

HEART TO HEART 4

FOR RCB-4



USER'S MANUAL

KONDO[®]
KONDO KAGAKU CO., LTD.

Preface

Thank you for choosing KHR series and HeartToHeart4. The newly designed HeartToHeart4 is easier to use than the former HeartToHeart3, multifunctional and scalable.

- Motion can be controlled per-project.
- Corresponds to Microsoft NET Framework.
- Multi-window system enables separation and connection of all windows.
- Scalability is enhanced by applying plug-in system for motion creating parts.

This manual describes the method of installation and use of HeatToHeart4. In such descriptions, hardware operation of KHR series may be required. We recommend that you read the hardware manual, as well.

Licensing

- The installation and use of HeatToHeart4 (here on referred to as “this software”) is allowed only if agreed to the present licensing terms.
- This software consists of executable format files, dynamic link library, setting files and sample data files. The entirety of the aforementioned files as well as libraries that are added on in the future is referred to as “this software.”
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- This product is assumed to be used in Japan. Use and transportation out of Japan may require registration and permission in accordance to related laws.
- The contents of this manual and this software are subject to changes without notice for improvement or other reasons.

Condition of Use

| C a t e g o r y | R e q u i r e m e n t s |
|-----------------|---|
| OS | Windows XP (service pack 2 or later), Windows Vista |
| Processor | Pentium 4 2GHz or above |
| Hard Disk | 32 MByte or larger (not including data file) |
| Memory | 256MByte or larger |
| Drive | CD-ROM drive (for installation) |
| USB | 1 or more USB 2.0 port(s) |
| Software | Microsoft. NET Frame work 2.0 is necessary |

Precautions

- This manual and this software may be applied to some of our microcomputer boards and servo motors for robots. However, please be informed that applicable functions may be limited.
- Please contact the following service section for reports of defects, inquiries and comments regarding this software. However, please be informed that we do not respond to individual requests for software update.

Correspondence

Kondo Kagaku co., LTD. Service Section

support@kondo-robot.com

(Inquiry by email is welcomed, but replies may require some time.)

Glossary

Mouse

| | |
|-------------|--|
| Click | Press button on mouse once and immediately let go of button. |
| Left Click | Click left button on mouse once |
| Right Click | Click right button on mouse once. |
| Drag | Move mouse while pressing down on button of mouse. |
| Drop | Letting go of mouse button after dragging. |

Window

| | |
|-----------|--|
| Focus | Condition under which buttons etc. can be operated, and the action of creating such condition. |
| Dialog | A window from which the focus can not be changed unless operation in that window is completed. A modal window. |
| OK Button | A button which says “OK” or “YES”. |
| Active | Condition wherein a window is operable. A focused condition. |

Hardware

| | |
|--------|---|
| IO | INPUT and OUTPUT |
| AD | Analog-Digital transducer. |
| PIO | Programmable IO. Input and output can be switched using 2 digital values (may be chosen between 0 V or 5 V). |
| COM | Communication |
| GND | Ground. Reference Potential. In this manual the point at which 0 V is obtained. |
| bps | Bit per second. Data transportation speed of communication circuit etc., and refers to the number of bits that can be transferred in one second. |
| EEPROM | Electric Erasable Programmable ROM. ROM (Read Only Memory) that can be electrically written/erased. Data is not erased even without current. May be referred to simply as ROM in this manual. |
| RAM | Usually refers to Random Access Memory, but refers to all volatile memory in this manual. Memory area from which content disappears when power is shut off. |
| ROM | Read Only Memory. Memory area in which once written, content remains saved even after power is shut off. In RCB-4HV, EEPROM is used so read/write can be repeated. |

SOFTWARE

| | |
|------------|---|
| Menu | Item that can be selected. When selected, corresponding process is performed. |
| Pull-down | When menu is selected with a mouse, a more detailed item list is pulled out making them selectable. |
| Main Menu | Pull-down menu in the main window. |
| Toolbar | Corresponding process occurs by clicking an icon or word. Refers to the movable menu in HeartToHeart4. |
| ComboBox | Box-shaped pull-down menu. Some allow entering of text. |
| csv format | CSV (Comma Separated Values) format refers to data format wherein each data is separated by a comma (.). Mainly enables reading by spreadsheets and data. |

Glossary

Keyboard

| | |
|-------|---|
| CTRL | Control key |
| SHIFT | Shift key |
| SPC | Space key |
| ALT | Alt key |
| ENTER | Enter key |
| DEL | Delete key |
| + | Press two keys simultaneously. Ex: CTRL + X press X key while pressing down on Control key. |

Robot Servo Motor Device

| | |
|------------------|--|
| Servo Motor | A motor that has control function and can adjust its rotational angle on its own. |
| Serration | The ridge on the servo motor axis for the purpose of easy attachment of arms etc. |
| Servo Horn | Attached to serration and transmits motor power to others. |
| Trim | Gap from center position that can be specified by the servo motor. Occurs due to the distortion from serration when servo horn etc. is attached. The adjustment of this gap is called trim adjustment. |
| Stretch | The tenderness of the servo motor motion. Compliance. |
| Gyro Sensor | Sensor that detects angle and angular velocity of an object. Can measure angle of mounted object. |
| Mixing | Adjustment of output angle of servo motor based on input from sensor etc. |
| Free (powerless) | Condition where no force is added on to output axis of servo motor. Output axis can be moved freely with your hands. |
| Hold (retention) | Condition where servo motor is stopped at the current position. |
| Teach | Mode in which current position is frequently updated under powerless condition. Value is saved when hold state is obtained after rotating output axis of servo motor in powerless condition. |
| Frame cycle | The interval at which order is sent to servo motor when setting rotational angle of servo motor. Can be selected from 10, 15, 20 and 25 ms for RCB-4HV. |
| Number of frame | When rotating servo motor from a certain angle to another angle, the action of smoothing out motion by fragmenting the interval into several spans is called complementing, and the number of span is called number of frame. The time consumed for each frame is equivalent to the frame cycle. Thus, when a sequence of motion that takes ten frames is completed at a frame cycle of 10 ms, the time consumed would be $10 \times 10 = 100$ ms. |
| Neutral | Center position of the motion area of servo motor. 7500. |

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RCB-4HV Introduction to Hardware

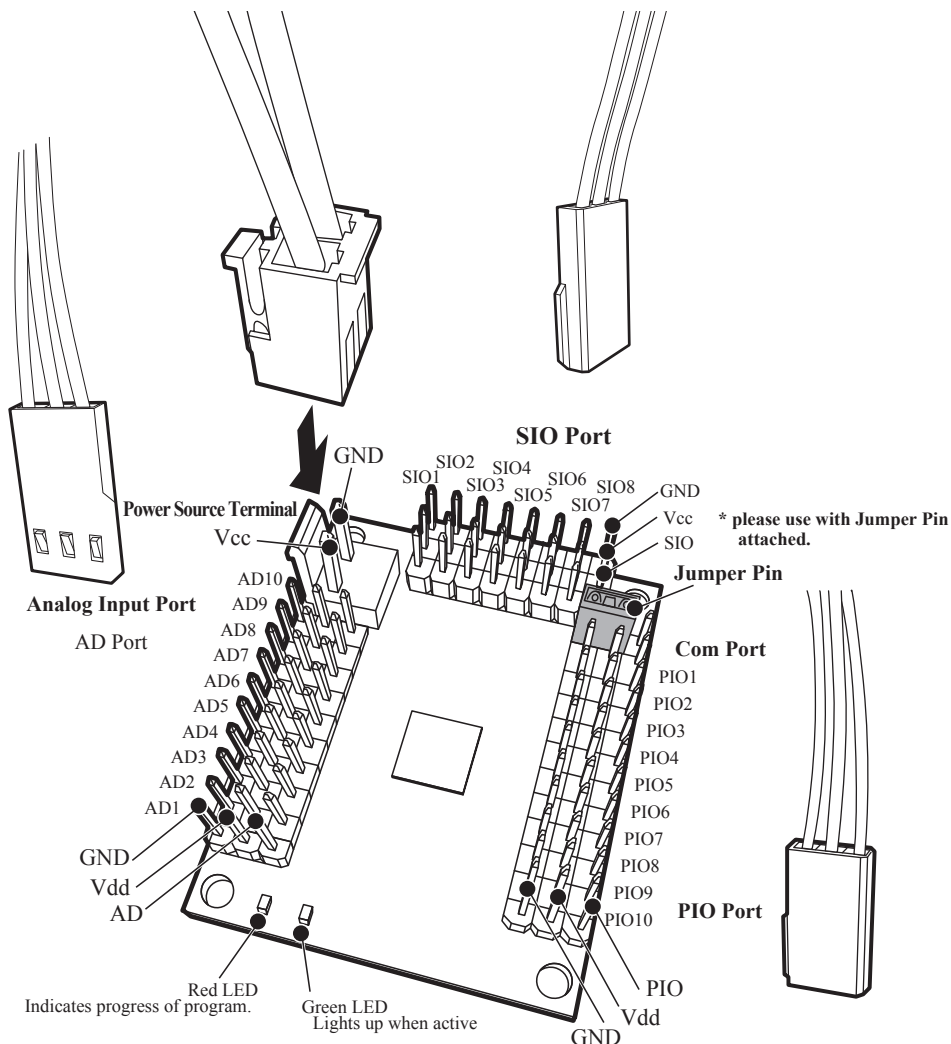
Features

- M16C/26A microcomputer by Renesas Technology has been adopted.
- Contains eight SIO ports for two systems of ICS3.0 compliant device, and can connect up to sixty-four ICS3.0 devices.
- With ten AD ports, multiple analog sensors can now be used. Further, AD input for power management is available separately.
- Ten PIO ports have been newly mounted. Use of ON/OFF switch and light up of LED is made easier.
- The COM ports enable a maximum speed of 1.25 Mbps.
- EEPROM, known for its high-speed and high capacity, has been adopted.

Change from RCB-3

- All PWM ports have been eliminated.
- RX port (low-speed serial port) has been eliminated.
- Microcomputer has been changed from M16C/26 to M16C/26A.
- EEPROM enables 1 Mbit high-speed communication (2.5 times the communication speed of RCB-3) and is now a 256 kByte high capacity ROM (twice the size of RCB-3).
- Reset button has been eliminated.

Part Names



RCB-4HV Introduction to Hardware

Specifications of Hardware

| | |
|------------------------|---|
| Dimensions: | 45 x 35 x 13 (W x H x D) mm. *Same as RCB-3 |
| Weight: | 12g |
| Interface: | SIO port, COM port, AD port, PIO port |
| Power Supply Voltage: | Our specific HV power source is recommended. Minimum 6 V, Maximum 15 V. (Does not necessarily guarantee motion of device.) |
| Internal Voltage: | Set at 5 V by a regulator (for 1 A). |
| Power Supply Terminal: | Please use battery or stabilized power supply corresponding to the above operating voltage. |
| Com port: | Used for data communication by connecting to PC using serial USB adapter HS. Conventional serial USB adapter can also be used. (When using conventional product, communication speed may be limited.) |
| AD port: | For connecting analog device. Operating voltage is 0 to 5 V. Check maximum current for device needing power supply. |
| PIO port: | For connecting digital binary input/output device. Can be used as an output and operating voltage is 0 V (LOW), 5 V (HIGH). Resistance is connected in series, so LED can be connected directly. However, please check operating voltage for the LED. |
| SIO port: | For connecting device corresponding to ICS. Operating voltage is the same as power supply voltage. DO NOT CONNECT device corresponding to 0 to 5 V (such as analog sensors). Operation may be limited according to the corresponding version of the connected device. |

Introduction to Software

In the new HeartToHeart 4, data can be written simultaneously by saving all motion data to a project file. The motion and settings of robot can be converted according to the make up of the robot, the content of the game or the type of sensor used.

The screen structure is multi-window, which enables connection and separation of functional sub windows to the main window. Since the motion edit window can be used as a tab-form multi-window, by opening several motion data and using editing functions such as copy-and-paste among them, motions can be created easily.

Further, online running function enables reproduction of motion on the editing screen without saving motion to ROM. In online running, step-running and repeated running is possible. Corresponds to Run, Stop and Run-From-Middle, even after saving to ROM.

In Motion Edit screen, conventional methods for using position has been inherited; mean while, additional changes is made possible by creating control (what used to be called “Objects” in HeatToHeart 3) using DLL (Dynamic Link Library). Also, by basically implementing one function to one control, program editing in the motion editing screen is much clearer. Further, by exhibiting icons for each function, the flow of program is much easier to see.

Preparations

Installing Software

Setup program boots up automatically when CDROM attached to the kit is inserted to the drive. Continue installation process as instructed by the setup program.

In order to run this software, “Microsoft .NET Framework Ver. 2.0” is necessary. Install “Microsoft .NET Framework Ver. 2.0” as instructed by the setup program, as well. In WindowsXP, when service pack 2 or later is installed, “Microsoft .NET Framework Ver. 2.0” is installed, too. In Windows Vista, “Microsoft .NET Framework Ver. 2.0” is pre-installed.

If setup program does not automatically boot up, activate installer by opening CDROM and double clicking “Setup.exe” in the “Software” folder.

Uninstalling Software

- | | |
|----------------|--|
| Windows XP: | Select “HeartToHeart4” from “Add/Remove Programs” in the Control Panel and uninstall. |
| Windows Vista: | In Control Panel, select “Program” then “Programs and Features” then “Uninstall/Change” and choose “HeartToHeart 4 Ver. 1.0.0” to uninstall. |

Installing Serial USB Adapter HS Driver

After installing HeartToHeart 4, install driver for serial USB adapter HS. Please refer to “KONDO USB DRIVER INSTALL MANUAL” in CDROM for installing procedures.

Files Installed (Outline)

- | | | |
|-----------------|---|--|
| Install Folder: | Standard c:\Program Files\HeartToHeart4 | |
| Content: | HeartToHeart.exe (Program file) | |
| | Projects (Folder that contains sample projects) | |
| | Toolbox (Folder that contains controls) | |

Do Not rewrite files in the install folder.

Folders and Files Automatically Created After Installation

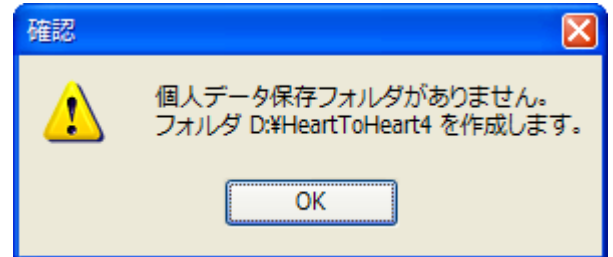
Folder Automatically Created: My Document\HeartToHeart4

- | | | |
|----------|------------|---|
| Content: | Projects | For saving project files created |
| | Log | Folder for saving log of output data etc. |
| | Motions | Folder for saving motion data etc. |
| | HTH4.xml | File for storing project data |
| | Layout.xml | File for saving state of window |

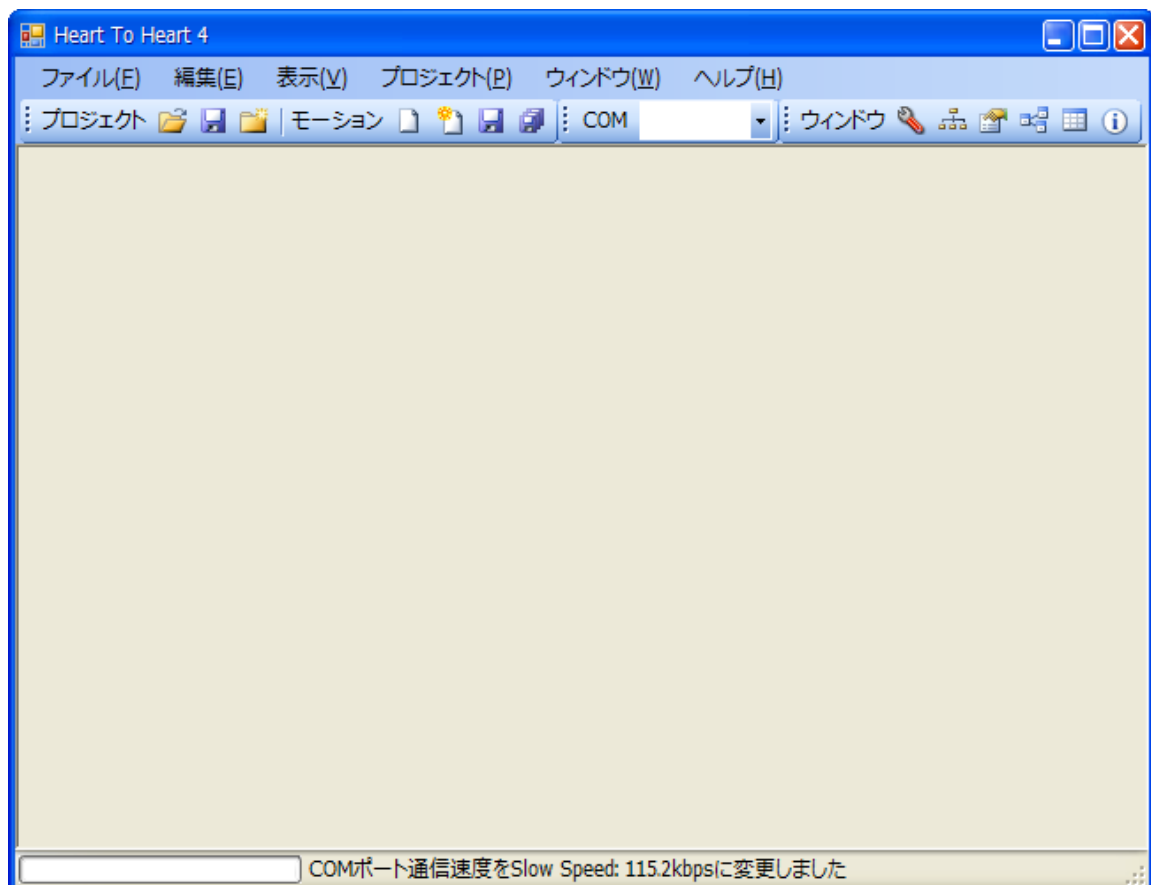
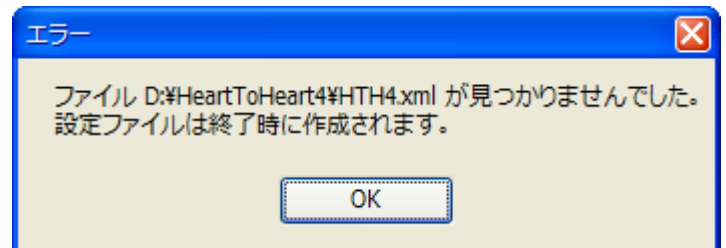
Start-up and Shut-down of Software

Start-up of Software

1. Click “HeartToHeart4.exe” in “HeartToHeart4” from the Start menu.
2. When starting up for the first time, a folder for saving data is created in the “My Document” folder. Here, press the “OK” button.



