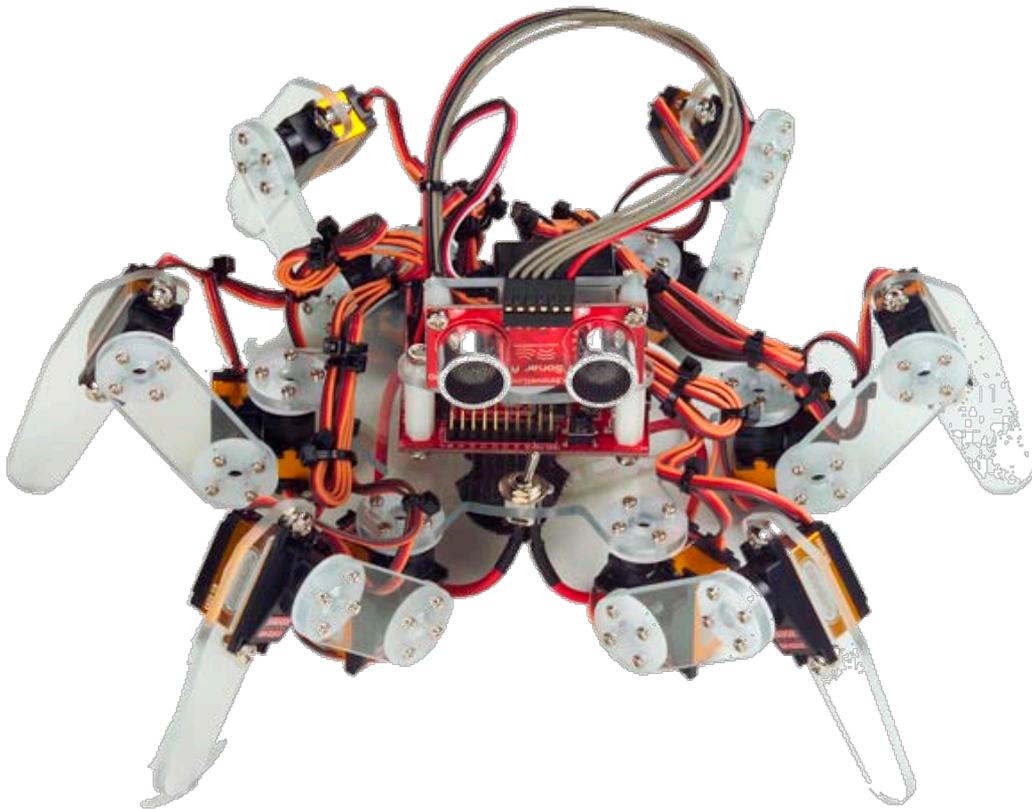


Mini Hexapodinno

18-DOF Robot

Instruction Manual

Version 1.12



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Errata

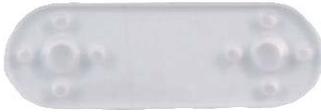
We hope the users may regard this document as a lively and practical instruction manual. We have put tremendous efforts in making this instruction manual complete and correct; however, there may be unavoidable missing parts or errors. With a view to providing the user updated and complete information in the instruction manual, we keep improving and supplement the contents of this instruction manual. If you find any error in this manual, please contact us via the e-mail service@innovati.com.tw. Any related update information will be disclosed on our website. Please visit our website <http://www.innovati.com.tw> for more updated information.

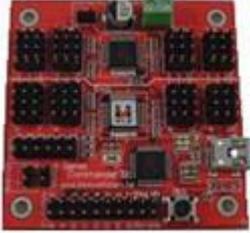
Precautions

- This kit comprises Servo Commander 32 and the attached CD-ROM contains instructions for use and functions. Please refer to these for optimal effects.
- The input voltage to the Servo Commander 32 must correspond to the voltage rating of the servo. **Servos provided in this kit are rated 4.8-6V**; over or under voltage may cause unpredictable results, even burnout of the motor. Make absolutely sure of the correct voltage before connecting the power supply.
- The kit provides a total of 19 servos. When operated simultaneously, they consume a large current; make sure the power supply or battery connecting to Servo Commander 32 is capable of providing **10A of current**, so as to properly operate the kit. Insufficient current may cause unexpected results and damage of the kit.
- When using a battery power supply to the module, the voltage may lower after some while of operation and cause abnormal actions of the kit. In such case, remove and fully charge the battery before using again. If prolonged testing and operation is required, we suggest you use a power supply unit to ensure uniform performance.

Prior to assembling the kit, install InnoBASIC Workshop as per the content of the CD; also make sure that the PC communicates with Servo Commander 32 via a USB Line connection, so that the entire assembly can be accomplished.

Part List

Item	Illustration	Qty.	Specifications and instructions
Assembly Kit Parts			
Main Board for module installation		1	PC body Main Board for accommodating parts of the mini hexapod robot. Six protrusions are designed for connecting six leg kits. The center part is for placing different modules or power supply according to different needs.
Leg Joint Plate		6	PC plate for connecting module installation board and supporting leg plate. Fix the servos at two ends by fastening screws.
Supporting Leg Plate		6	The supporting leg is made of PC material and connects servo terminal with screws.
Sonar Support (small)		1	PC plate for module installation and connecting the sonar module.
Sonar Back Plate		1	PC plate for connecting the sonar module and the servo.
Servo		18	Servo provides for 180° rotation movements capable of simulating articulation behaviors; connections with signal, power and ground are required for the operation. Pay attention to wire polarity. Avoid having the servo sustained to a same movement for a long period of time, to prevent wearing the motor. Dimensions (LxWxH): 22.8x12.0x25.4 (mm) Weight: 13.6g Speed: 0.09 (sec/60°) Torque: 1.6 (kg/mm)
Screw A		12	ISOT 3 x 8 mm
Screw B		72	1.7 x 5 mm

Screw C		4	ISOP 3 x 10 mm
Screw D		2	ISOP 3 x 6 mm
Plastic Post A		2	18mm
Plastic Post B		2	6mm
Nut		22	3 x5 mm
Module Kits			
Servo Commander 32		1	Servo Commander 32 combines the features and functions of both BC1 and Servo Runner A. It can store programs and control the movements of servos. I/O Ports and cmdBUS are also provided.
SonarA		1	SonarA module can measure the distance of 2cm-5m by emitting and receiving the sound waves. It can communicate with Servo Commander32 through cmdBUS.
Power Line with Switch		1	Used for connecting the battery and the module boards for switching the power on/off.
Velcro Cable Strap		1	It is attached on the module installation board for fixing the power supply (battery).
Double-sided Tape		1	Used for attaching and fixing servos.
USB Line		1	Links Servo Commander 32 with PC, allowing downloading of PC program to Servo Commander 32 or performing communication in Debug Mode.

Cable Strap		30	Used for fixing wires, so that they do not tangle or affect motions unexpectedly during the operation of the servo.
Charger		1	<p>Red : Charging Green : Slow charge after normal charge. The battery contains more than 85% of power at this time. Fit for 5-10 packaged Ni-MH battery.</p>
Power Adapter		1	<p>Provide power for development and test. Do not use this for charge.</p>

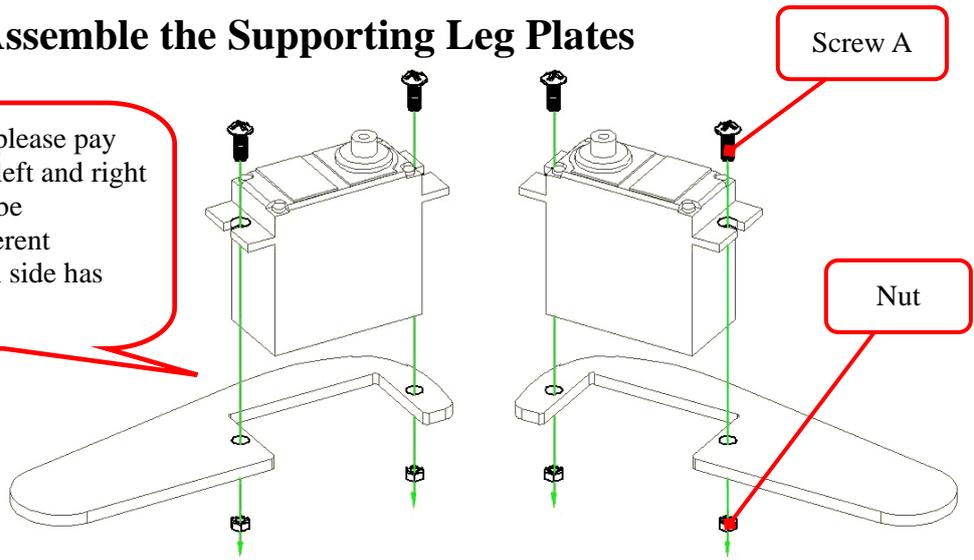
1. Tools

- Phillips Screwdriver (2mm and 3 mm)
- Long Nose Pliers
- Screw Glue (selectively used at the joint between nut and Aluminum Plate, to prevent the nut from loosening.)

2. Assembly Procedures

Step 1: Assemble the Supporting Leg Plates

While installing, please pay attention that the left and right leg plates should be assembled in different orientations. Each side has three leg plates.

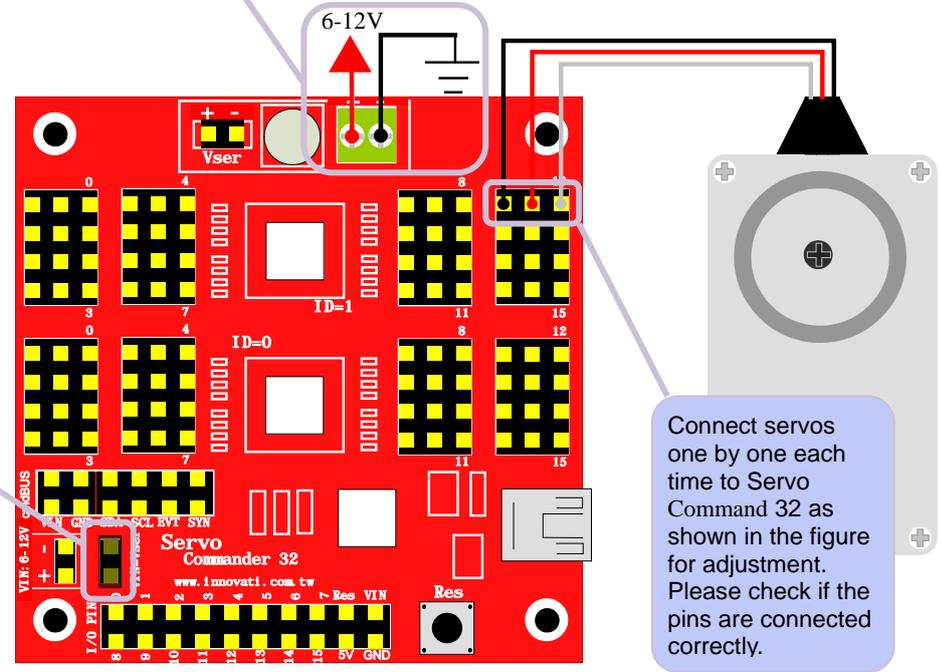


Step 2: Adjust the servo to the central point

- ◆ Connect the servos, Servo Commander 32 and power lines in the sequences as illustrated below.

Power supply input terminals. Please pay attention to the polarity of the power supply. It is necessary to connect the “+” terminal to the positive electrode of the power supply and connect the “-” terminal to the GND electrode.

Please make sure that a jumper is placed at position labeled “VIN=Vser”, which allows the control board and servos use the same power source which is connected to Vser connector externally.



Connect servos one by one each time to Servo Command 32 as shown in the figure for adjustment. Please check if the pins are connected correctly.

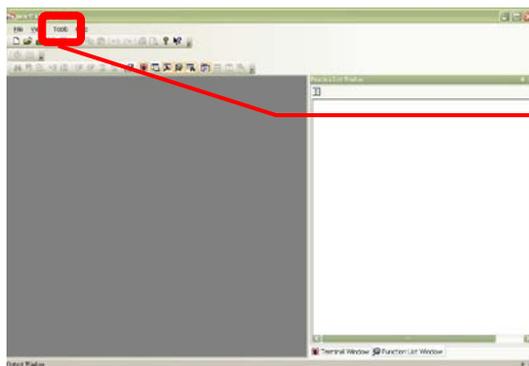
- ※ While connecting the power supply, please notice that the voltage of this kit should be 6V (please refer to Notices). It is recommended to use a voltage regulator to ensure that the voltage is within the safe range.

