RoboCrawler has been designed carefully for safety purposes. However, any electrical device, if used improperly, has the potential for causing fire, electrical shock or personal injury. To help ensure safe operation, follow these guidelines:

**WARNING**

**CHOKING HAZARD - Small Parts**
Not for children under 3 years.

This product must be assembled by adults or under the supervision of adults.

Packaging contains important information and must be retained for future reference.

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**After the RoboCrawler was assembled, follow the procedures below for quick startup check.**

- Observe all warnings, precautions and instructions.
- Regularly inspect the battery pack for damage.
- Stop using, disconnect the battery pack immediately if RoboCrawler functions in an abnormal manner, produces unusual sounds or smells or becomes too hot to touch.

Follow these procedures for quick startup check:

- Make sure the power switch is "OFF".
- Connect the battery pack to the power lead inside battery compartment.
- Use the magic tape to tighten the battery onto the battery compartment.

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RoboCrawler is not a toy.
- Remember that safety is the most important thing. Always keep the User Guide at hand for quick reference.
- Should there be any inconsistencies between the English and Chinese versions, the English version shall prevail.

⚠️ This model is suitable for people of 15 or above. Keep RoboCrawler and its parts away from children. Supervision is required for inexperienced user.
Follow these procedures for quick startup check

- Insert two AAA (1.5V) batteries into the IR remote controller. The battery compartment is at the back of the controller.
- Hold the RoboCrawler body upside down, then switch the power on.
- Wait for a few seconds until all servos are moving to places.

⚠️ It will take a few seconds for RoboCrawler to activate.

- Turn RoboCrawler over and let the legs pointed to the ground.
- Put RoboCrawler on a rigid, flat and level surface.

⚠️ When losing balance, it will fall down and may cause damage or injury.

If you are operating RoboCrawler on a table, make sure it will not fall from the table to the ground below. While RoboCrawler can survive most falls on level surface as a result of unbalanced movements, dropping from an altitude will definitely damage some servos.

⚠️ RoboCrawler performs better on wooden floor. Avoid operate it on rough surfaces such as carpet and avoid operate it on slippery surfaces such as glass.
The jumper have to be plugged on three different positions of 2-pin slot on the PCB board in order to provide correct functioning, tuning, RF remote normal function situation and Infra Red Remote normal function situation.

So pay attention for the position where the jumper is being located.

After changing the jumper position, switch on the power again to activate the new setting.
Features:

1. 8 servos for 8 degrees of freedom for the legs.
2. Each motion routine can have up to 30 sequences, and each sequence can have up to 15 poses.
3. Sequence and pose can be reused for other motions to save flash memories.
4. One motion routine can have up to 450 pose transitions.
5. RS232 serial connection to PC for motion programming and execution.
6. IR Hand held remote to execute the user created program motions.

Package Informations
Name: RoboCrawler
Height: 3.25" ~ 5.25" (82mm ~ 132mm)
Weight: 21.5 oz. (610g) with batteries
Included: Complete hardware with 8 servos, 8MHz controller, IR remote control, graphical motion editor software

Hardware Features
Controller:
- ATmega32 -16PU
- Interrupt Driven kernel for RF remote and Servos handling
- 12 servo channels
- 20 I/O interface for add on hardware
- 8KB flash for more than 300 user motions

Power:
- provide regulated 5V DC and unregulated 6V ~ 7.2V DC for add on hardware

Software Features
- Graphical User Interface
- Fine tune the servo setting
- Create motion routines
- Pose can be reused by other sequence to save storage
- Sequence can be reused by other routine to save storage
- User can use the PC to run the motion step by step to create the motion
- Download the motion and setting to RoboCrawler
- Once download, motion can be run through the IR remote controller
- Motion routines can be shared among user by exporting the routines to a motion file
- User can run other's motion by importing the motion file

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Building the RoboCrawler

Parts to assemble RoboCrawler

Servos

Servo SV4031A x 4 pcs
(Length of wire: 125mm)
- L LEG x 1
- R LEG x 1
- L LEG x 1
- R LEG x 1

Servo SV4031B x 4 pcs
(Length of wire: 200mm)
- L LEG x 1
- R LEG x 1
- L LEG x 1
- R LEG x 1

Plastic Parts

Servo Bracket
PLR100001 x 4 pcs
- BODY x 4

Servo Bracket
PLR100002 x 4 pcs
- L LEG x 1
- R LEG x 1

Servo Attachment A
PLR100003A x 4 pcs
- L LEG x 1
- R LEG x 1

Servo Attachment B
PLR100003B x 4 pcs
- L LEG x 1
- R LEG x 1

Washer
PLR100004 x 8 pcs
- L LEG x 1
- R LEG x 1
- BODY x 4

Servo Horn
PLR100010 x 8 pcs
- L LEG x 1
- R LEG x 1
- BODY x 4

Collar
PLR300002 x 4 pcs
- L LEG x 1
- R LEG x 1
- BODY x 4

Wire Bracket
PLR1000WB x 4 pcs
- L LEG x 1
- R LEG x 1

Shield
PLR300001 x 1 pc
- BODY x 1

Wooden Parts

Claw
WR3000030 x 4 pcs
- L LEG x 1
- R LEG x 1

Receiver Holder
WR3000020 x 1 pc
- BODY x 1

Main Body
WR3000010 x 1 pc
- BODY x 1

Before assembling, please check the right amount of each part included.
RoboCrawler

Building the RoboCrawler

Metallic Parts

- **HWD2xD5** x 12 pcs
- **PA2x6** x 12 pcs
- **PA2x3** x 8 pcs
- **PA1.7x7** x 8 pcs
- **PA2x5** x 40 pcs
- **PA2.5x8** x 8 pcs
- **KA2x6** x 16 pcs
- **PA2x28** x 28 pcs
- **PA2x32** x 8 pcs