3. Setting File for HeartToHeart4 is saved when shutting down for the first time.
4. When HeartToHeart4 is started, the following screen appears.



Here, nothing is done. Proceed to shut-down of software.

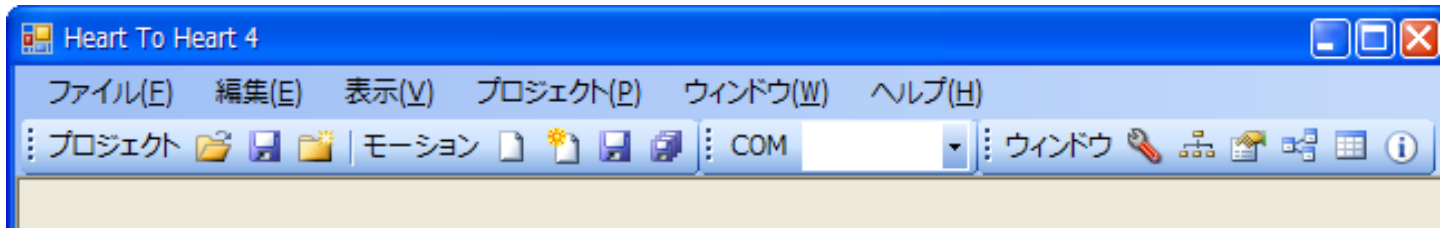
Shut-down of Software

To shut-down HeartToHeart4, select “Quit (Q)” from “File” menu in the main menu. When shutting down software, screen size and position is saved prior to shut-down.

Main Window

Main Window

The Main Window contains main menu and toolbar. Other Sub Windows may be connected to or separated from the Main Window.



Main Menu

In the Main Menu, files are read or written. The parenthesized and underlined alphabets following each item in the menu indicates the shortcut key. The item may be chosen by pressing each alphabet while pressing down on the ALT key. For example, the file menu “File (F)” can be opened by pressing ALT key and F key. If the abbreviations such as “Ctrl + S” is shown, the item can be chosen by pressing CTRL key and S.

File Menu

ファイル(E) 編集(E) 表示(V) プロジェクト(P) ウィンドウ(W) ヘルプ(H)

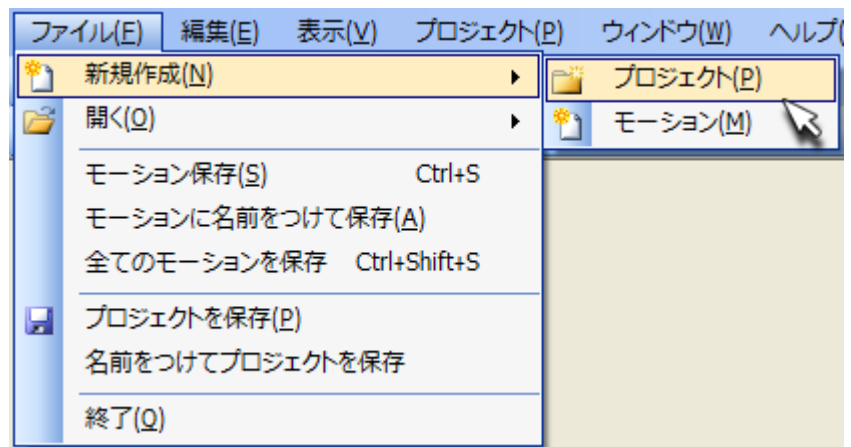
In the File Menu, files are read and saved.

1. New Document

- (a) Project: Project is freshly created. Existing projects may also be imported as new projects.
- (b) Motion: Motion is freshly created. Motion can be created after reading in a project.

2. Open

- (c) Project: Existing project is read in.
- (d) Motion: Existing motion is read in. Motion can be read in after reading in a project.



- 3. Save Motion: Motion that is currently being edited is saved. In order to save a motion, the motion edit window has to be active.
- 4. Save Motion Under a Different Name: Choose a different name for the motion that is currently being edited and save. In order to save a motion, the motion edit window has to be active.
- 5. Save All Motions: All motions currently being edited are saved.
- 6. Save Project: Project is saved.
- 7. Save Project Under a Different Name: Choose a different name for the project and save.
- 8. Quit: Shut down HeartToHeart4.

Main Window

Edit Menu

In the Edit Menu, control arranged on the motion editor campus currently being edited (see Motion Editor Window section) is copied or pasted.

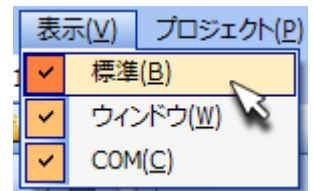
1. Cut: The selected control (see Motion Editor Window section) is cut. The cut control is saved on the buffer and thus can be pasted.
2. Copy: The selected control is copied. The copied control is saved on the buffer.
3. Paste: Control in the buffer is pasted. The position at which it is pasted would be on the bottom-right of the copied control. Control may be pasted on a different motion data, as well.
4. Delete: Selected control is deleted. The deleted control can not be restored.
5. Select All: Select all control on the campus currently being edited.



Display Menu

In the Display Menu, toolbars can be displayed or hidden. When toolbar is shown, a check mark appears on the left side of the item. For more details on toolbar, see “Toolbar” section.

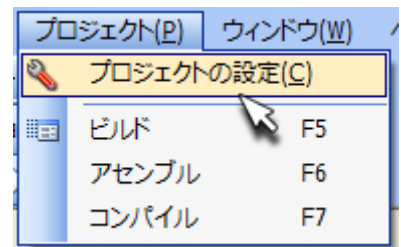
1. Standard: Standard toolbar is displayed.
2. Window: Window toolbar is displayed.
3. COM: COM toolbar is displayed.



Project Menu

In Project Menu, project is set.

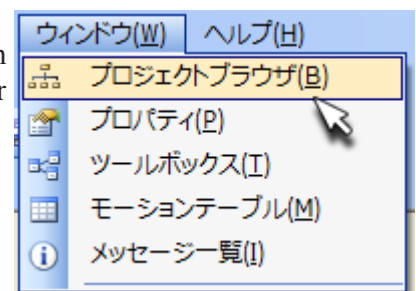
1. Project Setting: Displays Project Setting window.
2. Build: The motion currently being edited is built (see Motion Edit Window section) and written in RCB-4HV.
3. Assemble: The motion currently being edited is assembled (see Motion Edit Window section).
4. Compile: The motion currently being edited is compiled (see Motion Edit Window section).



Window Menu

Sub Windows to be connected to the Main Window is displayed or hidden. When the icon on the left side of each item is selected, the window is displayed. For details on Sub Window, see section “Sub Window”.

1. Project Browser: Display/Hide Project Browser window.
2. Property: Display/Hide Property window.
3. Tool Box: Display/Hide Tool Box window.
4. Motion Table: Display/Hide Motion Table window.
5. Message List: Display/Hide project message window.

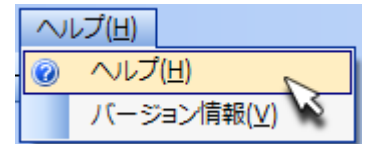


Main Window

Help Menu

Help and version information are displayed.

1. Help Menu: Help is displayed.
2. Version Information: Version Information dialog is displayed.










Toolbar

The Toolbar consists of Standard Toolbar, Window Toolbar and COM Toolbar.

Standard Toolbar

In Standard Toolbar, project and motion are controlled.









1. Project: Load Project , Save Project  and Create New Project .
2. Motion: Load Motion Data , Create New Motion Data , Save Motion Data  and Save All Motion Data .

Window Toolbar

In the Window Toolbar, the following Sub Windows are displayed or hidden.



1. Project Setting:  Display/Hide window that sets the content of the project.
2. Project Browser:  Display/Hide Project Browser window.
3. Property Window:  Display/Hide Property Window.
4. Tool Box:  Display/Hide Tool Box window.
5. Motion List:  Display/Hide Motion List Window.
6. Message Window:  Display/Hide Message Window.

COM Toolbar

In the COM Toolbar, communication speed of serial USB Adapter HS etc. is set.








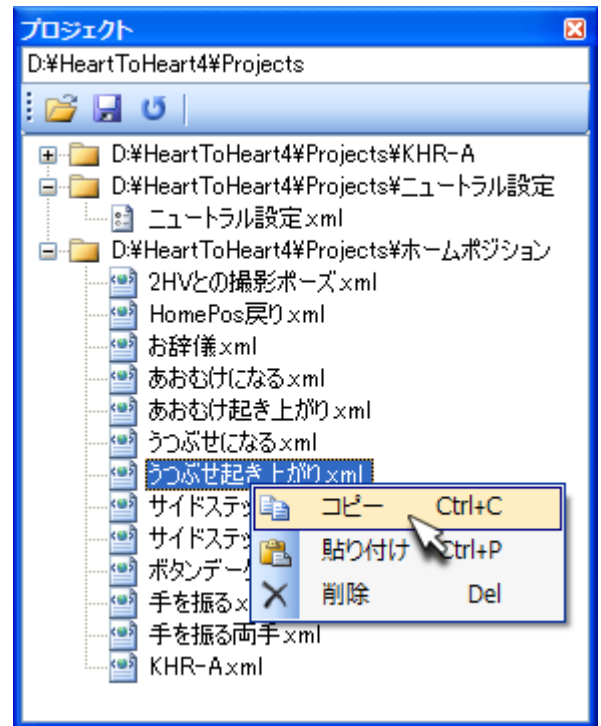
1. Select Port Box Menu: Displays list of all port (device) names currently connected to the COM port.
2. COM Button: The area that says COM is the Automatic Communication Speed Search button. By pressing this button, the communication speed of the COM port is automatically adjusted to match the communication speed of RCB-4HV. Normally not used.

Sub Window

Project Browser Window

In the Project Browser Window, project and motion files are controlled. The folders and files displayed on the Project Browser are normally located in the “HeartToHeart4¥Projects” folder (called Project Root) in the My Document folder. Main functions of the Sub Window are as follows:

1. Displays list of folders and files in project root. Files with the same name as the folder and having extensions “.xml” are the project files. Only the icons of the project files change on screen.
2. Project can be changed by double clicking the Project File  icon.
3. Motion Edit Window opens by double clicking the Motion File  icon.
4. By selecting a file and right clicking, a right-click menu (context menu) as shown in the figure is displayed, enabling copy, paste and delete. (When pasting file with the same name, the term “copy-“ is shown at the head of the file name. When pasting a file, specify the folder to which file is pasted after copying)
5. File name can be edited by slowly clicking file name twice. When file name is edited, the actual file name is automatically changed.
6. Motion list saved in the Motion List Window is displayed by double clicking project file.
7. When file is changed using, for example, Windows Explorer, the changes are reflected on the screen. (*foot notes)
8. Project root is changed by clicking Change Project Root button  and selecting an arbitrary folder. Normally not used.
9. Project is saved by clicking the Save button .
10. Project list is updated when Reload button  is clicked.



* When disabled, updated by clicking the Reload button.

Sub Window

Tool Box Window







The Tool Box Window displays a list of parts (controls) necessary for creating motion.

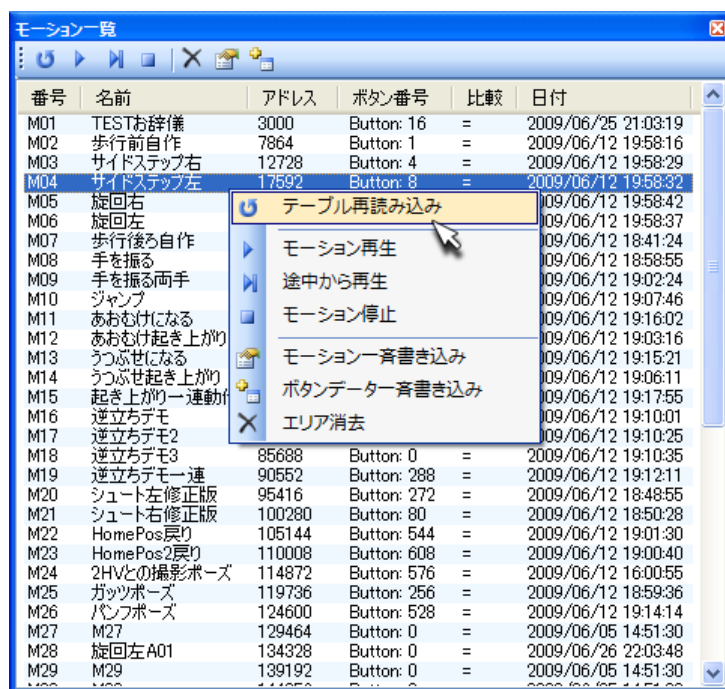
1. When Tool Box window is displayed, control details screen (left) appears.
2. Name of control, description of control and group are shown.
3. In the Toolbar Display menu, method of display can be chosen from Icon, List, Detail, and Align.
4. In the Sort Toolbar menu, files can be sorted by name and type. Further, by selecting Display by Group, files can be displayed by group.



Motion List Window

For writing motion saved in project and editing button data.







1. Motion number, motion name, write address, run button number, method of button comparison and write date are shown on the screen.
2. Motion is run by selecting motion name and clicking Run button .
3. Clicking the Stop button  while running motion stops the motion.
4. Motion is run from the beginning when the Run button is clicked while motion is stopped.
5. Motion begins from the stopped position when the Mid-run button  is clicked.
6. All motion saved in a project is written simultaneously when Write All Motion button  is clicked.
7. Button data allocated to each motion is written simultaneously when Write All Button Data button  is clicked.
8. When Area Delete button  is clicked after saving motion name, the area wherein that motion is saved is deleted. (Only the Return order is written.)
9. Buttons in the toolbar have the same function as the items that appear in the Right-click menu with the same icons.

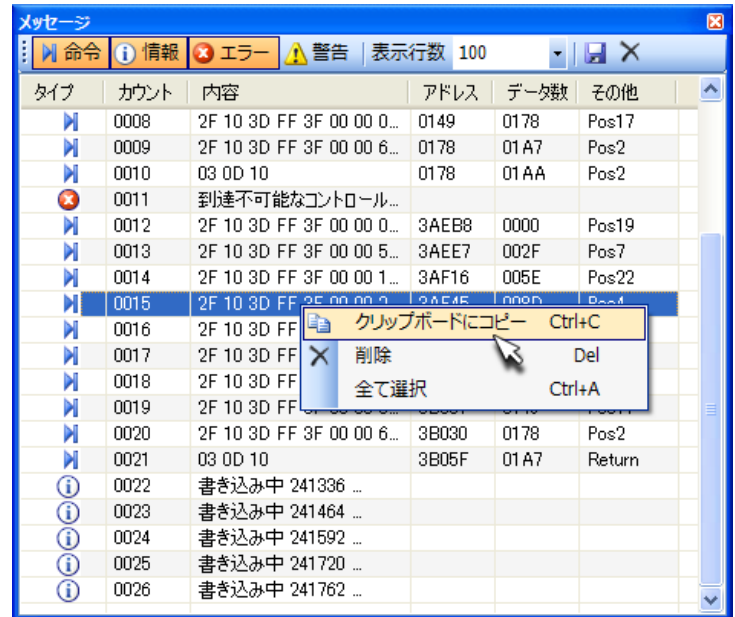


Sub Window

Message Window

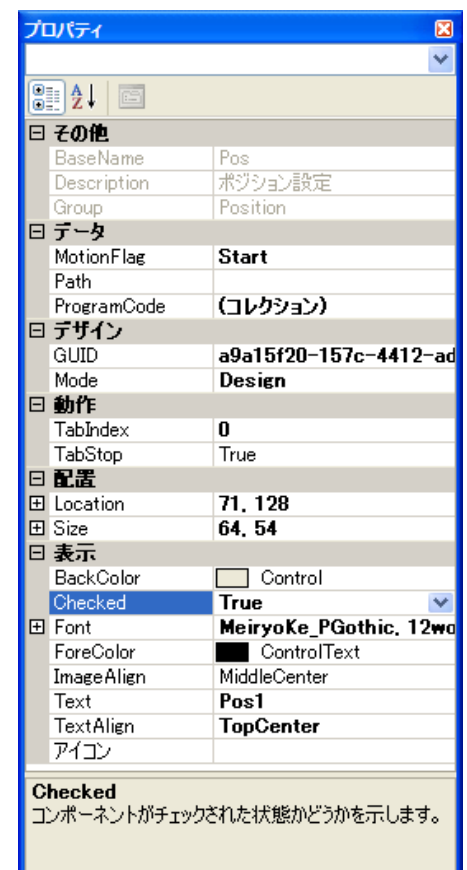
The Message Window displays log of all orders run or sent by HeartToHeart4. Since orders currently being run and error messages in relation to them appear, it is easy to detect where the program failed.*

1. The Message List Display field in the window shows the type of order currently being run, number, content, the address to which data was sent to, length of order, etc.
2. By clicking the Order button  in the toolbar, the backdrop of the button changes, and becomes selective. The order run or sent is displayed at this point.
3. By clicking the Information button  and turning it selective, messages related to information used in HeartToHeart4 appear.
4. By clicking the Error button  and turning it to the selective state, messages related to errors occurring in HeartToHeart4 appear.
5. By clicking the Warning button  and turning it to the selective state, messages related to warnings occurring in HeartToHeart4 appear.
6. The number of lines displayed is controlled in the Display Line Selection ComboBox. When not selected or under standard condition, the maximum number of lines for the message is 100.
7. By clicking the Save Log button , the list of messages currently displayed is saved as csv file.
8. Delete button .



Property Window

The property window is for future developers and power users, and will not be described in this text.



