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Chapter One HUMANOID KIT-Getting Started

1-1 Understanding HUMANOID KIT

What is HUMANOID KIT?

HUMANOID KIT is an all around bio-robot kit. The user can create not only whatever shape he or she wants, but also make it do different action.This kit will have the users' hands-on ability improved and comprehensive quality renewed.

Various Functions

HUMANOID KIT moves on itself based on the collected information from its sensors and joints. For example, you can create a puppy that reacts to claps. It stands up when hearing one clap, sits down when hearing two. Or make a robot that bows to a person, a robot that avoids obstacles, and a robot that plays with a ball. It can be operated with a remote controller. With the provided software, users without any knowledge related to robotics can easily program the robot's motions.

Simple Assembly

The basic components of HUMANOID KIT are H-M24 intelligent servo motor and H-S100 integrated sensor. With the help of some simple connectors, the user can link H-M24, H-S100 and H-CON101 all together quickly. The process is safe and convenient.

Below are the examples of robots built using the HUMANOID KIT.

1-2 Precautions

For your Safety   Please be aware of your own safety as you need to assemble by yourself. Before getting started, please read the instructions carefully:

Read the manual carefully before assembly.

Do not use any other tools other those provided in this kit.(no knives and drills)

Do not work on this product if you are sick , tired, and/or under the influence of alcohol.

Keep the robot away from your face.

Keep any parts out of reach of small children.

Be careful not to get your fingers stuck between the robot joints.

Do not operate the robot near water.

Do not store the robot under direct sunlight.

Keep away from fire and moisture.

Warnings while using for the first time:

Do not make your own cable if you are a beginner.

Do not use excessive force to assemble the robotic parts.

Please turn off the robot immediately if the robot joints are in an abnormal position due to wrong position set up.

If adaptor is used to power your robot, make sure your robot does not fall or make excessive movements to prevent cable damage.

While pulling out the cable, do not use excessive force to prevent cable damage.

While the intelligent servo motors are operating, if the LED is flickering, please turn off the robot for a while and restart it again.

Activate the robot on the floor, not on an elevated setting such as desks.There will be a service charge for repairs if the damage was inflicted due to the user's negligence.
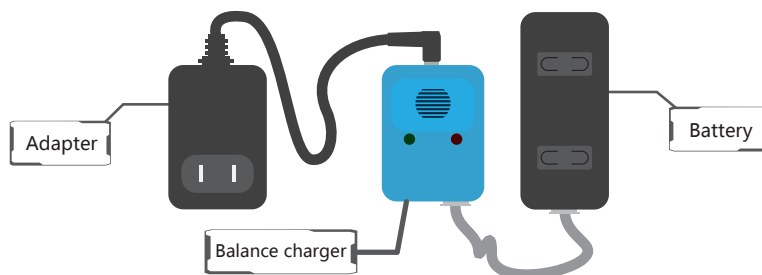
Charge the Battery
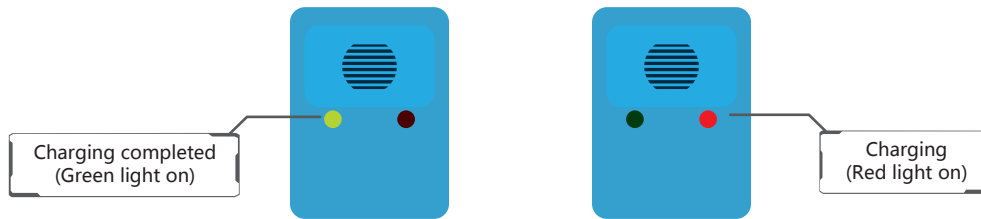
The power block for H1-S kit is lithium-polymer battery.

Steps of Charging

(Turn off the power after charging completed.)

STEP 1 : Link (Adapter，Balance charger，lithium-polymer battery)

Adapter

Balance charger

Battery

STEP 2 : Charge

Charging completed
(Green light on)
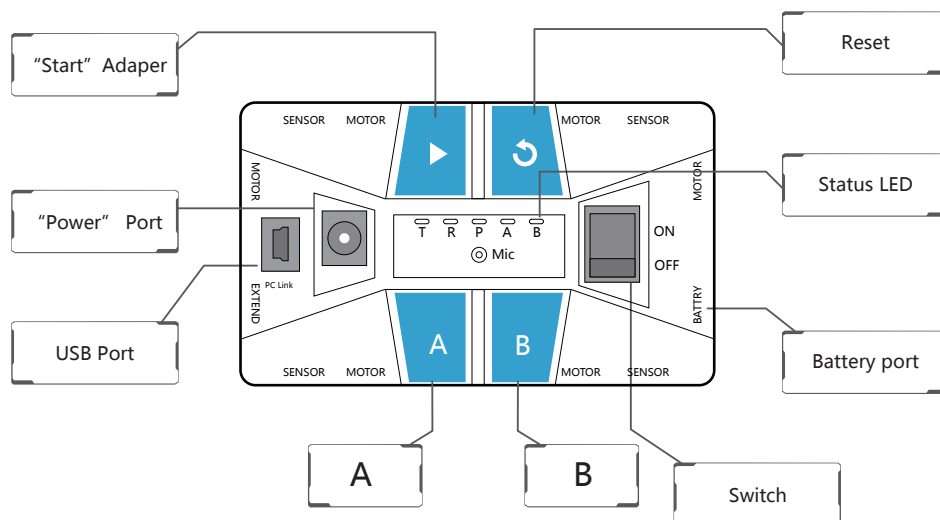
Charging
(Red light on)

※Notice for using power block. :

1.If there isn't enough battery left in the power block while using, the controller will give off a warning sound. Please charge the power block immediately.
2.Turn off the robot after using to avoid overdischarge, otherwise the capability of battery will drop quickly. Charge the battery if it is running low.
3.Fully charge the battery if the user will not use it for a long time, and store it in dry places.

1-3 Key Components of HUMANOID KIT

1-3-1 Hardware

● H-CON101 Controller

　　H-CON101 Controller is the controlling device of HUMANOID KIT, just like brain of the robot. It can handle 253 intelligent servo motors or H-S100 integrated sensor at the same time.There are 4 keys on the front side, bluetooth and gyroscope inside. Not only can it be linked with any kind of bluetooth devices, but tested in three dimensions.

"Start" Adaper

Reset

"Power" Port

Status LED

USB Port

Battery port

A

B

Switch

SENSOR MOTOR   MOTOR SENSOR
MOTOR
T R P A B
◎ Mic
ON
OFF
PC Link
EXTEND
MOTOR
BATTRY
A B
SENSOR MOTOR   MOTOR SENSOR

SENSOR 〉〉 Sensor port

MOTOR 〉〉 Intelligent servo motor port

BATTRY 〉〉 Battery port

● Power Supply

Power block and adaptor are included in the kit. Controller can be supplied by either power block or adaptor. Switch the controller on, the LED marked with "P" starts blinking.

● Communication

Connect the controller to PC by both USB ports linked with USB cable.

● Select and Run a Program

H-CON101 controller can store two sets of independent VJC programs. You can select where to download the program to. After downloading is completed, user can choose which one of the two programs to run by pressing A or B on H-CON101 controller. The chosen program starts when START is pressed.

● RESET

To reset the robot, press the "RESET" button to put it on standby, or turn off the power.

● A,B buttons

Commands can be input to the robot using these buttons. Before running program, please select Program A or B.

● I/O ports

In order to meet user's need, H-CON101 controller provides 4 I/O ports
(the ports marked "SENSOR" on the controller) for the expansion of sensors and actuators.

● H-M24 Intelligent Servo Motor

H-M24 Intelligent Servo Motor is a servo actuator designed for robot's joints. The user can control its position and speed. It can be used as wheels by setting it to rotate endlessly. It has function to detect temperature/ over current/ over voltage as well.

| Bolt |
| 4P connector |

| Central line |
| LED |
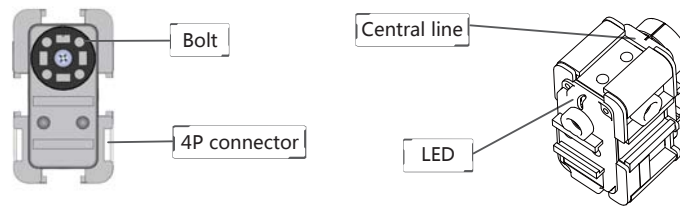
1-1 Ports on the intelligent motor

●ID

ID is an unique number assigned to each H-M24 to distinguish each one of them when it is all connected to the H-CON101. Therefore, all the H-M24s connected to the H-CON101 must have different IDs.

H-CON101   ID-1   ID-2   ID-3
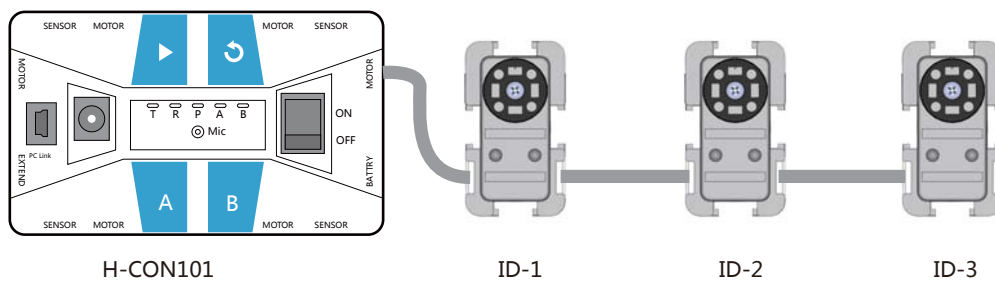
1-2 Connection of the intelligent motors

●Characteristic of ID

A user can manipulate the ID of the H-M24. The H-M24s in H1 series are provided with a preset ID, the user can change their IDs by exclusive software.

●Use as joints

When using the H-M24 in joint mode, it can move from -150～150° and the controller can control the position/speed value. To control the position, we set the position value from 0～1023. For example, like the image below, the position value "0" is -150 degree, the position value "512" is 0 degree, and the position value 1023 is 150 degree.

0°
（DATA=512）

CW   CCW

150°   -150°
（DATA=1023）   （DATA=0）
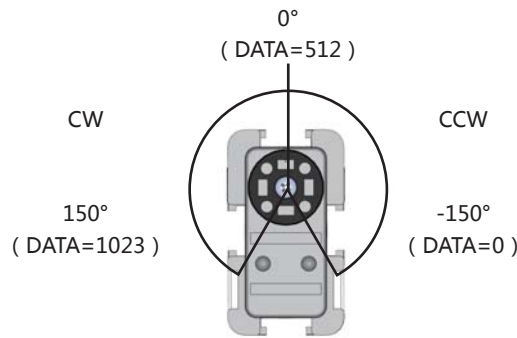
1-3 Position value illustration

● Use as wheels

When using the H-M24 in wheel mode, it needs to be set to rotate end-lessly with an appropriate speed value.The speed value can be set from -1023～1023. The speed value "0" means the motor stops, the speed value "-1023" is the max clockwise speed, the speed value "1023" is the max counter-clockwise speed.

● H-S100 Integrated Sensor

H-S100 integrated sensor is like the eyes and ears of robot.It contains functions such as distance measuring, light intensity measuring, sound detecting etc.It also has IR sensor which is used to detect objects or col-or(black/white).

Not only the structure of H-S100 is the same as H-M24, but also they share the same way of communication(RS-485).