- **L LEG** x 2
- **R LEG** x 2
- **L LEG** x 2
- **R LEG** x 2
- **BODY** x 12
- **L LEG** x 2
- **R LEG** x 2
- **L LEG** x 2
- **R LEG** x 2
- **L LEG** x 1
- **R LEG** x 1
- **L LEG** x 1
- **R LEG** x 1
- **BODY** x 4
- **L LEG** x 6
- **R LEG** x 6
- **L LEG** x 6
- **R LEG** x 6
- **L LEG** x 2
- **R LEG** x 2
- **L LEG** x 2
- **R LEG** x 2
RoboCrawler

Building the RoboCrawler

### Others

- **Mounting Tape**
  - MS7513K01 x 1 pc
  - BODY x 1
  - (12.7 x 250) mm

- **RoboPhilo Controller**
  - RBMB07V01 x 1 pc
  - BODY x 1

- **Battery Box**
  - RBCA00001 x 1 pc
  - BODY x 1

### Infra Red Remote

- **Serial Port Cable**
  - RBCA00001 x 1 pc
  - BODY x 1

- **Spiral Cut Tubing**
  - RBPTB003 x 4 pcs
    - L LEG x 1
    - R LEG x 1
    - L LEG x 1
    - R LEG x 1

### Optional Parts

- **Philo Junior Wireless Remote Set**
  - RBWLC001 x 1 set
  - BODY x 1

- **Double side tape**
  - TD8006002 x 1 pc
  - BODY x 1

- **AA Battery** (not included)
  - x 5 pcs
  - BODY x 1 set

---

### Before assemble LEGS

The configuration of left forward leg and right rear leg are the same while right forward leg and left rear leg are the same.

You should notice that and separate for assembling accordingly.
Step 1  Remove the bottom plate of SV4031A

Losen the screws PM2x27 of the servo SV4031-A.

Step 2

Assembled the PLR100002 with PLR100003A with the screws KA2x6 properly.

Over tightening screws will damage the parts. After turning the screw to bring the two parts in contact, add 1/16 of a turn will hold the parts tight.
Step 3

Assembled Servo SV4031A with PLR100003A as shown with screw PM2x28.

Chamfer is located at this side.

Step 4  Remove the bottom plate of SV4031B

Losen the screws PM2x27 of the servo SV4031B.

Step 5

Assembled the servos SV4031B with PLR100003B with two pieces of screws PA2x28 primarily.

Tuning servos before assembling a leg

Plug the jumper on slot 1 for coarse tuning

Two pieces of screws PA2x32 are used for assembling with the CLAW later.

There are 15 slots on each side of the PCB, each slot has 3-pin, the slots for four legs are allocated to slot 4 to 7.
Tuning servos with PCB

Step 6  Make sure the power switch is ‘OFF’. Plug in the servo to slot 4 to 7 according to the instructions in step 7, then connect the battery.

Step 7  Left forward leg - SV4031A Slot 5  
       Left forward leg tip - SV4031B Slot 4  
       Right rear leg - SV4031A Slot 6  
       Right rear leg tip - SV4031B Slot 7

Step 8  Switch on the power. Then the red light will be on and all servos will rotate 90° automatically then stop. It will take a few second to complete the process.

Assembling left forward leg and right rear leg  

Carefully slide the top and the bottom of SV4031B into PLR100002.

Step 9  Assemble as shown

Assembled Servo SV4031A with SV4031B. Plug the SV4031B into the PLR100002 as shown.

Do not tighten this screw. (PA2x5)

PLR100002

PLR100003A

SV4031A

PLR100004

PLR100003B

SV4031B

PLR100010

(PA2x32)

Do not press too hard.

WR3000030

90 degree marker alignment
Step 10 There are 4 large holes and 4 small holes on PLR100010. Insert PLR100010 to SV4032B and try to align the 4 larger holes to the holes on PLR100002. If the holes do not line up, remove PLR100010 and rotate it by 90°, re-insert and check again if the holes align better. You may need to repeat this step a few times to find the best aligned holes.

Step 11 Apply screws to fix PLR100010. It is normal that the bottom marks are not in perfect alignment at this stage, it will be adjusted electronically at the fine tuning stage.

Step 12 Switch off the power and remove the battery and left front leg/ right back leg from the PCB.

Step 13 Check to see if the leg can bend forward by 90° or more and backward by 90° or more. If not, repeat the whole process starting from Step 6.
Parts to assemble a leg of RoboCrawler

Assemble right forward leg and left rear leg

Step 1 Remove the bottom plate of SV4031A

Over tightening screws will damage the parts. After turning the screw to bring the two parts in contact, add 1/16 of a turn will hold the parts tight.

Losen the screws PM2x27 of the servo SV4031A.

Step 2

Assembled the PLR100002 with PLR100003A with the screws KA2x6 properly.

Chamfer is located at this side.
Step 3
Assembled Servo SV4031A with PLR100003A as shown with screw PM2x28.

Chamfer is located at this side.

Step 4  Remove the bottom plate of SV4031B
Losen the screws PM2x27 of the servo SV4031B.

Step 5
Assembled the servo SV4031B with PLR100003B with the screws PA2x28 properly.

Tuning servos before assembling a leg
Plug the jumper on slot 1 for coarse tuning

There are 15 slots on each side of the PCB, each slot has 3-pin, the slots for four legs are allocated to slot 4 to 7.
Tuning servos with PCB

Step 6  Make sure the power switch is ‘OFF’. Plug in the servo to slot 4 or 7 according to the instructions in step 7, then connect the battery.

Step 7  Left rear leg - SV4031A Slot 6
         Left rear leg tip - SV4031B Slot 7
         Right forward leg - SV4031A Slot 5
         Right forward leg tip - SV4031B Slot 4

Step 8  Switch on the power. Then the red light will be on and all servos will rotate 90° automatically then stop. It will take a few second to complete the process.

Assembling right forward leg and left rear leg

Step 9  Assemble as shown

Carefully slide the top and the bottom of SV4031B into PLR100002.
Tuning right forward leg and left rear leg

Step 10 There are 4 large holes and 4 small holes on PLR100010. Insert PLR100010 to SV4032B and try to align the 4 larger holes to the holes on PLR100002. If the holes do not line up, remove PLR100010 and rotate it by 90°, re-insert and check again if the holes align better. You may need to repeat this step a few times to find the best aligned holes.