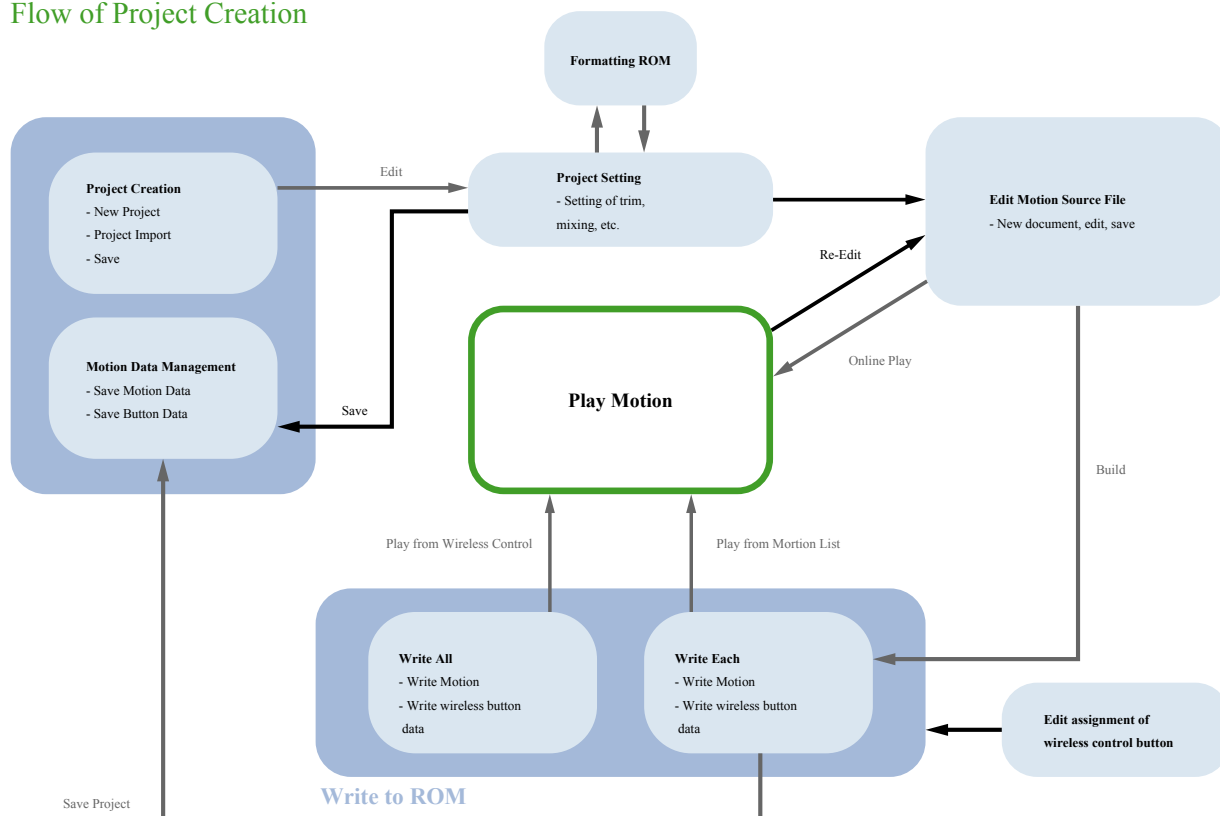
* This manual don't explain about program. Refer the Reference Manual which release later.

Creation of Project

Here, RCB-4HV (KHR-3) is connected to a computer and sample motion for robot is run by HeartToHeart4. Here, the method of importing and using sample motion installed with HeartToHeart4 is described.

In HeartToHeart4, projects must be created or read at the beginning. Initial settings, motion data and mixing

Flow From Project Creation to Running and Data Saving



settings, as well as position and trim data of RCB-4HV are saved in the project file.

After creating or reading a project, make sure to check the trim data etc. in the project setting window. Then, edit motion data, proceed to build process, and then write into ROM of RCB-4HV.

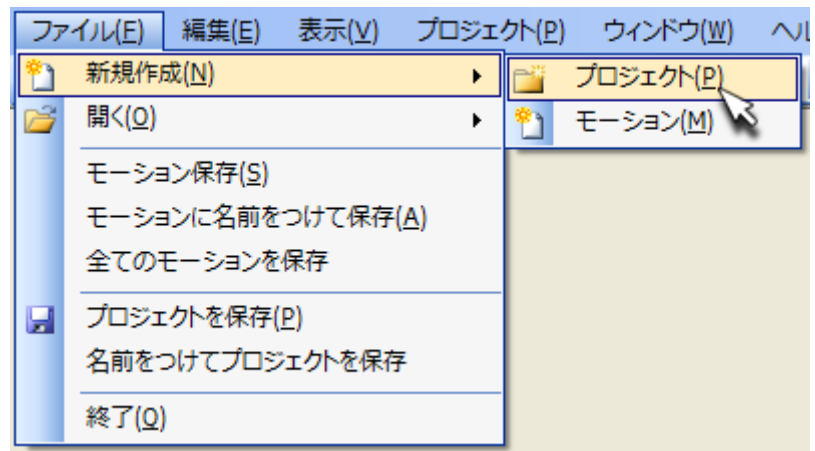
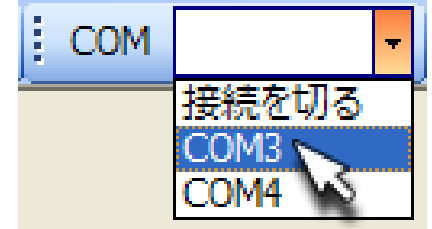
After writing motion data to ROM and assigning wireless controller button, the robot becomes controllable.

Data written in the ROM is also saved in the project, so motion data can be sent in bulk by opening a project.

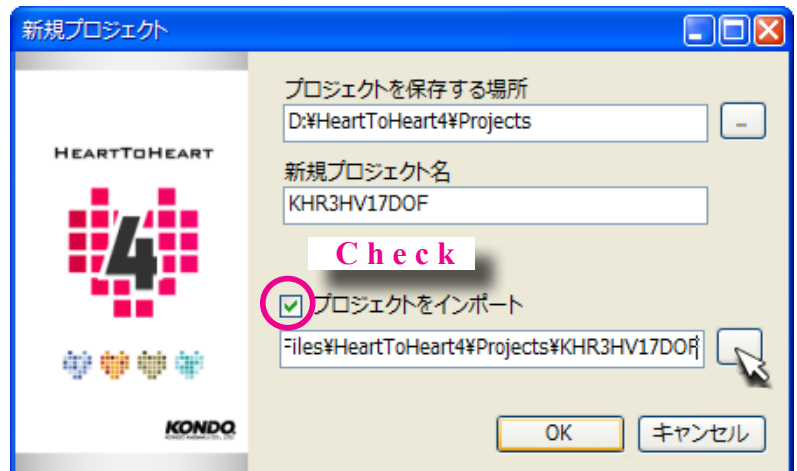
Creation of Project

Project Creation / Import

1. Connect RCB-4HV with a personal computer using serial USB adapter HS, and turn power switch of KHR-3 (RCB-4HV) ON.
2. Boot HeartToHeart4.
3. Select the COM port to which the serial USB adapter HS is connected to in the ComboBox at the left of the COM toolbar. In the screen, COM3 and COM4 are selectable. (Differs depending on environment.)
4. Select “Project” from New Document menu in File menu.
5. New Project Dialog appears.

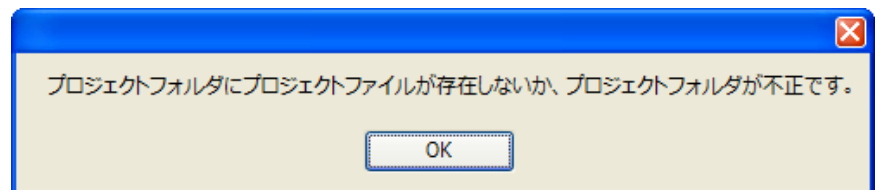


1. Do not change “Save Project at:”
2. Use an appropriate name for “New Project Name”. Here, “Hello_KHR3”, the same name as the project being imported, is used.
3. Assign a project folder for initial position by clicking the reference button at the bottom right side of the dialog (where the cursor is in the screen shot). Normally, a folder inside “c:\Program Files\HeartToHeart4\Projects\Hello_KHR3” folder should be selected. Further, check “Import Project” box.



If a folder that does not contain a project or if the project file is not valid, the following dialog appears. In such case, reselect the correct project folder.

4. Import is completed by clicking OK button. A folder with the name “Hello_KHR3” containing a project file in the name of “Hello_KHR3.xml” appears in the “HeartToHeart4\Projects” folder in the My Document folder.



Creation of Project

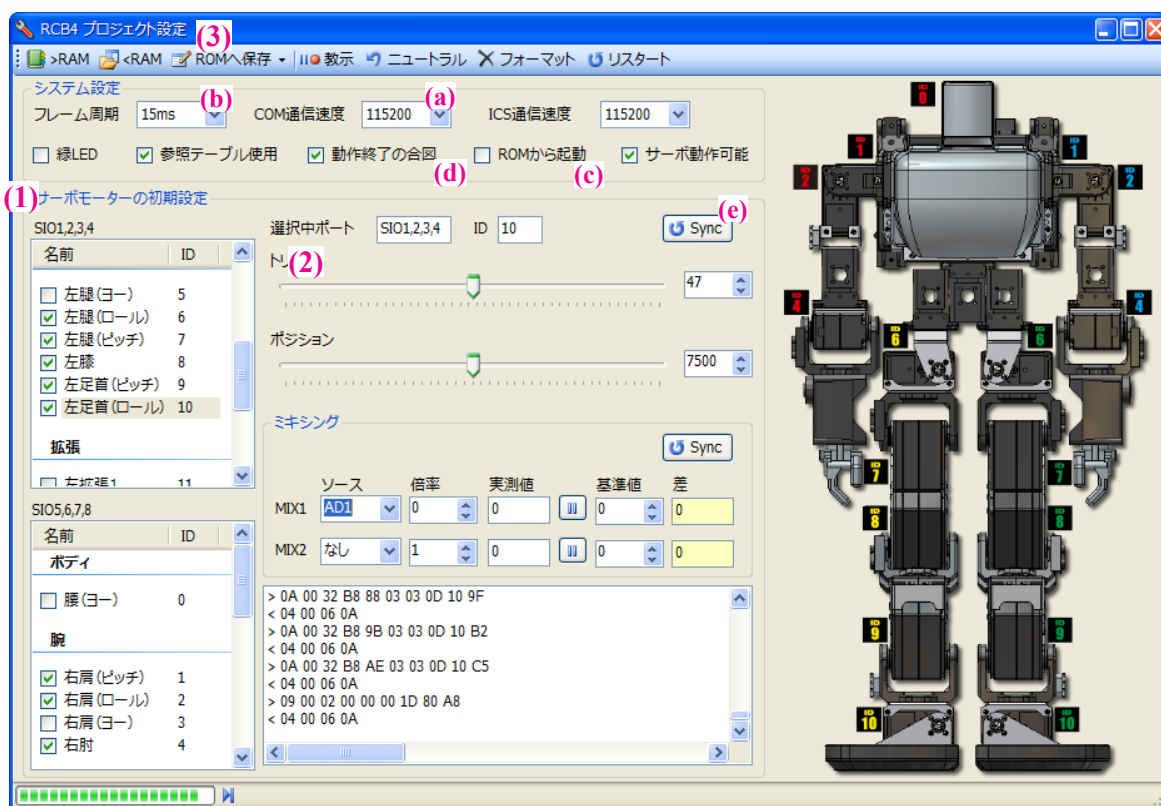
Check Project Construction

Project Construction can be confirmed in the project browser window. The project folder created contains a motion file along with a project file. (See Project Window section)

In HeartToHeart4, one folder basically contains one project file, and the project file should coincide the folder name. All other motion files can have an arbitrary name.

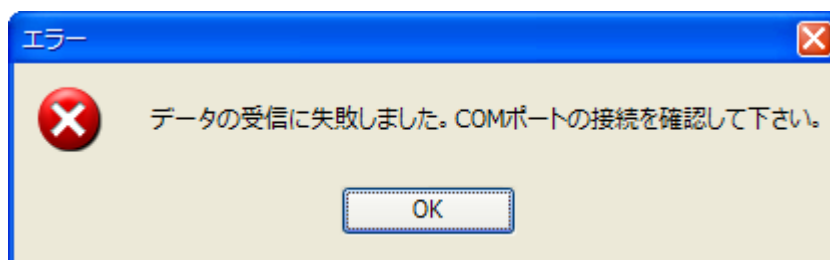
Project Setting

Next, project is set. In the project setting screen, editing of startup position, adjustment of trim position, and analog mixing are mainly set.





When project is loaded, Project Setting Window must be displayed.

1. The following dialog may appear when opening project screen. This message appears when the bow rate setting is wrong or when the serial USB adapter HS is not connected. If such is the case, select the correct COM port in the COM toolbar in the Main Window and select the communication speed you wish to use in the COM communication rate setting field in the project setting window.



Creation of Project

2. In the Project Screen, first confirm the following settings in the system setting.
 - (a) COM communication rate (arbitrary) => first select the communication rate you wish to use.
 - (b) Frame Cycle (15 ms) => 10 ms when servo motor is 1.25 Mbps.
 - (c) ICS communication rate (115200) => adjust according to the communication rate of the servo motor connected.
 - (d) Activate from ROM (ON) => when rebooting, runs from data saved in EEPROM.
 - (e) Servo Operable (ON) => makes ICS device operable.
3. Next, servo motor is operated. To make servo motor operable, after reading project, click Write To RAM button  in toolbar and write the values edited in the project to RAM. (For new project, position is set at 7500 and trim is set at 0.) If writing to RAM is successful, servo motor rotates to its initial position for about 2.5 to 6 seconds (depending on the frame cycle setting).
4. To use robot, trip adjustment is done here. There is a list of standard servo motors connected to SIO1 to 4, SIO5 -8 in RCB-4HV in the “Servo motor initial setting” (1) field in the project setting window. Click on the servo motor for which you wish to adjust the trim, click the Sync button in the servo motor initial setting field and synchronize the movement of the servo motor and the trim track bar (2).
5. When trim is adjusted for all servo motors, select “save all” (3)  in the “Save To ROM” menu of the toolbar. All trim positions set are saved to the EEPROM. The next time the robot is booted, the servo motor moves to this position automatically. The position is set as the neutral position.
6. All basic settings are completed. Overwrite save the project by selecting the save project menu in the file menu or the toolbar of the main window.

Run Motion

After saving all in ROM, motion can be run by opening the Motion List Window. See “Motion List Window” section in page 16.

LED Display

When RCB-4HV is rebooted after trim data and motion data are saved to the ROM, LED display changes as follows:

1. Green LED and Red LED light up when booted.
2. Red LED disappears while the robot moves from the powered off position to the Home position (about 2 to 5 seconds).
3. After movement to Home position is completed, Red LED appears slightly darker. This indicates a state where main loop is run and waiting for the next order.
4. When communication error occurs during data writing to ROM and robot is rebooted, Red LED lights up because program on ROM is faulty. In such case, check connection and reload data.

Creation of Project

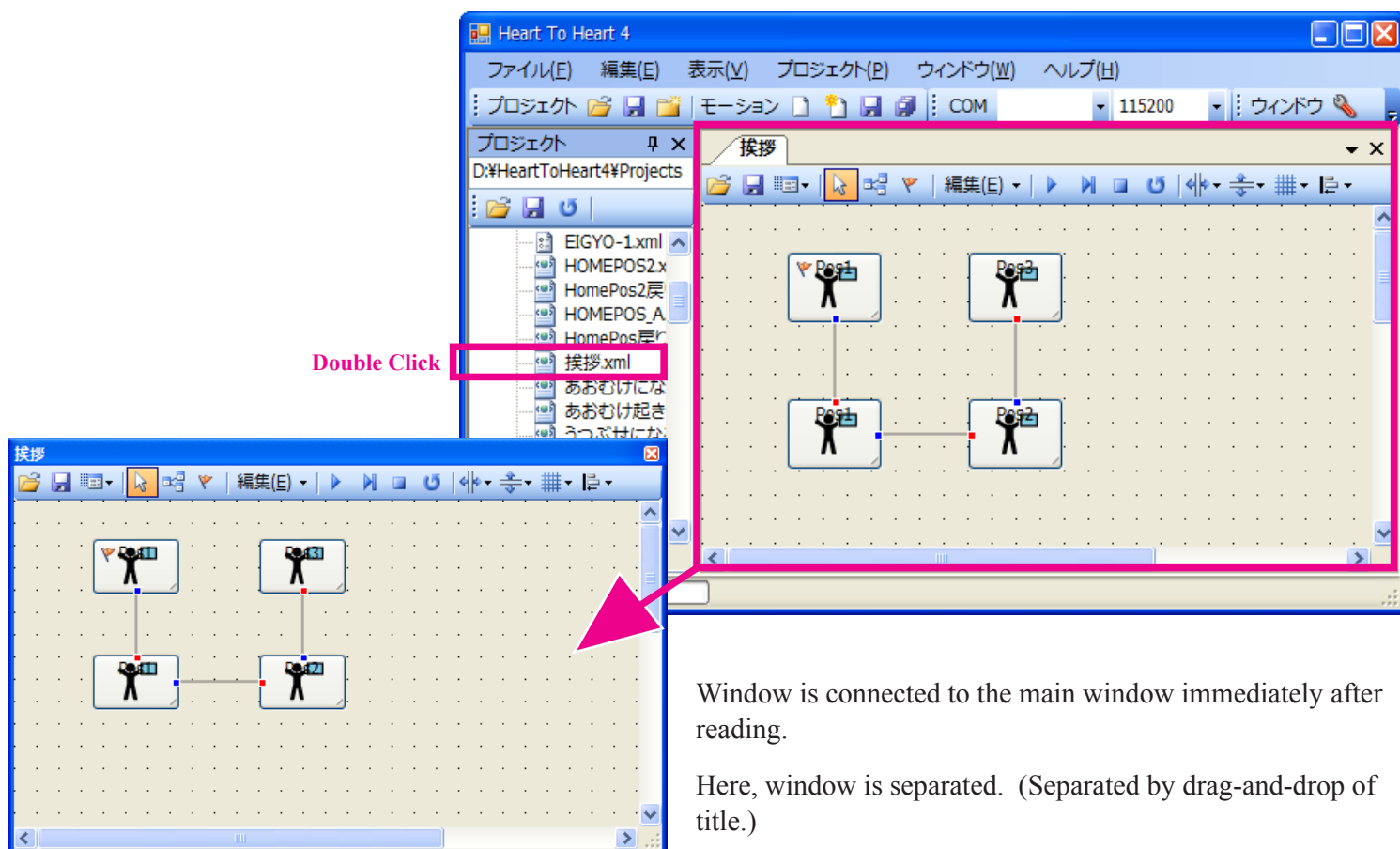
Running Motion Source File

After editing motion source file, build process is done and written to the ROM of RCB-4HV. Here, the process of sample motion reading to build and run are described. For specific motion editing, see “Creating Motion - Basics” section.