- i. **Connect the PC and Servo Commander 32 with a USB line.**
- ii. **Connect the power line of the servo to the power supply. (Please make sure that the voltage and current from the power supply are within the range required by the servo. After the power cord is connected, the servo may make a transient motion due to receiving a switch surge; this is normal.)**
- iii. **Start the innoBASIC Workshop**



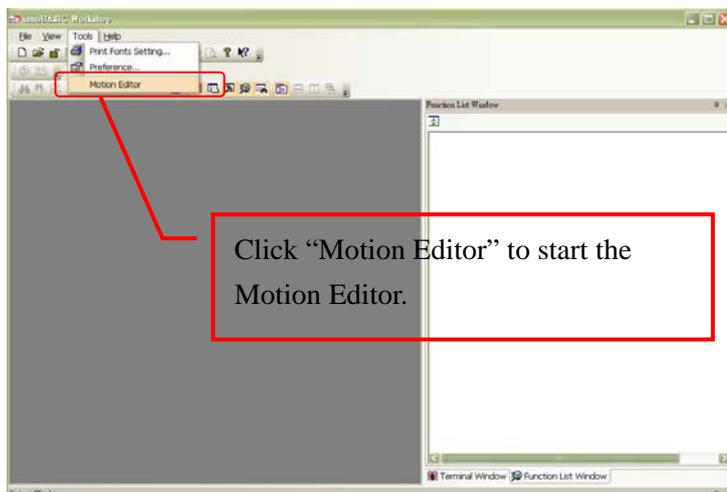
Click the application in the innoBASIC Workshop folder to start the innoBASIC Workshop.

- iv. **Click the “Tool” item in the menu bar on the top.**



After clicking each item, a pull-down menu with more function items will be displayed.

- v. **Click the “Motion Editor” in the pull-down menu (If a warning window appears, it means that the BASIC Commander is not correctly connected. Please check if the USB line is connected or unplugged, and then plug it in again to ensure a correct connection. Exit the Motion Editor and then re-click this button.)**



Click “Motion Editor” to start the Motion Editor.



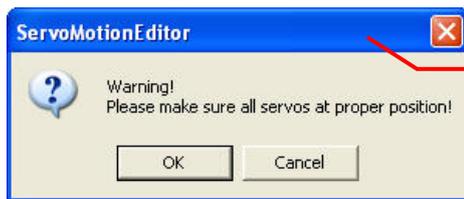
If this message appears, it means that the USB cable is not connected correctly.

- vi. If the connection is correct, the message “Downloading Editor Program...” will be displayed on the PC screen meaning that the program is being downloaded. Please wait a moment.



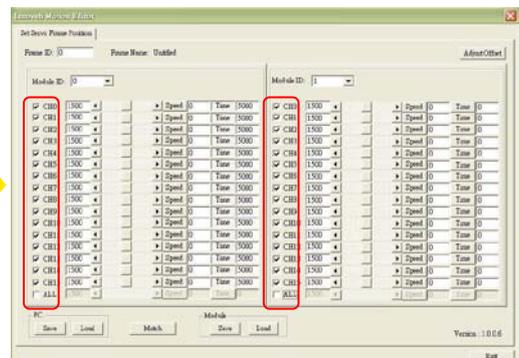
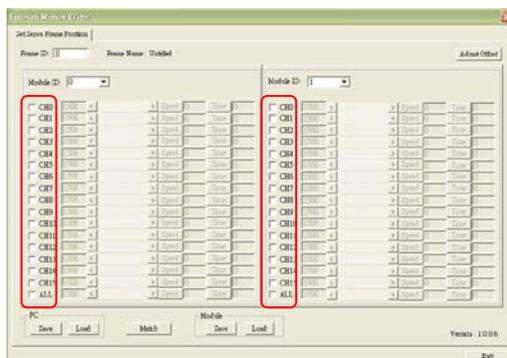
The message means that the program is being downloaded. Please do not remove the USB cable.

- vii. After the downloading is complete, a notification window will appear. Please make sure that each servo has been connected correctly. After confirming all the connections, please click “OK”. (If “Cancel” is clicked, the Motion Editor will be closed. If there is any component that is incorrectly connected at this moment, please click “Cancel” to terminate the program.)



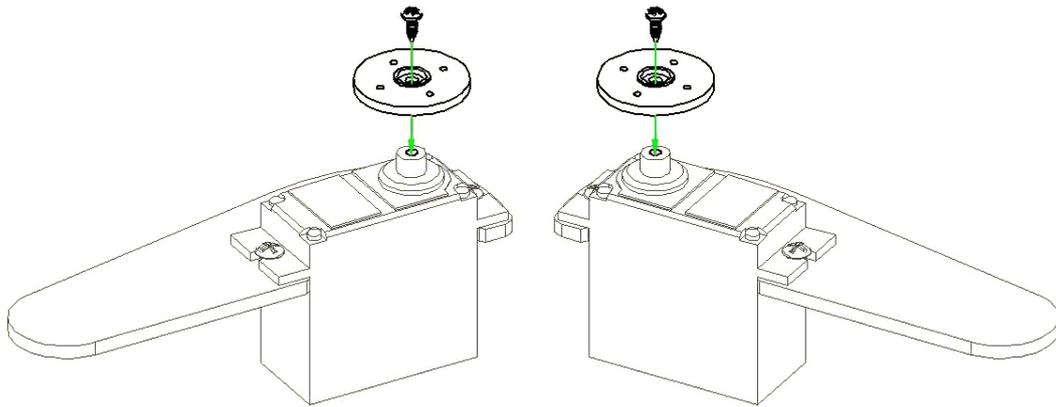
The message appears for notifying the download is complete. Please make sure that each component has been connected correctly.

- viii. Please check the checkbox for activating the servos on the left side to move all the servos to their central points. Please note that the number next to it should be 1500. If it is not 1500, please click the number directly, enter the number 1500 and then click “Enter”.

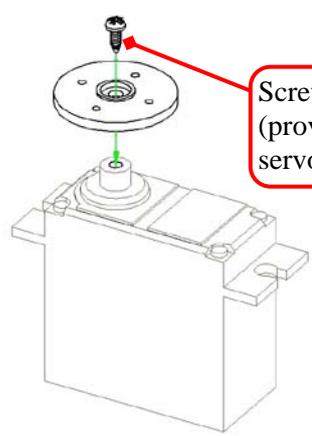


◆ Check if all servos are at the correct positions; Please maintain the servo at the same angle before the disk is fastened during the assembly. In case the disk is moved, please follow this adjustment procedure again to prevent from any unexpected movement or damage to the parts.

Step 3: Mount Servo Disks



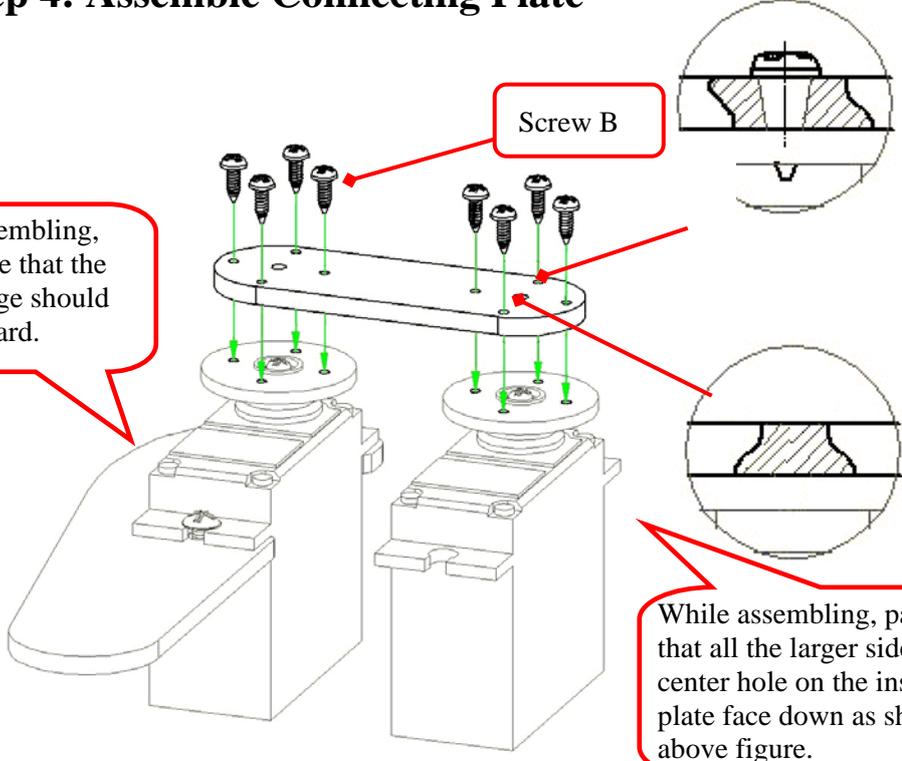
Notices during assembly: Please maintain the servo at the same angle before the disk is fastened during the assembly. In case the disk is moved, please follow this adjustment procedure again to prevent from any unexpected movement or damage to the parts.



Screws for servo disks (provided with the servo)

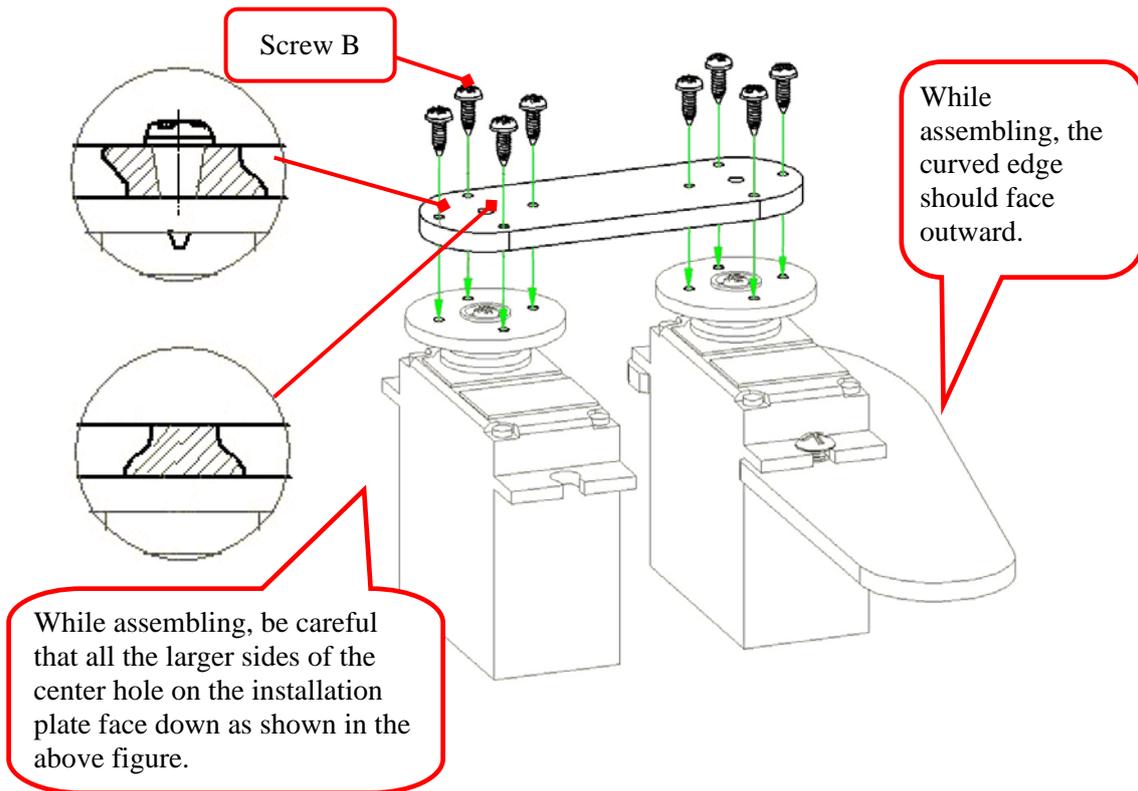
Step 4: Assemble Connecting Plate

While assembling, please note that the curved edge should face outward.