Step 11 Apply screws to fix PLR100010. It is normal that the bottom marks are not in perfect alignment at this stage, it will be adjusted electronically at the fine tuning stage.

Step 12 Switch off the power and remove the battery and right front leg/ left back leg from the PCB.

Step 13 Check to see if the leg can bend forward by 90° or more and backward by 90° or more. If not, repeat the whole process starting from Step 6.
RoboCrawler

Building the RoboCrawler

Parts for assembling BODY

- **WR3000020** x 1 pc
- **PLR300001** x 1 pc
- **WR300010** x 1 pc
- **PLR100001** x 4 pcs
- **RBCA0001** x 1 pc
- **RBMB07V01** x 1 pc
- **MS7513K01** x 1 pc
- **AA Batteries** (not included) x 5 pcs

**Dimensions:** (12.7 x 250) mm

- **PLR100004** x 4 pcs
- **PLR100010** x 4 pcs
- **PLR300002** x 4 pcs
- **HWD2xD5** x 4 pcs
- **PA2x3** x 8 pcs
- **PA2x6** x 12 pcs
- **PA2x5** x 20 pcs
- **PA2.5x8** x 4 pcs
- **PA2x28** x 4 pcs
Assembling BODY

Tighten the screws as shown.
(PA2x6) x 12 pcs

Each chamfer pointed to the bottom of body.

Please make sure the battery box is plugged to the PCB card before tightened all screws.

Tuning servos with PCB before combining legs

Step 1 Make sure the power switch is ‘OFF’. Plug in the servo to slot 4 to 7 respectively according to the instructions as list as in step 3, then connect the battery.

Plug the jumper on slot 1 for coarse tuning
Step 2  Switch on the power. Then the red light will be on and all servos will rotate 90° automatically then stop. It will take a few second to complete the process.

Step 3  Right forward leg - SV4031A Slot 5  
         Right forward leg tip - SV4031B Slot 4  
         Right rear leg - SV4031A Slot 6  
         Right rear leg tip - SV4031B Slot 7  
         Left forward leg - SV4031A Slot 5  
         Left forward leg tip - SV4031B Slot 4  
         Left rear leg - SV4031A Slot 6  
         Left rear leg tip - SV4031B Slot 7  

Assemble legs to body

Step 4  Assemble as figure shown.
         Slide the joint connector of leg carefully into the PLR100001.

Fixing the legs adjacent to the PLR100001 properly. Then tighten the servos with the screws PA2 x 5 and PA2.5 x 8.
Assembling legs to body

Step 5  Tighten all the screws as shown.

Step 6  Turn the RoboCrawler upside down and tighten the screws as shown.

Plug the servos to PCB

Step 7  Select the jumper on the PCB

Plug the jumper on slot 5 for normal functioning of IR remote.

The next step is to fine tune the RoboCrawler. Follow all the steps in the Fine Tuning section and complete the fine tuning of RoboCrawler.
Mounting for battery box

Step 8  Insert the mounting tape across the body of RoboCrawler as shown.

**Mounting tape**

MS7513K01

Mounting tape for mounting the battery box with the body and prevent dropping down of battery from the upside down battery box.

Step 9  Place the double side tape as shown.

Step 10  Fix the battery box with mounting tape.

Assemble the cap to body

Tighten the canopy with the screws PA2x3.

**PA2x3**

x 2 pcs

⚠️ Make sure the screws PA2x3 does not pierce through and block the leg from turning.
RoboCrawler

Coordinate system for each joint

Right Back Leg
Right Front Leg
Left Back Leg
Left Front Leg

R LEG
L LEG

Front

90° 180° 0° 180° 90° 90° 180° 180° 90° 0° 0° 180° 180° 0° 90°
Generic Step to run Fine Tuning.

1. The jumper on upper right hand corner of the PCB should be placed to 2-pin slot 5 for normal operation and fine tuning.

2. Install the Motion Creator in your PC.
   (Windows XP, Vista or Windows 7 Operating System)
   1. Put in the RoboCrawler CD and open the folder for installation.
   2. Double click the file dotnetfx and follow the instruction to install the .net 2.0 redistributable from Microsoft.
   3. Double click the file vcredist_x86 and follow the instruction to install the Visual C++ 2005 SP1 redistributable from Microsoft.
   4. Installation done.
   5. Connect the serial cable between the PC and RoboCrawler. Copy the "robocrawler.exe", "loadCrawler.exe" and "crawler-motion.txt" to the local disk folder.
   6. Double click the file RoboCrawler from the local disk folder to start the RoboCrawler 1.0.
   Follow the instructions in Configuration Operations.
   Open the factory default motion file (Crawler-motion).
   7. Because your RoboCrawler is a Kit version, please follow the instructions in Fine Tuning section.

3. Connect the RoboCrawler to the computer by using the Serial cable provided.

4. Run RoboCrawler.exe (RoboCrawler 1.0).

5. Select Configuration tab.

6. Select Port # to setup serial COM port.

7. Enter motion file name: Crawler-motion click 'Open'
8. Enter different position value for a servo.
   e.g. right leg -- the leg should move. If not, change the COM port # in configuration tab and retry.

9. There are 3 values to tune for each joint.
   
   Position -- change the servo position.
   Offset -- define the servo position at 0 degree.
   ATV -- adjust the physical travel angle for the input position degree.

10. Common Fine Tuning step for joints allow 0 degree.

   a. Enter 0 to position to move the joint at 0 degree.
   b. Increase or decrease the offset value to line up the marker.

   c. Enter position 180° degree.

   d. If the angle from 0 to 180° is less than 180° degree, increase ATV by clicking the up arrow of ATV. Otherwise, click the down arrow of ATV until the marks align.

11. Click “Save” button to save the tuning setting for this servo.

12. You need to use “Save Motion” in configuration tab to save the tunings to a file, otherwise, the tunings will be lost after the program exits.
13. You can click 'Save Motion' to save to the same file after each joint tuning.