From Sample Motion Reading to Running

In the sample project file, sample motion data is saved in advance. Read this data.

1. Open Project Browser Window, and read motion source file “greeting.xml” in the current project folder by double clicking.
2. When reading of motion source file is completed, motion edit window appears at the center of the main window, and the greeting motion data appears.



Window is connected to the main window immediately after reading.

Here, window is separated. (Separated by drag-and-drop of title.)

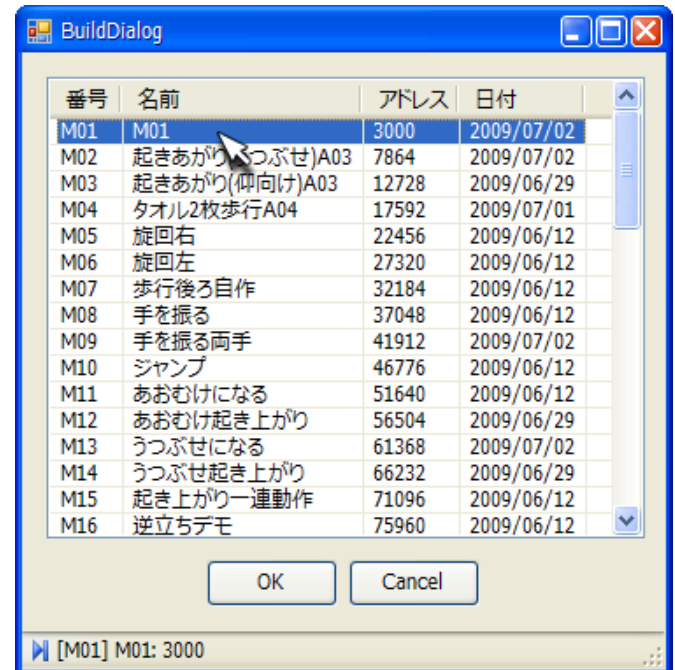
3. The process of converting motion source file from ROM to an executable program is called building. Here, the greeting motion is registered to motion data number M01.
 - (a) Select Build from Build Menu in toolbar of Motion edit window, or select Build from Build Menu of Main Window.
 - (b) Build dialog appears. (Right Figure)
 - (c) Select place where you wish to write in to from the motion data list shown in the Build dialog.
 - (d) Writing begins by clicking OK button. The state and content of writing is displayed in the message window.

Creation of Project

4. When build is completed, motion name is logged in in the Motion List Window. Click motion you wish to run and then click on the run button or select motion run in the context menu.


Sample motion run is completed.

The state of connection of the control is saved in the motion data, but data is restructured as a program through the build process. Through this build process, motion data is automatically recorded in the project data. Motion data is saved by saving project.



Register all motion data simultaneously.


Data recorded after completing build process and motion data saved in project in advance can be saved on the RCB-4HV ROM simultaneously. By using this function, various patterns of motions created in advance can be interchanged simultaneously.

1. Read project file in which motion data is saved.
2. Motion data names etc. saved appear in the Motion List Window.
3. Click on the Write simultaneously button  in the Motion List Window to write simultaneously.

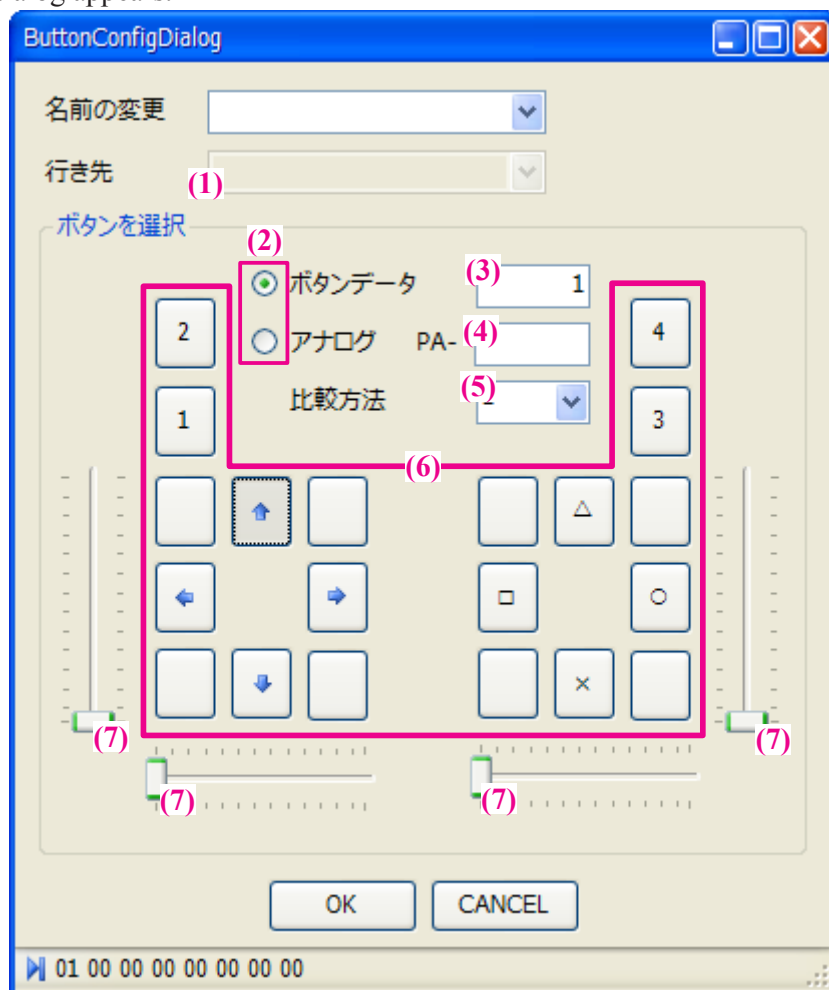
Creation of Project

Linking Wireless Controller Button to Motion

To run motion data through wireless controller, Begin Run button must be assigned. Wireless controller button is recorded from the Motion List Window.

1. In the Motion List Window, double click on the motion field to which you wish to register a wireless controller button, at the same where the necessary motion data is written in the ROM.
2. The following Button Data Registration dialog appears.
3. Click on the button you wish to register and click OK. The button data is linked to the motion. More than two button data can also be used in combination.
4. After completing button registration for each motion you wish to run, click Button Data Registration button  in toolbar of Motion List Window, to register all button data.
5. The maximum number of button data that can be registered is 25.
6. After registration, turn on power of RCB-4HV again, and try restarting.

Project reading to sample motion running is completed.



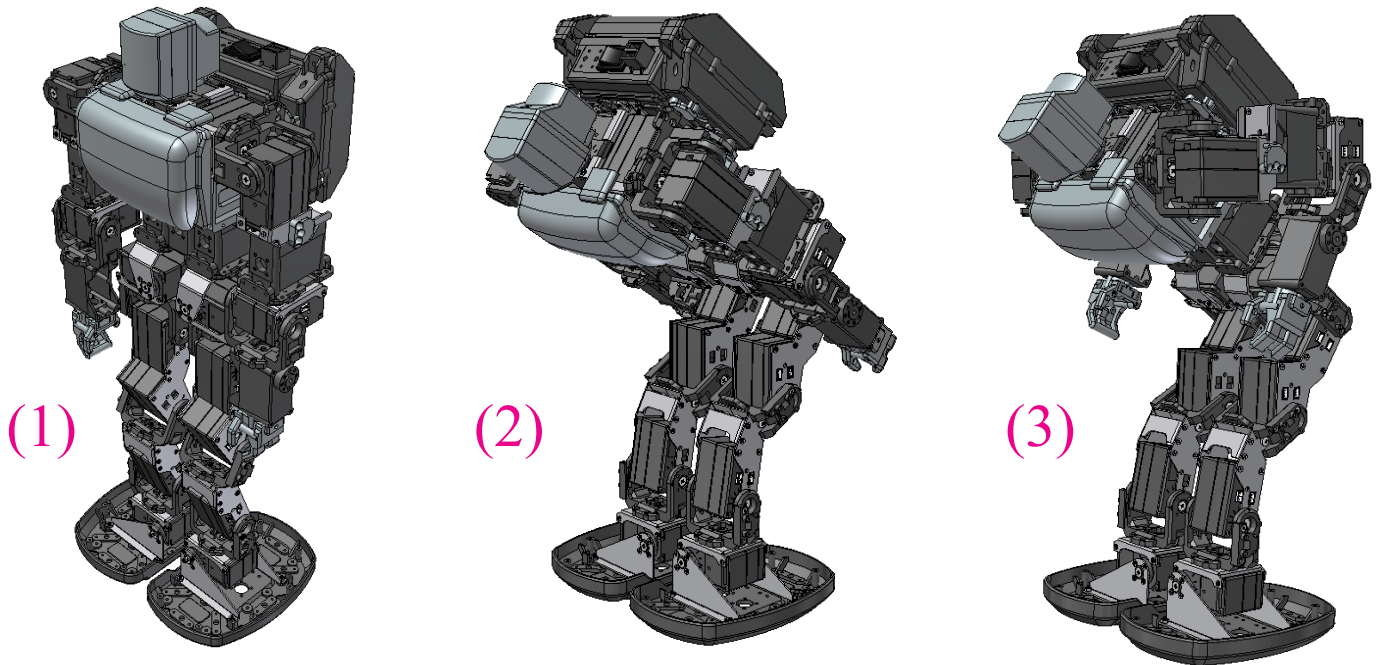
Description of all operation parts.

- (1) Destination when button data condition coincides is assigned.
- (2) Switches automatically depending on the type of data last set.
- (3) The corresponding control input value appears by clicking each button.
- (4) The corresponding port names and analog values appear by scrolling the four track bars.
- (5) Method of comparison: When comparing to analog value, comparison operator is selected.
- (6) Button
- (7) Track Bar

Creating Motion - Basics

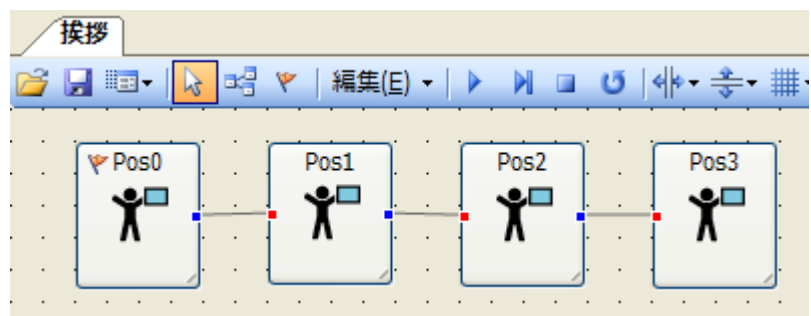
Editing Sample Motion

Here, the greeting sample motion is edited so as to make a slight change in the position of the arm, written to RCB-4HV, and run. We will try changing the greeting pose in figures 1 to 2 to that of 3.




<Preparation>

1. Boot HeartToHeart4 and open sample motion project.
2. Open greeting motion.
3. Pos0, Pos1, Pos2, and Pos3 appear on screen, but the red flag on Pos0 shows the control at which motion



begins. Each control is connected by a line, which indicates that the process proceeds from the red connector to the blue connector. See Motion Edit Window section for more detail.

4. Run the greeting motion to check the content of the motion. Running can be done by clicking the run button  in the toolbar in the motion edit window. If running does not proceed properly or if running stops midway, put a check mark on the check box of the "Signal Motion End" field.

Creating Motion - Basics

<Basics on Position Editing>

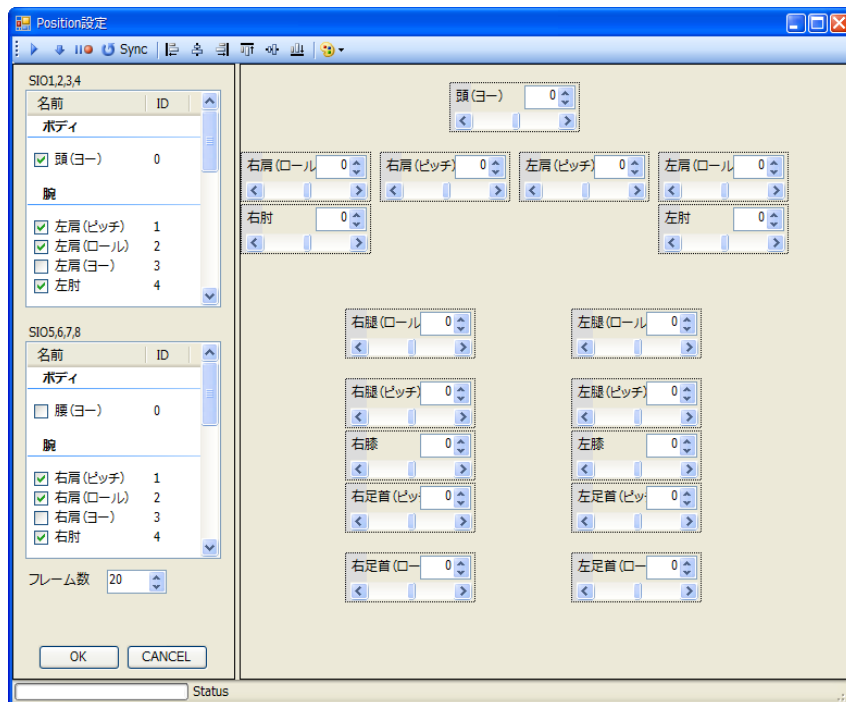
5. Double click the “Pos0” control on the upper left side of the greeting motion.

6. A Position Edit Dialog appears.

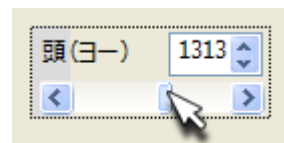
In the example, 17 axis setting is completed, but if you wish to start from scratch, see “Motion Editing” section.

7. When Sync button is pressed, sync button appears as if being pressed down (or background color changes). At this point, synchronization of the position data and position data of RCB-4HV (robot to which it is attached) begins. Synchronization stops by clicking once again.

8. By moving the scroll bar in the position panel (see figure) of the servo motor you wish to move, while synchronized, the position input value is changed and the rotation angle of the servo motor changes. Or, by directly typing in the value into the position input field and pressing Enter, can change the angle of the servo motor. Here, neutral position is shown as 0. Thus, when entering 0, the actual value sent to the servo motor is 7500, and the robot moves to the neutral position.



Head (Yo) angle is being changed using the slider.



Creating Motion - Basics

9. In this example, in order to create the greeting pose wherein the hands are at the hip position, the following servo motor position data should be rewritten. Caution! Entering values while pressing sync button, and pressing ENTER causes the servo motor to move to the entered values.

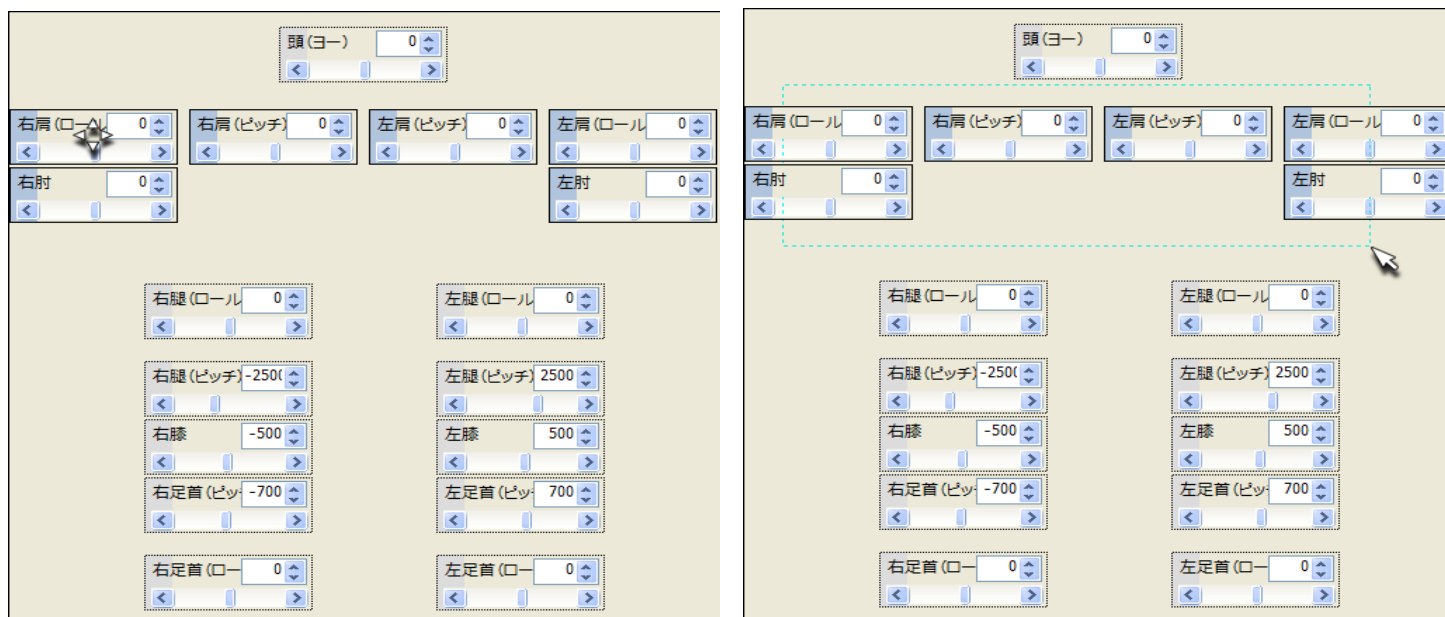
| Right Shoulder (Roll) | Right Shoulder (Pitch) | Left Shoulder (Pitch) | Left Shoulder (Roll) |
|-----------------------|------------------------|-----------------------|----------------------|
| -600 | 1000 | 1000 | 600 |
| Right Elbow 3400 | | | Left Elbow -3400 |

10. When position of each servo motor is set, enter frame number in the frame number enter field at the bottom left hand. A slightly longer 60 is selected.
11. The set servo motors rotate to the positions by pressing the run button in the position setting dialog.
12. When setting is completed, press OK button and complete position setting of Pos0.

