

**A word from Tiger Electronics**

Thank you for buying the WonderBorg. Please read this instruction manual carefully before using your WonderBorg, and always use the product as directed. We also recommend that you keep this instruction manual in a safe place.

**What is the WonderBorg?**

The WonderBorg is a robot kit developed especially to let you experience the fun of creation. It's easy and fun to assemble the WonderBorg, even if you have no special knowledge of programming or mechanical engineering. Let the WonderBorg introduce you to the wonderful world of robots!

**⚠ Caution**

**Be sure to read this**

- Please be sure to read this instruction manual thoroughly before operating the WonderBorg.

**Notes on Handling:**

- Do not touch the terminals or allow them to get wet or dirty, as this could cause the product to malfunction.
- This product is a piece of precision machinery. Do not use or store it in extreme temperatures, or subject it to severe shocks. Under no circumstances should the electronic parts in this product be disassembled.

**Notes on Use:**

- This product is comprised of precision electronic parts. It should not be dropped, allowed to get wet or dirty, or disassembled. Avoid using or storing this product in environments where the temperature is very high or very low.
- Inevitably, some of the parts have sharp points and dangerous edges, so please take care when assembling the product.
- Attempting to operate the WonderBorg using an infrared remote control device for another appliance such as a TV set may cause this product to malfunction.
- Malfunctions may occur if the product is placed beside a window in direct sunlight, directly below a fluorescent light or other strong light source.
- If a malfunction occurs, switch the power OFF, then ON again.
- Do not place stickers over the transmitter and/or the receiver as this could cause malfunctions.
- If any object gets in the way between the transmitter and receiver, the product will become unable to sense infrared, and will cease to function.
- When the batteries run low, malfunctions may occur. In this case, replace the batteries.
- This product uses reflective sensors, so the infrared sensor may be unable to function properly if the sensor is dirty.

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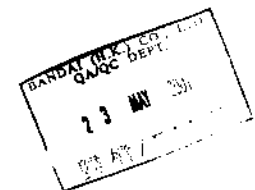
**Hardware Variations:  
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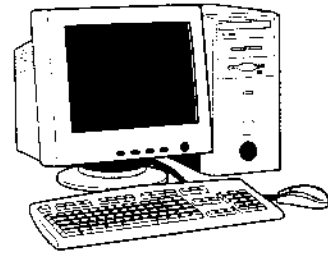
Software ----- 22

RECORD	
Part No.	Date
Qty.	
Part	
Qty.	
Remarks	



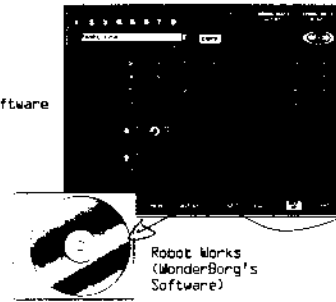
REFERENCE

**Configuration of the WonderBorg**



Your computer transmits Program instructions to the Interface

Download software onto PC.



Robot Works (WonderBorg's Software)

*Change LEDs - Stick to board*



Interface

The Interface downloads Program to the WonderBorg



WonderBorg

**WonderBorg**

The WonderBorg is a robot you assemble yourself. It has feet that can move backwards/ forwards and right / left, various sensors, and its own built-in computer. Its movements are controlled by programs you can create on your PC.

**Robot Works**

Robot Works is the WonderBorg's own programming software. You install this software on your computer from the CD-ROM included. By simply living up blocks on your computer screen, you can create your own programs for the WonderBorg.