14. Save to a different motion file name mycrawler to keep the original default motion file.

15. Open the new file mycrawler for subsequent motion work.

### Fine Tine legs

- $\theta < 180^\circ$, increase ATV value
- $\theta > 180^\circ$, decrease ATV value

1. Enter $0^\circ$ to each leg position. Adjust offset to align marker.

2. Enter $180^\circ$ to each leg position. Adjust ATV to align marker.
RoboCrawler

Fine Tuning

Fine Tune leg tip

θ < 180°, increase ATV value
θ > 180°, decrease ATV value

1. Enter 0 to each leg position.
   Adjust offset to align marker.
2. Enter 180 to each leg position.
   Adjust ATV to align marker.
1. Click 'Save Motion' in Configuration tab to save the settings and click 'Open' to open the file. Power off the RoboPhilo.
2. Click 'Connect' and wait for ready message.
   Power on the RoboCrawler and then click 'OK' within 5 seconds.
   Click 'Load Motion'.
   Click 'Load Tuning/ Setting'.
   Click 'Disconnet'.
   Power off the RoboCrawler.
3. You have completed the Fine Tuning and you can power on the RoboCrawler to play.

Warp the servo wires

Wrap the servo wires by using the supplied wire wrapping tubes.
Cut the wire spiral down so that it spiral the wire up to the legs, such that the servo wires mounted neatly.

Tighten the wire bracket onto the leg with screw PA1.7x7 as shown.

Wire Bracket PLR1000WB

Wire wrapping tubes RBPTB0003
100mm x 4pcs
1. RoboCrawler 1.0 Installation
   a. dotnetfx
   b. vcredist_x86
   c. RoboCrawler
   d. Crawler-motion
   e. LoadCrawler

2. RoboCrawler Operations
   a. Configuration Operations
   b. Pose Operations
   c. Sequence Operations
   d. Routine Operations
   e. Key Operations
   f. Fine Tuning Operations

3. Hand Held Remote
4. Motion File details
5. Sample Motion Routine exercise
Motion Creator Installation
System Requirement: Windows XP, Vista or Windows 7 Operating System with 512MB

1. Put in the RoboCrawler CD and open the folder for Installation.
2. Double click the file dotnetfx and follow the instruction to install the .net 2.0 redistributable from Microsoft.
3. Double click the file vcredist_x86 and follow the instruction to install the Visual C++ 2005 SP1 redistributable from Microsoft
4. Installation done.
5. Connect the serial cable between the PC and RoboCrawler, copy the “robocrawler.exe”, “loadCrawler.exe” and “crawler-motion.txt” to the local disk folder.
6. Double click the file RoboCrawler from the local disk folder to start the RoboCrawler 1.0. Follow the instructions in Configuration Operations. Open the factory default motion file (Crawler-motion).
7. Because your RoboCrawler is a Kit version, please follow the instructions in Fine Tuning section.

Windows is a trademark of Microsoft Corporation, registered in the U.S. and other countries.
Configuration Tab

Use the configuration tab to open the motion file to make modification or to download the latest motions to the RoboCrawler. After you open the motion file, you can use the other tabs to modify the motion or fine tune the RoboCrawler. You can connect to the RoboCrawler and download the current opened motions to the RoboCrawler.

1. Global Serial COM Port Setting
   Port # - select the COM port from the available list of serial port to connect the PC and RoboCrawler.

2. Global Setting – Default setting for moving RoboCrawler
   - Speed – 0 - 15
   - Mode – C = continuous mode.
     E = equal steps mode.
     W = wait mode.
   - Steps – 0 - 127
   - Position increment – 0 – 100
   Need to set up the remote to send command at the same ID.
   0 is the fastest.
   All servos will arrive at the final position at the same time.
   Each step unit is 20 ms wait.
   Move faster with larger step value for the 'Continuous Mode' with non zero speed.
   Define the number of steps to reach the final position for the 'Equal Steps mode'.
   Define the number of 20ms intervals to wait for the 'Wait mode'.
   Defines the increments for each click of the up down button for position.

3. File
   - Motion file name – file to open or save. (don't type in the extension "txt")
   - Open – to read in the motion file.
   - Save Motion – to save the latest motions and fine tune settings to the motion file.

4. Program Robot – Download motion to RoboCrawler
   After the RoboCrawler is connected to the PC, it will show the Serial Number and the Firmware version of RoboCrawler.
   - Serial # – Serial Number for RoboCrawler
   - Version # – Firmware version for RoboCrawler
   Connect – (1) Connect the serial cable from the PC to RoboCrawler.
     (2) Select the com port.
     (3) Click 'Connect' and wait for ready message.
     (4) Power on the RoboCrawler and then click 'OK' within 5 seconds.
   Disconnect – switch to command mode for RoboCrawler motion after download.
   Load Motion – download the imported motion to RoboCrawler after the connection is successful.
   Load Tuning/Setting – download the fine tuning and other settings to RoboCrawler.
Pose Tab

Use the Pose tab to design the RoboCrawler pose by entering the Servo Joint positions in degrees. After you open the motion file, you can retrieve the existing Pose name positions for modifications. You can save the new or modified Pose to the same name or another unique name. Each Pose can be used in more than one sequence. You can connect the RoboCrawler to a PC and play the motions interactively.

1. Servo Position – Current RoboCrawler position
   Click the up down arrow or enter the degree value for the servo joint position. RoboCrawler will move to the position.

2. Pose
   Pose Name – The position name assigned to the current positions.
   Get – Retrieve the positions for the Pose Name from the opened motion file.
   Save – Save the current positions to the Pose Name. **You need to save the motions to a motion file, otherwise, the motion settings will be lost after you exit the program.**
   Delete – Delete the Pose name.

3. Play – Play motion to RoboCrawler
   After the RoboCrawler is connected to the PC in command mode, you can press play to move RoboCrawler to the current positions.
   Speed – 0 – 15 **0 is the fastest**
   Mode – C = continuous mode.
   E = equal steps mode. All servo will arrive at the final position at the same time.
   W = wait mode. Each step unit is 20 ms wait.
   Steps – 0 – 127
   Move faster with larger step value for the ‘Continuous Mode’ with non zero speed.
   Define the number of steps to reach the final position for the ‘Equal Steps mode’.
   Define the number of 20ms intervals to wait for the ‘Wait mode’.