Creating Motion - Basics

<Edit by Smart Teach>

- 13.** Set position data so that the arm position for Pos1 and Pos2 are the same as that of Pos0.
- 14.** To check the pose of Pos1, press Move button on the upper left side and run position set in Pos1.
- 15.** You may enter the same data as those for Pos0, but here, an efficient teaching method that uses Smart Teach function is described. In the Position Setting Dialog, select an arm servo motor (right shoulder (pitch), right shoulder (roll), right elbow, left shoulder (pitch), left shoulder (roll), left elbow). There are two ways to select: One is by moving the mouse cursor to the position panel, and clicking when the shape of the mouse cursor changes (left figure), which causes the color of the panel to change and become selective. The other is by surrounding the relevant position panels by dragging mouse from outside the position panel (right figure).

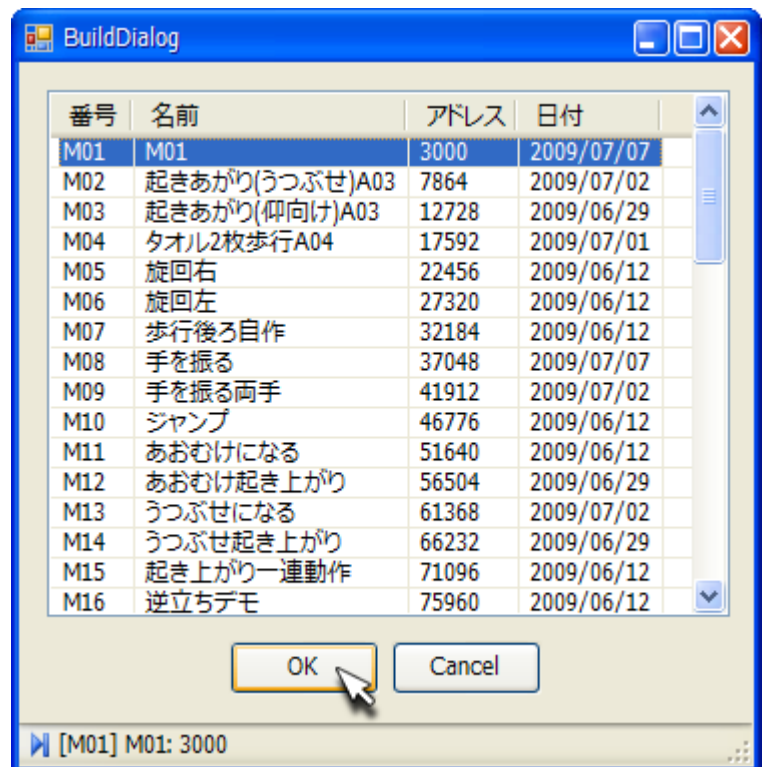
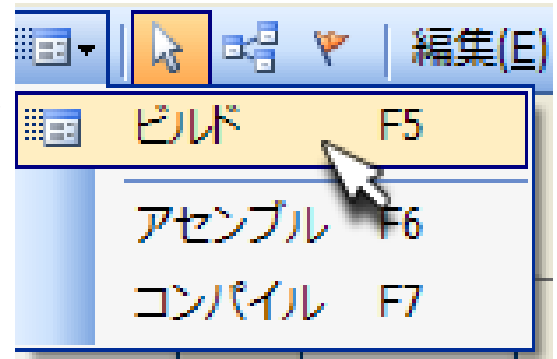


- 16.** After selecting the relevant position panel, click Smart Teach button once. Only the servo motor of the position panel turns into the teach state. Move the servo motor in the instructive state accordingly to obtain the desired position.
- 17.** When setting of position is completed, press Smart Teach button once again to reflect the position instructed to the Position Panel.
- 18.** When setting is completed, click OK button and close position setting dialog, and save control data for Pos1.
- 19.** Change the position of the Pos2 control so that the arm is bent using the same method.
- 20.** When completed, run by clicking the Run button in the Motion Edit Window.
- 21.** Clicking the Save button in the toolbar of the motion edit window causes overwrite save. If you wish to save by another name, choose "save motion under different name (A)" in the file menu of the main window.

Creating Motion - Basics

<Save motion to ROM and run>

22. When motion data editing is completed, save motion data to ROM. (By saving motion data under different names, you will be able to use those data in the future for copy/paste.)
23. Open build menu in the toolbar in Motion Edit Window, and select build. Or for the same effect, click F5. “Build” refers to the action of transforming the control structure of the motion edit window to a program that is understandable by RCB-4HV (assemble), and then recording on ROM by modifying write address (compile) etc.
24. Build dialog opens. Assign field you wish to write and click OK. In the figure, M01 is used.
25. When writing is completed, the “OSU” position is registered to the M01 of the Motion List Window.
26. By selecting “OSU” motion in the Motion List Window and clicking Run button, the motion is run.



Creating Motion - Basics

Creating Motion from Scratch

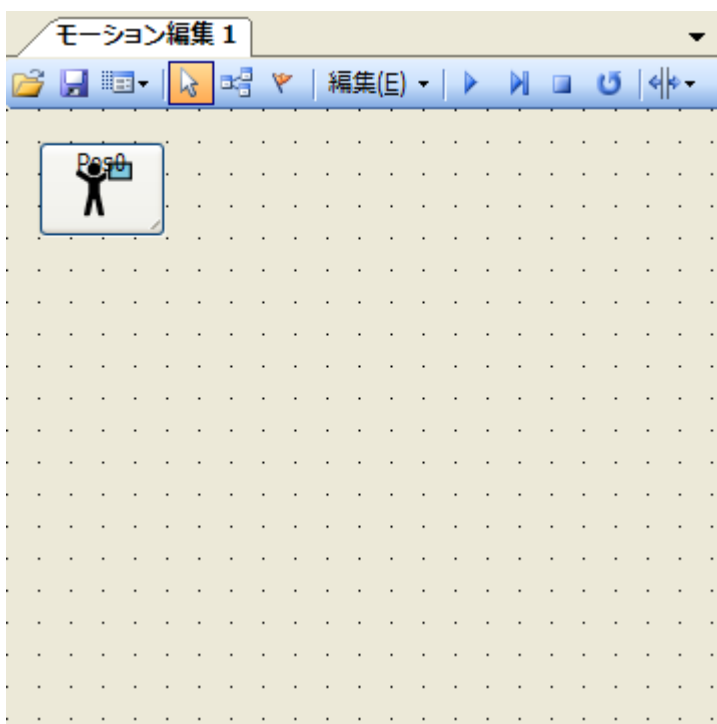
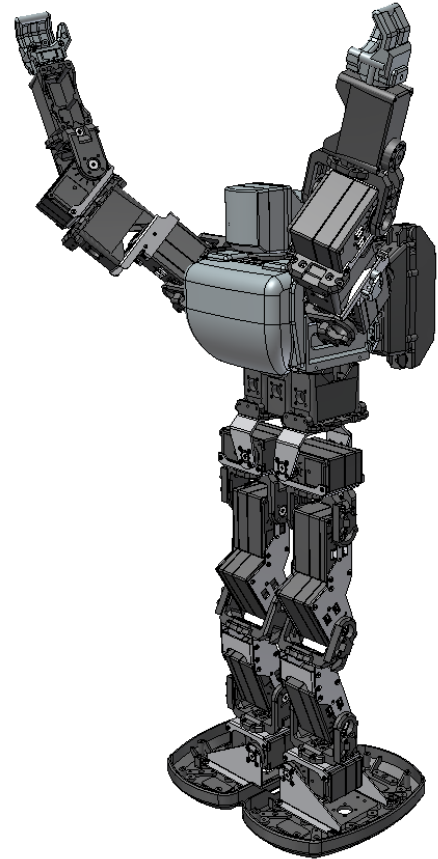
In this section, the method of creating and running new motion data is described. As an example, the Home position data is set as that shown in the following figure, where the robot swings both arms several times.

<New Project>

1. First, create a new project or read an existing project.
2. Connect COM port, and complete trim adjustment etc. in the Project Setting Window.
3. Select motion from new document menu in the file menu of the main window, or click new motion data button in toolbar.
4. Open tool box window from tool box of window menu, or press “display tool box” button in window toolbar.

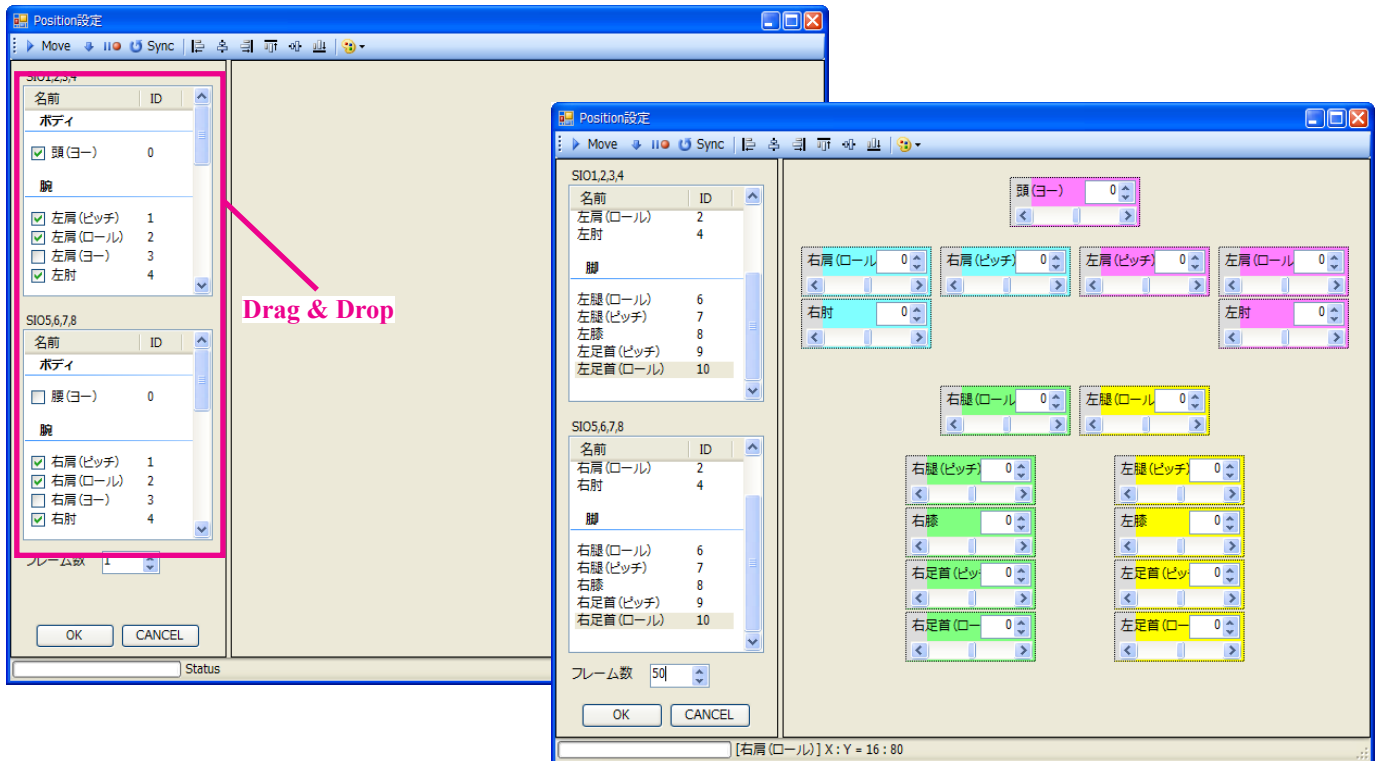
<Create Basic Position>


5. From tool box window, drag-and-drop Pos control to canvas of motion edit window.
6. Double click Pos control and open Position Setting dialog.



Creating Motion - Basics

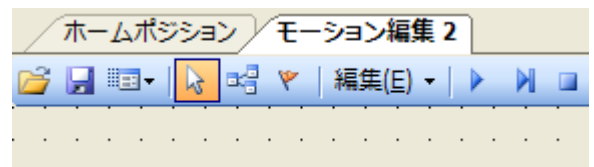
7. In the initial state, position panel is not arranged in the position setting dialog. Drag-and-drop and align the necessary position panels from the left list. All values in the position panel are 0.



8. When alignment is completed, set frame number to 80 and click OK.
9. Motion data file should be saved at this point. Click the motion save button  in the toolbar of the motion edit window, and name the file "Home position.xml". The name of the tab saved changes.
10. Further, the color and position of the Position Panel is controlled by the project, so project file must be saved too. Select "save project" from file menu and save project.


<Create Motion Data>

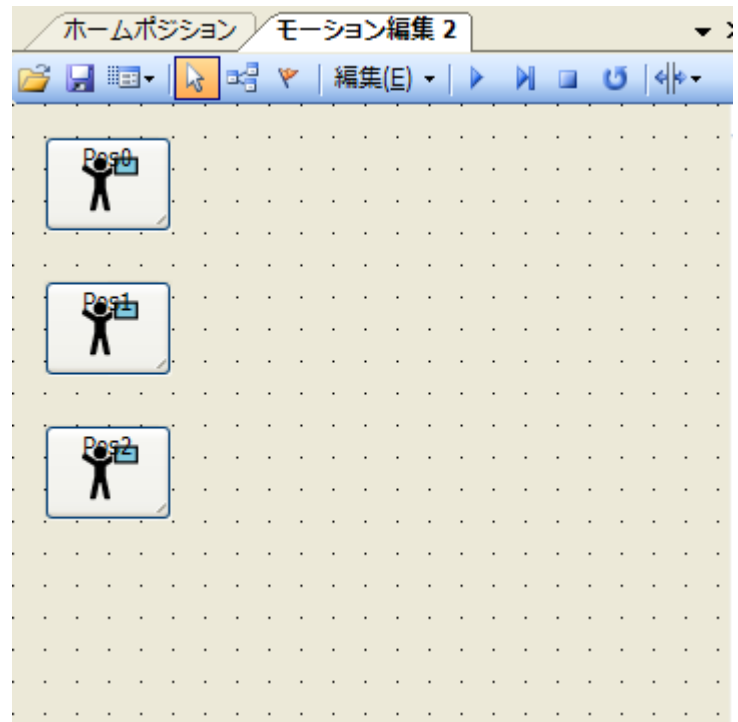
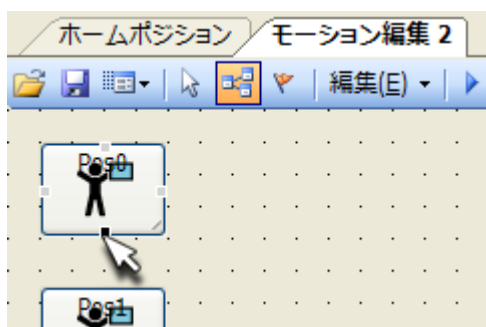
11. After saving Home position, create new motion data from New in file menu. The Motion Edit Window appears with two tabs on screen. Tab screen is displayed at the foremost by clicking the text on the tab. Also, window can be separated or connected through drag-and-drop of tab.
12. Click "Home position" tab to bring forward, and click Pos0 created in the preceding step. When in the selective state, the button appears to be pushed in.
13. Select "copy" from the right-click menu or the edit menu in the toolbar of the Motion Edit Window. The short cut key CTRL + C can also be used.
14. Click "Motion Edit 2" tab to bring screen to the foremost, and select "paste" from right-click menu to paste the control copied in step 13.



Creating Motion - Basics

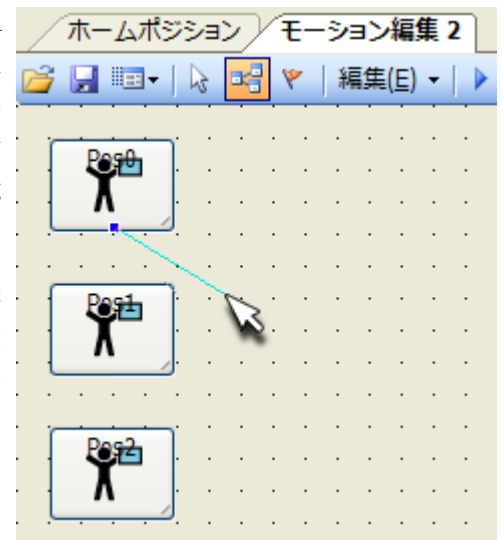
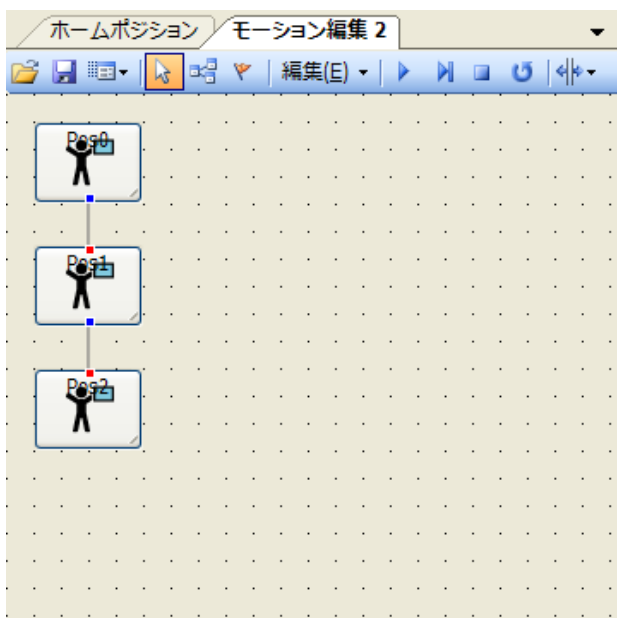
- 15.** Repeat copy-and-paste three times and align controls as shown in the screen.

- 16.** Press the connect button  in the toolbar and switch over from edit mode to connect mode. When mouse cursor is moved close to control in connect mode, connection points appear. The connection points are shown as grey squares and the point candidates appear black. Connection is made to the closest connection point even without clicking on a specific point (point snap function).



- 17.** Move mouse cursor and click on a connection point candidate. A line appears from the point. Move mouse to the control to which you wish to join, and connect the line. If you wish to cancel the connection process midway, press ESC key. If you mistakenly make a connection, the line changes from grey to black by clicking on the line itself, and become erasable by pressing the DEL key.