**Interface**

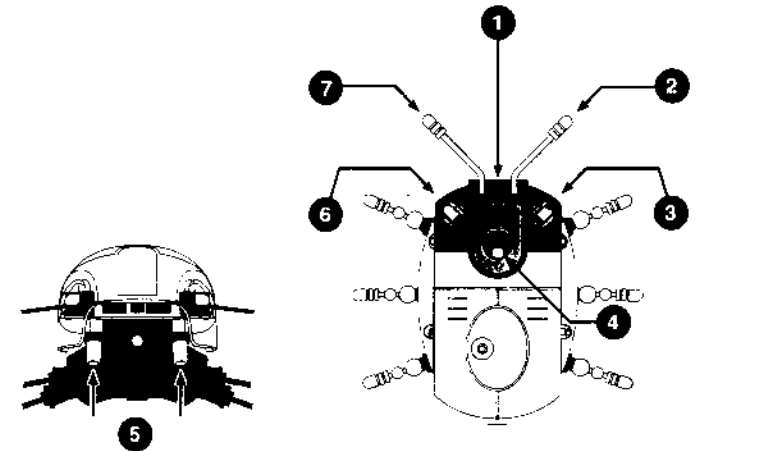
The Interface is the device that transmits your programs from the PC to the WonderBorg. It also sends infrared signals to the WonderBorg transmitting the information you designed in your program.

**The WonderBorg's Body**

The computer determines how the WonderBorg reacts to information perceived by the sensors. The left and right legs are moved by their respective rotors. When the legs on both sides move forward, the WonderBorg advances. When the legs on the right move forward and the legs on the left move backward, the WonderBorg turns to the left.

The various sensors are shown below

**WonderBorg's Sensors**



- 1. Infrared signal receiver: Distinguishes infrared signals coming from the Interface
- 2. Antenna (right): A sensor in the antenna socket enables the robot to react when the antenna touches something
- 3. Infrared LED (right): Used to detect objects up to 20cm away
- 4. Brightness sensor: Distinguishes between light and dark
- 5. Floor sensor: Used to decide whether the floor is there or not
- 6. Infrared LED (left)
- 7. Antenna (left)

**APPROVAL SHEET**

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

Teacher: \_\_\_\_\_

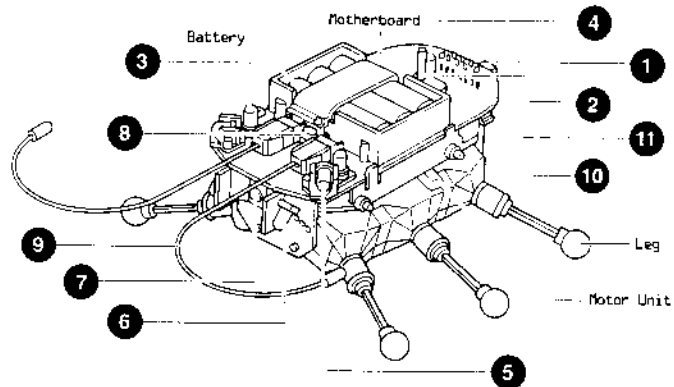
Also has:  
Internal clock sensor: Keeps track of passage of time  
Step sensor: Counts how many steps the WonderBorg has walked

The computer links the sensors with the WonderBorg's movements (i.e. the turning of the right and left rotors) in accordance with the program written by the user.