Distance Measuring Part   Wireless Receiving Part

Sound Detecting Part
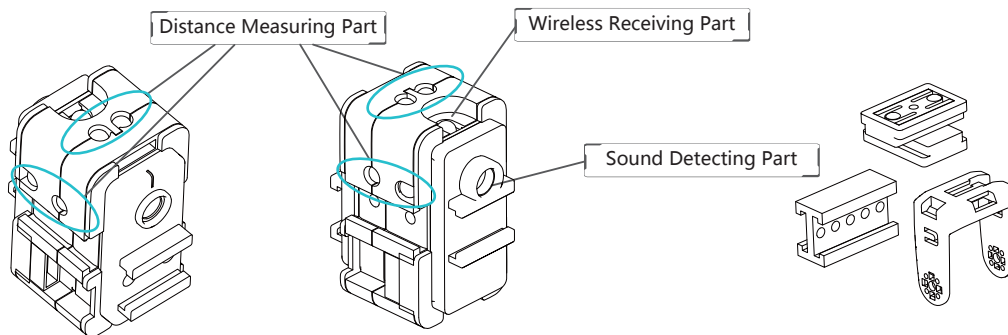
1-4 Integrated sensor   1-5 Illustration of connectors

● ID

The preset ID of the integrated sensor is 100. The allowed range of ID is 100-120.

● Connectors

Connectors include main body components, cable, wheels etc.With the help of connectors,without any screw or nut, the user can link the controller,

1-3-2 Software

To install the software, you need:

■ PC：A computer based on X86   [Request]
■ OS：WindowsXP，Windows7, Windows8   [Request]
■ RAM: 512M or more   [Suggest]
■ Hard Drive Space: At least 512M   [Suggest]
■ Resolution: More than 1366X 768   [Suggest]

Introduction of the Software:

The software, that HUMANOID KIT provides, contains model programs. The user can realize complex control by editing the model programs. Besides, high level users can write original programs by utilizing the expanded function in the software.

The user can create his/her own project soon by simply choosing the provided model programs.After downloading program to A or B, the user can control robot to do some of the basic functions which are elaborated in Quick Start. See more information, please refer to <Quick Start>.
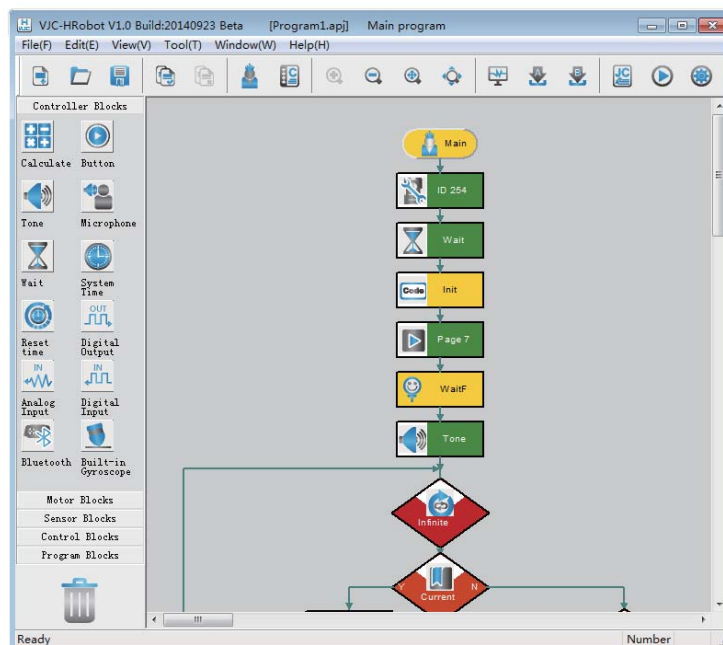
1-6 Model Program, Edit Window

VJC-HRobot contains functions such as flow chart editor, motion editor, model editor etc. You can use one or multiple editors to control the robot and/or edit programs. Also, you can use model program or your original program to control the robot.

1-4 Assembly Instructions

Steps to assemble a humanoid robot are as following:

Step1 Read Instructions.

Before assembly, please read this book(User' s Guide) thoroughly. Please refer to the provided assembly manual for the detailed assembly instructions and the basic robot motions.

Step2 Decide on the Robot' s Shape and Functions

Decide what kind of robot to make, what it is used for and what it looks like(robot joints). HUMANOID KIT is a reconfigurable kit capable of building diverse robots, but it is recommended to start by building the examples in the manual first.

Step3 Assembly/Wiring

Assemble the H-M24 intelligent servo motor, H-S100 integrated sensor around the H-CON101. Once everything has been assembled, wire each H-M24 or H-S100 to the H-CON101 with the provided cables like the image below. Please make sure the cables are long enough for the bent/stretched joints.
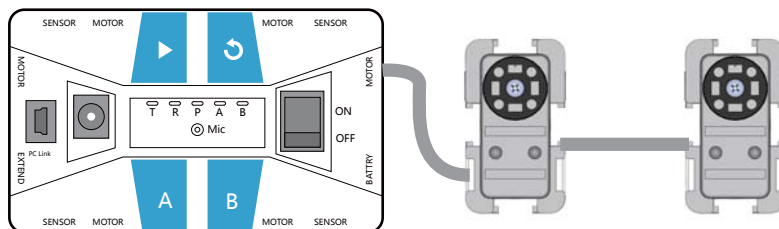
Step4 Check Assembly

Once robot is built, turn on the controller, press A and B button to see if the robot is at the right shape. If not, please refer to Quick Start for check & correct.

Step5 Programming with VJC-HRobot

For users who want to built your own robot, please choose blanket project on selection window. Those who build the standard robot can download model programs. If users are not satisfied with the model ones, they can edit and change them.

Step6 Download/Execute

After downloading program onto A or B, press "A" or "B" and "▶" on the controller to run the program.

Chapter Two Program for HUMANOID KIT

2-1 Installation of VJC-HRobot V1.0

The user can get the installation program of VJC-HRobot V1.0 from the disc. The setup program is "HRobot Setup V1.0.exe". Double click on it and press "Yes" or "Next" to finish installation. Before installing, you can choose where to install the program to. The preset installation directory is on the C drive. When installation is completed, there will be a Shortcut of "VJC-HRobot V1.0" on the desktop. Double click on it to open the program interface.

2-2 Framework of VJC-HRobot V1.0

The core of VJC-HRobot 1.0 editor is flow chart programming, which is assisted by RobotTerminal, RobotMotion, RobotForm. With the help of those software, it makes the robot more flexible, intelligent and convenient.

```
                  ┌──────────────────────────┐
                  │      VJC-HRobot          │
                  │ Flow Chart Programming   │
                  └──────────────────────────┘
                              │
        ┌─────────────────────┼─────────────────────┐
┌───────────────┐     ┌───────────────┐     ┌───────────────┐
│ RobotTerminal │     │  RobotMotion  │     │   Robotform   │
└───────────────┘     └───────────────┘     └───────────────┘
```
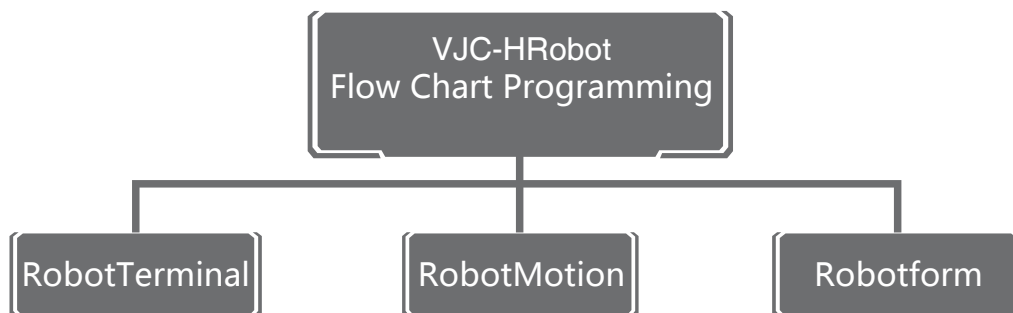
Flow Chart Programming: To edit the program for controlling robot. Control robot when and in what situation to make action.

RobotTerminal: To show, configure and control robot controller, intelligent motor and integrated sensor.

RobotMotion: To edit robot's motion and demonstrate the programmed motions.

RobotForm: To build a virtual robot created by the user on computer.

2-3 VJC-HRobot V1.0 Model Programs Selection

Double click on the icon of VJC-HRobot V1.0, a dialog box will appear.
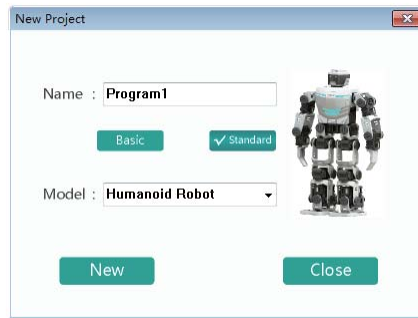
2-1 Dialog box of model programs selection

Project Name: The user must input the project name and click
    "Yes" to enter the programming interface.
Model: Names of the model programs that the user may need.

2-4 Project Interface of VJC-HRobot V1.0

    After selecting the model program, the user will enter an interface like shown below:
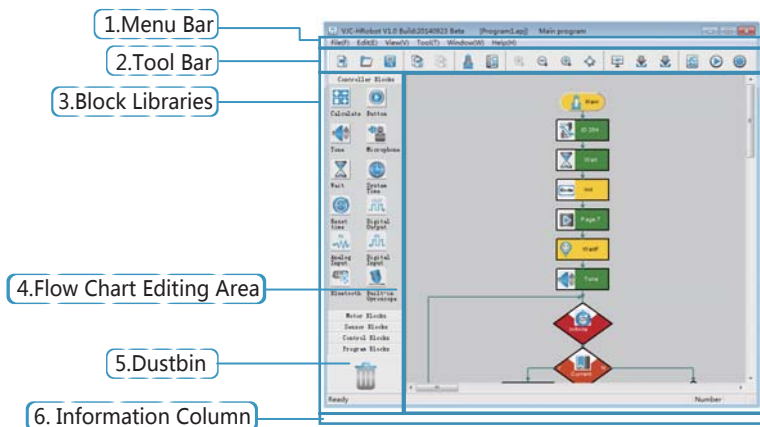
2-2 VJC Flow Chart Interface

Name of each part of the interface:
1.Menu Bar   2.Tool Bar   3.Block Libraries   4.Flow Chart Editing Area
5.Dustbin   6. Information Column

2-5 Functions of Menu and Toolbar

| Menu	Option Name	Icon	Function
File (F)	New(N)		Change the project's name and model's name.
	Open(O)		Select an item to open.
	Save(S)		Save current project. If saved for the first time, a dialog box will be open.
	Save As(A)	无	Open a new dialog box to save current project to another file.
	ESC(C)	无	Exit from current project
Edit (E)	Start Copy/Stop Copy		Enter copy mode. Start copy/ Stop copy.
	New Subprogram (N)	无	Open dialog box of creating a new subprogram. The user can select a subprogram from "Subprogram Location" on the menu.
	Delete Current Subprogram	无	After entering a subprogram, the user can delete it. If the subprogram has been applied, the user cannot delete it.
View (V)	Tool Bar(T)	无	Show or hide tool bar
	Status Bar(S)	无	Show or hide status bar
	Show JC Code (C)		Show or hide JC code window on the right. You cannot edit this window.
	Zoom In (I)		Zoom in the flow chart
	Zoom Out (O)		Zoom out the flow chart
	Full Screen Zoom(Z)		Show the whole program in one screen
	Full Screen (F2)		Show the flow chart in full screen. Press "ESC" to exit.
Tools (T)	Download to A(A)		Download current program to A
	Download to B(B)		Download current program to B
	Online Test		Show information of controller, intelligent servo motor and integrated sensor in real time.
	Set up for Bluetooth Match	无	Set up the match between remote control with controller
	JC Code Editor		Switch to JC Code Editor from Flow Chart interface
	Action Editor		Edit robot's action
	Model Editor		Edit model robot's structure
Window	Main Program Window		Switch to main program

2-6 VJC Programming

VJC, the graphic interactive C language, supports standard flow chart programming and standard C language programming. Beginners can learn it quickly, meanwhile advanced users can fully use it to develop much more complicated projects.

2-6-1 Functions of Block Library

It makes the complicated programming language into simple, graphic blocks. The user can use them by dragging the icons from the Block Library.