- 18.** When controls are connected, the connector of the starting point turns blue, and the connector of the end point turns red. Using the same steps, connect all three controls. When all connection is made, save motion data under the name “wave_hand_basic.xml”.



Creating Motion - Basics

<Edit motion>






- 19.** Pos0 should be left as it is, since it is the first position when running the motion. Open control of Pos1 by double clicking. When position setting dialog is displayed, change to the pose where both arms are raised and opened wide, using Smart Teach function and Sync button. Press OK button when completed and save position data. The following table shows reference positions.

| | | | |
|-------------------------------|---------------------------------|-------------------------------|-----------------------------|
| Right Shoulder (Roll) -800 | Right Shoulder (Pitch) -4000 | Left Shoulder (Pitch) 4000 | Left Shoulder (Roll) 800 |
| Right Elbow 1000 | | | Left Elbow -1000 |

- 20.** Next, open Pos2 and set to posture where the arms close in the raised position. When editing is completed, press OK button and close Position Setting dialog. The following table shows reference positions.

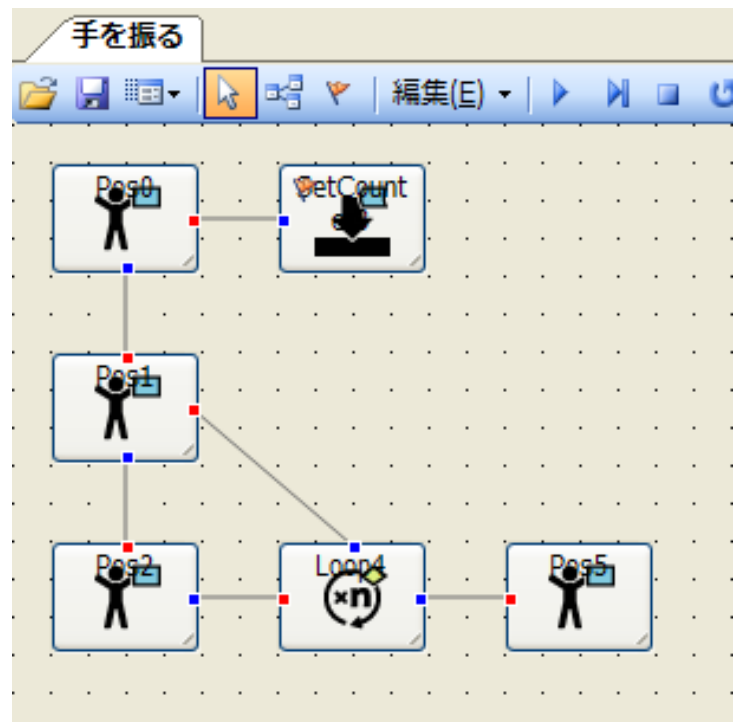
| | | | |
|------------------------------|---------------------------------|------------------------------|------------------------------|
| Right Shoulder (Roll) 250 | Right Shoulder (Pitch) -4000 | Left Shoulder (Roll) 4000 | Left Shoulder (Roll) -250 |
| Right Elbow 1000 | | | Left Elbow -1000 |

<Online Run>

- 21.** Run data up to this point. Find the control with the Start Flag  before pressing the Run button. If you wish to change the position of the Start Flag, click the flag mode button  and click on the control from which you wish to start. If you right-click instead, a Stop Flag  appears. The stop flag indicates the stop position when online run is performed.
- 22.** Set the start flag at Pos0 and push run button. Online run begins until motion finish position.
- 23.** By pressing the Step-Run button, controls are run one at a time. When run is completed, the Step-Run mark  appears on the next control that is to be run. By pressing the step-run button again, the control with the Step-Run mark is run.
- 24.** Pressing the Stop button  while step-running or running causes motion to stop. The step-run mark disappears and the start position is reset to the control with the start flag.
[caution] If only the focus moves and motion is not executed in online run, put a check mark in the “Signal Motion End” check box in the project setting window.

<Inserting Repeat Process>

- 25.** Next, the open-arm state and closed-arm state are repeated five times to create a waving motion. Position SetCounter control and Loop control from the toolbox window of “wave_arm_basic.xml” currently being edited, add Pos0 by copy-and-paste (Pos5) and align as shown in the figure. Connection should be made as SetCounter - Pos0 -, Pos2 - Loop4 -, Loop4 - Pos1, Loop4 - Pos 5. The value following the control name indicates the order by which control was arranged, and may not coincide completely.

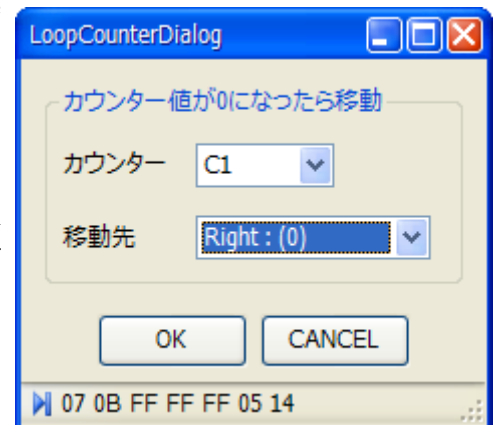
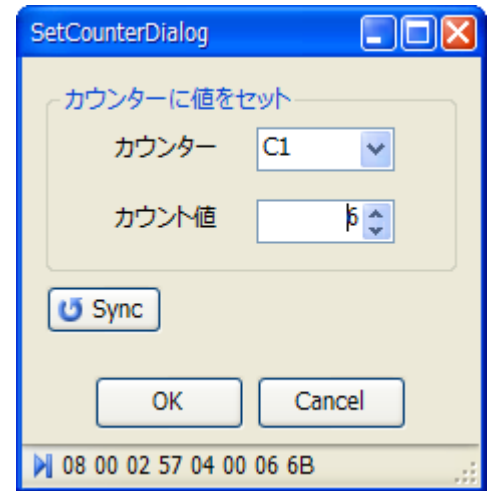


Creating Motion - Basics

26. In the Loop Counter control, when the set count value minus 1 becomes 0, the process moves on to the appointed control. In the Loop counter control, you must first subtract 1. Thus in the connection method exemplified here, if you wish to repeat five times, the SetCounter control must be set to 6.
27. Select C1 for SetCounter control counter and enter 6 as count value.
28. Next, loop counter control is set. There must be two lines extending from the loop counter control to other controls to which process moves on (i.e. the connection point on the loop counter is blue, and the connection point on the other controls are red). One control is for proceeding when condition of loop counter control matches, and the other is for when condition does not match. In the present setting (see figure), when condition does not match, the process moves on to Pos1, thus repeating the waving action until it is repeated 5 times, at which point the condition becomes a match and moves on to the Home position.
29. Online run is not fully supported for conditional branching, so write to ROM and check motion. Run is successful if robot waves five times by running from ROM.

<Adjusting Motion>

30. When transferring from Pos0 to Pos1, the arms are rapidly raised. However, since the robot is light-weighted, this rapid motion alone can cause swaying. In such case, increasing frame number to slow down motion or inserting a position which does not keep the arms away from the body into Pos0 and Pos1, are effective.

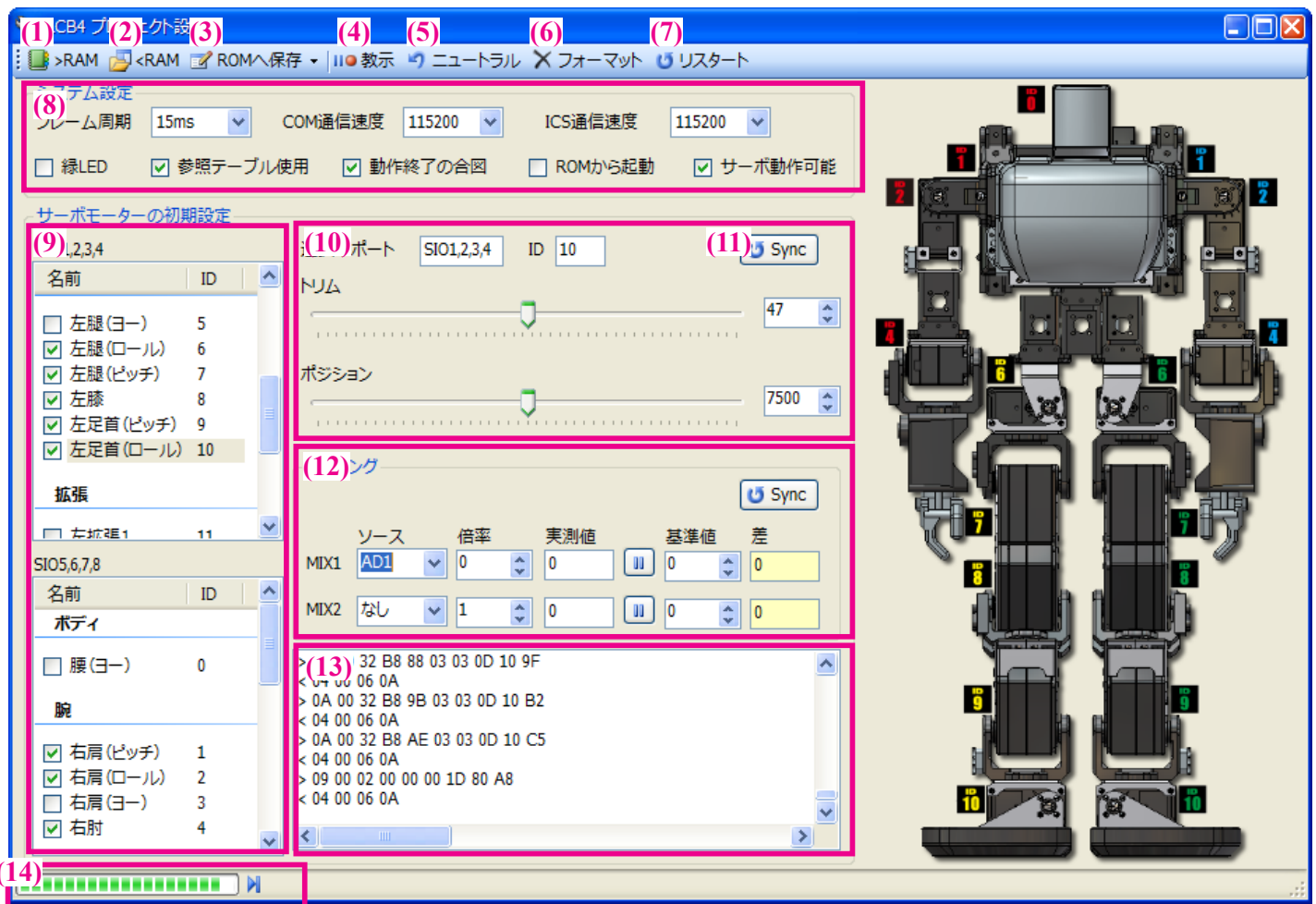


End of Creating Motion - Basics.

Project Setting Window

In HeartToHeart4, initial setting of RCB-4HV, motion program data, and wireless control assignment are all saved as project setting file. The Project Setting Window is a window that enables the operation of such project settings by GUI. Mainly, setting of servo motor, analog mixing and frame cycle can be set. By clicking the check boxes and Write buttons on screen, communication with RCB-4HV begins, so synchronize the communication speed of your computer and that of RCB-4HV to make changes to the data.

If position is changed in the project setting window and written to the ROM, Home position becomes as specified, but all position data are saved as neutral when saving project.







Part Names

- | | |
|--|--|
| <p>(1) >RAM: Develop trim data of servo motor position etc. on RAM.</p> <p>(2) <RAM: Read system setting from RAM.</p> <p>(3) Save to ROM: Write various data to ROM so as to enable booting from ROM.</p> <p>(4) Teach: Obtain position using teach function.</p> <p>(5) Neutral: Return data currently being edited to neutral (Pos=7500, Trim=0).</p> <p>(6) Format: Initialize ROM data.</p> | <p>(7) Restart: Initialize program in ROM.</p> <p>(8) System Settings: Select option related to system initial setting.</p> <p>(9) Servo motor is selected.</p> <p>(10) Change servo motor trim position.</p> <p>(11) Sync button: Transfer pertinent settings to RCB-4HV.</p> <p>(12) Mixing: For mixing setting.</p> <p>(13) Display content of communication with RCB-4HV</p> <p>(14) Status: Display status.</p> |
|--|--|

Project Setting Window

Toolbar





1. RAM write Button  is for developing set trim position data etc. on to RAM of RCB-4HV, and moving servo to that particular position.
2. RAM read button  is for reading the current system setting values from RAM and reflecting on screen.
3. A pull down menu appears by clicking Save to ROM menu.

 ROMへ保存 ▾ || ● 教示 

全て保存

初期化命令を保存

初期値を保存

 - (a) All button: Orders of (b) and (c) are processed consecutively.
 - (b) Save Initialize Order: In RCB-4HV, initialization order region and initialization data save region are registered on separate areas on the EPROM. This button reads only the initialization order.
 - (c) Save Initial Value: Only the initialization data is saved. If Initialization order is saved in the past, only the initial value is saved. Data is reflected when rebooted.
4. Pressing the Teach button  switches to Teach Mode.
5. By pressing the Neutral button , the currently edited trim data becomes 0 and position data is initialized to neutral. Pressing the RAM Write button after pressing the Neutral button results in the robot to change position to the neutral position.
6. ROM can be initialized (a state of no records) by pressing the Format button .
7. Software is rebooted by pressing the Restart button .

System Setting

In the System Setting field, options related to system initial setting can be selected.

8. Frame cycle: The time interval for sending orders to servo motor when running motion. Assign 15-20 ms when ICS communication speed (later described) is 11500, and 10-15 ms when it is 1250000. The smaller the interval, the more agile the motion becomes, but if communication speed is slow, motion may not finish within the frame cycle.
9. COM communication speed: The rate of communication between the computer and RCB-4HV. When COM communication speed is changed, always match the communication speed in the COM toolbar of the main window.
10. ICS communication speed: The rate of communication of the serial device connected to the SIO port of RCB-4HV, such as servo motor. If not set correctly, servo motor etc. will not operate.
11. Green LED: Not used.
12. Use Reference Table: In HeartToHear4, the wireless control button data list is located in the RAM, which the firmware refers to and links to motion data. This determines whether to use the reference list or not. Normally checked.
13. Signal Motion End: When servo is moved, RCB-4HV sends a reply after motion is completed. Normally checked.
14. Reboot from ROM: Not used when booting from ROM. Normally checked.
15. Servo Operable: Activate operation of ICS device. Taking the check mark off stops operation of servo motor etc.

Project Setting Window

Initial Setting of Servo Motor

- 16.** Servo Selection Field: SIO 1, 2, 3, 4 field and SIO 5, 6, 7, 8 field are available as servo motor selection field, and names corresponding to each ID are registered. Signal is not sent to the pertinent servo motor when the check mark is taken off and written onto RAM or when written on ROM and rebooted, thus shortening the frame cycle. However, in this manual, the optimum frame cycle is not discussed.
- 17.** Sync button: RCB-4HV and trim position data in the project setting screen are synchronized when Sync button is pressed. Select name from servo motor list and press Sync button. Servo motor name can be reselected while pressing the Sync button, as well.
- 18.** Trim Track Bar: Adjusts trim of servo motor. The value that appears on the right side change by sliding. Value can be directly typed in to the input field, as well. Track bar can be slid using mouse or moved 5 at a time by mouse-click or pressing the PageUp, PageDown keys on the keyboard. Pressing the cursor key left/right moves the value 1 at a time. It also corresponds to mouse wheel.
- 19.** Position Track Bar: Adjusts position of servo motor. Method of operation is the same as that of trim track bar.

Motion Edit Window

Analog Mixing

Analog mixing refers to the adjustment of servo motor angle through input from sensor. Usually used to stabilize posture of body by controlling vibration and inclination of body through multiplying a suitable factor to output values of gyro sensors etc.

Description of Operating Portion

- (1) Source: Assign input port for mixing data. If mixing is not done, select "none."
- (2) Factor: Assign a factor for increasing or decreasing effect of mixing data. If you wish for an inverse effect, assign a - (minus) value.
- (3) Measured Value: The actual output of the analog port assigned in the Source field.
- (4) Capture button: Transfers measured value being measured to standard value.
- (5) Standard Value: Set standard value of mixing data.
- (6) Difference: The difference between standard value and measured value is displayed. Servo motor output is adjusted by multiplying factor to this value.
- (7) Sync Button: When pressed once, communication with RCB-4HV begins and measured value is taken from the analog port assigned in the source. Pressing once more ends communication.