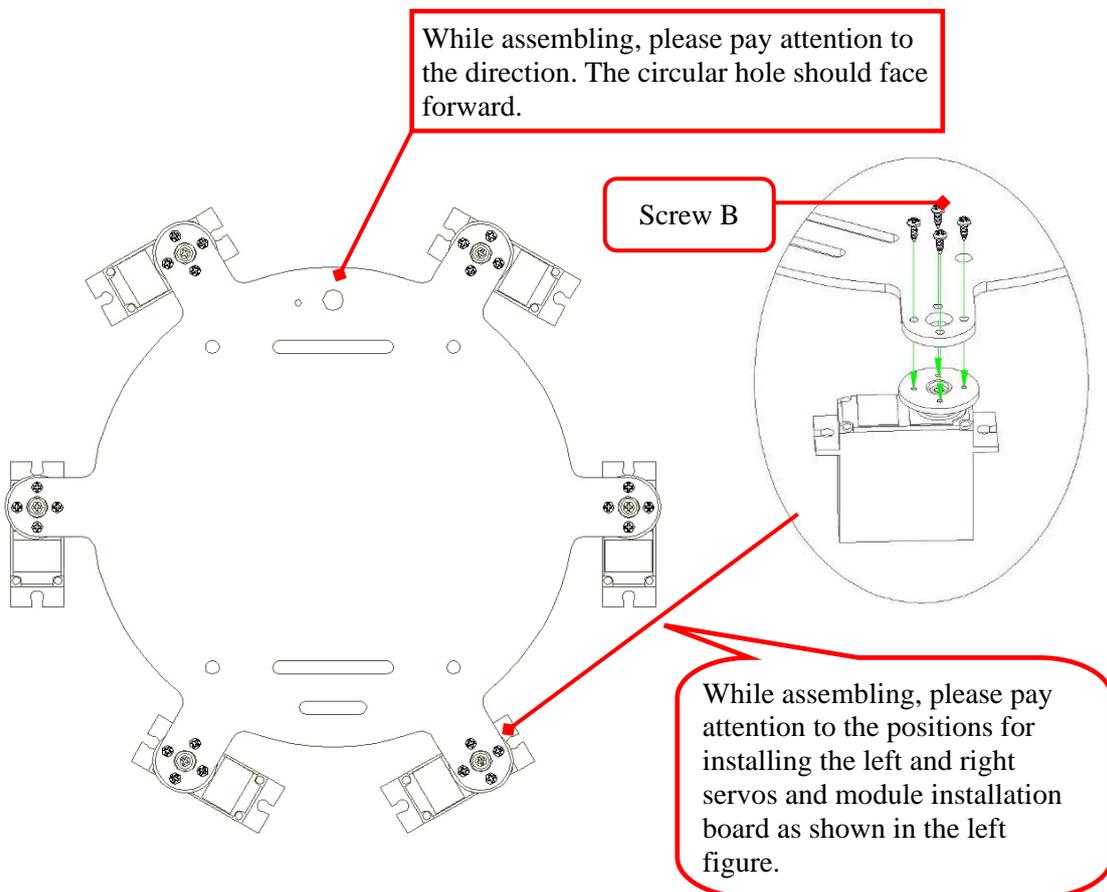


Screw B

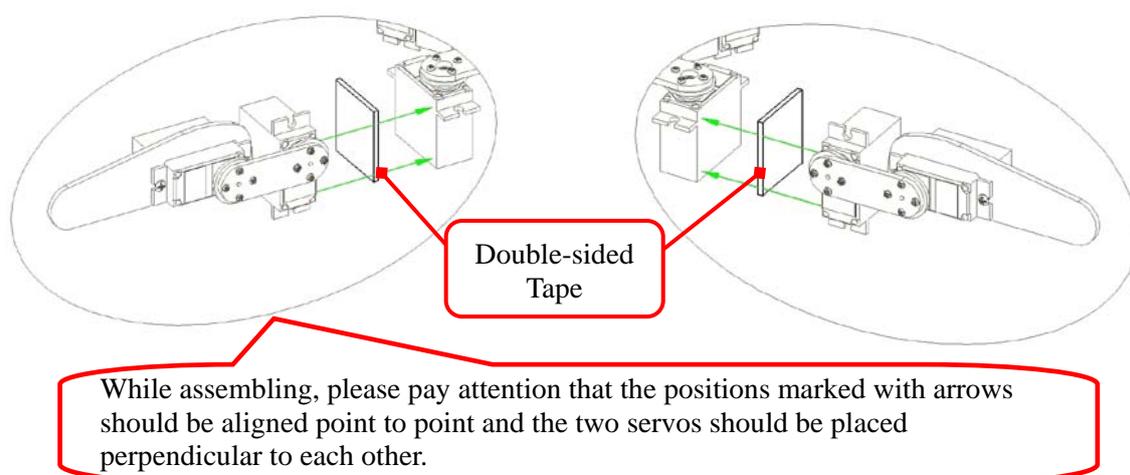
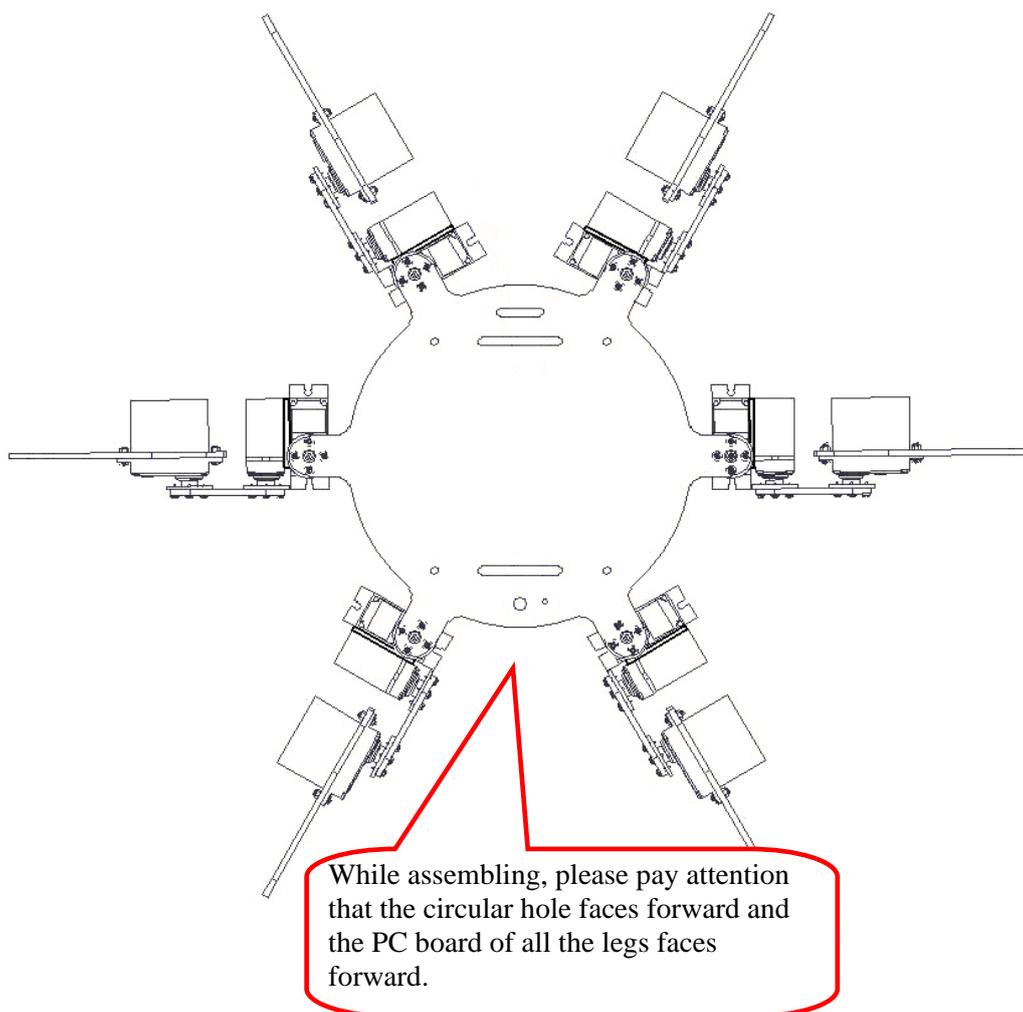
While assembling, pay attention that all the larger side of the center hole on the installation plate face down as shown in the above figure.



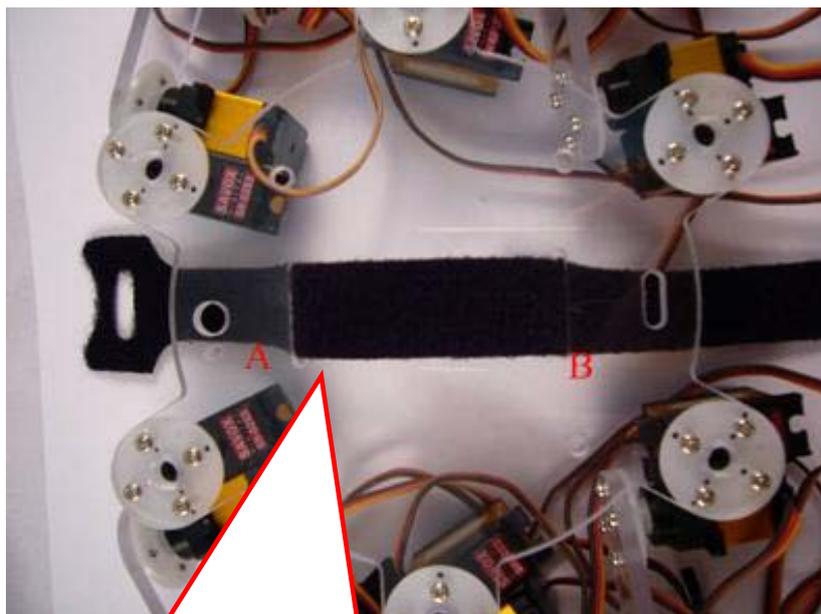
Step 5: Assemble the Module Installation Board