BANDAI ELECTRONICS LTD  
G.A. Q.C. UNIT  
13 MAY 2001



**Names of Parts**



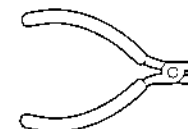
- 1. POWER switch**  
When this switch is turned ON, the WonderBorg enters standby mode. When the WonderBorg is not in use, this switch should be turned OFF.
- 2. START/STOP switch**  
If this switch is pressed once while the power is ON, the WonderBorg will start moving in accordance with the program. If the switch is pressed again, the WonderBorg will stop moving.
- 3. Eye (Red LED)**  
This LED is a Light-Emitting Diode. The eyes will flash when the WonderBorg detects the presence of a wall or an infrared signal. The flashing of the eyes is controlled by Robot Works.
- 4. Green LED**  
This LED flashes while the program is being executed, and while the program is being halted. When the floor sensor is OFF, the green LED flashes rapidly. When the POWER switch is turned OFF, the green LED goes out.
- 5. Infrared LED 1**  
This LED sends out infrared rays. It is used to detect obstacles lying ahead and to send signals to other WonderBorgs.
- 6. Infrared LED 2**  
This LED sends out infrared rays to keep track of whether the floor is there or not.
- 7. Infrared Receiver**  
This is the sensor that receives infrared rays. It receives programs with infrared signals.
- 8. Light Sensor**  
This is the sensor that detects whether the WonderBorg's surroundings are light or dark.
- 9. Antenna**  
The socket of each of the antennae is a sensor. The WonderBorg can be programmed to react when one or both of its antennae touch something.
- 10. Connector**  
This connects the motor's units and the motherboard.
- 11. Option Connector**  
This is an external input/output terminal. It can be used to add an extra sensor or other device.



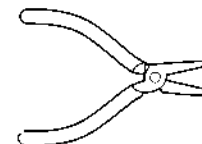
**Tools Required**

Note: These tools are not supplied with this product.

**Wire-cutters**



**Needle-nose pliers**



**Phillips screwdriver**

Note: This tool is used in the Hardware Variations section.



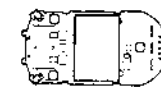
**Others**

APPROVAL RECORD	
Checked by	AA alkaline battery: 2
QA	AAA alkaline battery: 1
Eng.	Note: The AA and AAA batteries are not included with this product and must be purchased separately.
Mktg.	
Review	
Date	

**List of Parts**

**Electronic Parts**

Motherboard: 1

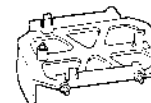


**Plastic Parts**

Body Shell: 1



Frame: 1



Battery Cover: 1



**Motor Parts**

Motor unit: 2

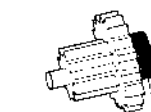


**Replacement Gears**

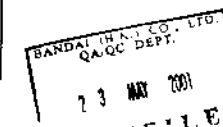
Pinion Gear 2 (white) (low-speed, high-torque type): 2



Gear Unit 3-2 (low-speed, high-torque type): 2



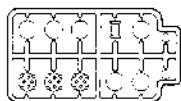
Black ring



**List of Parts**

**Set of Rubber Parts (with runners)**

Set of Rubber parts: 2



Foot A: 6



Foot B: 6



Leg Housing: 2



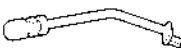
Antenna socket: 2



Antenna Protector: 4 (2 are spares)



Plastic Antenna: 4



Plastic Leg: 5

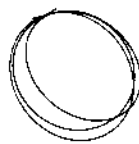


Thin Foot: 8

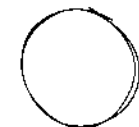


**Other Parts**

Special plastic leg wire (thick): 1



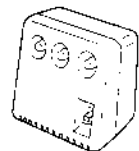
Special plastic antenna wire (thin): 1



Robot Works CD: 1

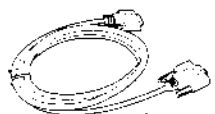


Interface: 1



Interface Cable

(RS-232C serial connection): 1



Sheet of decals: 1  
Instruction Manual (this manual): 1  
Test Field: 1

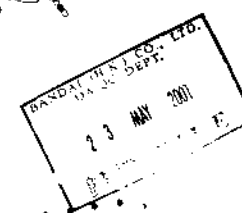
Now, at last, you are ready to start assembling the WanderBorg.

Please be sure to follow the instructions exactly.

You will need to be extremely careful, because you are going to assemble a set of precision electronic parts.

Be careful not to mix any of the parts which look similar to one another, such as the gears.

But don't worry too much, or it won't be any fun. Have fun assembling your WanderBorg - just take it nice and slow.