サーボモーターの初期設定

SI01,2,3,4

| 名前 | ID |
|---|----|
| ボディ | |
| <input checked="" type="checkbox"/> 頭(ヨー) | 0 |
| <input checked="" type="checkbox"/> 腕 Select Servo | |
| <input checked="" type="checkbox"/> 左肩(ピッチ) | 1 |
| <input checked="" type="checkbox"/> 左肩(ロール) | 2 |
| <input type="checkbox"/> 左肩(ヨー) | 3 |
| <input checked="" type="checkbox"/> 左肘 | 4 |

SI05,6,7,8

| 名前 | ID |
|---|----|
| ボディ | |
| <input type="checkbox"/> 腰(ヨー) | 0 |
| 腕 | |
| <input checked="" type="checkbox"/> 右肩(ピッチ) | 1 |
| <input checked="" type="checkbox"/> 右肩(ロール) | 2 |
| <input type="checkbox"/> 右肩(ヨー) | 3 |
| <input checked="" type="checkbox"/> 右肘 | 4 |

選択中ポート SI01,2,3,4 ID 1 Sync

トリム 0

ポジション 7500

ミキシング

| ソース | 倍率 | 実測値 | 基準値 | 差 |
|----------|----|-----|-----|----|
| MIX1 AD1 | 3 | 660 | 600 | 60 |
| MIX2 AD2 | 1 | 0 | 0 | 0 |

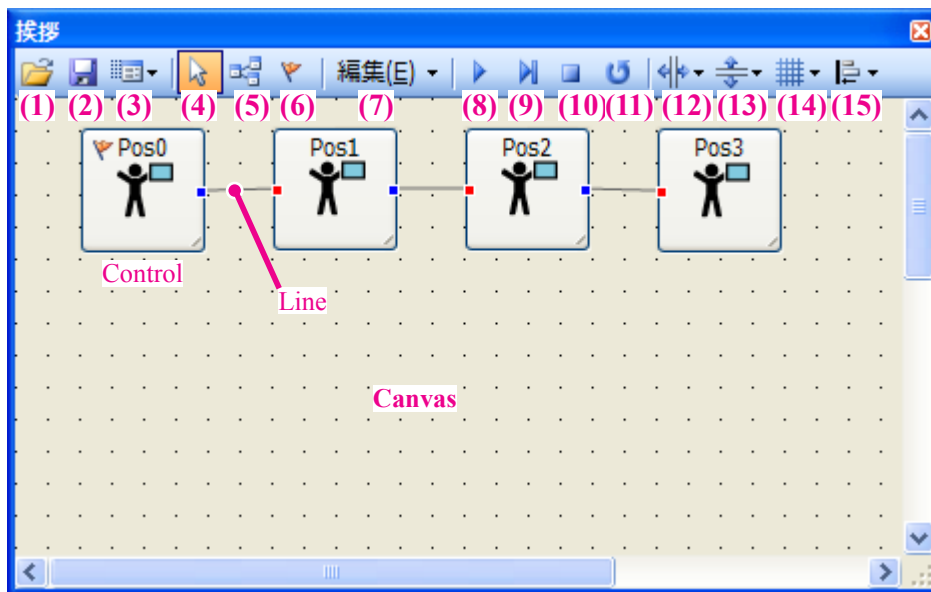
Sync

< 05 00 94 02 9B
> 0A 00 0E 00 02 3A
< 05 00 24 00 02 50
> 0A 00 20 00 00 00 0E 00 02 3A
< 05 00 00 00 05
> 0A 00 20 00 00 00 24 00 02 50
< 05 00 94 02 9B

1. Select servo motor to which you wish to incorporate mixing in the servo motor initial setting field of the Project Setting Window.
2. Press Sync button on upper right side of mixing field and begin synchronizing with RCB-4HV.
3. Assign the analog port to which the sensor to be used is connected in the ComboBox of the MIX1 source. At Sync state, the actual data is written into the measured value field.
4. Set the standard value by referring to the measured value. When factor is decided, mixing setting is completed.
5. Press Sync button once again to end synchronizing.
6. In order to replicate mixing setting at startup, save to project file and then write to ROM. Settings will be reflected at reboot.

Motion Edit Window

In the Motion Edit Window, layout of control, connection, and writing of motion data is done. Processing order is determined by connecting controls.






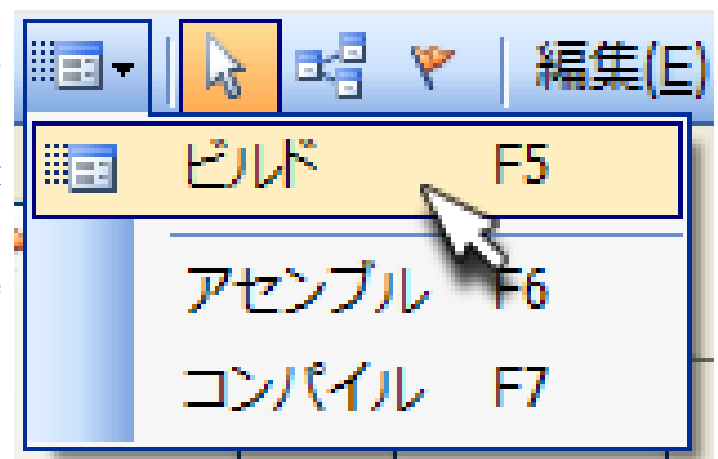
Parts Name

- (1) Read Button
- (2) Save Button
- (3) Build Menu
- (4) Select Button Connect Button
- (5) Flag Button
- (6) Edit Menu
- (7) Run Button
- (8) Step-run Button
- (9) Stop Button
- (10) Repeat Button
- (11) Canvas Width Setting Menu
- (12) Canvas Height Setting Menu
- (13) Grid Size Setting Menu
- (14) Alignment Menu

1. Read motion by pressing Read button. Control is added on when reading into an already-open file.
2. Save motion by pressing Save button. Once saved, it becomes overwrite save. If you wish to change name and save, select "save motion under new name" from file menu in main menu.
3. In the Build menu, the motion data edited is transformed into program. The condition of build, assemble and compile is displayed by having the message window open.
 - (a) Build (F5): Build dialog appears by selecting menu. Motion data is written in ROM when write position is set in the dialog and OK is pressed.
 - (b) Assemble (F6): Programs of controls laid out on canvas is collected and sorted. Usually not used.
 - (c) Compile (F7): Transfer address is rewritten by checking the connection state of the assembled program. Usually not used.









<Edit Menu>

4. Select Button  : Used to select control.
5. Connection Button  Used to connect controls with line.
6. Flag Button  : Flags can be attached to start and end positions of control. Start flag is attached by left-clicking and Stop flag by right-clicking.
7. Edit Menu: Copy, Cut, Paste can be done. The same operation is made possible by right-clicking.




Motion Edit Window

<Online Run>


8. Run Button  : Motion on canvas is run from the Start Flag position to the end or the Stop Flag position.
9. Step-run Button  : Program of control with the start flag or the midterm run position is processed. Step-run is ineffective for some controls.
10. Stop button  : Run is stopped. While step-running, all mid-run marks disappear.
11. Repeat Button  : By setting repeat button during regular run, repeat run is performed. To stop, press Stop button.
12. Canvas Width Setting Menu , Canvas Height Setting Menu  : Size of canvas is changed.
13. Grid Size Setting Menu  : Grid size is changed.
14. Alignment Menu  : Controls are aligned. Align Left, Center Vertically, Align Right, Align Top, Center Horizontally, Align Bottom can be selected from the menu.

<Arrangement of Control>

Arrangement Procedure

1. If toolbox window is not displayed, click toolbox button  in window toolbar, or select toolbox window from window menu in main menu.
2. Drag control from toolbox window and drop into canvas of Motion Edit Window.
3. The dropped control can be moved by dragging with mouse. Dragging while pressing CTRL key moves control according to the grid.
4. Shape of the mouse cursor changes when mouse comes in close contact to the right-hand and bottom-hand of the control. Size of control can be changed by dragging at such state. Further, control size can be changed by dragging the bottom-right corner. By pressing CTRL key while changing size, the size can be changed in accordance with the grid. Also, by pressing the SHIFT key while changing size, the horizontal and vertical amount of change becomes equal.

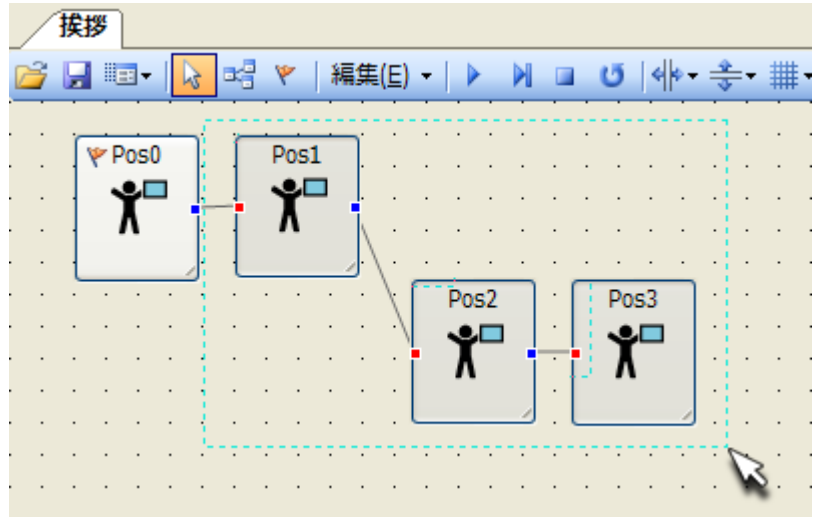
<Connecting by Line>

5. Mode is changed to line connection mode by pressing the Connect button . By bringing the mouse cursor on the control in Connection Mode, the four connection points are shown in grey. By clicking control at such state, the connection point closest to the cursor snaps. (Point snap function: closest connection point is automatically determined and connection is made.)
6. Line appears by moving the mouse cursor after snapping. Snapping to another control at this state displays line and fixes the connection. Process transfer from blue connection point to red connection point.
7. Pressing ESC key while snapping cancels connection.
8. If you wish to reconnect a line after being fixed, first click on the line and turn it selective (line changes to black) and then press DEL key to delete line.

Motion Edit Window

<Selection>

- 9.** To select control, click on a control. Control appears as if button is being pressed down.
- 10.** To select a plurality of controls, click control while pressing SHIFT key.
- 11.** Multiple selection is also possible by dragging mouse in a manner surrounding the controls you wish to select.
- 12.** Control is deleted by pressing DEL key after selecting.



<Copy, Cut, Paste>

- 13.** Control is saved to the software buffer by pressing CTRL + C keys or selecting Copy from edit menu after selecting control.
- 14.** Pressing CTRL + V while being saved in buffer enables pasting a copy on the canvas.
- 15.** Control is saved to the software buffer and deleted from canvas by pressing CTRL + X keys after selecting control.
- 16.** Copy-and-paste can be done across each Motion Edit Windows.

Description of Control

Here, controls used in the creation of motion are described. Examples described in this section are used for the sole purpose of describing control and has no meaning in its movement. Further, even though there are four snap points to connect each control with another control, the valid number of connections are set depending on each control. Operation may not proceed properly for some controls if the number of connections are less or more than the valid number. The number of valid connections are shown in the description of each control, but fulfilling these conditions does not guarantee operation of the program.

Setting dialog appears when each control is double clicked. In order to enable the values set in the setting dialog, make sure to click OK button when closing dialog. Closing window by the window quit button or the cancel button will not enable the values.

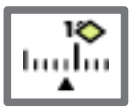
Conditional Branching / Repetition

In the Conditional Branching / Repetition controller, the destination of motion can be branched by setting conditions from analog input etc. When assigning branch destination, always connect destination first and select destination from dialog. Further, when the set conditions are insufficient, command cannot be generated. This control does not support online-running.

The following steps are common for obtaining setting dialog in each control.

1. Arrange control in screen by drag-and-drop of control in the Motion Edit Window.
2. For conditional branching control, first connect two (and only two) destinations to the control. Other controls can be connected later.
3. Double click control to obtain setting dialog.

CmpAD (compare analog input values to determine destination)



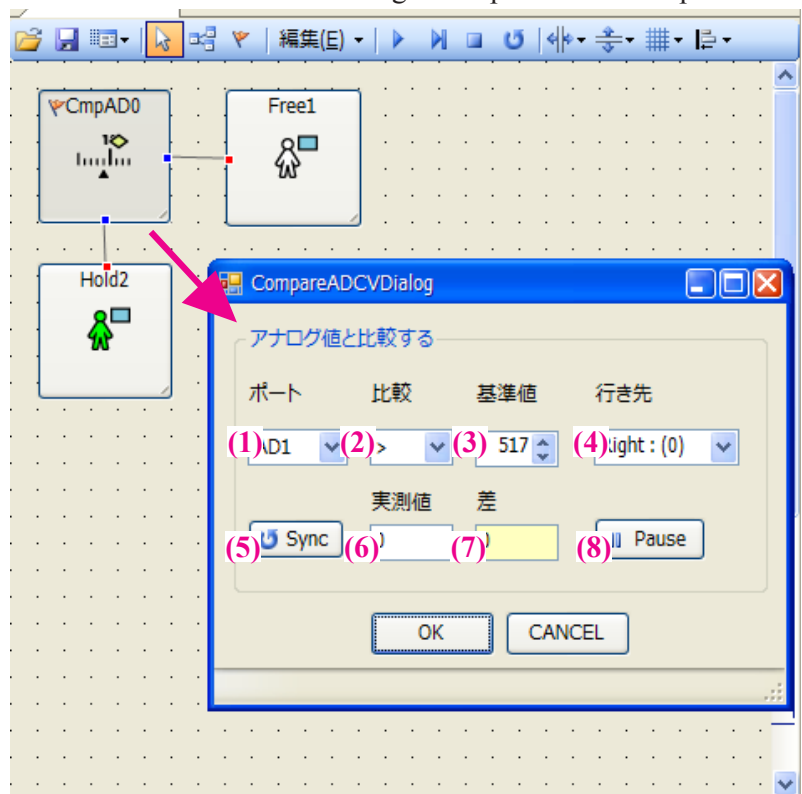
The dialog shown at the bottom left side of the screen is the dialog that opens when CmpAD control is double clicked. Set port, comparative operator, standard value and destination in the Setting dialog and press OK to complete setting.

The screen shows Free Position control and Hold Position control connected to an Analog Branching control. When the value of AD1 port is larger than the standard value (517), the control to be run next is Free1 control on Right. Otherwise, Hold2 control is run.

Number of valid connection points: Output 2

Part Names

- (1) Port: Select analog port.
- (2) Comparison: Assign comparative operator. value of AD is = (equal to) > (more than) >= (more than or equal to), < (less than), <= (less than or equal to) != (not equal to)
- (3) Standard Value: Assign a standard value.
- (4) Destination: Select destination from Top, Bottom, Left and Right, when condition matches. Unconnected items are not shown.
- (5) Sync button: Read analog value from RCB-4HV.
- (6) Measured Value: Displays the analog value of the port read when Sync button was pressed.
- (7) Measured Value: Displays the analog value of the port read when Sync button was pressed.
- (8) Pause: Copies measured value to standard value.



Description of Control

Compare Button

(determine destination from the button input value of wireless controller.)

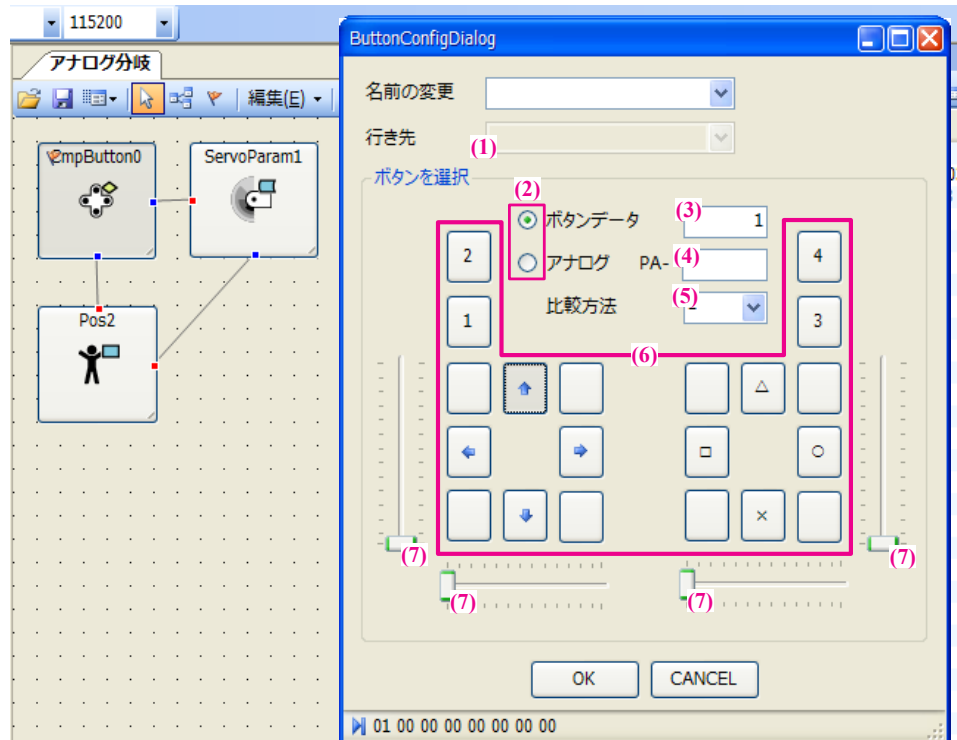


In the button branching dialog, motion can be branched based on button input values and analog input values of wireless controller.

Button becomes selective by clicking dialog button ([UP], [DOWN], [TRIANGLE],[CIRCLE] etc.), and corresponding control input value appears. When button is clicked, comparative operator is fixed at “=”. Corresponding analog port and analog input value appears by sliding the track bar.

In the screen, when button [UP] is pressed, Pos2 control is run after servo motor parameter is changed. If this is not the case, Pos2 control is run without changing parameters.

Number of valid connection points:
Output 2



Description of all operation parts.

- (1) Destination is assigned when button data condition matches.
- (2) Switches automatically depending on the type of data set at the end.
- (3) The corresponding input value appears when each button is clicked.
- (4) The corresponding port name and analog values appear by scrolling the four track bars.
- (5) Method of Comparison: Select a comparative operator when comparing with analog value.
- (6) Button
- (7) Track bar

Description of Control

Loop Counter (proceed to the assigned control when 1 is subtracted from the set value and the result is 0.)



The loop counter is used in pair with the set counter control. Counter number (C1 - C10) is set in the set counter control.

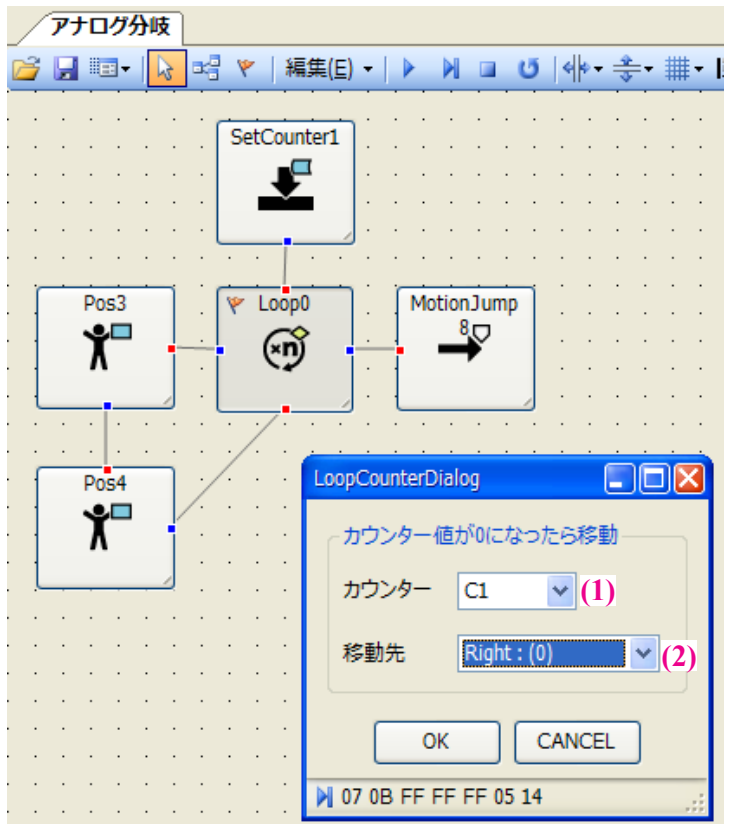
When loop counter control is run, 1 is subtracted from the set counter value each time, until the result is 0, whereby the process moves on to the specified control.