Step 6: Assemble the Module Installation Board and Legs



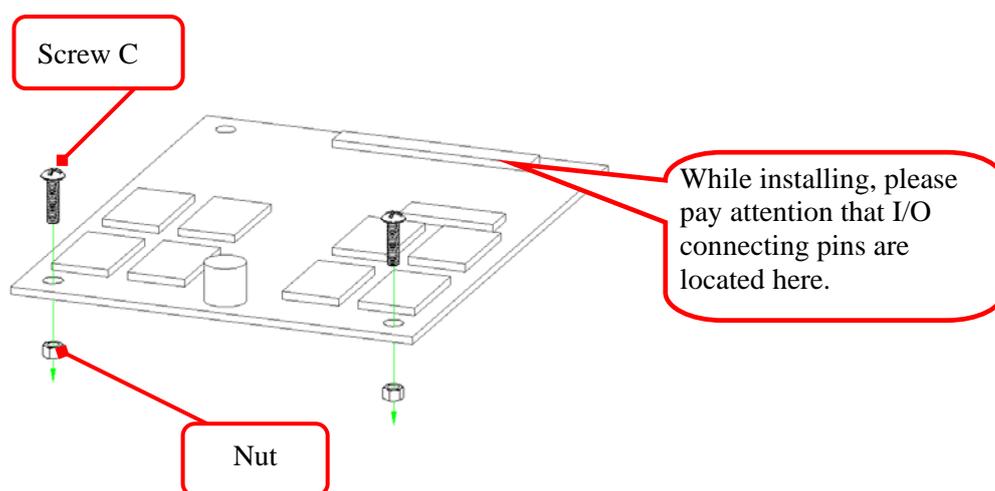
Step 7: Install the Velcro Cable Strap

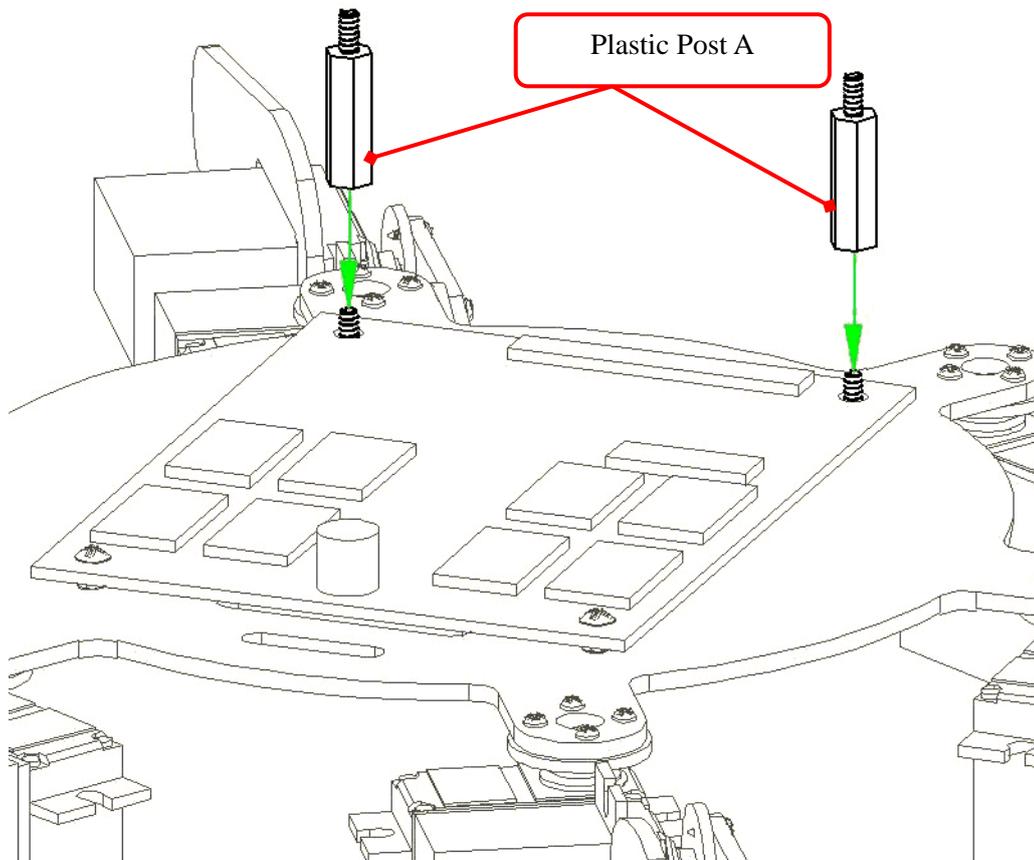
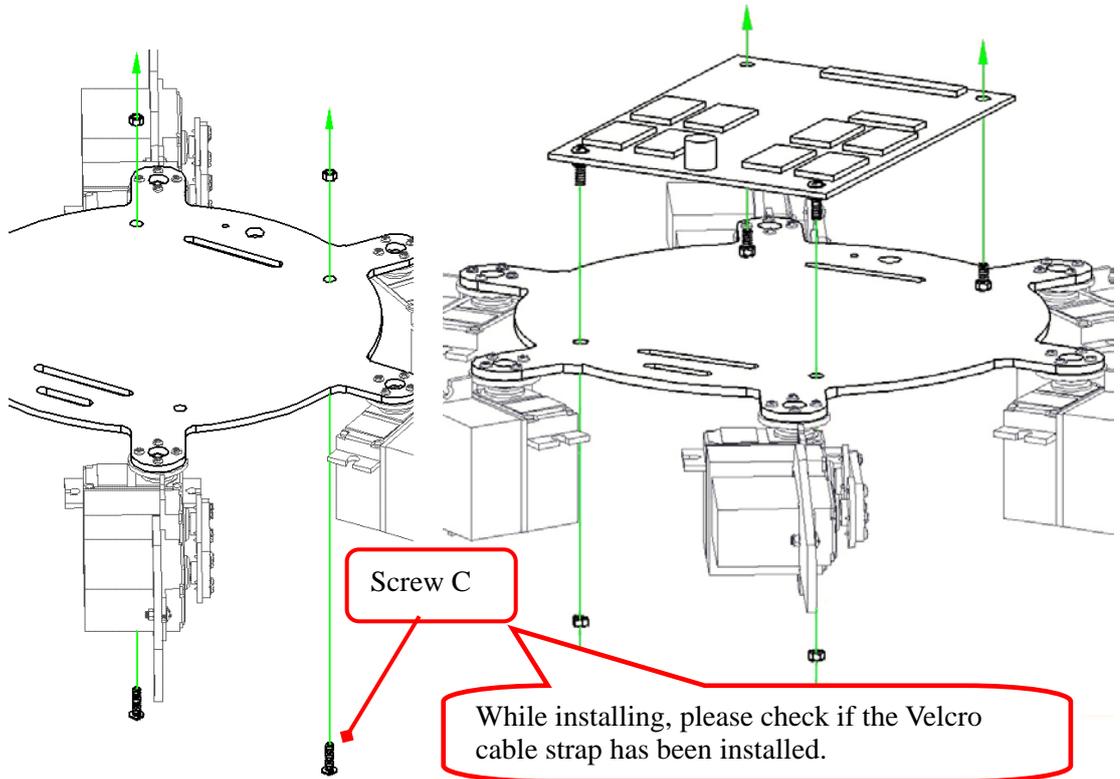


While installing the Velcro cable strap, please pass the strap upward through Point A on the Module Installation Board and then pass it downward through Point B.

Note: The two ends of the cable strap under the Module Installation Board should be balanced in length as shown in the above figure.

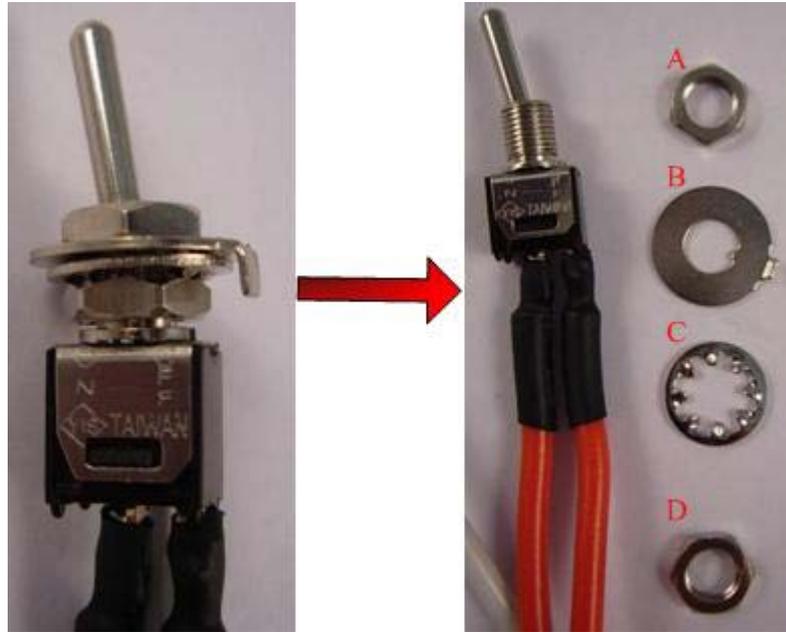
Step 8: Install Servo Commander 32.





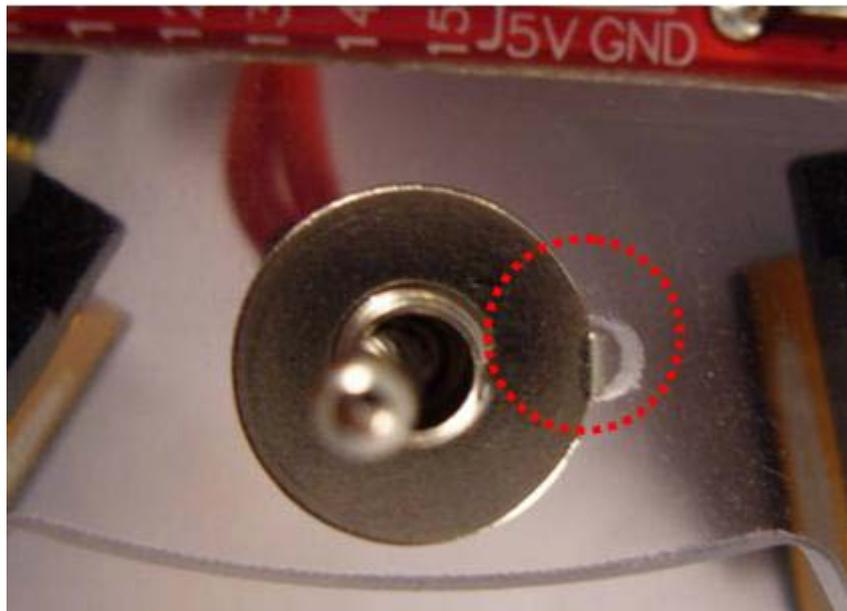
Step 9: Install the Power Switches

- A. Remove the nut and washers on the switch as shown in the following figure. It is disassembled into the Power Line with Switch, Nut A, Washer B, Washer C, and Nut D.

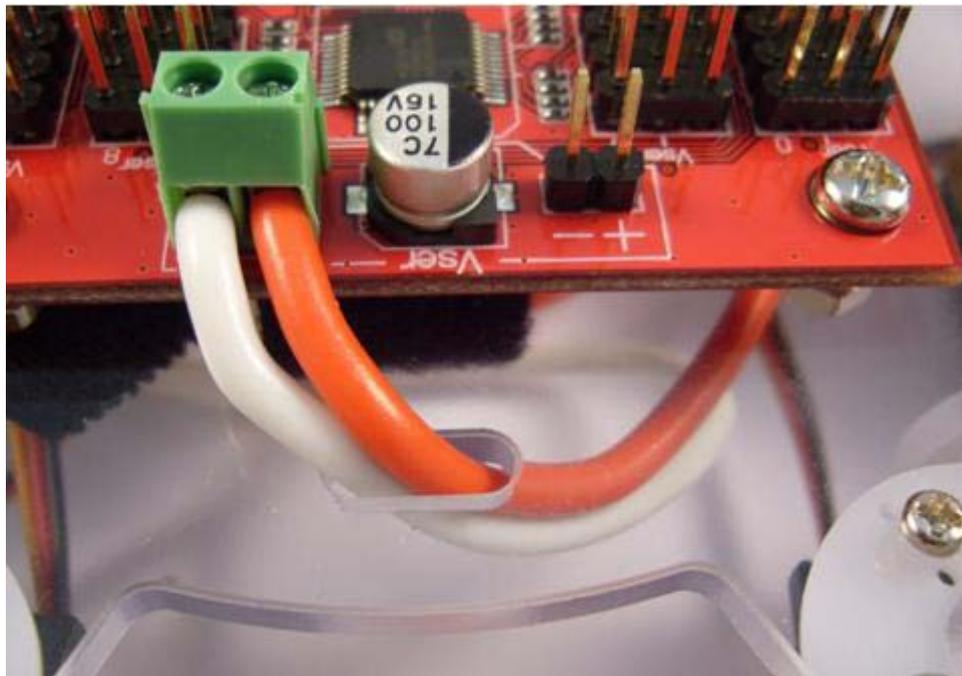


- B. Assemble them in the sequences of Nut A → Washer B → Module Installation Board → Power Line with Switch as describe above.

Note: While installing Washer B, please pay attention that the protruded part on Washer B should be hooked into the small hole on the Module Installation Board as shown in the following figure.

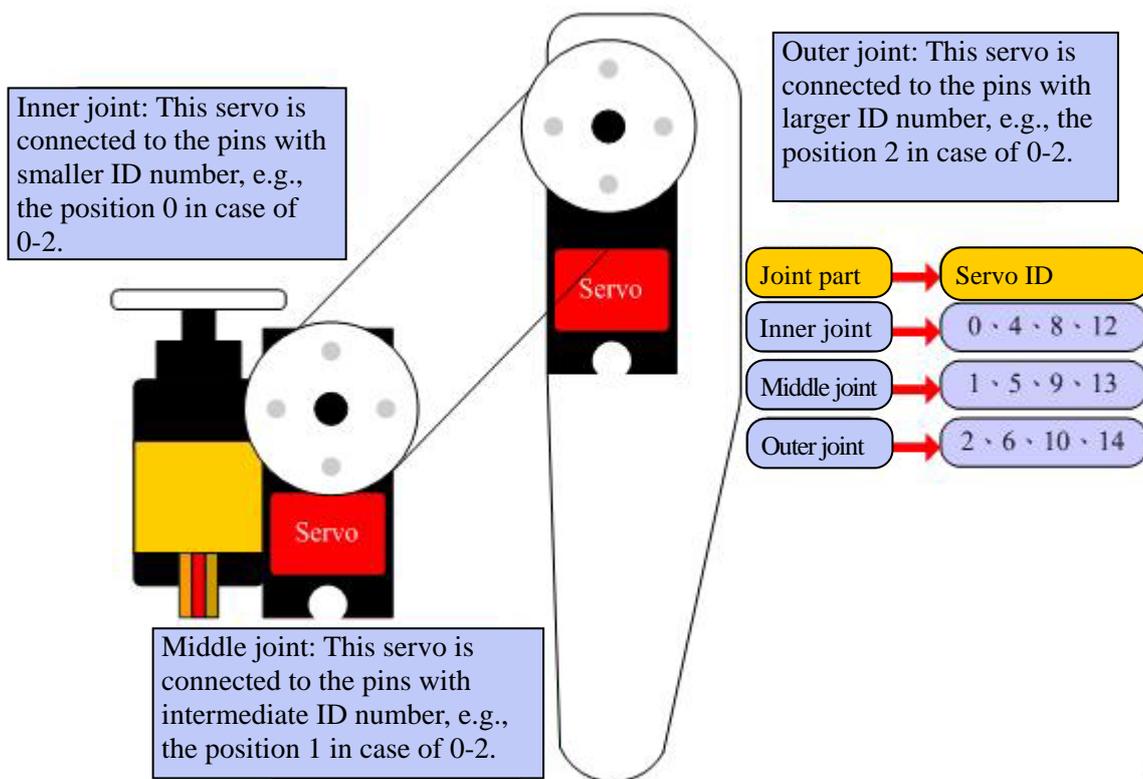


- C. Pass the red and white wires upward through the hole and then fix them into the power input terminals with the screws. While installing, please pay attention to the polarity. The red wire should be connected to the “+” terminal and the white wire should be connected to the “-” terminal.