**APPROVAL**

Checked by: \_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

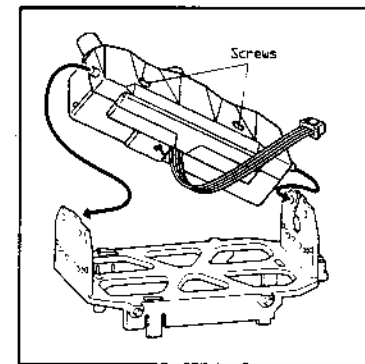
**The Basics**

**Assembling the Mechanism**

**1-1**

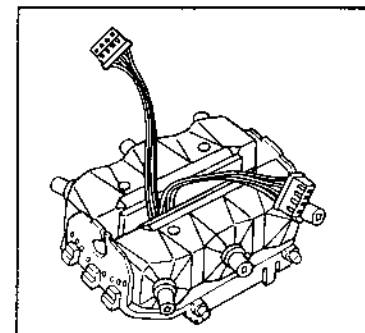
Using your fingers to open the frame slightly, take one of the rotor units and slot the pins on its front and rear into the holes in the frame. The motor unit should be inserted so that the cable exit is facing the inside, and the screws are uppermost.

Note: Be careful to insert the motor unit the right way up.



**1-2**

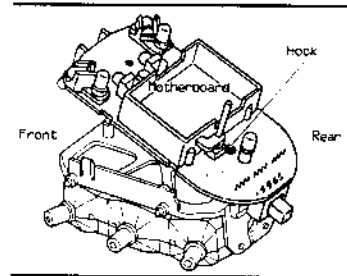
Insert the other motor unit in the same way. Make sure the cables are protruding, as shown in the diagram. The assembly of the WanderBorg mechanism is now complete.



**Installing the Motherboard**

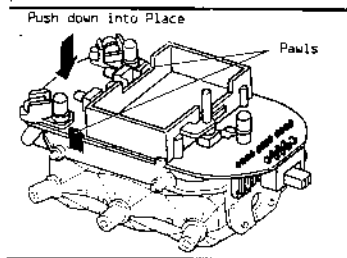
**2-1**

Slot the hook on the frame into the hole at the rear of the motherboard.



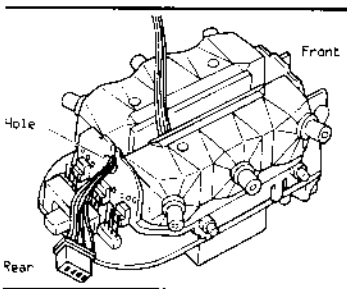
**2-2**

Press the motherboard down with your fingers until the pawls click into place, preventing the motherboard from being pulled off.



**2-3**

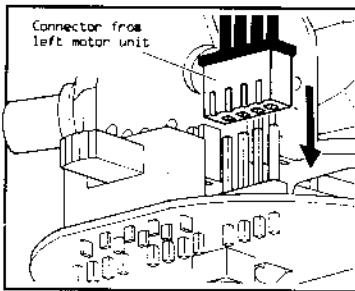
Pass the motor unit cables through the hole in the rear of the frame. Guide them through the hole one at a time.



**2-4**

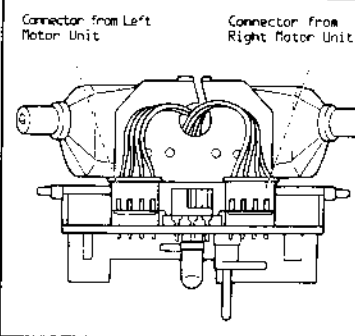
Plug the motor unit connectors onto the connectors on the rear underside of motherboard. The connector from the motor unit installed on the left should be plugged into the motherboard's left connector, and the connector from the right motor unit should be plugged into the motherboard's right connector. (Do not plug either into the motherboard's central connector.)

Note: Make sure the connectors are facing the same way, as in the diagram. The four pins of each motherboard connector should be inserted into the holes.