1.Contents of the Block Library

There are five types of blocks in flow chart programming, which are Controller Blocks, Motor Blocks, Sensor Blocks, Control Blocks and Program Blocks.
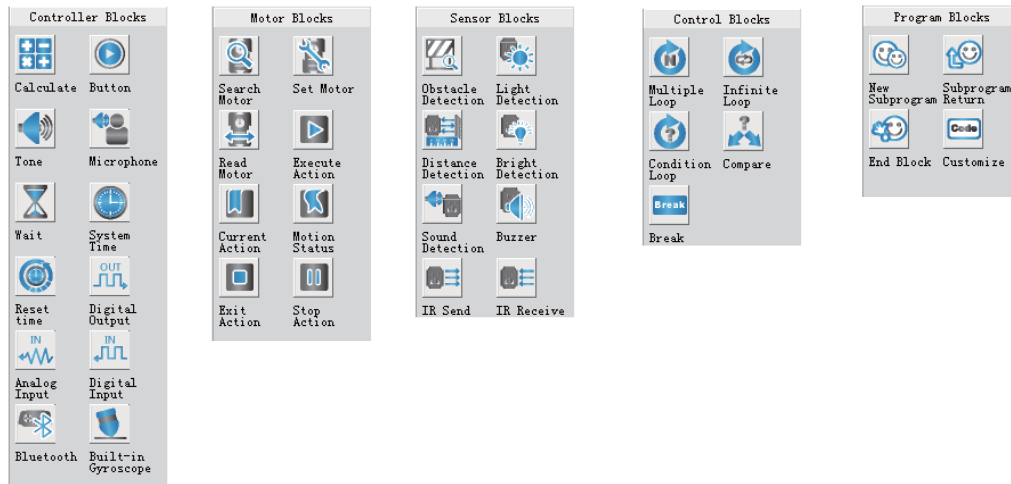
2、Conrol Blocks

Control Blocks are designed for testing and setting the Controller and I/O ports.

S. N.	Icon	Name	Function
1		Calculate	Define integer variable or do mathematical calculation;
		Button Status	Read button status info of the controller; "Start", "A" and "B" keys on HCON-101 can be read. With this block, keys on the controller can be used as a button in the software;
3		Sound Making	Set time for the buzzer inside the controller, measured by second.

4		Sound detection	Read analog input value from relative I/O port on the controller; generally used by voice sensor for data collection; For more info, see "Digital Input".
5		Wait	Wait a certain amount of time, measured by second.
6		System time	Read current time of the controller; unit of return value is second;
7		Reset time	Clear system time, and start timing again
8	OUT	Digital output	It refers to the digital output function of I/O ports on the controller; all on-off-type actuators can use this function; "Channel Number" parameter for this block corresponds to I/O port on the controller, "Status" parameter corresponds to the DO on-off status of the I/O port;
9	IN	Analog input	Read analog input value from relative I/O port on the controller; AI "Channel Number" corresponds to I/O port number on the controller; Clicking "Analog Input1" can help you rename the variable name; Clicking "Convert it to be a 'Compare block' after detection" can switch the block to be a judgment block; "Condition loop" block will be referred in control blocks in detail;
10	IN	Digital input	Read digital input value from relative I/O port on the controller; DI "Channel Number" corresponds to I/O port number on the controller; Clicking "DI Var1" can help you rename the variable name; Clicking "Convert it to be a 'Compare block' after detection" can switch the block to be a judgment block; "Condition loop" block will be referred in control blocks in detail;
11		Bluetooth Input	For checking status of the remote controller.
12		Inside Gyroscope	For checking robot's posture. Ranged from -16384~16384

3、Intelligent Servo Motor Blocks

Intelligent servo motor blocks are mostly used execute blocks of Humanoid robot, including execute blocks for main humanoid robot parts(control module of intelligent motor, playing of Motion page).

| S. N.	Icon	Name	Function
1		Search Intelligent motor	Search the connected intelligent motor by its ID. If the intelligent motor is connected, return to 1, otherwise, return to 0. For more info, see "Digital Input"
2		Set Motor	Set the attributes of the intelligent motor and controlling a single or the whole intelligent motors. For more info, see "Intelligent Motor Attribute List"
3		Read Motor	Read the attributes of individual intelligent motor. See "Intelligent Motor Attribute List" for more info.
4		Execute Action	For playing appointed action(created by Motion editor). See "Motion Editor" for more info.
5		Quit Action	For quitting playing action. The controller will quit playing the action after finish executing the action.
6		Pause	For pausing the playing action. Robot will stay at current status.
7		Current Page	For checking the page number of action that the robot is executing, ranged from 1 to 127.
8		Motion Status	For checking if the robot is executing the action page.(1 for Yes, 0 for No)

Note: When the user put 254 in the dialog box of Set Motor, the controller will start the same operation to all the intelligent motors.

4、Sensor Blocks

Integrated Sensor Blocks are commonly used blocks for Humanoid Robot, containing distance measuring, light intensity detection, sound detection, buzzer, IR receiving and transmitting.

S. N.	Icon	Name	Function
1		Obstacle Detection	For detecting obstacle at 3 directions. If obstacle detected on the left,it shows 1;in the middle, it shows 2; on the right,shows 4.
2		Light Detection	For detecting light at 3 directions. If light detected on the left,it shows 1;in the middle, it shows 2; on the right,shows 4.
3		Distance Measuring	For measuring distance on the left, in the middle or on the right.
4		Light Intensity Detection	For detecting light intensity on the left, in the middle or on the right.
5		Sound Detection	Read input sound value(0-255) from the integrated sensor. Usually used for gathering data from sound detection sensor.
6		Buzzer	The integrated sensor can make a musical sound by setting the musical note and time on the buzzer.

7		IR Transmission	Set the IR data that needed to be Transmit.
8		IR receiving	Read the received IR data.

5.Control Blocks

In user program, return value from each port generally has either of the below two functions: data storage or judgment making. And judgment making is used more frequently. As to VJC software, three judgment modes are available, they are: while sentence, if...else... sentence, for sentence.If a program wants to make a judgment, there should be an object and reference value. The object for comparison is often the return value of a certain sensor or updated variable value. So each block that is capable of "reading" function in sensor blocks can be converted to a "Condition judgment" block.

S. N.	Icon	Name	Function
1		Multiple loop	The block works as "for" sentence in C language. "Loop number" parameter in this block means how many times the block will loop. Exact loop number is specified by users
2		Infinite loop	The block works as "while (1)" sentence in C language. It repeats the body inside the sentence infinitely.
3		Condition loop	The block works as "while" sentence in C language. Parameters are the conditions that can be set by users. As long as the loop condition is met, the loop will continue, or the loop will be terminated and the program will run below sentences.
4		Compare	The block works as "if...else..." sentence in C language. Parameters can be set by users. If the condition is met, the program will implement the "Y" branch, or the program will implement the "N" branch.
5	Break	Break	The block works as "Break" sentence in C language. It is used inside a certain loop. When the program implements to this block, the quit the current loop.

Condition expression

"Condition" mentioned above is an expression including three parts: left part, middle part and right part. Left and right part can be formulas, variables or numerical values, while the middle part can be ==, !, =, >, <, >=, etc. Return value of such condition sentence only has two possibilities, they are 0 and 1. If return value is 0, the condition is not met. If return value is 1, then the condition is met.

When setting condition loop and condition judgment, you can find "Condition 1" and "Condition 2". Usually we only use "Condition 1". "Condition 2" will become valid if "Valid" option on tab "Con-

dition 2" is selected. After "valid" on tab "Condition 2" is selected, other parameters for "Condition 2" will be activated (refer to below picture).

Detailed description:

① Only when "Valid" selected will parameters for "Condition 2" become activated;

② Logic relation means the relation between "Condition 1" and "Condition 2". Three logic relations are available, they are "AND", "OR" and "NOT" (for C language, "&&", "||" and "&&!" instead). Parameters for "AND", "OR" and "NOT" can be formulas or values. Three results are available for the calculation:

"Condition 1 AND Condition 2": when both conditions are met, result is 1, or result is 0;

"Condition 1" OR Condition 2": result will be 1 if one condition is met at least, or result is 0;

"Condition 1 NOT Condition 2": If return values for both conditions are different, result is 1, otherwise result is 0;

6、Program Blocks

When write complex programs, there could appear several instructions repeatedly. The user can define them as subprograms by applying to Program Blocks.

S. N.	Icon	Name	Function
1		New Subprogram	This block can be used to build a new subprogram. Users can also reference a subprogram of another program. Subprogram can be taken as a package of many blocks for realizing a certain function. By using subprograms, the main program can be simplified.
2		Subprogram return	This block is used to end a subprogram and only can be used in subprograms.
3		End block	This block can be used to end a task or the main program. It generates no JC codes. It must be the last block of a task.
4		Customize	With this block used, users can write new programs with JC code.

7.Variables box

All kinds of variables in VJC-HRobot are put into the "Variables Box". Variables are automatically managed, created, evaluated, cited and recycled in the "Variable Box". You can use variables easily with the "Variables Box".

Yellow variable means that it has had a value, and white variable means that it is empty. Every variable in "Variable Box" is like a drawer. If you want to read and write variables, you need the "key" assigned by "Variable box".
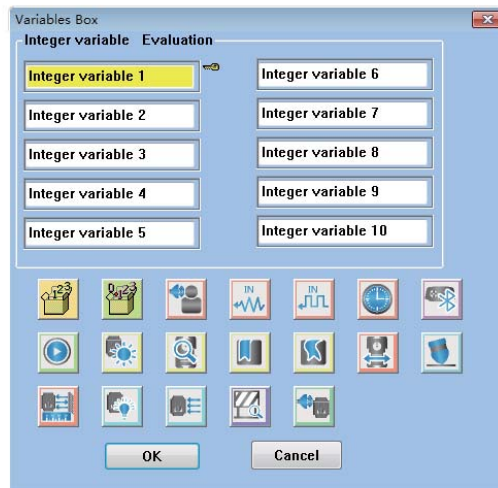
2-3 Variables box

2-6-2 Block Edition Area

1.Mouse operation

Users can introduce a block to the flow chart by clicking that block on the panel left to the flow chart area, and then click the mouse again to release the block after it's dragged to the right position in the flow chart area.Double click the block inside the flow chart area, and then you will see a pop-up dialogue box.Then you can set the parameters of this block in the dialogue box.Right click the mouse on a certain block inside the flow chart area, and then you will see a pop-up menu list. Items on the menu list are "Copy", "Paste", "Property", "Delete", "Copy to clipboard". Right click the mouse on the blank area inside the flow chart area, you will find "Paste from clipboard". What's notable is that VJC supports cross-window copy-and-paste function.

2.Adding, linking and inserting of blocks

Adding a block is easy. Users just need to drag a block into the flow chart area from the panel left to the flow chart area. To make the block effective, users should link the block to the flow chart. Besides, inserting of blocks is also frequently used. Below are some FAQ:

FAQ 1: Why blocks in flow chart area should be linked together?

Reply: If these blocks are not linked together with the "Main" block (on the top of the flow chart area), they are not part of the program and will not play any function for the program. When programming with VJC, you should drag blocks which you need to the flow chart area and then link them to the "Main" block (on the top of the flow chart area).

After these blocks are linked to the flow chart, their corresponding JC code will be generated automatically. You can see these JC code on the code zone right to the flow chart area. JC code (right to the flow chart area) is also a mark to check whether the program is valid. If blocks are not linked to the flow chart, no code related to this will be generated, and of course you can't find the related JC code of this block on the code zone. In this circumstance, the block means nothing to the program.

FAQ 2: How to link a block to the bottom of the flow chart?

Reply: To add a block to the end point of the flow chart, users should select a block on the panel left to the flow chart area by clicking the mouse, and then users should drag the block to the end point of the flow chart. When the cursor is on the end point of the last block in the flow chart, click the mouse, and then you will find the new block is linked to the main body of the program.

Notice: Red point on each block can be hidden by clicking "Block joint" in "View" of the main menu.