   Position Increment – defines the increments for each click of the up down button for position.
   Auto Play – If checked, RoboCrawler will move on any change in the positions, otherwise, RoboCrawler will move after you click “Play” button.
   Play – Move RoboCrawler to the current specified positions.
RoboCrawler

Sequence Tab

Use the Sequence tab to design a series of movement states by assigning the speed and mode to move the specific Pose name one after the other.

Each State Name defines the speed and mode to move to the Pose name. State Names are unique per Sequence and cannot be shared with another Sequence.

After you open the motion file, you can retrieve the existing Sequence name’s state for modifications.

You can save the new or modified Sequence to the same name or another unique name.

Each Sequence can be used in more than one Routine assignments.

You can connect the RoboCrawler to a PC and play the Sequence interactively.

1. Sequence

Sequence definition

Seq - Click the up down arrow to reorder the states to move

Speed – 0 – 15 ( 0 is the fastest )

Mode – C = continuous mode
E = equal steps mode.
All servos will arrive at the final position at the same time.
W = wait mode. Each steps unit is 20 ms

Steps – 0 - 127
Move faster with larger step value for the ‘Continuous Mode’ with non zero speed.
Define the number of steps to reach the final position for the ‘Equal Steps mode’.
Define the number of 20ms intervals to wait for the ‘Wait mode’.

Select - Mark State assignments for deletion or Play
Reset - Reset assignments to previously saved version
Apply Changes - Update all the new sequence changes
Delete - Delete the selected state assignments

2. Sequence Name – The name assigned to the current Sequence States.

Get – Retrieve the positions for the Pose Name from the opened motion file.

Save – Save current Sequences to the Sequence Name.
You need to save the Sequence to a motion file, otherwise, the Sequence settings will be lost after you exit the program.

Delete - Delete the Sequence name.

3. Play – Play Sequence to RoboCrawler

After the RoboCrawler is connected to the PC in command mode, you can press play buttons to move RoboCrawler through the current Sequence states.

Select All - Mark all the states in this page for deletion
Clear All - Uncheck all the states for deletion or Play
Play All - Move RoboCrawler through the current specified order of states one after the other.

Play Prev – Move RoboCrawler to the previous specified state
Play – Move RoboCrawler through the current specified state
Play Next – Move RoboCrawler to the next specified state
Routine Tab

Use the Routine tab to design a series of movement states by assigning the Sequence to move one after the other.

Each Routine Name defines a list of Sequence to move one after the other. Routine Name are unique per Motion File and can be used with another Key command assignments.

After you open the motion file, you can retrieve the existing Routine name’s state for modifications.

You can save the new or modified Routine to the same name or another unique name.

Each Routine can be used in more than one Key command assignments.

You can connect the RoboCrawler to a PC and play the Routine interactively.

1. Routine – Sequence definition
   Seq - Click the up down arrow to reorder the Sequence
   Sequence Name – Select the sequence name to add to the Routine.
   Select - Mark Sequence assignments for deletion or Play
   Reset - Reset assignments to previously saved version
   Apply Changes - update all the new Routine changes
   Delete - Delete the selected Sequence assignments

2. Routine Name – The name assigned to the current Sequences
   Get – Retrieve the sequence states for the Sequence Name from the opened motion file
   Save – Save current Sequences to the Routine Name. You need to save the Routine to a motion file, otherwise, the Routine settings will be lost after you exit the program.
   Delete – Delete the Routine nameSequence Name – The name assigned to the current Sequence States.

3. Play – Play Routine to RoboCrawler
   Select All - Mark all the Sequence in this page for deletion
   Clear All - Uncheck all the Sequences for deletion or Play
   Play All - Move RoboCrawler through the current specified order of Sequences one after the other.
   Play Prev - Move RoboCrawler to previous specified Sequence
   Play - Move RoboCrawler to current specified Sequence
   Play Next - Move RoboCrawler to next specified Sequence
RoboCrawler

Key Operations

Key Tab

Use the Key tab to assign the Routine to the 2 digit key command or remote key command.

After you save the assignments and save the motion file from the Configuration tab, you can open the new motion file and download the motion along with the key assignments to RoboCrawler.

You can then use the remote to run the Routine as follows:

- Press up to 2 digit keys for 0 - 99 then “Enter” to execute the Routine assigned to this key command.

Press the Remote Key marked KEY1 to KEY 12 to execute the Routine assigned the Remote Key command.

1. Key # Operation assignment

Routine Name - Select the Routine for the key number.
Select - Mark Routine assignments for deletion or Play.
Previous - Show previous 15 key numbers assignments.
Next - Show the next 15 key numbers assignments.

2. Remote Key

Routine Name - Select the Routine for the remote key.
Select Key - Mark Routine assignments for deletion or Play.

3. Play

Run RoboCrawler 1.0 with the selected Routine.
Select All - Mark all the routine assignment in this page for deletion and Play.
Clear All - Uncheck all the Routines for deletion or Play.
Delete - Delete the selected Routine assignments by setting it to no_op.
Update Changes - updates all the new key assignment changes for the key# on the current page, otherwise, the current changes are lost after you scroll to the previous or next page.
Play - Run RoboCrawler 1.0 with the selected Routine.
Reset - Reset assignments to previously saved version.
Save Keys - Save the current settings.

You need to save the Key setting to a motion file, otherwise, the Key settings will be lost after you exit the program.
RoboCrawler

**Fine Tuning Operations**

**Fine Tuning Tab**

RoboCrawler requires fine tuning to move the motion position more accurately. You can follow the steps for each servo to adjust the offset and ATV value.

**Position** - Move the servo to the specified degree
**Offset** - Define the position of the servo at 0 degree
**ATV** - Adjust the servo travel angle for 180 degree

**Set Init Position** - Save the current position as the power on position. You need to follow by 'save' to save this setting, and then 'save motion' in Configuration Tab to save it to the motion file before downloading the setting.