**2-5**

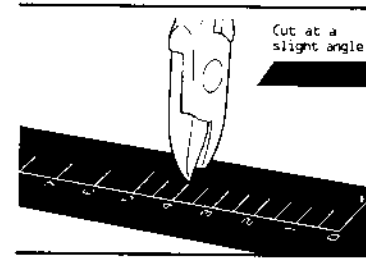
When both motor unit connectors are plugged into the motherboard, the installation of the motherboard is complete.



**Fitting the Legs**

**3-1**

Using a pair of wire-cutters, cut the plastic-covered leg wire into lengths of about 4cm. Cut the segments at a slight angle, so that they will be easier to insert later. Cut six identical segments. Use the handy ruler on page 56 of this manual.

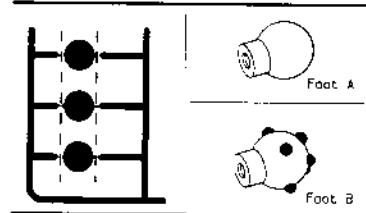


**3-2**

Using the wire-cutters, snip either "Foot A" or "Foot B" off the runners, when you do this, snip close to the foot. Snip out all six units.

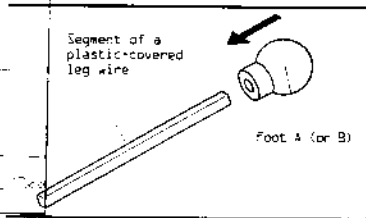
Note: Foot A - These work best on flat, even surfaces.

Note: Foot B - These provide a good grip on uneven surfaces.



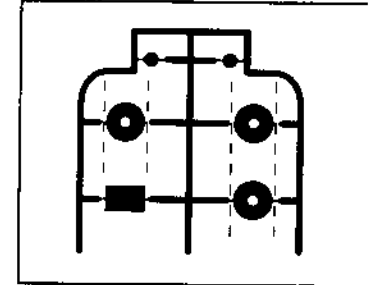
**3-3**

Insert one end of a segment of plastic-covered leg wire into one of the Foot A or Foot B units, pushing it in as far as it will go. Do the same for all six units.



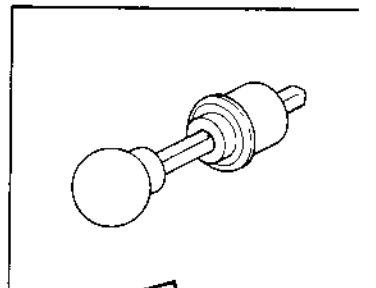
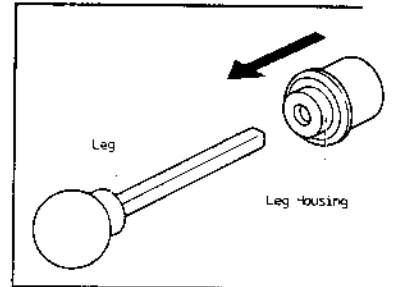
**3-4**

Using the wire-cutters, snip out the six leg housings from the runner.



**3-5**

Insert one of the legs into a snipped-out leg housing. Do this for all six legs.



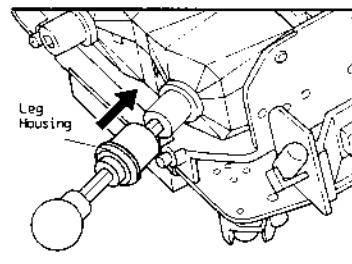
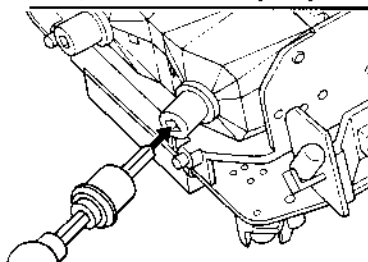
**APPROXIMATE**

Component	Quantity
Leg	6
Leg Housing	6
Foot A	6
Foot B	6
Segment of a plastic-covered leg wire	6