FAQ 3: How to make sure a block is linked to the flow chart?

Reply: When the new block is linked:

　　① an arrow appears between the new block and the block above it.

　　② Red point on the block which is above the new block disappears.

　　③ New JC code corresponds to the new block is generated in the code zone.

FAQ 4: How to insert a new block in the flow chart?

Reply: Steps for adding a new block between block A and block B:

　　① Click block B to move away block B and following blocks from the flow chart. And then click the mouse again to free them from the cursor (See picture 2);

　　② Drag a new block to the flow chart area and link it to block A (See picture 3);

　　③ Click block B to link Block B and parts below it to the newly added block (See picture 4);

④ Check: Observe the JC code zone to see whether new JC code of the new block is generated or not.
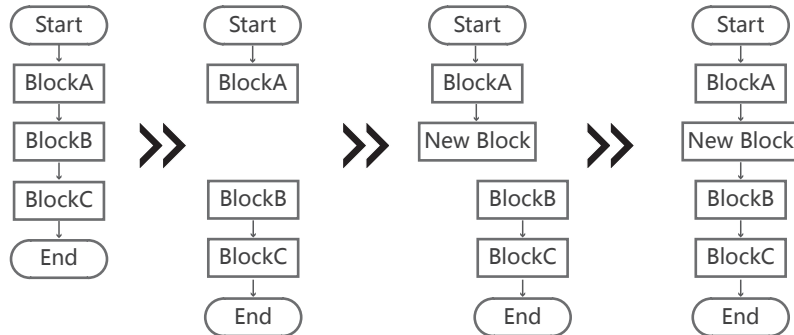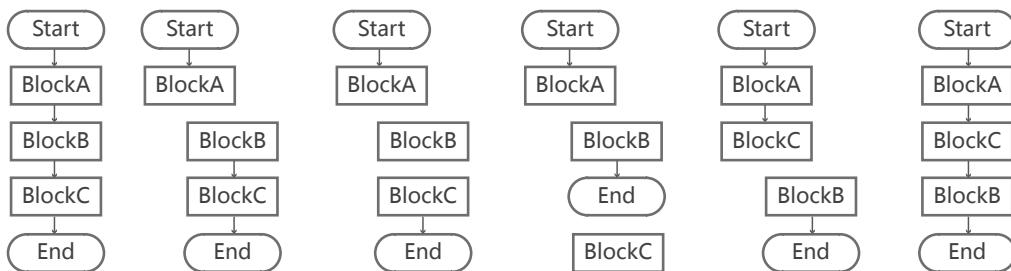

2-4 inserting of blocks

3.Moving blocks

Basic operation: Once you click your mouse on a certain block, the block is picked up. Then you can drag it to any position inside the flow chart area. You click the mouse again, the block is put down.

Follow below steps to switch the position between block B and block C:

2-5 Adjust the Order

4.Copy and paste blocks

Flow chart can be copied and pasted. Copy & paste operation can be classified into two types: copy & paste in the same window; copy & paste in different windows. Below are the detailed operation steps:

Right click the mouse while the cursor is on the first block of the block group you want to copy. Then you will see a pop-up menu listing below options: Copy, Paste, Property, Delete, Copy to clipboard. The picture on the right shows the options, you can take it as a reference.

After you click "Copy" on the pop-up menu, the selected block group will be highlighted by a green frame, indicating the blocks inside are copied. Refer to the right picture as a reference.

If you want to cancel copy operation, just press "ESC" or click your mouse on a blank area inside the flow chart window.
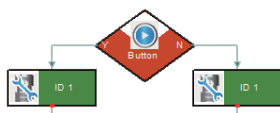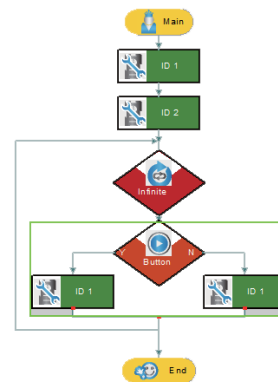
Right click the mouse on the "Red point" where you want to place the copied block group firstly. Then click "Paste" in the menu that popped up.

If you want to copy in one flow chart window and paste to another window. Then Please use "Copy to clipboard" and "Paste from clipboard". Please be notified that subprogram cannot be copies and pasted.

2-6-3 Deletion of blocks

Most blocks in Flow Chart area can be deleted(except Main Program block and Subprogram block). If you want to deleted a block,

(1)pick up the block that you want to delete and drag it into the garbage can. Before you move cursor on the garbage can, you can cancel your

operation by click on the right mouse button.

(2)move cursor to the block that you want to delete, click on the right mouse button, and select "Delete".

(3)Before deleting a certain subprogram, make sure the subprogram is not used in the Flow Chart area. Find the subprogram in Program Blocks, and drag it onto the garbage can.

2-6-4 Shortcut key

F2 Full screen

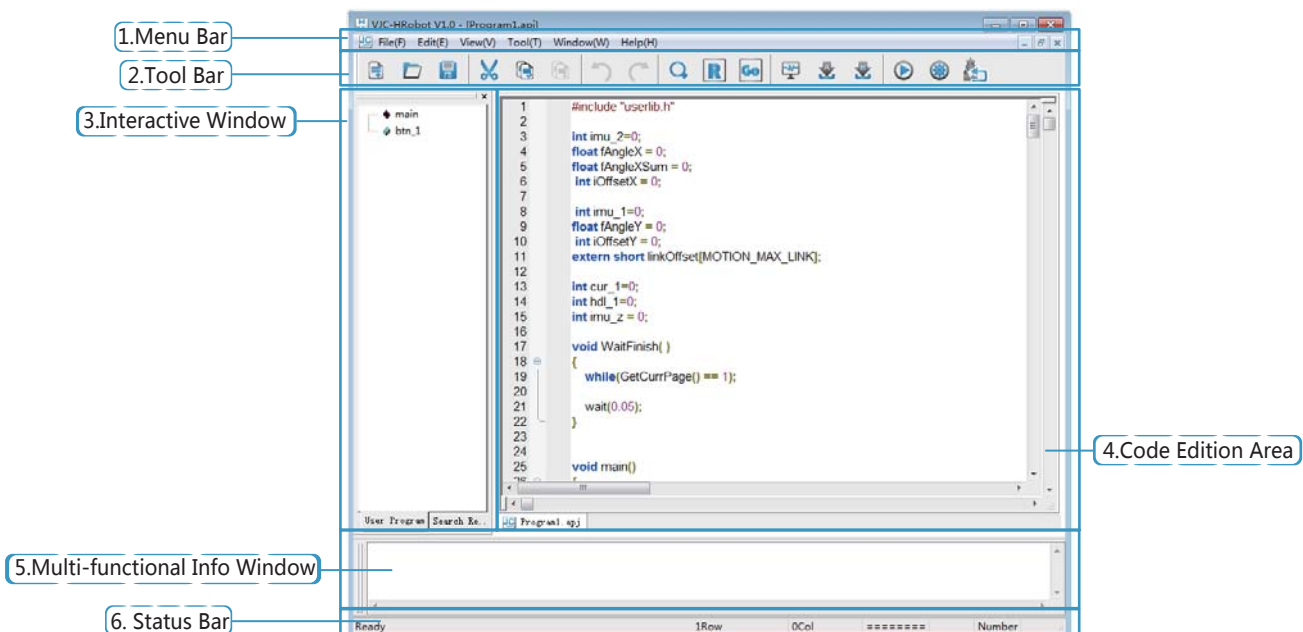**F1** Help

F5 Download to A

F6 Download to B

F9 Mark the block with the opposite color

ESC Exit full screen or cancel

2-7 JC Code Programming

The original version of VJC code is affiliated to C language, commonly called JC code. When it comes to VJC-HRobot, it has already been developed into standard C language, so users who are familiar with C language

2-6 window JC Code Programming

Name of each part of the interface:

1.Menu Bar 2.Tool Bar 3.Interactive Window 4.Code Edition Area
5.Multi-functional Info Window 6. Status Bar

Flow Chart Editor: Return to VJC Flow chart interface.

There are some differences among the Menu, Tool Bar, and Flow Chart under the JC code interface.

2-7-1 Fuctions of Menu and Tool

Menu	Option Name	Icon	Function
File (F)	See VJC Interface	See VJC Interface	See VJC Interface
Edit (E)	Go to Line(G)	Go	When you click this item, a dialogue box for line setting will pop up. Under JC code interface, each line of JC code has a serial number.
View (V)	Interactive Window	(Not Available Yet)	Hide or Show Interactive Window
	Multifunction window	(Not Available Yet)	Hide or Show Multifunction Window
Tools (T)	Compile in real time	(Not Available Yet)	When this function is confirmed to use, just-in-time compile result will be displayed in the "Interactive Window" for better helping you find grammar errors or cautions.

2-7-2 Interactive Window

Interactive window refers to the window on the bottom side of the JC code interface. In general, compile error, cautions, progress errors, etc will be displayed in this area. The position of the interactive window can be reset by dragging.

2-7-3 Multifunction window

On the left side of JC code area is the default area for the multifunction window. Multifunction window can divided into two sub windows: User Program, Find in File. "User Program" window displays the main program, subprogram, variables of the current program. Users can easily position any of these items (such as a variable) in the JC code area by double clicking the item in the multifunction window. Select an item in the JC code area and then right click your mouse, you will see a pop-up menu list. Click "Find All", then you will find the results are listed in the "Find in All" window on the left side of the JC code area.

2-7-4 Shortcut key

Ctrl + F2: Cancel marks

Shift + F2: Look for marks

Ctrl + "**+**" **:** Zoom In JC code

Ctrl + "**-**" **:** Zoom In JC code

Ctrl + "**W**" **:** Search all

Ctrl + "**F3**" **:** Search down

Shift + "**F3**" **:** Search up

Ctrl + F: Open the search dialog

Ctrl + A: Select all

Ctrl + H: Replace

Ctrl + Z: Repeat

Ctrl + C: Copy

**Ctrl + V:** Paste

Ctrl + X: Cut

2-7-5 Some Good Habits

❶ Try not to change structural layout of the program. VJC can set the indentation and alignment automatically, we suggest not to change it.

❷ Make comment after changing a program, especially when changing a variable or subprogram.

❸ Before writing a program, the user need to get some basic understanding about function of the controller by referring to the functions that are generated by the Flow Chart blocks.

2-8 RobotTerminal Detector

Test Online shows real-time data of the controller, intelligent motor and integrated sensor.

2-8-1 RobotTerminal Introduction of the Interface

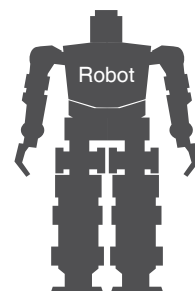⊞ Select "Test Online" in VJC-HRobot Project Interface and start real-time testing. The interface is shown below.
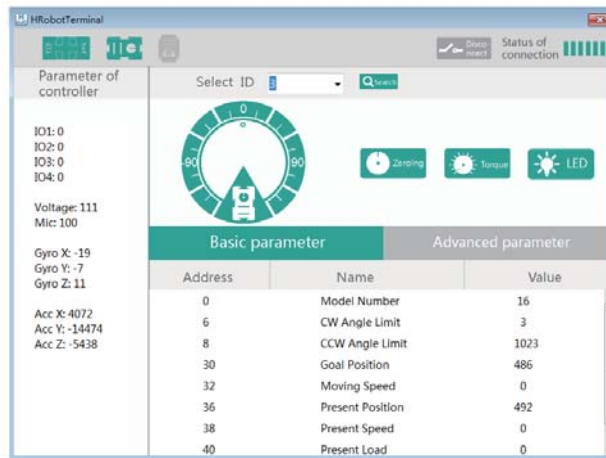
2-7 RobotTerminal

2-8-2 Function of Test Online

● Connection

A、Hardware Connection

2-12 Hardware Connection

As shown in the picture, connect to hardware of the robot, and turn on the power.

