sets.
  - F2: 2pcs
  - N1: 4pcs
  - S1: 4pcs

- **Step 12**
  - Assemble 4 sets.
  - N1: 4pcs
  - S1: 4pcs
  - F3: 4pcs
  - F10: 4pcs
  - S6: 4pcs

**Step 13 ~ Step 14**  Leg 2 : Assemble 2 sets

- **Step 13**
  - *Check assembly point
  - F7
  - S1: 4pcs

- **Step 14**
  - *Assemble in a same manner.
  - Motor
  - F7
  - S1

**Step 15 ~ Step 16**  Leg 3 : Assemble 2 sets

- **Step 15**
  - *Check assembly point
  - F7
  - S1: 4pcs

- **Step 16**
  - *Assemble in a same manner.
  - Motor
  - F7
  - S1
Comprehensive Kit Robot Series

**Leg 4 (Type 1): Assemble 2 sets**

**Step 17**
- Insert nuts
- N1: 8pcs

**Step 18**
- Check assembly point
- Assemble in the same manner.

**Step 19**
- Insert nuts
- N1: 8pcs

**Step 20**
- Assemble in the same manner.

**Leg 5 (Type 2): Assemble 2 sets**

**Step 17**
- Insert nuts
- N1: 8pcs

**Step 18**
- Check assembly point
- Assemble in the same manner.

**Step 19**
- Insert nuts
- N1: 8pcs

**Step 20**
- Assemble in the same manner.
Step 21  Hind Leg 1

※ Insert nuts  
N1 : 8pcs

Step 22  Hind Leg 2

※ Insert nuts  
N1 : 8pcs

Step 23  Body–Hind Leg Assembly

※ Insert nuts  
N1 : 4pcs
Step 24 Foreleg Assembly

※ Insert nuts

N1: 12pcs

Step 25 CM-5 Assembly

S1: 2pcs

CM-5
[Battery included]
Step 26 Wiring 1

※ Wiring

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

Connector

1. Expansion PCB
   - CABLE-6
   - CABLE-10
   - CABLE-14
   - CABLE-6
   - CABLE-14
   - CM-5
   - CABLE-18
   - CABLE-18
   - CABLE-14

2. Expansion PCB
   - CABLE-14

3. Expansion PCB
   - CABLE-18

4. Expansion PCB
   - CABLE-14

5. Expansion PCB
   - CABLE-18

6. Expansion PCB
   - CABLE-14

7. Expansion PCB
   - CABLE-18

8. Expansion PCB
   - CABLE-14

9. Expansion PCB
   - CABLE-18

10. Expansion PCB
    - CABLE-14

11. Expansion PCB
    - CABLE-18

12. Expansion PCB
    - CABLE-14

13. Expansion PCB
    - CABLE-18

14. Expansion PCB
    - CABLE-14

15. Expansion PCB
    - CABLE-6

16. Expansion PCB
    - CABLE-10

17. Expansion PCB
    - CABLE-14

18. Expansion PCB
    - CABLE-6

19. Expansion PCB
    - CABLE-10
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:57742 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.

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 the 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
* Front View
* Top View

Left and right are identical. Front and back are identical.

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.*
[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
  - F2
  - F1
  - S1: 4pcs

- Step 3: Assemble 6 sets.
  - N1: 4pcs
  - F3
  - F7
  - S1: 4pcs
  - F3

- Step 4: Assemble 6 sets.
  - N1: 3pcs
  - F5
  - F4
  - S2: 3pcs

**Step 5** Assemble Leg: Assemble 6 sets

- Insert nuts N1: 4pcs

**Step 6** Leg (TYPE 1) 1

- Insert nuts N1: 4pcs

---

※Check assembly point

---

※Using motors 1, 2, 7, 13, and 14 assemble 6 sets.

※Check assembly point
Step 7  Leg (TYPE 1) 2

- Step 6
- Step 7: Leg (TYPE 1) 2
- Step 8
- Step 9: Leg (TYPE 1) 3: Assemble additional 2 sets
- Step 10: Leg (TYPE 2) 1

*N: Insert nuts
- N1: 4pcs

*Check assembly point

*N: Following Step 8 ~ Step 7, assemble additional 2 sets.
Step 11 Leg (TYPE 2) 2

* Insert nuts
N1 : 4pcs

* Check assembly point

Step 12 ~ Step 13 Leg (TYPE 1) 3 : Assemble additional 2 sets

Step 14 Sensor

* Insert nuts
N1 : 4pcs

F3 : 2pcs

S1 : 4pcs

CABLE-10

Step 10

Step 11

Step 12

Step 13

Step 5

Step 5

Step 5

Step 5

Step 10 ~ Step 11, assemble additional 2 sets.

Following Step 10 ~ Step 11, assemble additional 2 sets.
Comprehensive Kit Robot Series

Step 15  CM-5 Assembly

- Using the connector inside of CM-5 cable.
- Using side connector of CM-5 cables.

Step 16  Whole Body Assembly

- Insert nuts

N1: 28pcs

S1: 4pcs

S3: 4pcs

ADAPTOR-CM5

Expansion PCB

CABLE-10

CABLE-18

Connector

Connector

CM-5

Battery

Step 14

Step 7

Step 15

Step 12

Step 11

Step 13

Step 10

Step 9

Step 8

Step 1

Step 2

Step 3

Step 4

Step 5

Step 6

Step 14

Step 7

Step 15

Step 12

Step 11

Step 13

Step 10

Step 9

Step 8

Step 1

Step 2

Step 3

Step 4

Step 5

Step 6

Step 14

Step 7

Step 15

Step 12

Step 11

Step 13

Step 10

Step 9

Step 8

Step 1

Step 2

Step 3

Step 4

Step 5

Step 6
Step 17  Wiring and Completion

※Bottom view

※Wiring

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

※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.