**Fitting the Legs**

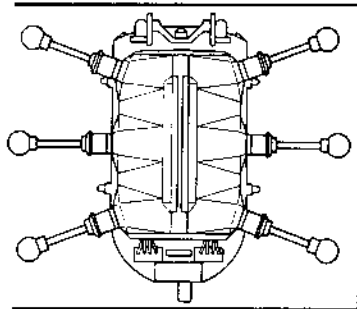
**3-6**

Insert the legs into the sockets on the WonderBorg's body. Push each segment of plastic-covered leg wire into the socket as far as it will go. If you have difficulty inserting the wire, push it in from a slight angle.



**3-7**

Fit all six legs in the same way. Fitting the legs is now complete.



**Fitting the Antennae**

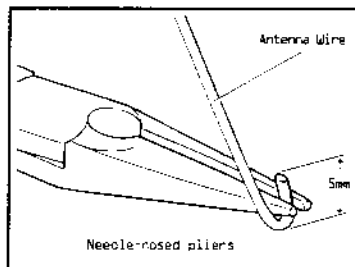
*Correction done 7/1/00*

**4-1**

Using the wire-cutters, cut a length of about 15cm off the plastic-covered antenna wire (use the handy ruler on the page 5a of this manual).

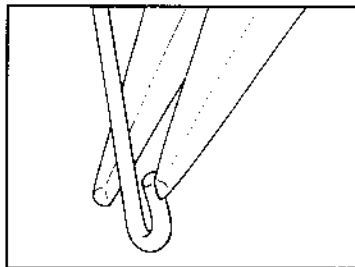
**4-2**

Using the needle-nosed pliers, bend back the last 5mm or so of the wire.



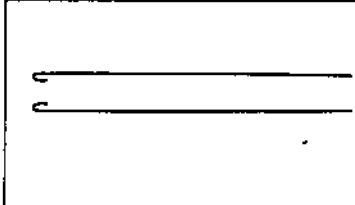
**4-3**

Using the needle-nosed pliers, squeeze the bent end of the wire to sharpen the bend.



**4-4**

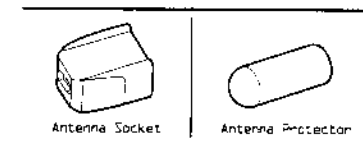
Do the same thing to another identical piece of wire.



**Fitting the Antennae**

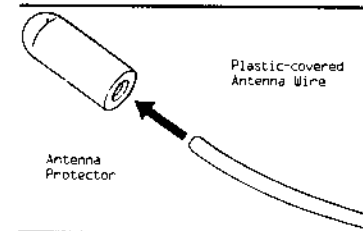
**4-5**

Using the wire-cutters, slip two of the antenna sockets and two of the antenna protectors off the runner. (The other two antenna protectors are spares.)



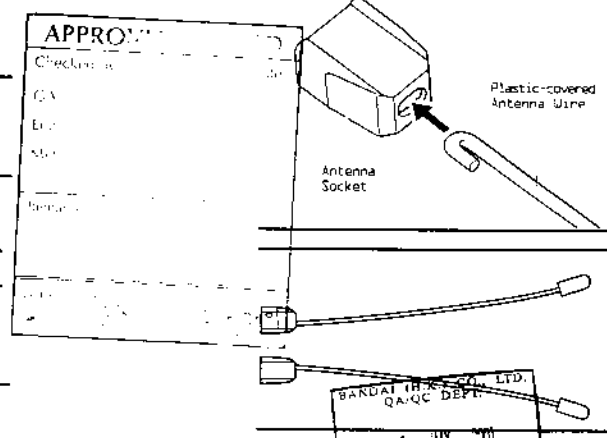
**4-6**

Insert the end of one of the segments of plastic-covered antenna wire into an antenna protector as far as it will go. Do the same with the other one.