Open the factory motion file. Follow the manual to fine tune the RoboCrawler.

Once you have finished the settings, you need to save the settings to the motion file in the Configuration tab.

Save to a new motion file name. Save a copy of the motion file as back up.

Use the new motion file to create your own motion routines.

---

**Up/ Down arrow**

- Click the up down arrow or enter the value for the position, offset or ATV. Once you enter the value, RoboCrawler will move the corresponding servo.

**Reset button**

- Reset the current settings to a previously saved check point.

**Save button**

- Save the current settings to a check point that you can reset back to. Once you have finished the settings, you need to save the settings to the motion file in the Configuration tab.
Handheld Remote Controller can control up to 4 robots independently with 4 channels assignments. Program Routines for 12 remote keys and up to 99 two digits key commands.

**POWER** – turn on/off the servos. In power off mode, RoboCrawler will keep the Controller running only.
- SEND – Not used
- SPEED – Not used
- MODE – Not used
- STEPS – Not used

Press up to 2 digits then "Enter" to issue a 2 digit key command to RoboCrawler to execute the assigned Routine motion.

- "SERVO" - Not used
- "POSITION" - Not used

Press "REPEAT" to repeat the previous motion until "Enter" or new motion command is pressed.

Remote Key
Press the remote key to send the remote key command to RoboCrawler to execute the assigned Routine motion.

Setup the RoboCrawler ID to send the command.

Press "POWER" + "SETUP", 00-31, one of the CH-A to CH-D key to assign the 2 digit Robot ID to the Channel Key pressed.

After the channel key is pressed, the command will send to the assigned Robot ID.

You can control up to 4 robots with one remote by pressing the specific channel key to switch the robot ID to send the command to assigned robot.

All Channels have Robot ID 31 after battery is changed.
Motion File

The motion file contains the configuration parameters and the motion with remote control key assignments.

The file contains 5 sections with the section name taken as the first parameter:
1. config – defines the general configuration parameters.
2. servo – defines the configuration parameters for each servo joint.
3. pose – defines the position for each servo.
4. sequence – defines the list of states to move.
5. states – defines the speed and mode to move to the specified pose.
6. routine – defines the list of sequence to move.
7. key – defines the routine assignments to 99 two digits key command and 12 remote key command for the handheld remote controller.

Setup RoboCrawler

RoboCrawler comes with the factory default motion file. It contains the factory settings and the predefined motion with remote key assignments. You need to run the Motion Creator program – RoboCrawler 1.0 and open the motion file to download to RoboCrawler.

Create new motion

Make a copy of the factory default motion file before creating your own motion. Since the configuration and servo settings are necessary for RoboCrawler to function, you need to open the factory default motion file first. You can then modify the motions or add your new motions with new remote key assignments. After you complete the motion changes, you need to save all the changes and save the motions to another motion file.

Download the new motion to RoboCrawler

You need to open the new motion file and connect the PC to RoboCrawler for download. Download the motion and the tuning/setting to RoboCrawler.

Do not change the order of the parameters token order, Do not change the order of the Key section for 2 digits key, predefined key and the remote key.
General Configuration Parameters

Pulse1  - pulse parameter (not changeable)
Pulse2  - pulse parameter for 1 deg (not changeable)
Pulse3  - Pulse parameter for servo (not changeable)
RemoteID  - Robot ID. After open this motion file and download the tuning/setting to RoboCrawler, RoboCrawler will use this Robot ID.
LowPower  - Value used to blink the LED once the battery voltage drops before this value. The value can be 0 – 100. The higher the number, the earlier the LED will blink.

Servo Configuration Parameters

Servo-13  - Left forward leg tip
Servo-14  - Left forward leg
Servo-15  - Left rear leg
Servo-16  - Left rear leg tip
Servo-1  - Right forward leg tip
Servo-2  - Right forward leg
Servo-3  - Right rear leg
Servo-4  - Right rear leg tip

all other servo - not used

Init pos  - Initial position in degrees after power on
Offset  - Define the position of the servo at 0 degree
ATV adjustment  - Define the servo travel parameter for 180 degree degrees
Upper Limit  - The upper limit of angle for the servo to turn
Lower Limit  - The lower limit of angle for the servo to turn
Pose Configuration Parameters

name – Pose name for the joints positions
LS – Left forward leg tip
LUA – Left forward leg
LE – Left rear leg
LW – Left rear leg tip
RS – Right forward leg tip
RUA – Right forward leg
RE – Right rear leg
RW – Right rear leg tip

all other servo - not used

Sequence Configuration Parameters

NAME – defines the name for this sequence containing a list of the states.

State Configuration Parameters

NAME – defines the name for states.
Speed – 0 – 15
Mode – C = continuous mode.
E = equal steps mode.
W = wait mode.
Steps – 0 – 127

0 is the fastest.
All servos will arrive at the final position at the same time.
Each step unit is 20 ms wait.
Move faster with larger step value for the 'Continuous Mode' with non zero speed.
Define the number of steps to reach the final position for the 'Equal Steps mode'.
Define the number of 20ms intervals to wait for the 'Wait mode'.

Pos name – defines the pose name for this state to move at the speed and mode defined.
Routine Configuration Parameters

NAME – defines the Routine name that contains a list of sequences in one line.
Sequence name – defines the sequence name for the motion.

Key Configuration Parameters

NAME – defines the key name assigned to the Routine.
Routine name – defines the routine name assigned to the key command.

KEY_1 .. KEY_99 – defines the key name for the 2 digits key command.

KEY_NW – key name for turn left
KEY_N – key name for move forward
KEY_NE – key name for turn right
KEY_W – key name for move left
KEY_E – key name for move right
KEY_S – key name for move backward
KEY_FRONT_UP – key name for turn right
KEY_FRONT_DOWN – key name for turn left
REMOTE_KEY_1 .. 12 – defines the key name for the 12 remote key commands

Do not change the order of the parameters token order.
Do not change the order of the Key section for 2 digits key, predefined key and the remote key.
1. **System Requirement:**
   Windows XP, Vista or Windows 7 Operating System.