B、Software Connection

Select button [connect] to connect，When connection is successfully done, the button turns to be [disconnect]

If the connection hasn't been done successfully, the possible causes could be as follow.

    1. Power switch on the controller hasn't been turned on

    2. The controller hasn't been connected to the computer.

    3. The port has been occupied. Either the Action Editor or the Test Online can use the port, not both.

When the connection has been successfully done, interface of the controller will show like below.

➢ Data of Controller

Parameter of controller

IO1: 0
IO2: 0
IO3: 0
IO4: 0

Voltage: 111
Mic: 126

Gyro X: -20
Gyro Y: -7
Gyro Z: 12

Acc X: 4090
Acc Y: -14476
Acc Z: -5424

» This shows the input value of the I/O ports on the controller. This function can be used when the I/O ports are plugged with other sensors.

» The actual voltage is 1/10 of the read value (Voltage)

» Angular speed on different coordinates.

» Accelerated speed on different coordinates.

● Parameters Interface of Intelligent Motor and Integrated Sensor

Select ID [▾] [🔍 search]

If you put 1-18 to "Select ID", parameter of the corresponded intelligent motor will show.

If you put 100 to "Select ID", parameter of the integrated sensor will show. When there is only one intelligent motor connected and the ID of it is uncertain, the user can click on "Search" button to find it.

1、Query the Parameters of Intelligent Motor

>> Some shortcut buttons of intelligent motor.
[1]Drag the dot to adjust its angle.
[2]Button for adjusting to the zero position.
[3]Button for enable or disable the motors.
[4]Button for turning on or off the LED.

>> Basic parameters/ advanced parameters of the intelligent motor. For more info, please see Appendix 3.

2.Query the parameters of the integrated sensor.

>> List of functions. Distance measuring, light intensity measuring, sound detecting, IR sending etc.

Address	Name	Value
26	IR Left Fire Data	219
27	IR Center Fire Data	202
28	IR Right Fire Data	255

>> List of parameters for the selected module. See Appendix 3 to learn more.

2-9 HRobotMotion

HRobotMotion is like muscle of the robot, whereas the Flow Chart program is like the brain.With the brain, without the muscle, the robot will be handicapped, not able to operate some motions. However, with the muscle, without the brain, the robot won't be able to move as the user wants.

2-9-1 HRobotMotion Interface of Motion Editor

▶ Select the switch key to start the Motion Editor The interface is
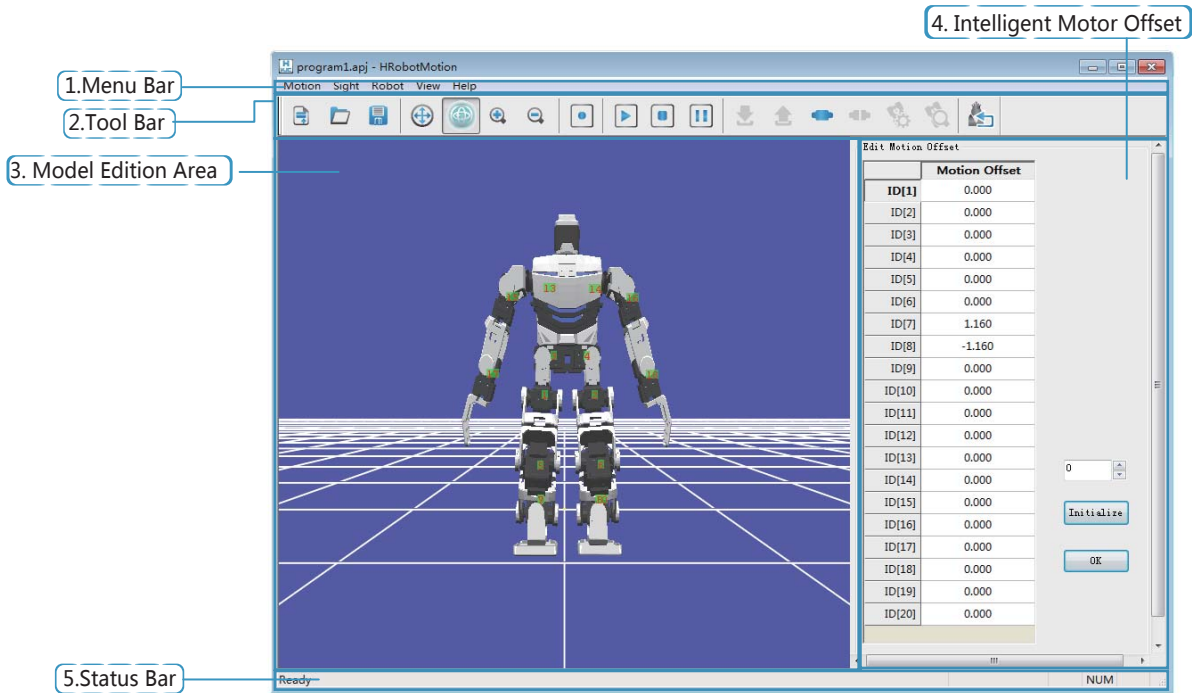
2-9 HRobotMotion interface

Name of each part of the interface:

1. Menu Bar   2. Tool Bar   3. Model Edition Area   4. Intelligent Motor Offset
5.Status Bar

Flow Chart Editor: Return to VJC Flow chart interface.

2-9-2 Functions of the Menu and Tools

Menu	Name	Icon	Function
Motion (M)	New (N)		Create a new motion page.
	Open (O)		Open a project file.
	Save (S)		Save the current model.
Sight (S)	Panning View (M)		Robot on the display window moves horizontally.
	Rotate View (R)		Robot on the display window rotates.
	Zoom in (I)		Zoom in on the view
	Zoom out (O)		Zoom out on the view
	Front View (F)		See the model from the front

	Front View (F)		See the model from the front
	Side View (S)		See the model from the side
	Down View (D)		See the model from the top
Robot (R)	Connect		Connect the robot to the controller
	Disconnect		Disconnect the robot to the controller
	Download Motion		Download motion page to the connected controller
	Read Motion		Read motion page from the connected controller
	Write Angle		Send the posture that the user selects to the robot and execute it.
	Read Angle		Show angle values of the intelligent motor in real time.
	Play Motion		Execute current setting (motion page, repeat times etc.)
	Stop Motion		Stop the motion page. Before stop, the robot will execute the set exit page.
	Brake Motion		Stop executing current motion page. The exit page won't be executed.
	Select Intelligent Motor		Select the ID number of the intelligent motor that is connected to the robot.
View (v)	Tool Bar		Hide or show tool bar
	Status Bar		Hide or show status bar
	Intelligent Motor ID		Show or hide ID of the intelligent motor
	Basic Parameters		Interface for beginner. It allows the user to adjust the motor.
	Standard Parameters		Interface for medium user. It allows the user to edit simple motion page.
	Advanced Parameters		Interface for advanced user. It allows the user to edit complicated motion page.
Help	Contents		Show HELP files
	About HRobotMotion		Show version number

2-9-3 Correction Value of the Intelligent Motor

If the intelligent motor hasn't been adjust to the zero position while assembly or using, it will cause imbalance when robot moves. Before operating the robot, please adjust the robot to its standard position, so that the robot will move more smoothly.

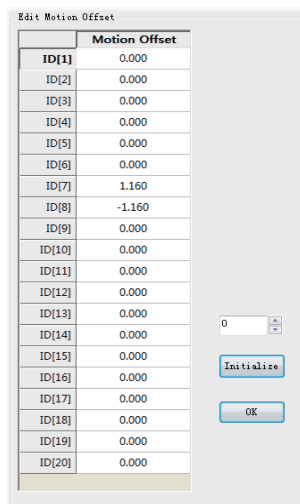※ **Robot's motion adjustment:**

Condition：Download the demo program for Humanoid robot to check the robot's motion. If one or two actions cannot be operated, then the user need to adjust the action one by one.

Way：Start the robot, pause to the position that robot is easy to fall, and adjust the corresponded intelligent motor's value.

※ **Conditions to robot's intelligent motor deviation adjustment:**

Condition：Download the demo program for Humanoid robot, and start it. If the robot cannot walk and turn normally, the user need to adjust the intelligent motor's deviation value.

Way：Start the robot, robot's original position is activated.First, check if the intelligent motors on robot legs are symmetrical (Motor ID 1-2, Motor ID 3-4, Motor ID 5-6, Motor ID 7-8). Then, put the robot on the table, adjust the motors where the joint is curved.

Edit Motion Offset

	Motion Offset
ID[1]	0.000
ID[2]	0.000
ID[3]	0.000
ID[4]	0.000
ID[5]	0.000
ID[6]	0.000
ID[7]	1.160
ID[8]	-1.160
ID[9]	0.000
ID[10]	0.000
ID[11]	0.000
ID[12]	0.000
ID[13]	0.000
ID[14]	0.000
ID[15]	0.000
ID[16]	0.000
ID[17]	0.000
ID[18]	0.000
ID[19]	0.000
ID[20]	0.000

0

Initialize

OK

2-10 Interface of motion offset for the intelligent motor

Motion offset: Select the intelligent motor to input motion offset.
Zero Clearing: Change the motion offset of the chosen intelligent motor to zero.
Yes: Save the intelligent motor's motion offset.

 ※**How to set the motion offset of the intelligent motors ?**

Intelligent motor ID	Shift Weight Forward	Shift Weight Backward
ID[1]	Reduce	Increase
ID[2]	Increase	Reduce
ID[7]	Reduce	Increase
ID[8]	Increase	Reduce
Intelligent motor ID	Shift Weight Leftward	Shift Weight Rightward
ID[3]	Reduce	Increase
ID[4]	Reduce	Increase
ID[9]	Reduce	Increase
ID[10]	Reduce	Increase

 ※**Ground rule for motion offset of the intelligent motor.**

 To keep the foot plate horizontal, try not to change a single intelligent motor's value with big number. The user can split it up to two motors, for example, if the right leg shifts weight forward about 10, correct motor ID[1] with -5 and motor ID[7] with -5, too.

2-9-4 Show the Standard Interface of Motion Page
 For medium and advanced users who want to write their own robot motions, they can expand the window by selecting "View" and click "Standard Parameters". The interface is shown below.
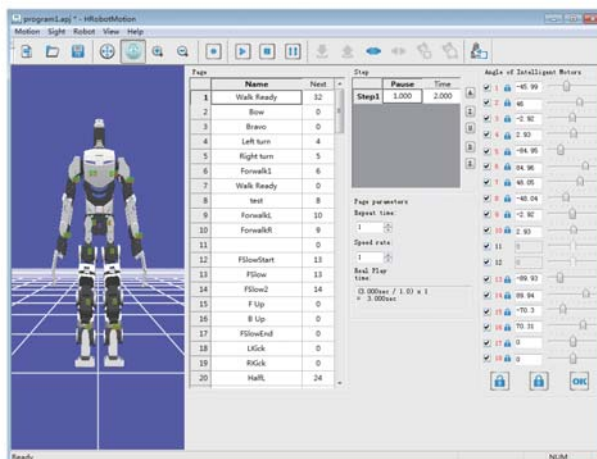
2-11 Interface of Motion Editor

Basic Operation

1.Connect/Disconnect the Robot

① Connect robot to PC by data wire that is provided with the product.

② Select to build connection between robot and PC. If connection is successfully done, this button will turn to gray.

If the connection fails, possible causes could be as following.

The RobotTerminal detector is still connected(the data can only be used by one program).

The controller has no power supply.

The controller hasn' t been reset(the controller can only connect to the computer when it has been reset)

No data wire connected.

Something wrong with the data wire or port on the controller.

③ Select from to disconnected the communication between robot and PC. If disconnection is successfully done, this button will turn to gray.

2.Download/Upload the Action File

① Connect the robot by clicking "Connect/Disconnect the Robot".

② Click to download the action file to the controller.

③ Download Sign: When the bar at the right bottom turns to green, the program download has completed.