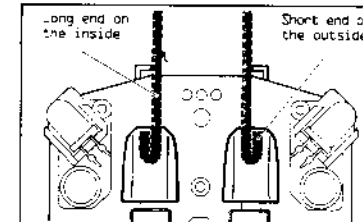
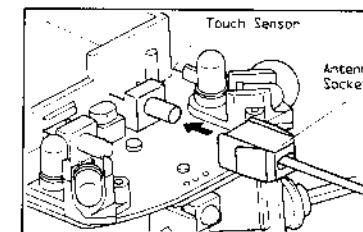
**4-7**

Insert the bent end of one of the antennae into one of the antenna sockets, as far as it will go. Do the same with the other one.

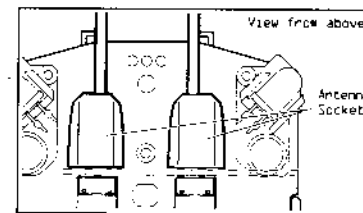


**4-8**

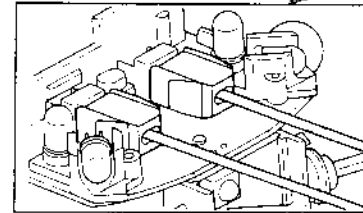
Plug one of the antenna sockets on to one of the motherboard's touch sensors, as shown in the diagram. When you do this, the cut end of the plastic-covered antenna wire should be facing outwards.



If you push the antenna socket too far in, the touch sensor may be unable to react. Leave a space of about 1 mm.



When both the left and right antenna sockets have been installed, the antenna installation is complete.



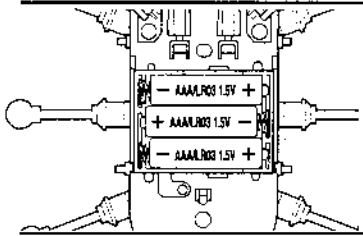
The WonderBorg's body is now complete.

*Correction done 7/1/00*

### Bending the Legs and Antennae

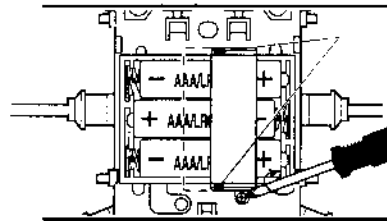
#### 5-1

Insert three AAA alkaline batteries (sold separately) in the WonderBorg, as shown in the diagram. Be careful to insert the batteries the right way.



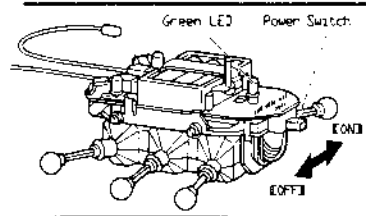
#### 5-2

Place the battery cover on top of the battery box. Be careful to position the battery cover with the holes positioned as shown in the diagram.



#### 5-3

Turn the WonderBorg's POWER switch ON. The WonderBorg's legs will move slightly, then stop immediately. The WonderBorg will make a beeping noise, and the green LED will light up.



If the WonderBorg does not work, check whether you have made a mistake in the assembly operation.

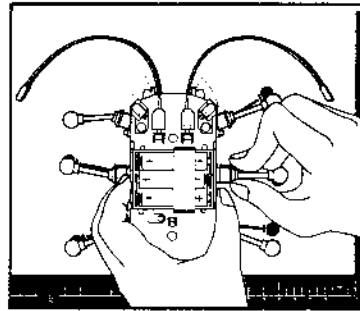
- Points to check:
- Are the connectors plugged in correctly?
  - Are the batteries inserted the right way?

#### 5-4

Turn the POWER switch ON.

#### 5-5

Place your WonderBorg on the leg and Antenna Bending Template on the page 5b of this manual. Bend the legs and antennae to match the illustration. They can be adjusted to any position. Once you have finished the adjustments, turn the power OFF.