2. **Put in the CRAWLER CD and open the folder for Installation.**

3. **Double click the file dotnetfx and follow the instruction to install the .net 2.0 redistributable from Microsoft.**

4. **Double click the file vcredist_x86 and follow the instruction to install the Visual C++ 2005 SP1 redistributable from Microsoft.**

5. **Installation done, copy the “robocrawler.exe”, “loadCrawler.exe” and “crawler-motion.txt” to the local disk folder.**

6. **Double click the file RobCrawler from the local disk folder to start the Crawler Motion Creator.**

7. **Select “Configuration Tab” to continue.**
**Configuration Tab**

Connect the serial cable from the computer to the RoboCrawler.

Power on RoboCrawler.

Select the COM port from the list. For multiple COM ports computer, you need to do some motion to validate the port is the one connected to RoboCrawler in the next steps.

Import the factory default motion file to try out a sample motion sequence.

Wait for the “Initialization is done” message, click ok.

1. Select the COM port from the list of available serial port to connect the PC and RoboCrawler. For multiple COM ports computer, you need to do some motion to validate the port is the one connected to RoboCrawler, in the next steps.

2. Enter the motion file “crawler-motion”. Click “open” to open the motion file to try out the sample routine sequence.

3. Select “Pose Tab” to continue.
Pose Tab

Use the Pose tab to design the RoboCrawler pose by entering the Servo Joint positions in degrees.

After you open the motion file, you can retrieve the existing Pose name positions for modifications.

If the RoboCrawler does not move, try plug the serial cable to another port until it moves.

---

Play motion to RoboCrawler

Select “sp-down” from the Pose Name.

Click “Get” to retrieve the pose positions.

Click “Play” to move RoboCrawler to the pose.

If RoboCrawler does not move, try plug the serial cable to another COM port.

Click “Auto Play” to turn on auto play mode.

Click the up/down or enter new position angle to the leg Joint, the leg should move.

Select “init” from the Pose Name.

Click “Get” to retrieve the pose positions.

Click “Play” to move RoboCrawler to init position.

Select “Sequence Tab” to continue.
Sequence Tab

Use the Sequence tab to design a series of movement states by assigning the speed and mode to move the specific Pose name one after the other.

Select a sequence from the list of sequence name.

Try Play All, Play, Play Next, Play Prev.

![RoboCrawler interface](image)

Play Sequence to RoboCrawler

Select “walk-fwd” from the Sequence Name.

Click “Get” to retrieve the list of states for the sequence.

Click “Play” to move RoboCrawler to the “tf2” state.

Click “Play Next” to move RoboCrawler to the next state.

Click “Play Prev” to move RoboCrawler to the previous state.

Click “Play Next” again until “tf11” state is played.

Select “walk-bwd” from the Sequence Name.

Click “Get” to retrieve the list of states for the sequence.

Click “Play All” to move RoboCrawler to walk backward.

Select “Routine Tab” to continue.
Routine Tab

Use the Routine tab to design a series of movement states by assigning the Sequence to move one after the other.

Create a routine from existing sequence.

Try Play All, Play, Play Next, Play Prev.

Play Routine to RoboCrawler

Select “walk-bwd” from Seq 1 Sequence Name.
Select “back_fwd” from Seq 2 Sequence Name.
Click “Update Changes” to update the new changes.
Enter “walk_b_f” to the Routine Name.
Click “Save” to save the two sequences to the routine name “walk_b_f”.
Click “Play All” to move RoboCrawler flip forward and then stand up again.
Click “Save” to save the new Routine.

Congratulations!
You have created a new Routine from the list of sequence.
Select “Key Tab” to continue.
Key Tab

Use the Key tab to assign the Routine to the 2 digit key command or remote key command.

Assign the new Routine to a remote key.

Try “Play” to run the Routine for the specified key.

Run RoboCrawler with the selected Routine.

Select “look-left” from the KEY 1 Routine Name to assign “look-left” to KEY 1.

Click “Update Changes” to update the new changes for this page.

Click the check box for KEY 1

Click “Play” to move RoboCrawler to look left.

Click “Save Keys” to save the changes.

Congratulations!

You have successfully assign a routine to the remote key.

Select “Configuration Tab” to continue.
Configuration Tab

Save the newly created motion.

Save the newly created motion to a new motion file using "Save Motion".

You can play the new motions with the newly created motion file through the computer.

Save the newly created motion.

Enter the motion file "mycrawler".

Click "Save Motion" to save all the motions to the new motion file.

Click OK to save the file.

You can play the motions connecting to the computer.
Configuration Tab

Load the new motions to the RoboCrawler

Download the new motion to the RoboCrawler.

Use the remote to exercise the newly created motion.

Use the remote to exercise the newly created motion.

Power off the RoboCrawler,

Click ‘Connect’ and wait for ready message.

Power on the RoboCrawler and then click ‘OK’ within 5 seconds.

If the connection is successful, you can see the Serial No. and the version of the RoboCrawler.

Enter “mycrawler” to the Motion File Name.

Click “Load Motion” to download the new motions to RoboCrawler.

Power off RoboCrawler.

Power on RoboCrawler.

Press KEY 1 on the remote, RoboCrawler will look-left.

Congratulations!

You have learned how to program the remote to play a newly created Routine.
RoboCrawler

Load CRAWLER program, motions and tuning settings to the RoboCrawler

Setup the COM port to connect PC to RoboCrawler
Use Verify option to check the motion file syntax error
Use Download menu to reload the RoboCrawler program, motion and tuning setting

You may need to reload the RoboCrawler program, motion and tuning setting if the RoboCrawler flash memory is corrupted after running in a very low power voltage. If the RoboCrawler does not stand up after power on for 20 seconds, you may need to reload the program, motion and tuning setting again.

Load Crawler Main Menu
Enter
C:an port setting
D:ownload menu
<power on the robot and then enter D within 5 seconds>
G:enerate new motion file with fine tune setting from the robot
<power on the robot, wait for it to standup and then enter G>
V:erify motion file
B:irth Certificate
<power on the robot, wait for it to standup and then enter B>
E:xit

Enter com port number to locate the connection port: 1
Enter com port number:

Serial port COM1 successfully reconfigured.