④ Click to upload the action file from the controller to current interface. Your action file that is edited previously will be lost, make sure to save before upload.

3.Demonstrate the Existing Action Online

①Connect the robot based on "Connect/Disconnect the Robot".

② Reset: All intelligent motors on the robot turn to zero position. The robot returns to its standard gesture.

③ Play: After downloading the action to the controller, press this button to demonstrate the action(Download the program before operation, otherwise the robot will demonstrate action that is saved previously).

④ Stop action: Stop the executing action. Before full stop, robot will execute action that is set for exit.

⑤ Brake action: Stop the executing action. No more action involved.

Program the Action

1.Frame of Action Programming

　　Take Humanoid Robot(16 intelligent motors) as an example, the angles of the 16 intelligent motors form an action step, multiple steps(7 at most) form an action page.To make steps consistent, they are connected by Execution Time and Pause Time. Action pages are connected by Next Page and Exit Page.
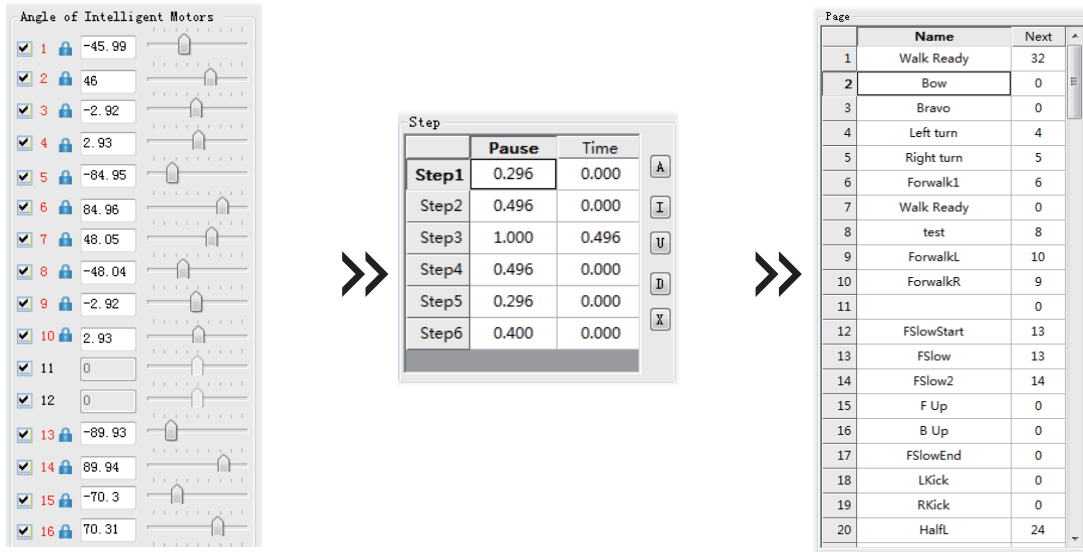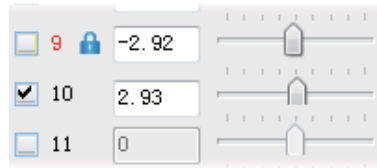

2.Posture Programming

Robot posture is combined with all the angles of the intelligent motors that move at one moment. It can also be called an Action Step.
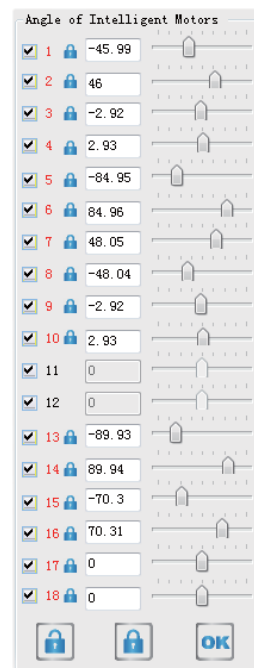
1 Three Status of Intelligent Motors

● Intelligent Motor Unused(The referred intelligent motor is not used on the robot model)

　　Sign: Like shown in the picture above, intelligent motor ID 11 cannot be edited.

　　Way to Switch: Menu "Robot" -> "Select an Intelligent Motor". The intelligent motor with a checked mark is used, the one without is unused.

● Lock the Intelligent Motor(The intelligent motor cannot rotate)

　　Sign: Like shown in the picture above, intelligent motor ID 9 is locked(ID number is shown in red and with an icon of a lock).

　　Way to Switch: Select the intelligent motor that need to be locked. Select 🔒 to lock it.

● Unlock the Intelligent Motor(The intelligent motor can rotate)

　　Sign: Like shown in the picture above, intelligent motor ID 10 is unlocked(ID number is shown in black and without an icon of a lock).

　　Way to Switch: Select the intelligent motor that need to be unlocked. Select 🔒 to unlock it.

2 Selection of Intelligent Motor
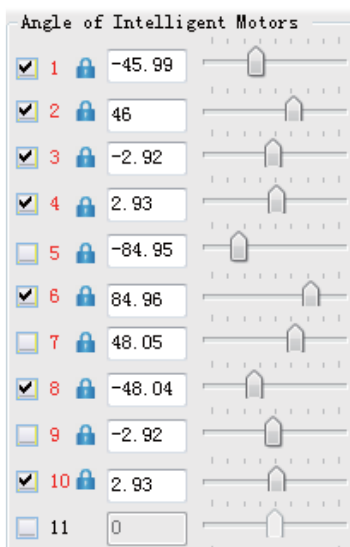
Wipe all Selection: Double right-click on the blanket area(gray area on the pic) to wipe all selection

Consistent Selection: Press and hold "SHIFT". Move cursor to select the intelligent motors consistently without press left-click(as pic above,intelligent motor 1/2/3/4)

Inconsistent Selection: Press left-click to select each one of the intelligent motor(as pic above,intelligent motor 6/8/10)

❸ Set the Angle(i.e. Online Programming)
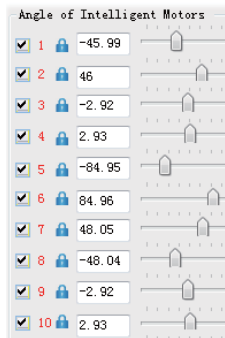
Way to Switch: Press 🖱️ in Tool Bar to set all intelligent motors.

Change the Angles of the Intelligent Motors: Insert numbers in the corresponded box or drag the scroll bar.

❹ Read the Angle(i.e. Demonstrative Operation)

Way to switch" Press 🔍 in Tool Bar to read all intelligent motors.

Procedure of Demonstration: Unlock the intelligent motor that you need to change. Rotate the motor into the position you want with your hand. Lock the intelligent motor and press OK to save.
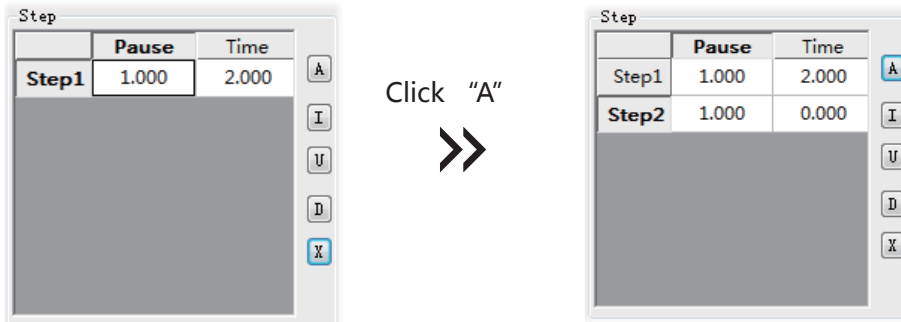
3.Edit the Step(i.e. Multiple Postures)
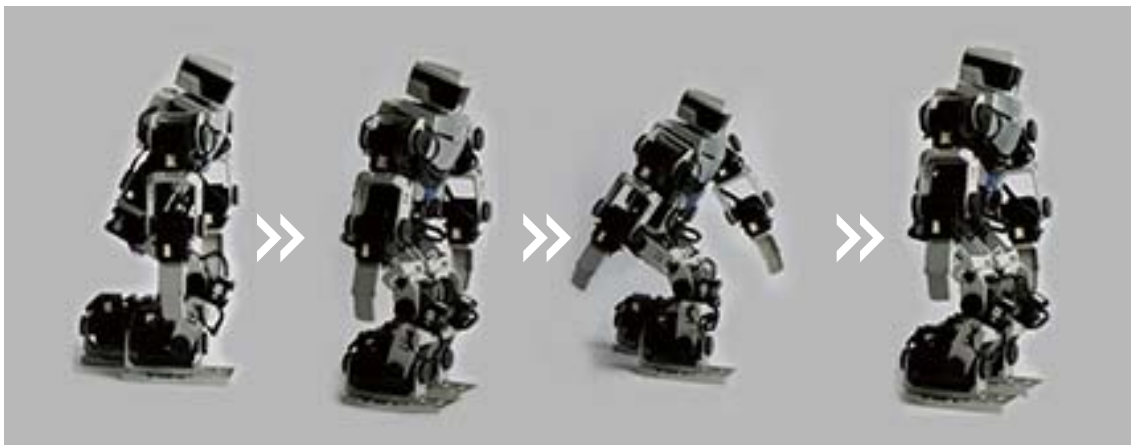
A step is the combination of robot's posture

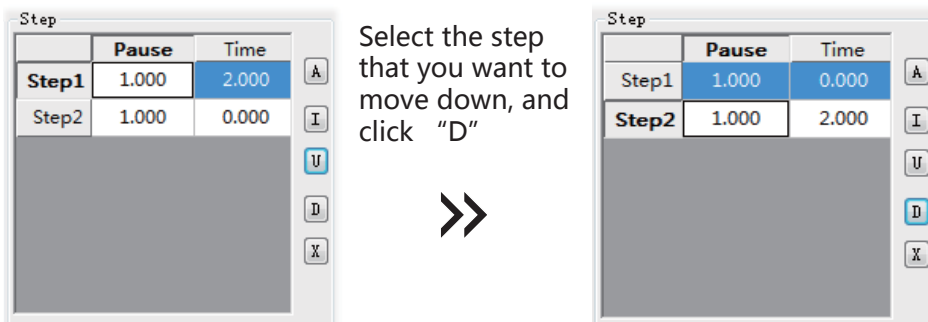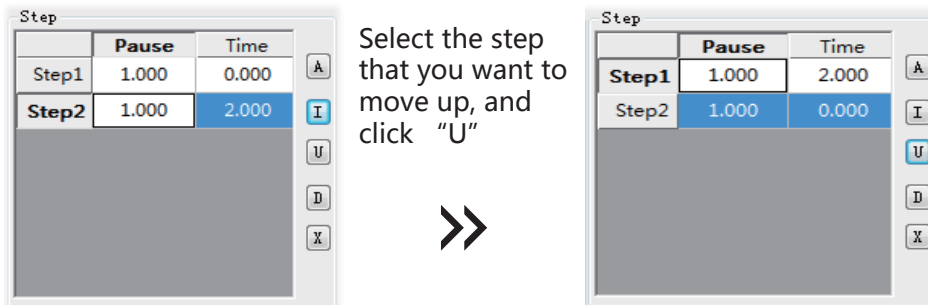**❶ Number of Steps: 7 at most(to form an Action Page)**

❷ Add/Insert/Move/Delete:
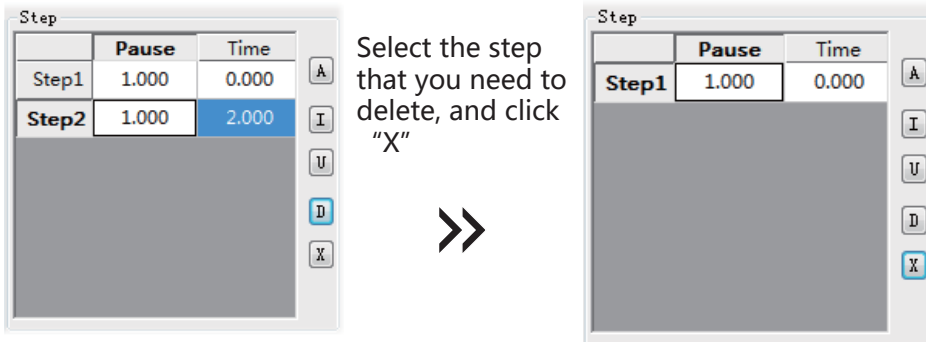
Add: To add a step at the end of Steps List.