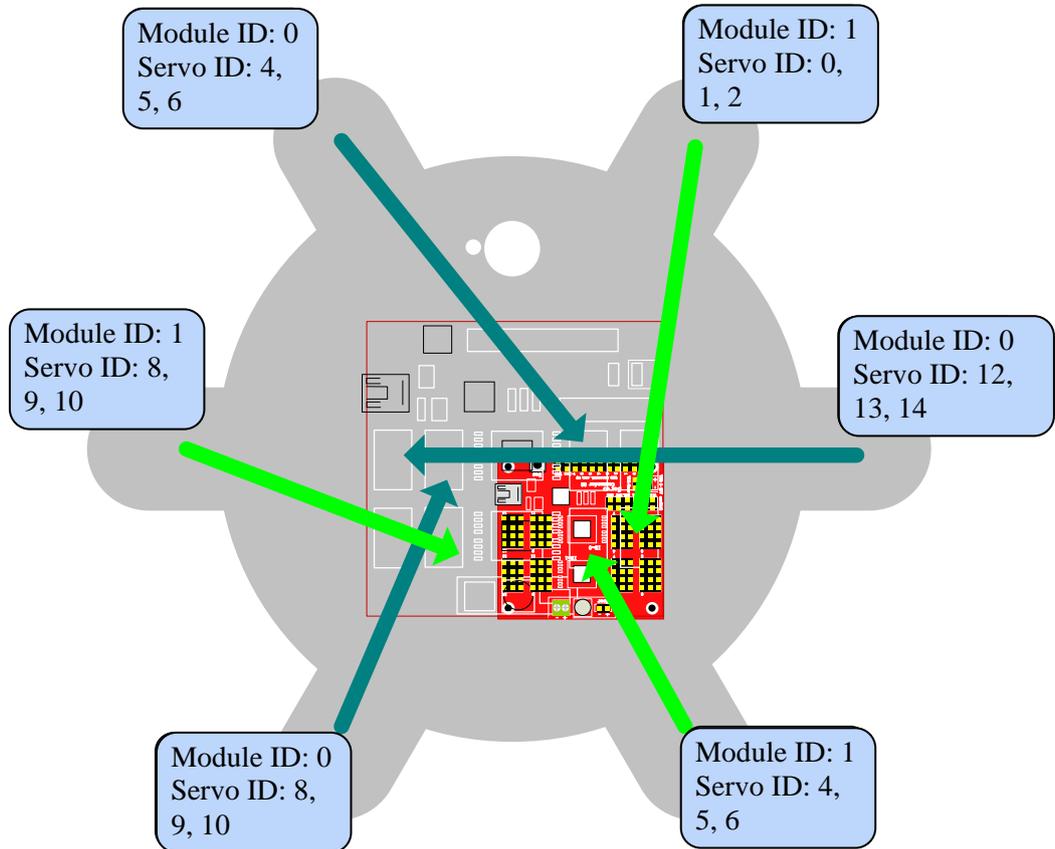


Step 10: Install Servo Wires to Servo Commander 32

Connect the control lines of each servo to the corresponding pins on Servo Commander 32. Please note whether the module IDs and servo IDs defined in the program agree with the module IDs and servo IDs on the Servo Commander 32 to be connected. The pin assignments for wire connection are as follows.

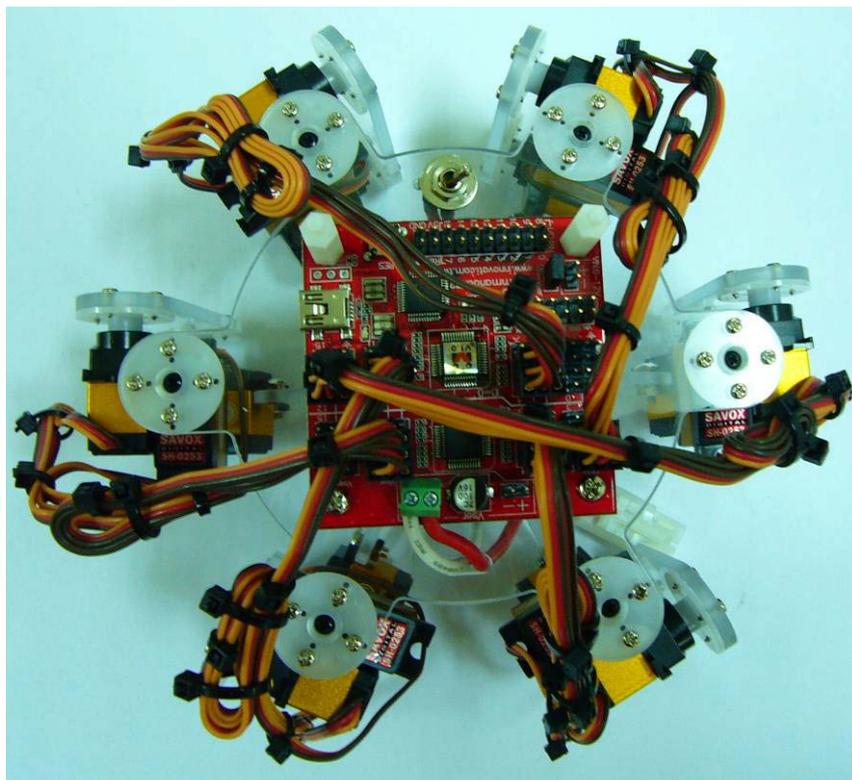


[Configuration of the IDs of the joints]

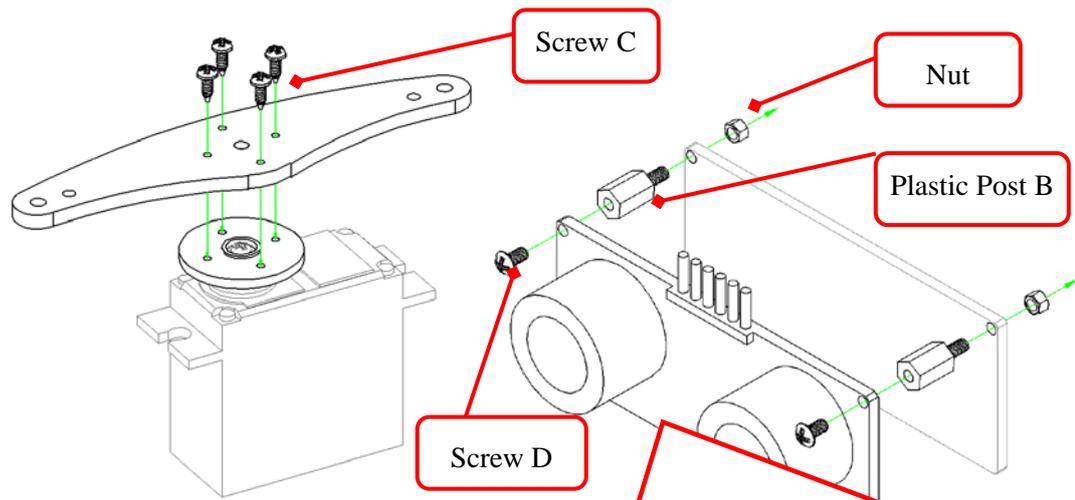


[Configuration of the pin assignments]

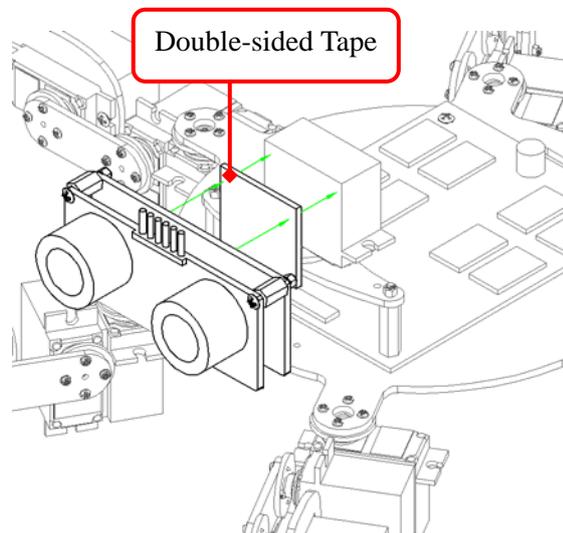
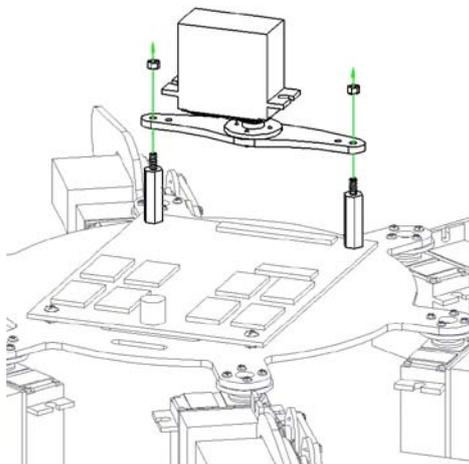
Note: The corresponding servo IDs are printed on Servo Commander 32. Pay attention that the orange (white) wire is the signal line, the red wire is the power line, and the brown (black) wire is the ground wire. Please connect these wires to the corresponding positions marked on the module to avoid damage to the module and then arrange the wires orderly as shown in the following figure.



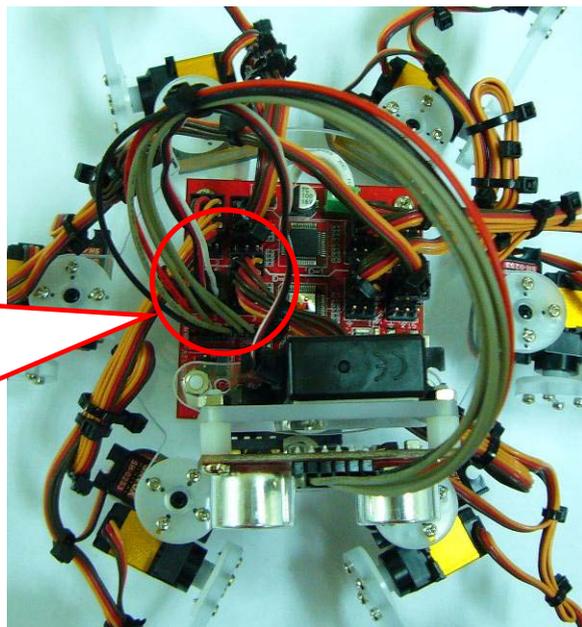
Step 11: Install the Sonar Module



While installing, please pay attention to adjust the ID of the sonar module to 3 according to Note 1.



After the installation is completed, connect the wires of the head servo to Pin 3 of Module 0 on Servo Commander32 and then connect the cmdBUS. While installing, please pay attention to the polarity as shown in the right figure.



3. Fine-tuning Initial Values of Servos

There might be some positioning errors in each servo that are possibly caused by installation or mechanical errors. Therefore, before assembling and installing, it is necessary to perform the adjustment so as to allow the follow-up operations to be positioned correctly.