[C микро-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.

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.
Comprehensive Kit Robot Series

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\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 shrinked 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)

176
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

[Image showing various parts and components with numbers indicating quantities]

※ 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.
  - N1 : 4pcs
  - F4
  - S3 : 4pcs
  - F10

- **Step 2**  Assemble 2 sets.
  - N1 : 4pcs
  - F4
  - S1 : 4pcs

- **Step 3**  Assemble 2 sets.
  - N1 : 4pcs
  - F5
  - S1 : 4pcs
  - F12

- **Step 4**  Check screw location
  - N1 : 4pcs
  - F5
  - S1 : 4pcs
  - F12

**Bottom View:**
- Check screw location

**Step 5**  Intersecting Joint : 4 sets

- **Assemble 4 sets using**
  - Motor 9
  - Motor 10
  - Motor 17
  - Motor 18

- **Completed**
  - N1
  - F6
  - S1 : 2pcs

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

- **Assemble in a same manner.**
- Motor 9
  - Motor 11
  - Motor 16

- **Completed**
  - N1
  - F7
  - S1 : 8pcs

**Insert Nuts**
- N1 : 8pcs
  - Motor 9
  - Motor 11
  - Motor 16
**Comprehensive Kit Robot Series**

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

- **Step 8**
  - Insert nuts
  - N1 : 8pcs

- **Step 9**
  - Completed
  - Assemble in a same manner.

**Step 10**  
Right Leg 1

- **Step 10**
  - Insert nuts
  - N1 : 4pcs

- **Step 11**
  - Right Leg 2
    - S-B : 3pcs
    - BU : 3pcs

---

**Step 11**

- **Step 11**
  - Check assembly point
  - S1 : 4pcs
**Step 12** Left Leg 1

- **Check assembly point**
- **Insert nuts** N1: 4pcs

**Step 13** Left Leg 2

- **Check assembly point**
- **S1**: 4pcs
- **S-B**: 3pcs
- **BU**: 3pcs
- **WA**: 3pcs

**Step 1**

- 14 motor

**Step 2**

- S1: 16pcs

**Step 7**

- BU

**Step 8**

- S-B: 3pcs

**Step 12**

- S-B

**Step 13**

- Check assembly point
Comprehensive Kit Robot Series

Step 14 ~ Step 15: Assemble Frame

Step 14
Assemble 2 sets.

Step 15
Assemble 2 sets.

Step 16: Right Arm 1

*Insert nuts

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

*Assemble taking note of the inserted location of nuts.

Step 17: Right Arm 2

*Check assembly point

*Check assembly point
Step 18 Left Arm 1

※ Check assembly point

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

※ Insert nuts
N1: 8pcs

N1: 2pcs

※ Assemble taking note of the inserted location of nuts.

Step 19 Left Arm 2

※ Check assembly point

※ Insert nuts
N1: 4pcs

N1: 4pcs

Step 15

S1: 16pcs

Step 14

Step 18

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

Step 20 Body 1

※ Insert nuts
N1: 4pcs

N1: 4pcs

F8

※ Insert nuts
N1: 4pcs

F1

N1

S1

F3

N1

S1

F8

N1

S1

N1

S1
Step 21 Body 2

- **S1**: 4pcs
- **F16**: 4pcs
- **CABLE-18**: 4pcs
- **N1**: 4pcs

*Front View*:
Pay attention to wire direction.

*Bottom View*:
Check the inserted nut location

Step 22 Body 3

- **S1**: 4pcs

Step 23 Body 4

- **F5**: 2pcs
- **S1**: 8pcs

*Check assembly points.*

Step 24 Lower Part of Body Assembly

- **S1**: 8pcs
- **S-B**: 2pcs
- **BU**: 2pcs

*Check assembly point*

*Completed*
Step 25  Arm Assembly

Step 26  Head Assembly
Step 27  Wiring
※ Upper part of body: Back view

※ Right Leg

※ Left Leg

※ When wiring, insert 2, 8, 11, 14 into the gap.

※ When wiring, insert 4, 10, 13, 16 into the gap.
Step 28 Completion

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

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

※ 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:001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019[0X13] Dynamixels Found.

**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.
Comprehensive Kit Robot Series

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. Adjust the 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 the “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 the 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.

<table>
<thead>
<tr>
<th>Dynamixel type</th>
<th>Available ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX-12</td>
<td>0~30</td>
</tr>
<tr>
<td>AX-S1</td>
<td>100~109</td>
</tr>
</tbody>
</table>

* 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.

- **SMPS**
- **Sereal Cable**
- **Quick Start**
- **CD**
- **N1 × 400**
- **N2 × 10**
- **S1 × 400**
- **S2 × 20**
- **S3 × 20**
- **S4 × 20**
- **S5 × 20**
- **S6 × 20**
- **S7 × 20**
- **S-B × 30**
- **CABLE-6 × 6**
- **CABLE-10 × 4**
- **CABLE-14 × 6**
- **CABLE-18 × 4**
- **CABLE-20 × 5**