Load Crawler Main Menu
Enter
C:an port setting
D:ownload menu
<power on the robot and then enter D within 5 seconds>
G:enerate new motion file with fine tune setting from the robot
<power on the robot, wait for it to standup and then enter G>
V:erify motion file
B:irth Certificate
<power on the robot, wait for it to standup and then enter B>
E:xit

Setup COM port
Power on RoboCrawler
Enter “C” to select COM port setting
Enter the COM port number you have connected to the RoboCrawler
If successful, you can continue to reloading the program, motion and tuning setting.
(lower case input is ok)
Reload CRAWLER Program

Enter "D" and wait for the ready message.

Power on the RoboCrawler and press enter within 5 seconds.

If the connection is successful, you can see the Serial No.

If it fails, double check the COM port connection. Do COM port setting again.

Enter "I" to load the CRAWLER program

Enter "crawler" to the file name
Enter "00000009" as the default serial no.

Enter "W" and then "P" to reload the CRAWLER program to RoboCrawler

If successful, you need to power off and power on the RoboCrawler to use the new program before reloading the motion and tuning setting.

(lower case input is ok)
Reload CRAWLER motion and tuning setting
Enter “D” and wait for the ready message.
Power on the RoboCrawler and press enter within 5 seconds.
If the connection is successful, you can see the Serial No.
If it fails, double check the COM port connection. Do COM port setting again.
Enter “L” to load the CRAWLER motion
Enter “crawler-motion” to the file name
Enter “W” and then “M” to reload the crawler-motion to RoboCrawler
Enter “C” to load the CRAWLER tuning setting
Enter “W” and then “C” to reload the CRAWLER tuning setting to RoboCrawler
If successful, you need to power off and power on the RoboCrawler to use the new motion and tuning setting.
The motion and tuning setting need to be set together. (lower case input is ok)
Enter input file name: crawler-motion

=========================================
Success: Motion file is good
=========================================

Robot Control Download Menu
Robot Serial No = 10008736
Robot Version = RBPHLO-01

I)mport encrypted program
L)oad motion
U)pdate C)onfiguration
W)rite Configuration/Motion/Program to Robot
E)xit

This operation may take up to 10 seconds

Enter C)onfiguration M)otion P)rogram to write to Robot: m

This operation may take up to 10 seconds

Enter C)onfiguration M)otion P)rogram to write to Robot: m

Download to Robot successful

=========================================

Robot Control Download Menu
Robot Serial No = 10008736
Robot Version = RBPHLO-01

I)mport encrypted program
L)oad motion
U)pdate C)onfiguration
W)rite Configuration/Motion/Program to Robot
E)xit

=========================================
Verify motion file

Enter "V" to select the verification
Enter the motion file name to check the syntax correctness
If the motion file is loaded ok, the check is successful. You can use the motion file in the Motion Creator GUI 'Crawler'
If there is syntax error, it will print out which pose, sequence or routine names are missing. It will stop at the first error. You may need to run the check again after the fix until the whole file is good.
Use this check if you copy motion routines from other files or you have manually edited the motion file.
It will also show how much flash memory is used for the motions in this file. It will show error if the motion is larger than 8K.
(lower case input is ok)

```plaintext
key KEY_E : op = walk-r
key KEY_S : op = walk-bwd
key KEY_FRONT_UP : op = turn-right
key KEY_FRONT_DOWN : op = turn-left
key KEY_BACK_UP : op = no_op
key KEY_BACK_DOWN : op = no_op
key REMOTE_KEY_1 : op = look-left
key REMOTE_KEY_2 : op = look-center
key REMOTE_KEY_3 : op = look-right
key REMOTE_KEY_4 : op = no_op
key REMOTE_KEY_5 : op = turn-left-45
key REMOTE_KEY_6 : op = sp-init
key REMOTE_KEY_7 : op = turn-right-45
key REMOTE_KEY_8 : op = no_op
key REMOTE_KEY_9 : op = fast-tl-45
key REMOTE_KEY_10 : op = sp-init
key REMOTE_KEY_11 : op = fast-tr-45
key REMOTE_KEY_12 : op = no_op

******************************************************************************
***** Success: Motion file is good *******************************************
******************************************************************************

Unused Routine definition, delete them if motion size is too large.
******************************************************************************

Unused Sequence definition, delete them if motion size is too large.
******************************************************************************

sequence 2 : name : turn-l
sequence 3 : name : turn-r
sequence 4 : name : turn-l-45
sequence 5 : name : turn-r-45

******************************************************************************
Unused Position definition, delete them if motion size is too large.
******************************************************************************

pose 19 : name : mu-init

Success: Motion download size 2524 is smaller than allowed 8192
******************************************************************************
```
Retrieve Fine Tune Setting

Enter "G" to select the generate new motion file option
Enter the existing motion file name to be updated with new fine tune setting from the robot
Enter the output file name
If the motion file is loaded ok, it will generate a new motion file with the new fine tune setting retrieved from the robot.
You may get invalid large numbers if the robot is just power on, wait for a minute and do it again. You may also get invalid large numbers if the robot has low power, plug in the charger and do it again.
(lower case input is ok)
Technical Data
Name: RoboCrawler
Height: 3.25" ~ 5.25" (82mm ~ 132mm)
Weight: 21.5 oz (610g) with batteries
Included: Complete hardware with 8 servos,
          8 MHz controller,
          IR remote control,
          graphical motion editor software

Safety precautions on the use and handling of battery

- Do not incinerate or mutilate batteries, may cause explosion or release of toxic material.
- Store batteries in a cool dry place.
- In case there is, excessive temperature or leakage from a battery, please stop using immediately.
- When not using a battery, disconnect it from the device.
- Never put a battery into water.
- Do not attempt to take batteries apart or subject them to pressure or impact. Heat may be generated or fire may result. The alkaline electrolyte is harmful to eyes and skin, and it may damage clothing upon contact.
- Keep away from children. If swallowed, contact a physician at once.