Click "A"

Insert: To insert a step before the step you select.

Click "I"

Move: To move one step up or down.

Select the step that you want to move up, and click "U"

Select the step that you want to move down, and click "D"

Delete: To delete the step you select.

Select the step that you need to delete, and click "X"

③ **Execution Time/Pause Time:**

Execution Time: Time it takes from starting the step till finish executing.
Time Resolution: 0.008s. Max Time:2.04s. Select from the drop-down list.

Pause Time: Time it takes to pause from finishing executing current step till the beginning of the next step.
Time Resolution: 0.008s. Max Time:2.04s. Select from the drop-down list.

Copy/ Paste：
    Select the Step, press "Ctrl+C" to copy
    Select the Step, press "Ctrl+V" to paste

4.Edit the Action Page

   Action Page is the combination of robot postures. Every action page can be set Repeat Times and Execute Speed(the bigger the number is, the faster the current action page runs)

❶ Parameters of the Motion Page

Repeat Times ： After the current page being called in VJC, it shows the times the page repeats.

Execute Speed ： It concerns the executing time of all motion steps, stop time and execute speed ratio. The bigger the value is, the faster the current motion page gets executed.

**❷** Execute the Motion Page

2-12 Action Page Programming

Range of Action Pages: 1-127, 127 pages in total.

Next Page: When it is not programmed with "Exit Playing", the program will execute the next action after finish the current page.

2-9-5 Advanced Parameters of Motion Page

For users who know much of robotics, they can expand the window by selecting "View" and tick "Advanced Parameters". The interface is shown below.
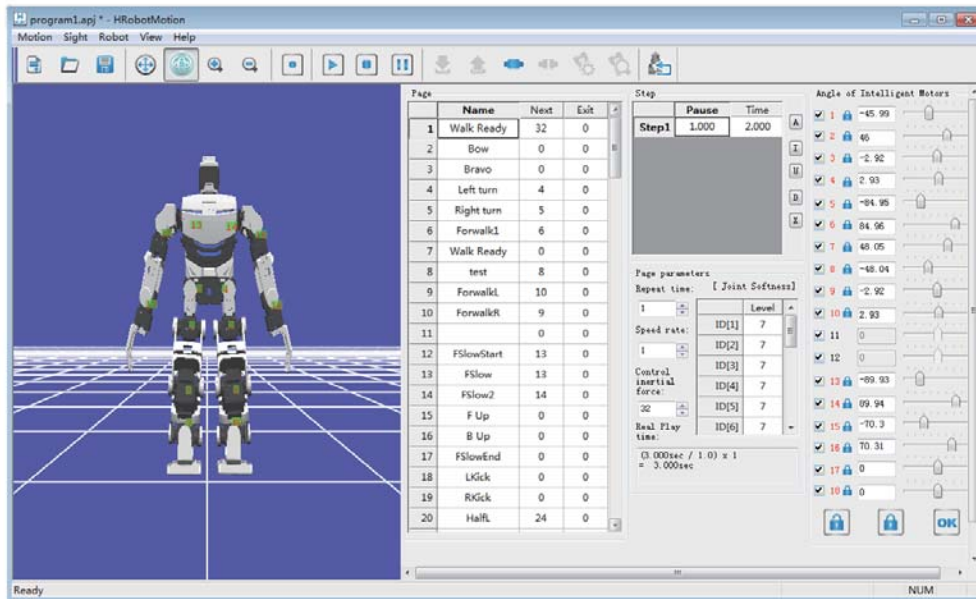
2-13 Interface of Motion Editor

Comparing to the Standard Parameters, it adds the parameters of exit page and joint flexibility.

❶ **Exit Page**

Exit Page: Apply to "Exit Playing" when executing the page or connecting to the page.

❷ **Joint Flexibility (Level 1-7)**

The higher the level is, the more smoothly the intelligent motor works. It suits for dance movements etc., but not for walk movements.
The lower the level is, the more powerful the intelligent motor works. It suits for walk movements.

2-10 HRobotForm Model Editor

3D model of the robot that the Model Editor creates can simulate robot's motion on the computer. HUMANOID KIT is a module-design robot kit, which can minimize the time used for building it. The same applies to the Model Editor, which is based on modules too. The user can

create whatever robot model rapidly by using this software.

2-10-1 HRobotForm Interface of Model Editor

Select the switch key to start the Model Editor. The interface is shown below.
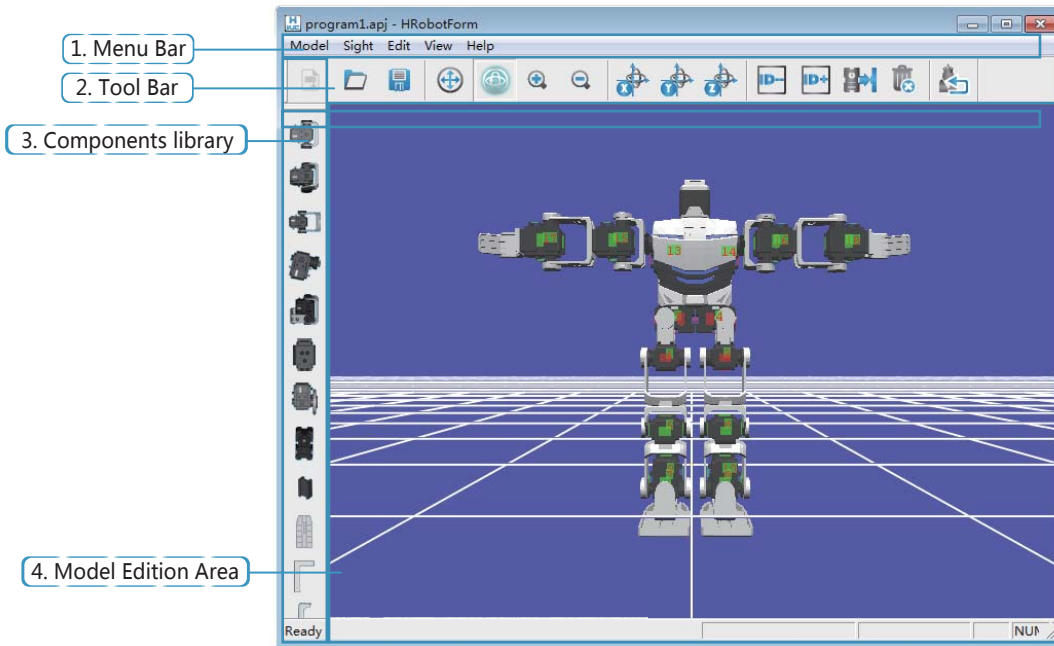
Name of each part of the interface:

1. Menu Bar   2. Tool Bar   3. Components library   4. Model Edition Area

Flow Chart Editor: Return to VJC Flow chart interface.

2-10-2 Functions of Menu and Tool Bar

Menu	Name	Icon	Function
Motion (M)	New (N)		Create a new model.
	Open (O)		Load model from a project file.
	Save (S)		Save the current model.
Sight (S)	Panning View (M)		Robot on the display window moves horizontally.
	Rotate View (R)		Robot on the display window rotates.
	Zoom in (I)		Zoom in on the view
	Zoom out (O)		Zoom out on the view

	Front View (F)		See the model from the front
	Side View (S)		See the model from the side
	Down View (D)		See the model from the top
Edit （T）	X-axis Rotation: (X)		The selected unit rotates 90 degree on X-axis.
	Y-axis Rotation: (Y)		The selected unit rotates 90 degree on Y-axis.
	Z-axis Rotation: (Z)		The selected unit rotates 90 degree on Z-axis.
	ID+ (+)		The ID number of the selected intelligent motor increases one.
	ID- (-)		The ID number of the selected intelligent motor reduces one.
	Connection:（C)		Connect the selected units according to the selected surface.
	Delete: （D）		Delete the selected unit.
View (v)	Tool Bar		Hide or show tool bar
	Status Bar		Hide or show status bar
	Intelligent Motor ID		Hide or show ID of the intelligent motor
	Connect Point(C)		Hide or show the connect point on the intelligent motor
Help	Contents		Show HELP files
	About HRobotMotion		Show version number

2-10-3 Components Library

　　This part of the interface contains almost all connectors of the HUMANOID KIT. With these components, the user can build 3D model of the robot that he wants.

Tip: Before adding components in the model edition area, you must select an existed component that you want the new component to connect to. At first, the new component will connect to the bottom plate.

2-10-4 Mouse Operation

Click the Left Button:

❶ Click on the unit to select.

❷ Click on the empty space to cancel selection.

❸ Click on the surfaces that need to be stuck together to select. Click on the empty space to cancel selection(Only two surfaces are select, can the instruction be valid).

Press and Hold Left Button to Drag:

When the unit is selected, press and hold left button to drag it.

Press and Hold Right Button to Drag:

Under the Rotate View mode, press and hold right button to rotate your vision. Under the Panning View mode, press and hold right button to move your vision horizontally.

Mouse Wheel:

Rotate the wheel to zoom in or out your vision.

2-10-5 Example of Model Edition

Step One: Click the left button to select the Bottom Plate.

Step Two: Add the output block by selecting in the blocks library.

Step Three: Choose an axis by left-clicking on the component. Drug it along the axis to the position you want.
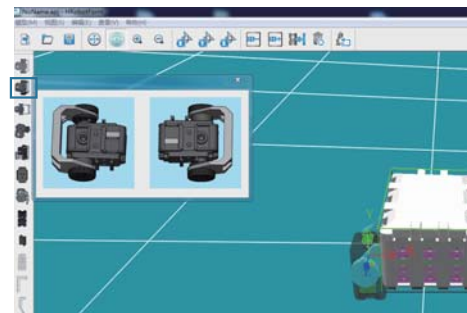
Step Four: Select the component and the connect surface and left click on "Connect" [icon] in "Tool Bar".
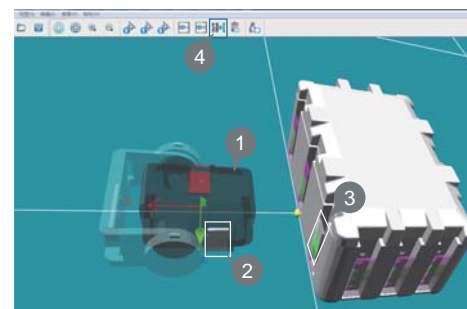
Step Five: Select the component from Step Three, and add a short U component on it.
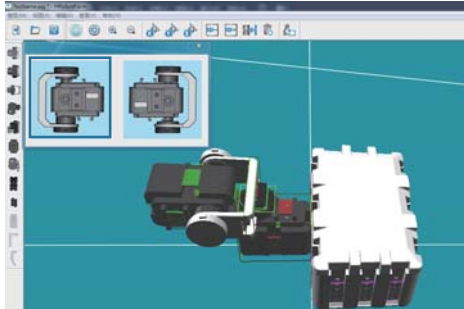
Step Six: Double click on the intelligent motor. Then, click the "Rotate toward Z" in "Tool Bar" to rotate it along the Z-axis for 90 degrees.
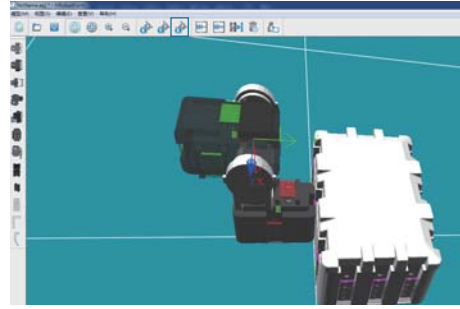
Step Seven: Left click on the blank space to cancel your previous selection.
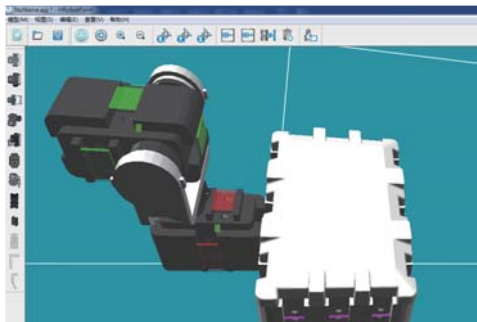
That's the end of PTZ building.