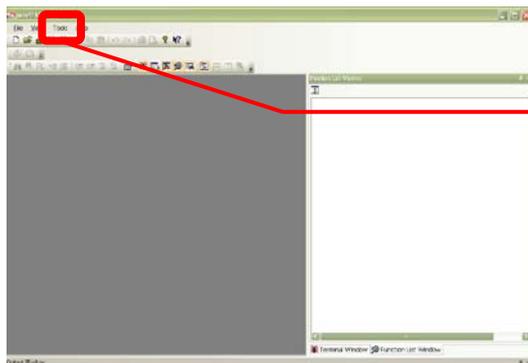
Fine-tuning in Software:

1. Connect the PC and the Servo Commander 32 on the Mini hexapod Robot with the USB line.
2. Connect the power line of the servo to the power supply (Please make sure that the voltage and current from the power supply are within the range required by the servo. After connecting the power line, the servo will make a transient motion after receiving the switch surge, which is normal. While connecting the power cord, please pay attention not to place your hands within the space where the servo will move into to avoid being clamped.)
3. Start innoBASIC Workshop.



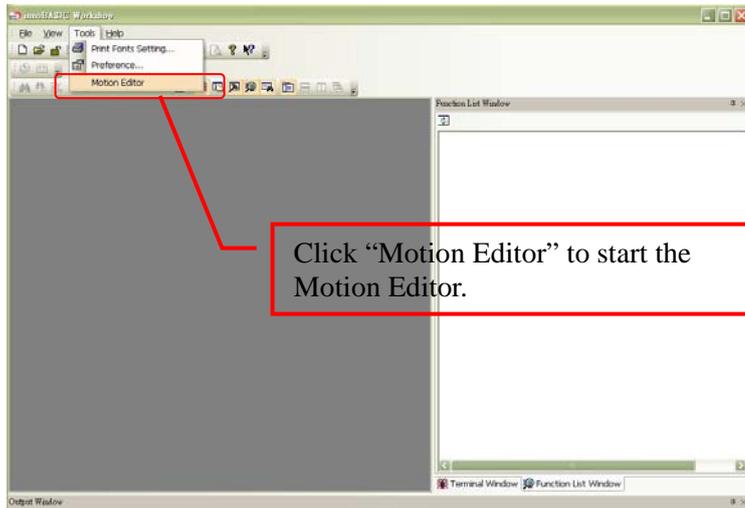
Click the application under the innoBASIC Workshop folder to start the innoBASIC Workshop.

4. Click “Tool” in the menu bar on the top.



After clicking each item, a pull-down menu with more function items will be displayed. Please click the “Tool” item.

5. Click the “Motion Editor” in the pull-down menu. (If a warning window appears, it means that the BASIC Commander is not correctly connected. Please check if the USB line is connected or unplugged, and then plug it again to ensure a correct connection. Exit the Motion Editor and then re-click this button.)



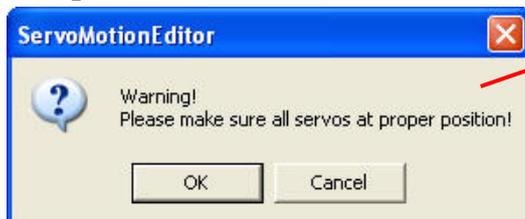
If this message appears, it means that the USB line is not connected correctly.

6. If the connection is correct, the message “Downloading Editor Program...” will be displayed on the PC screen meaning that the program is being downloaded. Please wait a moment.



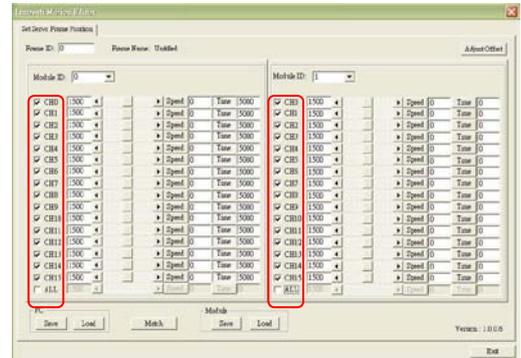
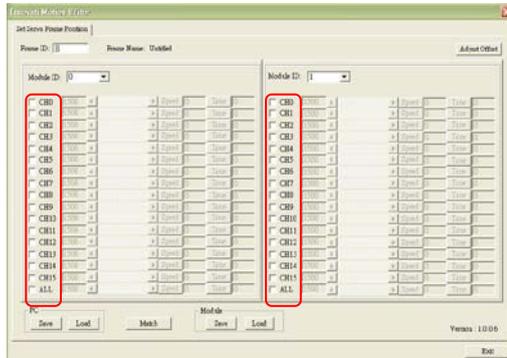
The message means that the program is being downloaded. Please do not remove the USB line.

7. After the downloading is completed, a notification window will appear. Please make sure that the fine-tuning of the mechanical parts has been performed successfully. After confirming all the mechanical parts are correctly assembled and tuned, please click “OK”. (If “Cancel” is clicked, the Motion Editor will be terminated. If the mechanical part is not correctly assembled at this moment, please click “Cancel” to terminate the program.)

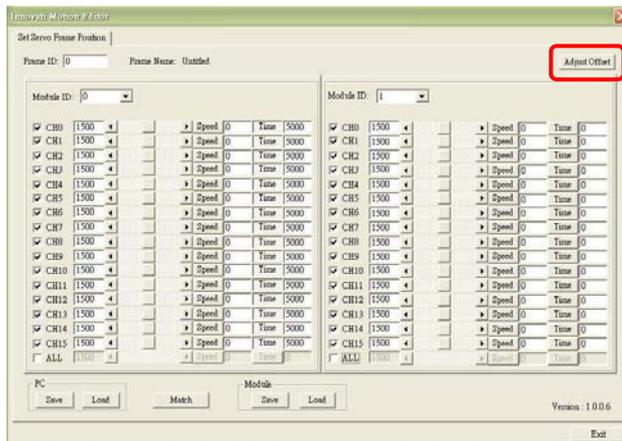


The message appears to notify that the download is complete. Please make sure that the servos have been connected correctly at the specified positions.

8. Please pay attention not to place your hands within the space where the servos may move into to avoid being clamped. Please check the checkbox for activating the servos on the left side one by one to move all the servos to their central points. Please note that the number next to each checkbox should be 1500. If it is not 1500, please click the number directly, enter the number 1500 and then click “Enter”.



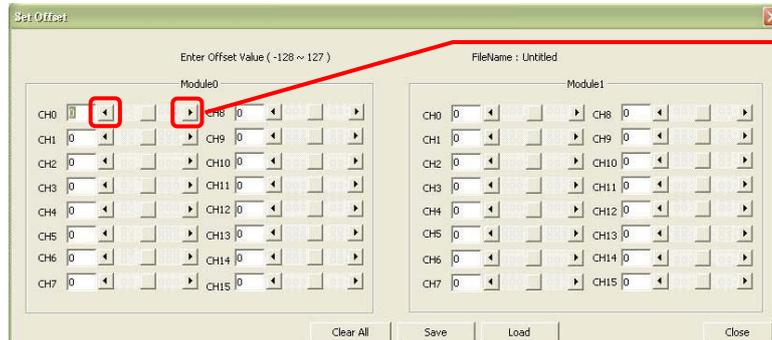
9. Click the “Adjust Offset” button at the upper right corner.



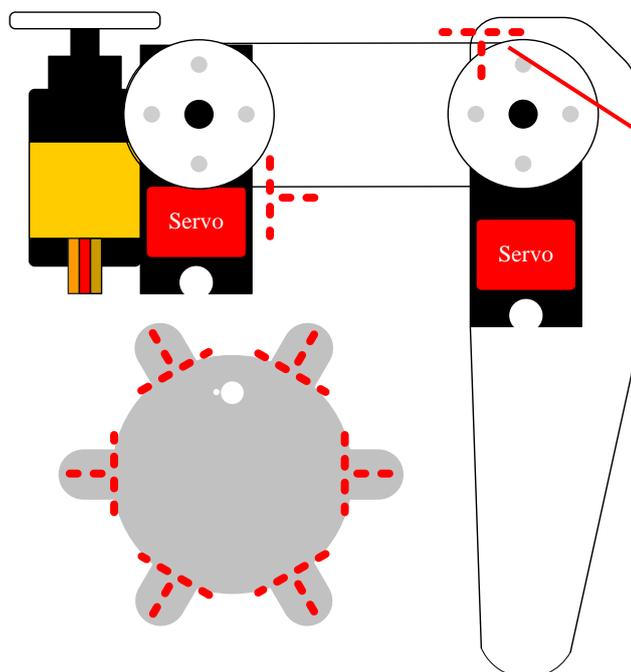
10. If the fine tune values are not yet stored, the Filename will be “untitled”. The user can specify a preferred name while storing the file.



11. Observe the servo that requires the fine tune and click the corresponding arrow buttons. The servo will rotate in the selected direction. Please make sure that the rotation is in the correct direction. If the reverse rotation is required, click the opposite arrow button. Adjust each servo to its central point one by one.



The left/right arrow buttons can be used to rotate the servo clockwise or counterclockwise. Please observe the rotation of the servo to the required central position. Then adjust the next servo.

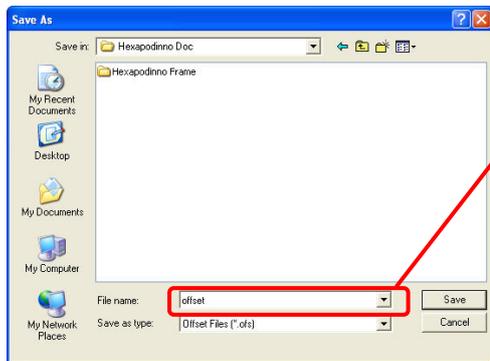


During fine-tuning, the parts shown in the figure with red marks should be adjusted to become perpendicular so as to evenly distribute the force to each leg and make them balanced.

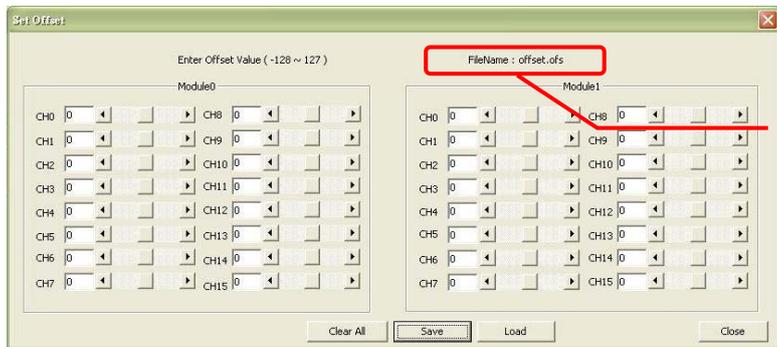
Note: If the fine tune is not able to make them perpendicular. The user can perform the adjustment described in Step 4 again.

12. Please write down the values after the fine tune. Click “Save”, select the location for storing the file, enter a preferred filename, and then click OK to save the values in the PC.



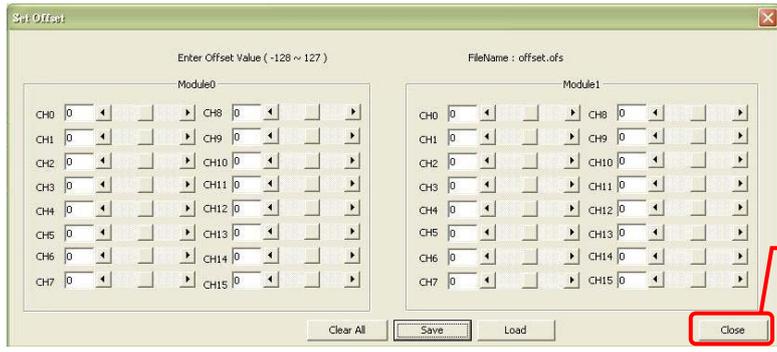


Please enter a preferred name in the “filename” and then click “Save”.



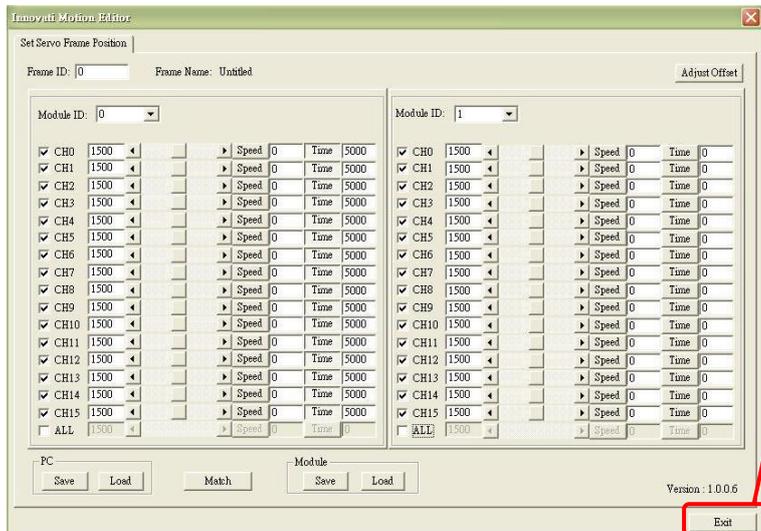
After the file is successfully stored, the filename of the last stored file will be displayed in the “Filename”.