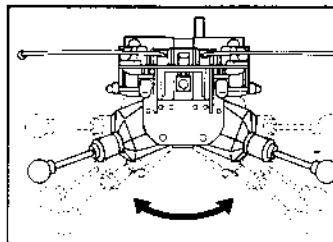
The bending of the legs and antennae is now complete.

Note: When the power is ON, the legs may move, so turn the power ON before adjusting them.

#### Extra Information

By changing the angle of the motor units, you can adjust the height of the WonderBorg. Note: If you adjust the angle of the motor units closer to the vertical direction (making the body higher), the WonderBorg will walk more smoothly over obstacles, but it will also be more prone to falling over.

Likewise, if you adjust the angle of the motor units closer to the horizontal direction (making the body lower), the WonderBorg will be less prone to falling over, but it will also be less inclined to walk over obstacles. The angle is altered in four stages.



#### APPROXIMATE

Check the angle of the motor units.

1. 45°

2. 30°

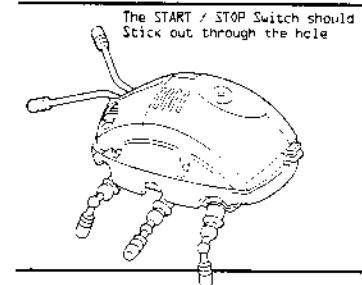
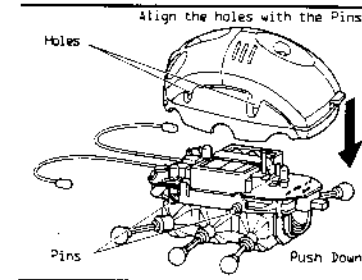
3. 15°

4. 0°

### Fitting the Body Shell

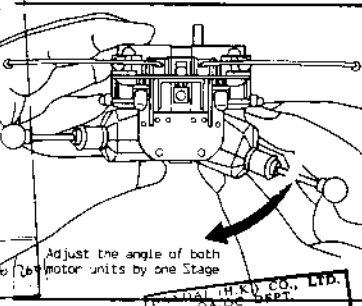
#### 6-1

Press the body shell down on to the WonderBorg's body so that the pins on the left and right side of the frame slot into the holes in the body shell. The START / STOP switch should protrude through the hole.

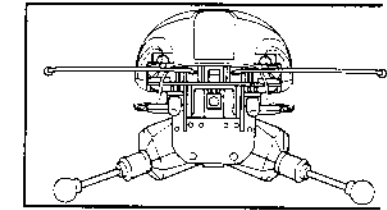


#### 6-2

Adjust the angle of the left and right motor units one stage away from the horizontal, so that they are slanted like the sides of the letter "M".



### Operational Testing

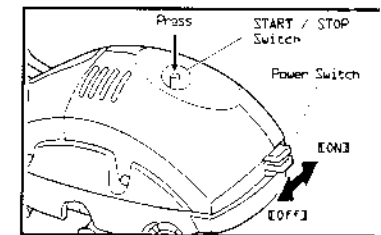


The WonderBorg is now complete. Next, carry out the following operational tests.

#### 7-1

Place the WonderBorg on the floor and turn the POWER switch ON. The legs should move slightly, then stop immediately. The WonderBorg should emit a beeping noise, and the green LED should light up.

#### 7-2



#### 7-3

The WonderBorg should emit a modulated beeping noise and start walking.

#### 7-4

The WonderBorg is pre-programmed with a test program (which is erased when you send it new data). Please check the following functions:

- Press right antenna: Rotates to the right
- Press left antenna: Rotates to the left
- Obstacle to right: Right eye LED flashes
- Obstacle to left: Left eye LED flashes

If the WonderBorg does not work correctly, check whether you have made a mistake in the assembly operation.

- Points to check:
- Are the connectors plugged in correctly?
  - Are the batteries inserted the right way?

#### 7-5

To halt the WonderBorg, press the START / STOP switch again.

#### 7-6

Turn the POWER switch OFF. The