Appendix 1 Summary of Single-functioned Block and Function Determination Block

1、Single-functioned block is like the picture shown on the right, it takes shape of a parallelogram.

We will use the "light detect" block as an example of a single function blocks. This block can examine the sensor readings. It's very simple and only one parameter, the sensor reading variable, needs to be set. Next, let's set up the block.

a) Just double click the block in your flowchart, and you will see a dialog like the figure below.
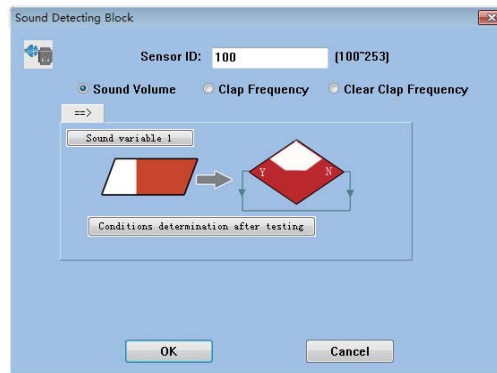
b) Click the "Light Var1" button and the Variables Box
c) Specify the variable to save the sensor reading. There will be a key in the end of the specified variable. Click "OK" and return.
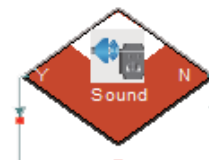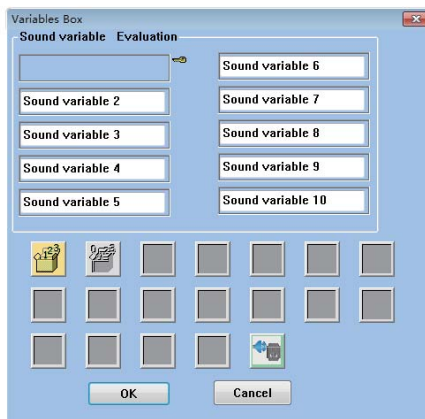
The sensor blocks can make conditional judgments.
The following figure shows an example of this kind of sensor block.
This block can not only specify the variable in which to save sensor readings, but it also can decide whether to execute the following

statements according to the variable value. It's a little complex because different blocks have different relationship expressions. Later, we will specify how to set the parameters and relationship expressions.

2、Switch from These Two Types of Blocks

When sensor blocks are moved from blocks library to flow chart area, they're still single-functioned block,which is to detect the value of sensor. The user need to switch their function to get the function determination sensor blocks.

The steps are as followed.

❶ Double click the left button on the single functioned block, a dialog box as showed below will pop up.

❷ Click the left button on the "After Detecting Completed, Start Determination" button, a dialog box as showed in picture 6-7 will pop up.
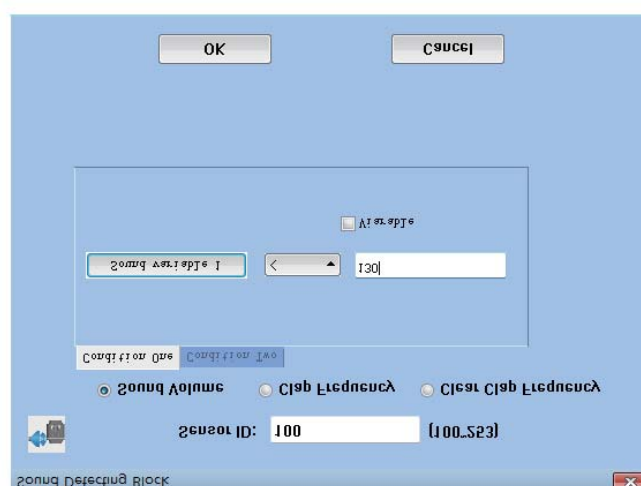
❸ Set the determination formula(such as "Button Variable One" ==0 etc.). Click on "Yes" when the setting is completed to generate the Function Determination Sensor Block. The shape of the block will change correspondingly.

Note: Please be aware that the process above is irreversible. The Function Determination Sensor Block cannot switch back to Single Functioned Block.

Appendix 2 Set the Remote Control Handle for Human-oid Robot

Step One: Select "Match Handle" from "Tools" in VJC-HRobot. Connect the remote control handle to the controller with data wire and turn on the controller.
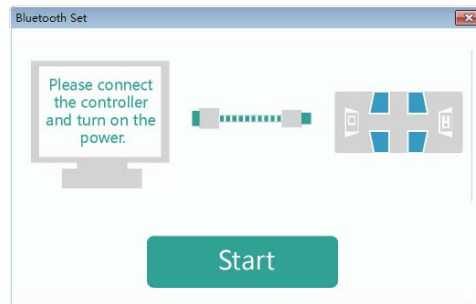
Step Two: Click "Start" to search. After searching the controller successful, the computer starts to build connection with it.
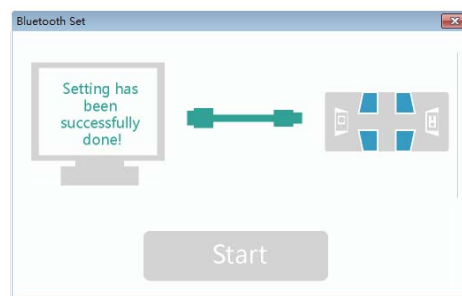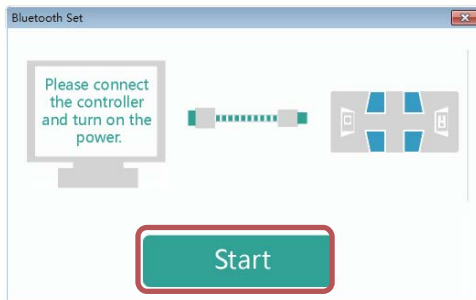
Step Three: After connecting to the controller successfully, the interface will turn to the interface of remote control. Please turn off the controller at first, connect it to the remote control with data cable and press battery button for 1-2 seconds to turn on the remote control. Click "Next" to enter the interface of remote control.

Step Four: Click "Done" to finish matching the Bluetooth set. Turn on the remote control and the controller to build the Bluetooth communication.

Solutions to commonly seen problems.

● Fail to connect to the controller.
Check if the MiniUSB port on the controller is successfully connected by the data cable and restart the power of it.

● Fail to connect to the remote control.
Check if the MiniUSB port on the remote control is successfully connected by the data cable and make sure the power of it is on

Appendix 3 Use the Remote Control Handle for the Humanoid Robot

1、Download remote controlling program.

a) Double click on [H VJC] to enter the programming software. Select "A00 Humanoid".

b) Put the data wire on the controller, switch on its power and download program to "A".

c) Press "A" and then "Start" on the controller to start remote control. The functions of the buttons are as below.

U	Move Forward	1/3/4	Perform Action
D	Draw Back	5+1/6+1	Get up from its Front/Back
L	Turn Left	2+R	Move leftward
R	Turn Right	2+L	Move rightward

Appendix 4 Properties List of the Intelligent Motor

Address	English Name	Function and Parameter
0/1	Model Number	1~1023 Model number 1-1023
2	Version of Firmware	1~255 Version number 1-255
3	ID	From 1 to 99 are intelligent motors. 254 is intelligent motor. From 100 to 253 are integrated sensors.
6/7	CW Angle Limit	0~1023 CW Angle Limit 0-1023
8/9	CCW Angle Limit	0~1023 CCW Angle Limit 0-1023
10	Joint offset	Default value 0
11	the Limit	The Highest Limit Temperature 0-255
24	Torque Enable	0:To prevent torque from being generated by cut off the power of the motor. 1:To generate torque by supplying power to the motor
25	LED	0: Shut down the LED 1:Turn on the LED
30/31	Goal Position	Current position value of the intelligent motor, ranging from 0 to 1022(0x3FF), unit is 0.29 degree.
32/33	Moving Speed	Current moving speed of the intelligent motor.The unit is 0.111rpm. For example, if the value is 300, it means the motor rotates counter-clockwise with the speed of 33.3 rpm. The unit of Rotate Mode is about 0.1%. If the value is 512, then the motor rotates counter-clockwise with 50% max torque.
34/35	Torque Limit	Max Torque Limit, ranging from 0 to 1023(0x3FF), unit is about 0.1%. If the value is 512, it means only 50% of the max torque will be used.
36/37	Present Position	Present position value of the intelligent motor, ranging from 0 to 1023(0x3FF), the unit is 0.29 degree.
38/39	Present Speed	Present speed of the intelligent motor.The unit is 0.111rpm. For example, if the value is 300, it means the motor rotates counter-clockwise with the speed of 33.3 rpm. The unit of Rotate Mode is about 0.1%. If the value is 512, then the motor rotates counter-clockwise with 50% max torque.
40/41	Present Load	The value of Present Load ranges from -1023-1023, the unit is about 0.1%. If the value is -1023-0, the load works counter-clockwise. If the value is 0-1023, the load works clockwise.
42	Present Voltage	Present voltage of the intelligent motor. The value is 10 times bigger than the actual voltage. For example, if the input voltage is 10V, the value shows 100.
40/41	Present Load	The value of Present Load ranges from -1023-1023, the unit is about 0.1%. If the value is -1023-0, the load works counter-clockwise. If the value is 0-1023, the load works clockwise.
42	Present Voltage	Present voltage of the intelligent motor. The value is 10 times bigger than the actual voltage. For example, if the input voltage is 10V, the value shows 100.

43	Present Temperature	Present temperature of the intelligent motor. The unit is Centigrade. The value equals to the actual temperature. For example, if the value shows 85(0x55), then the present temperature is 85℃
46	Moving	Sign of moving.1:The intelligent motor is moving. 0:The intelligent motor stays still.

Appendix 5 Properties List of the Integrated Sensor

Block	English Name	Function and Parameter
Distance Measuring	IR Left Fire Data	Ranges from 1-255
	IR CenterFire Data	Ranges from 1-255
	IR Right Fire Data	Ranges from 1-255
Light-intensity Measuring	Light Left Data	Ranges from 1-255
	Light Center Data	Ranges from 1-255
	Light Right Data	Ranges from 1-255
Obstacle Detecting	IR Obstacle Detected	If the IR distance value is bigger than the reference value, then the IR Obstacle detected value will be set to 1 to show that an obstacle has been detected. It can also be interpreted as it'll show 1 if obstacle is detected on the left, 2 in the center, 4 on the right. If obstacles were detected both on the left and in the center, the return data should be 3(1+2 equals 3).
	Obstacle Detect Compare Value	Obstacle Detect Compare Value. If the sensor value is bigger than the reference value, then the obstacle detect sensor will be set to 1, since the object is within the distance. If the sensor value is smaller than the reference value, then the sensor will be 0, since the object is not within the distance.
Light Detecting	Light Detected	If the light value is bigger than the reference value, the light detected value will be set to 1 to show that light is detected.
	Light Detect Compare Value	Light Detect Compare Value.If the sensor value is bigger than the reference value, then the light detect sensor will be set to 1, since light is stronger than a certain intensity value. If the sensor value is smaller than the reference value, then the sensor will be 0, since the object is not bigger than the certain intensity.
Sound Detecting	Sound Data	Detect the value of sound. The bigger the value, the louder the sound.
	Sound Detected Count	Times that sound has been detected. Mainly for reading. When being set, the value will turn back to zero.