13. Click the “Close” button at the lower right corner to close the window.



Click the “Close” button to close the window.

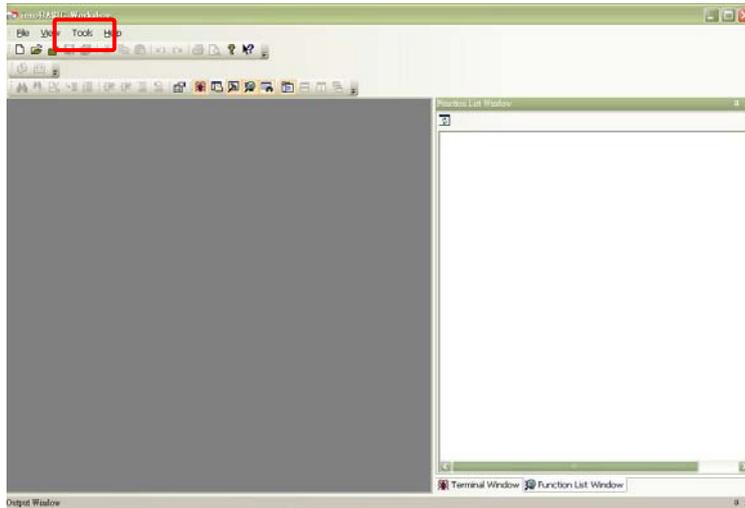
14. After returning the “Set Servo Frame Position” window, click the “Exit” button at the lower right corner to close the fine tune operation.



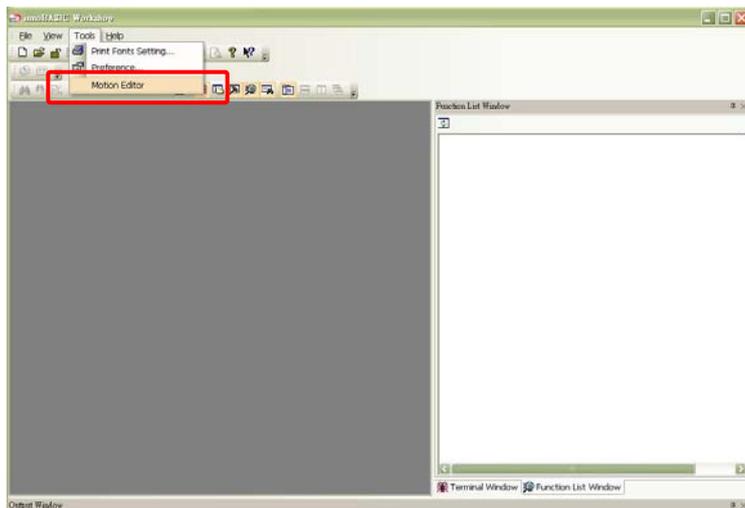
Click the “Exit” button to close the Motion Editor.

4. Perform Demonstrative Motions

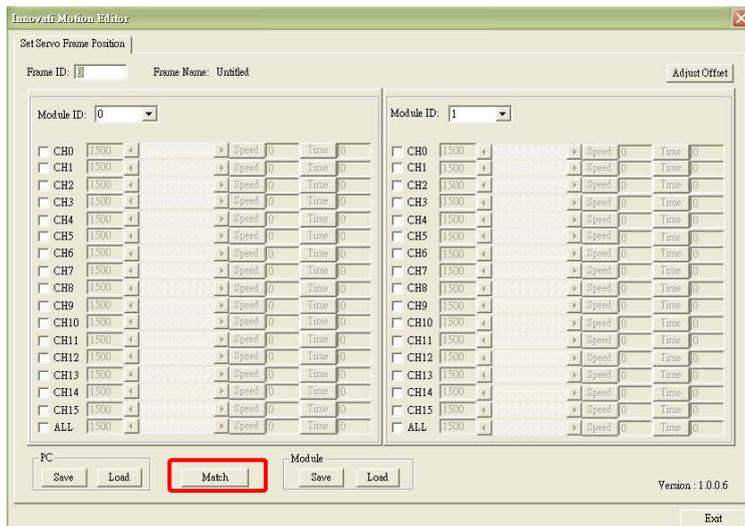
1. Please copy the folder “Mini 6-Legged Robot Documents” to the PC.
2. In the innoBASIC Workshop, click “Tool” in the menu bar on the top.



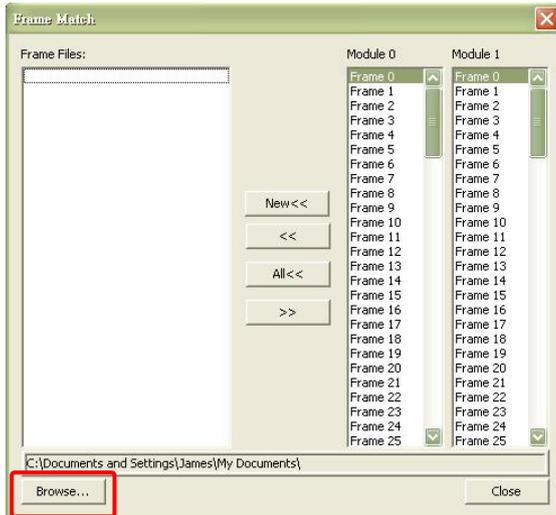
3. Click “Motion Editor” in the pull-down menu.



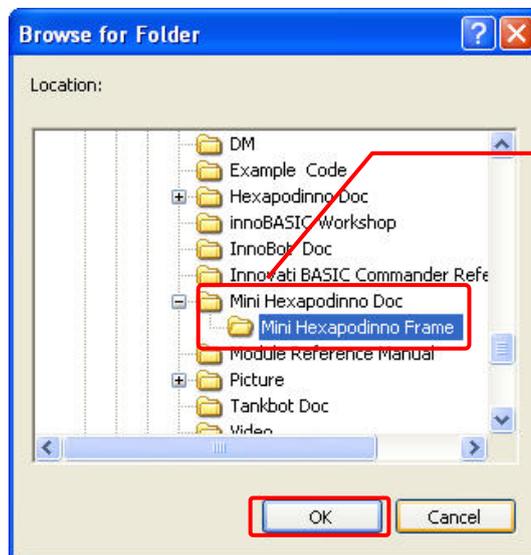
4. Click the button “Match” at the bottom of the Motion Editor.



5. Click the “Browse” button at the lower left corner.

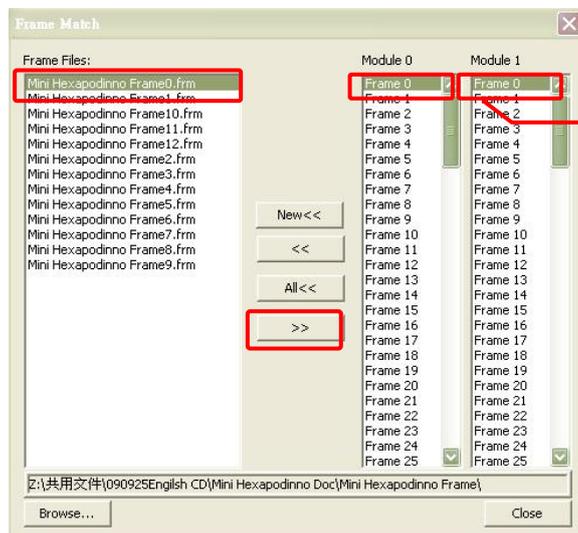


6. Set the “Browse” folder to the “Mini Hexapodinno Frame” folder under the “Mini Hexapodinno Doc” folder and then click the “OK” button.



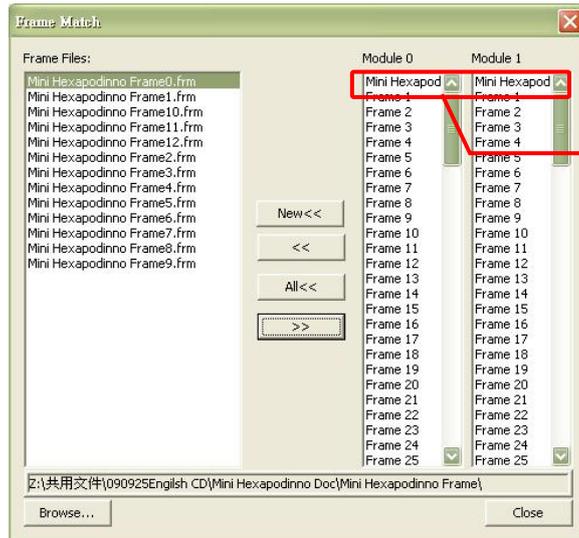
The selected folder will be highlighted. Please make sure that the selected folder is “Mini Hexapodinno Frame”.

7. Please click the “Mini Mini Hexapodinno Frame0.frm” below the motion files on the left side, click the “Frame 0” under the Module0 and Module1 and then click the “>>” button.



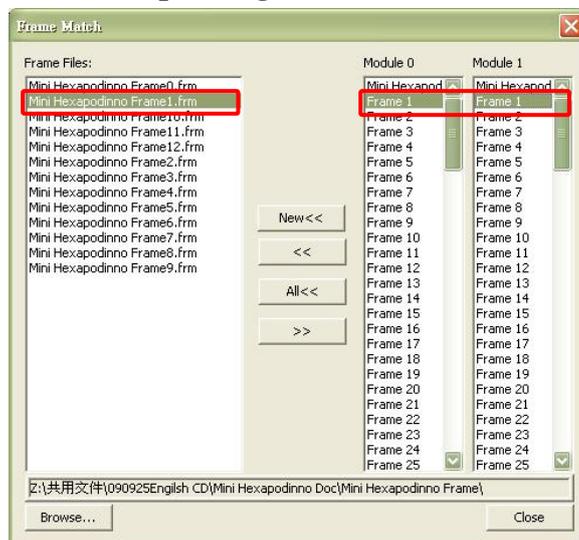
Before clicking the “>>” button to download the motion file into the module, please make sure that the “Frame0” under the Module0 and Module1 has been selected and highlighted.

8. Make sure that the “Frame 0” under the Module0 and Module1 has become “Mini Hexapodinno Frame0”.

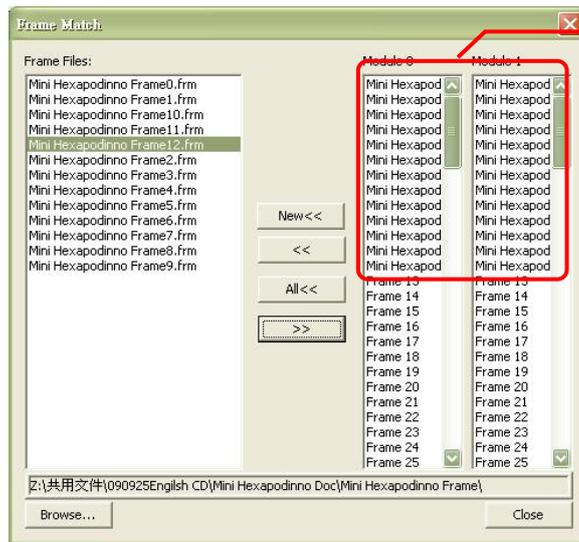


After the download is complete, the original text “Frame 0” will turn into “Mini Hexapodinno Frame0”.

9. Now click the “Mini Hexapodinno Frame1” below the Motion File and “Frame 1” under the Module0 and Module1 as the two steps describe above. Repeat the operation for all the motions until Frames 0-12 have been downloaded to the corresponding frames.

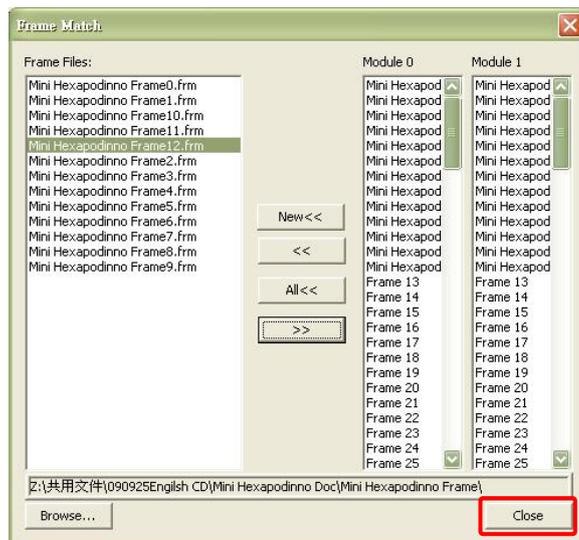


10. After all the download operations are complete, it is clear that all the motions above Frame13 under the Module0 and Module1 have been changed to the corresponding motions.

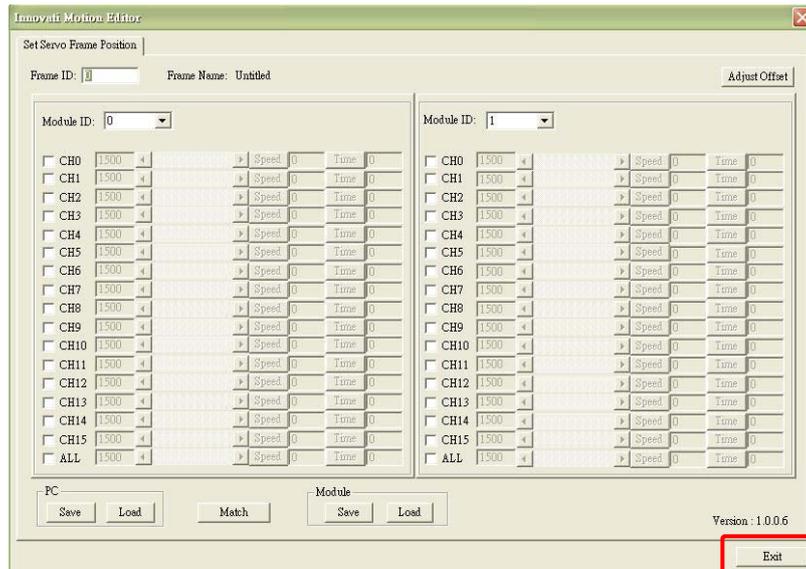


Please make sure that first 13 Frames have been successfully downloaded.

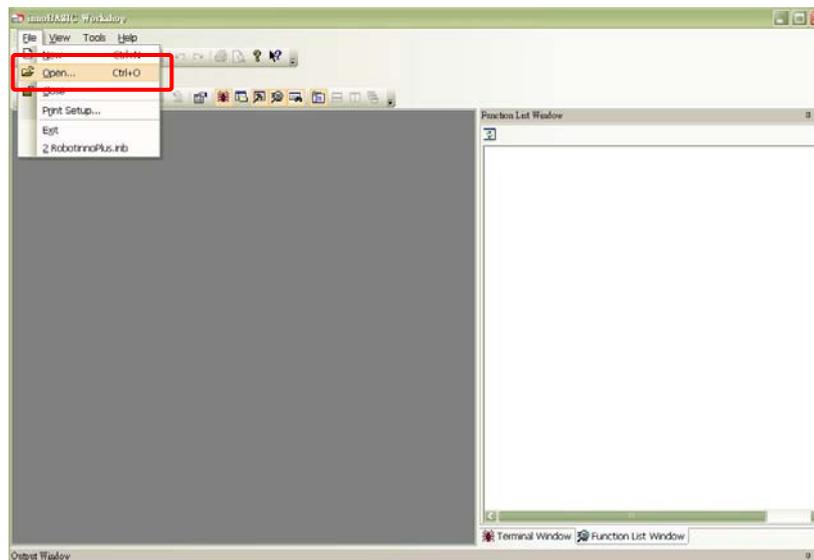
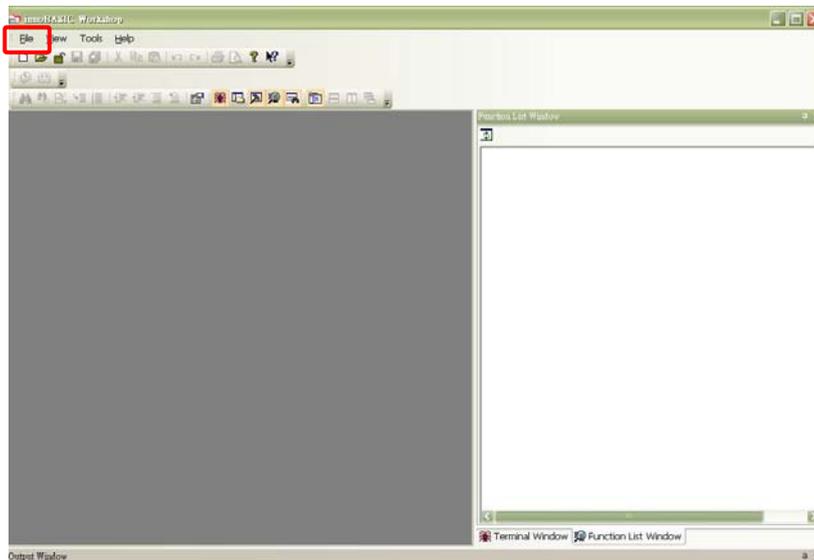
11. After the verifying the operations, click the “Close” button at the lower right corner to close the window for setting the corresponding motions.



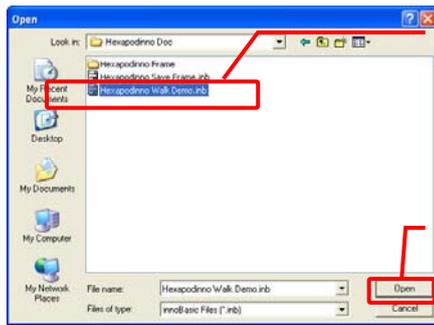
12. In the Set Servo Frame Position window, click the “Exit” button at the lower right corner to close the Motion Editor.



13. Click “File” in the menu bar and click “Open”.



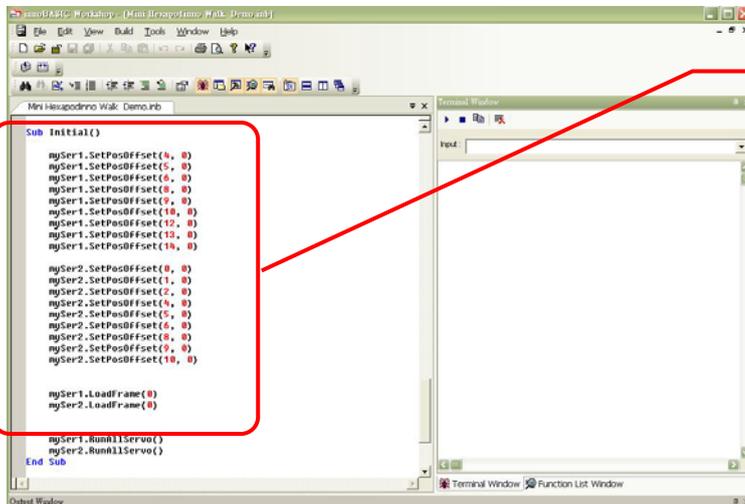
14. Please select the “Hexapodinho Walk Demo” in the folder and click “Open”.



The selected folder will be highlighted. Please make sure that the selected folder is “Hexapodinho Walk Demo”.

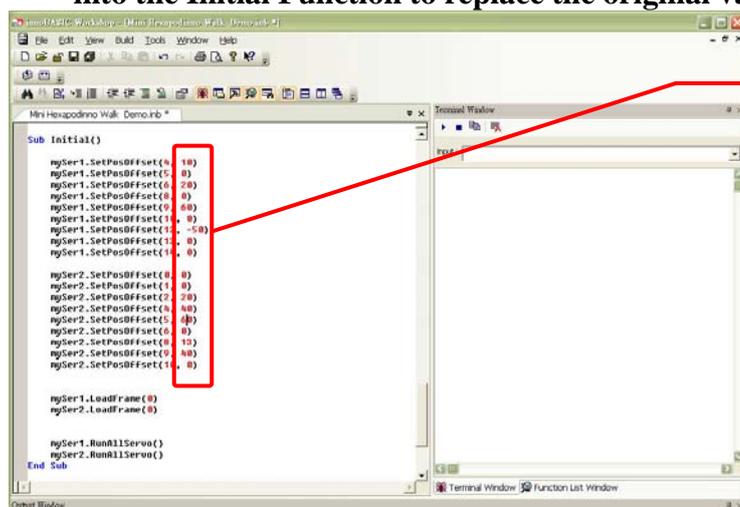
Click the “Open” button to download the program into the innoBASIC Workshop for editing or creating motions.

15. Move to the 141st line of the program to see the Initial Function. (To move within the program, the user can also click the mouse button at any position in the program and then rotate the mouse wheel to scroll to the program page.)



The number on the left side represents the line number of the program. The Function starts at “Sub” and ends at “End Sub” within which the operations are defined to store the fine tune values into the module. At the beginning of each program, it is necessary to set the fine tune values.

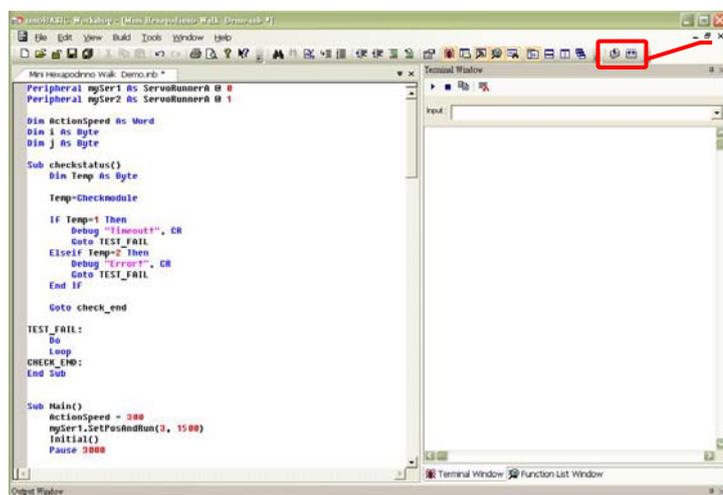
- Update the fine tune values, which are recorded during the software fine tune, into the Initial Function to replace the original values of "0".



The SetPosOffset command has two parameters: one is the Servo ID and the other is the fine tune value. Please enter the fine tune value according to the value recorded for each servo ID. The number in the figure is arbitrarily defined, Please do not enter the same number as shown in the figure.

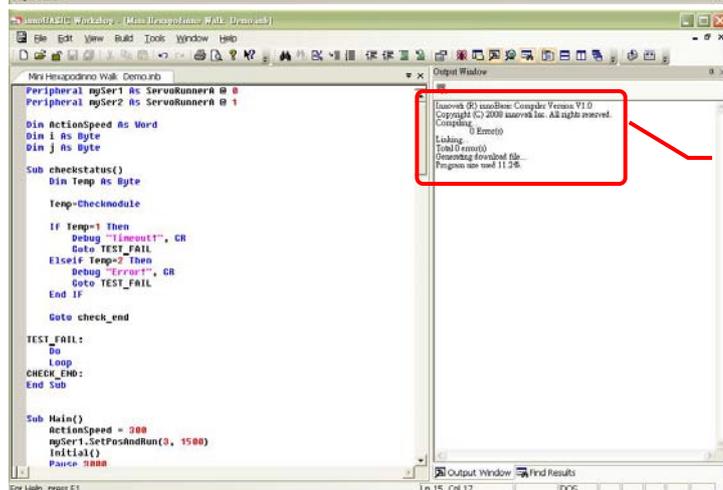
- Turn off the power switch to prevent the Mini Hexapodino from starting the motion directly after the program is successfully created.

- Press the "Build" button and wait until the download is complete.



If the user is not sure about the function of each button, the user can move the mouse pointer over the image. After a while, the English name will automatically appear. After clicking the "Build" button, the program will be downloaded into the BASIC Commander and stored automatically.

According to the layout, the "Build" button may appear at different position.



After the download is complete, the output window will display the used memory space. If there is any error, it will be displayed in the output window. Please make sure that no error is displayed in the output window.

- Remove the USB line that has been connected to the Mini 6-Legged Robot and place the Mini 6-Legged Robot at a location prepared for performing the motion operations.
- Turn on the DIP switch. The Mini 6-Legged Robot will perform a forward movement according to the demonstration program.