In the screen, first, a number is set to the C1 counter in SetCounter1 control. When process proceeds to the loop counter, 1 is subtracted from the C1 counter. If the result is larger than 0, Pos3, Pos 4 controls are repeatedly run. When the result becomes 0, MotionJump8 control is run, and the process proceeds to the specified motion.

Number of valid connection points: Output 2

Description of all operation parts.

- (1) Counter: Assign counter area.
- (2) Destination: Destination when the counter value set in SetCounter1 becomes 0, is selected from Top, Left, Right, Bottom. Unconnected control cannot be selected.



Setting Parameter

SetCounter

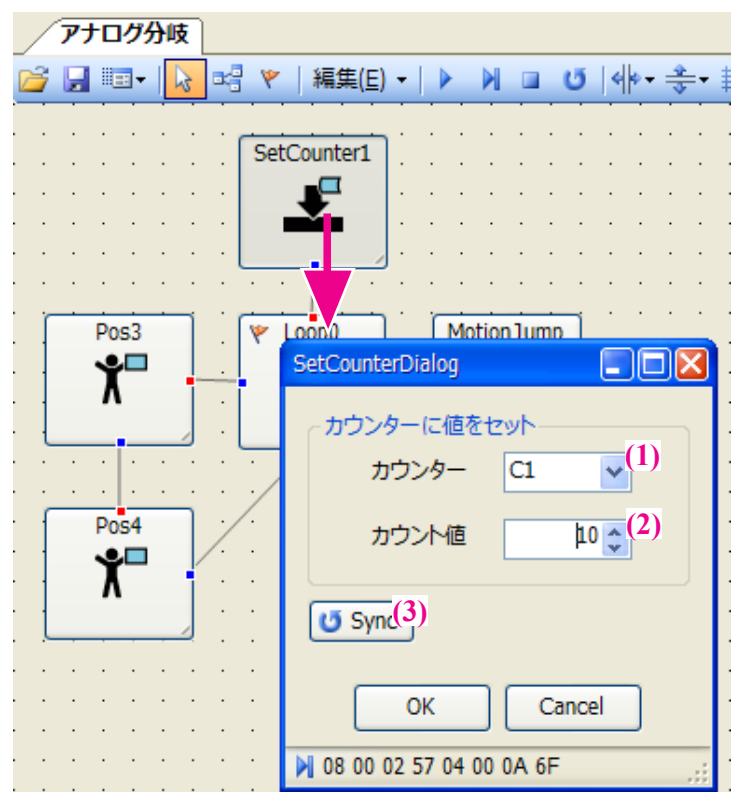


Input value into counter area (C1 - C10) in SetCounter control.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) Counter: Assign counter area.
- (2) Count value: Put value to be stored. (0 - 255)
- (3) Sync button: Substitute a value in the counter area.
(Data is set to RCB-4HV, but is not currently used.)



Description of Control

SetServoParameter

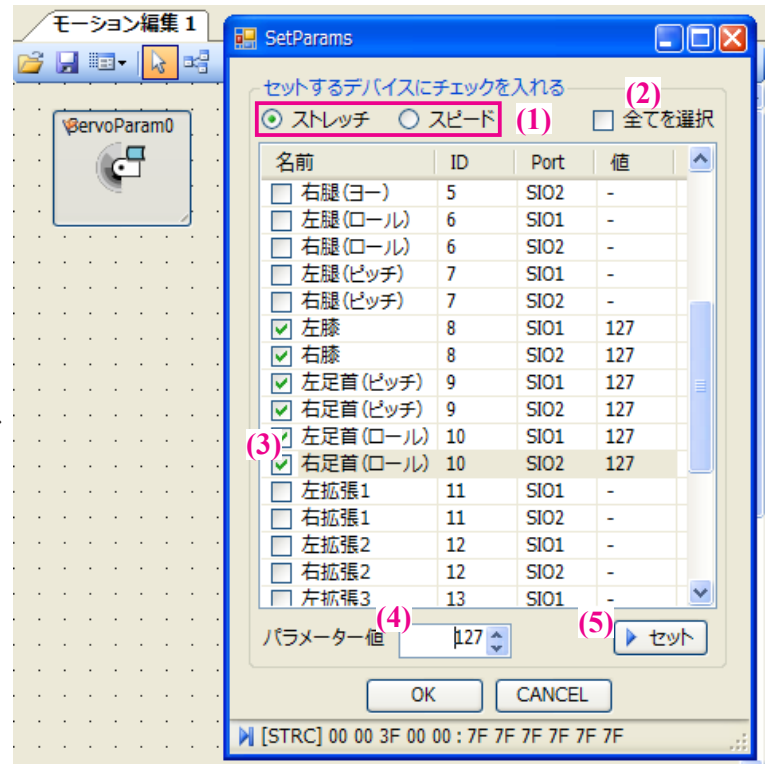


Stretch or speed of servo motor is changed.

In the setting dialog, names of servo, ID, insertion port and parameter values are displayed. First, stretch or speed on the dialog is selected. Then, put a check mark on the servo motor you wish to set and set parameter value at the bottom of the dialog. Parameters will not be correctly changed unless you add a check mark.

Both speed and stretch can be set in the range of 0 to 127. The speed becomes faster as the value becomes larger. Servo becomes more rigid (hard to move) as the stretch value increases.

Number of valid connection points: Output 0 or 1



Description of all operation parts

- (1) Assign parameter value.
- (2) Select All: The setting becomes effective for all servo motors when a check mark is inserted. Taking off the check mark cancels setting.
- (3) Add check mark to servo you wish to validate.
- (4) Parameter value: Select item from servo list and set parameter value. Corresponds to mouse wheel.
- (5) Data set is set to RCB-4HV online.

Setting Position

Free

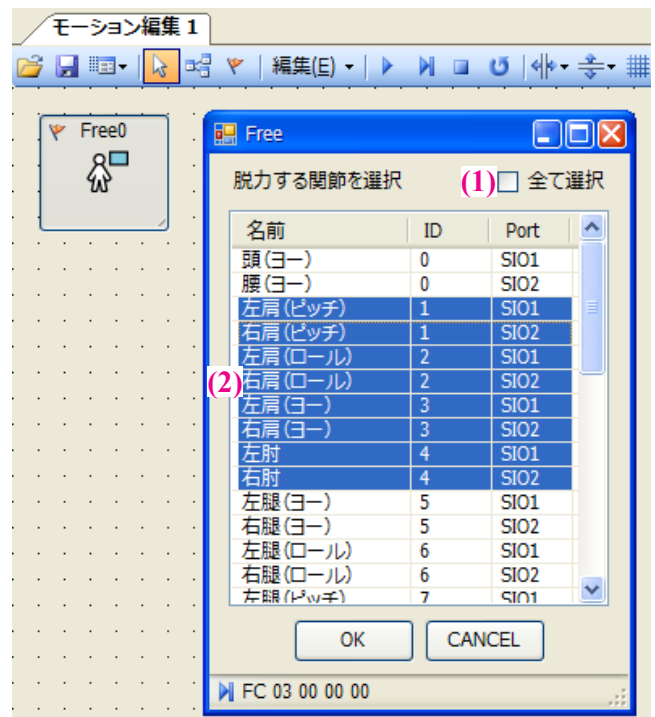


Turns selected servo motor to free (powerless) state. Multiple servos can be selected by pressing Control key while selecting. Pressing Shift key while selecting results in range selection. In the figure, left shoulder (pitch) to right elbow are at free state.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) Adding a check mark results in the selection of all servo motors.
- (2) Selected using left click of mouse.



Description of Control

Hold



Turns selected servo motor to hold state. Multiple servos can be selected by pressing Control key while selecting. Pressing Shift key while selecting results in range selection. In the figure, left shoulder (pitch) to right elbow are at hold state. Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) Adding a check mark results in the selection of all servo motors.
- (2) Selected using left click of mouse.



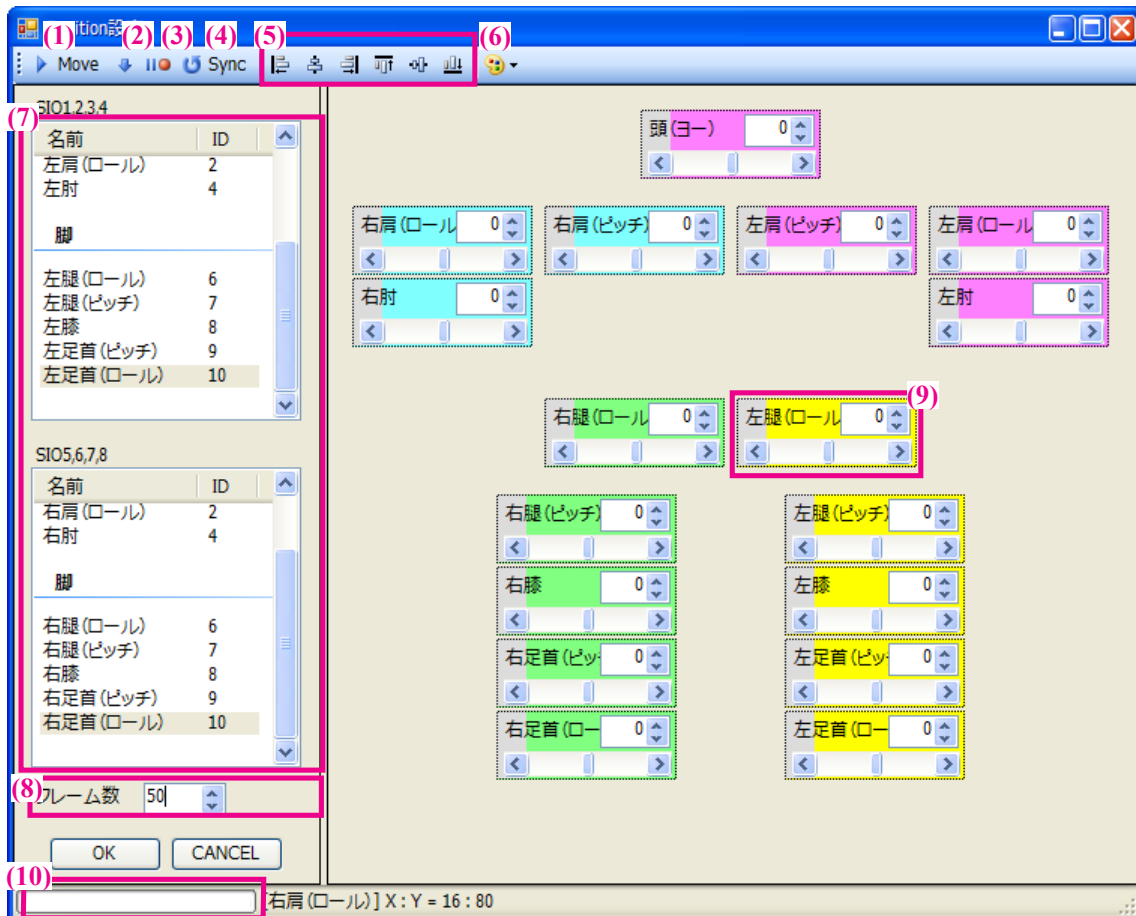
Position



Determines robot posture by selecting servo motor and setting its angle.






Part Names

- (1) Move button
- (2) Free button
- (3) Smart Teach button
- (4) Sync button
- (5) Align button
- (6) Color Selection menu
- (7) Servo Motor list
- (8) Frame number
- (9) Position Panel
- (10) Status



Description of Control

Toolbar

1. Move button  : Move to position assigned in the Position Setting dialog displayed. Also moves by clicking on the screen once and pressing SPC key.
2. Free button  : Turns robot to a powerless state.
3. Smart Teach button  : By pressing this button after selecting a position panel on screen, the selected servo motor switches to Teach Mode. By pressing this button once again after determining position of the servo motor, the present position is reflected on the position panel.
4. Sync button  : By pressing the Sync button, values set by the slider of the position panel is synchronized with that of RCB-4HV.
5. Align button  : Aligns selected panels. From left to right: Align left, Center Vertically, Align Right, Align Top, Center Horizontally, Align Bottom.
6. Color selection menu: Can change color of position panel selected.
 - (a) Foreground color: Changes color of text, and outline of position panel.
 - (b) Background color: Changes color of background.
 - (c) Return to standard: Returns to standard color.

<How to Use Position Panel>

1. Position Panel appears when item in servo motor list located at the left side of the position setting dialog is drag-and-dropped on to the blank page on the right.
2. By dragging while pressing CTRL key, position panel moves in accordance to the grid (fixed at 16 X 16).
3. Servo motors for which the check mark is taken off in the project setting window do not appear in the servo motor list.
4. Position panels already displayed can not be drag-and-dropped.
5. Position panel can be deleted using the DEL key after selecting.
6. Colors and position of the position panel is saved in the project file. If these settings are changed, make sure to save project.
7. Positions and such of the position panels are not tandem among each position panels on the window. Normally, one control in which all servo motors that are to be used in the position setting panel is created, and motion is created by copy-and-paste from this control.
8. By changing the frame number, movement from the most recent point to the presently set point takes place at the number of frames assigned. The amount of time necessary for completion of movement is number of frames x frame cycle.

Number of valid connection points: Output 0 or 1

Description of Control

SingleServo

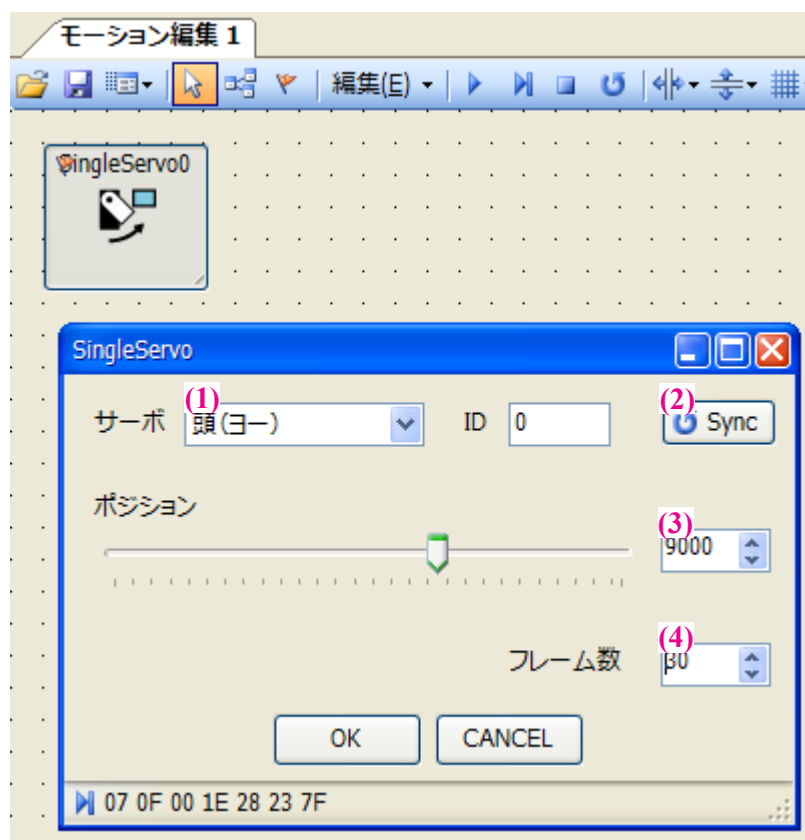


Control that moves only one servo motor. Select a servo motor from servo list and set position using the track bar at the center of the dialog. Number of frames can also be set.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) Select servo you wish to move.
- (2) The position of the track bar and the angle of the servo motor are linked by pressing Sync button.
- (3) The current position data is shown. You may also enter a value directly to run.
- (4) Assign a frame number.



Description of Control

Mov e Mortion

MotionJump

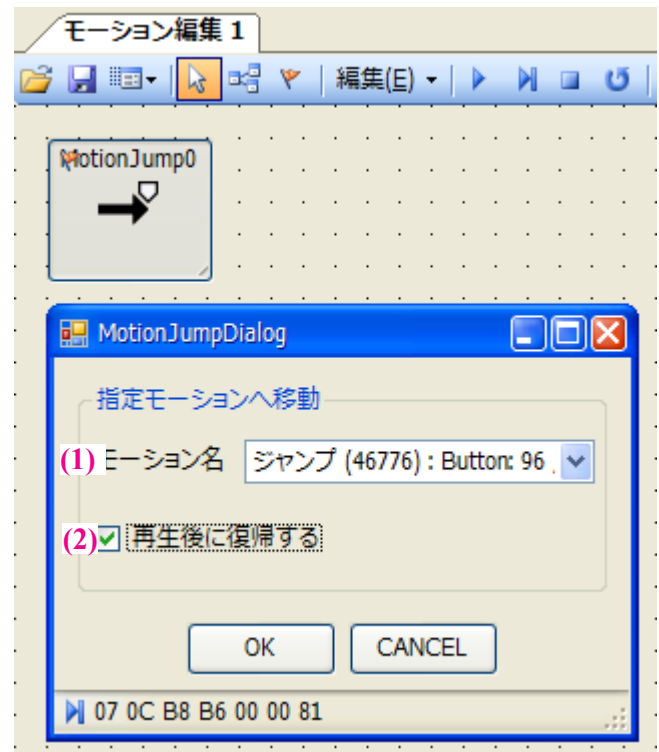


Moves to assigned motion. By adding a check mark in “Return After Running”, returns to present motion after completing motion of the jump destination. Other controls can be connected after return. Does not function in online running.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) Select destination.
- (2) By adding a check mark, returns to present motion after completing motion of the destination.



Ret



Returns from jumped destination. Used in combination with Motion Jump control, but since Ret is automatically inserted at the end of each motion, it is not used other than when demonstratively returning in the middle of a motion. Does not function in online-running.

Return order only returns to the call position, so there are no items to be set.

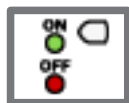
Number of valid connection points: Output 0



Description of Control

General Input/Output

Pio



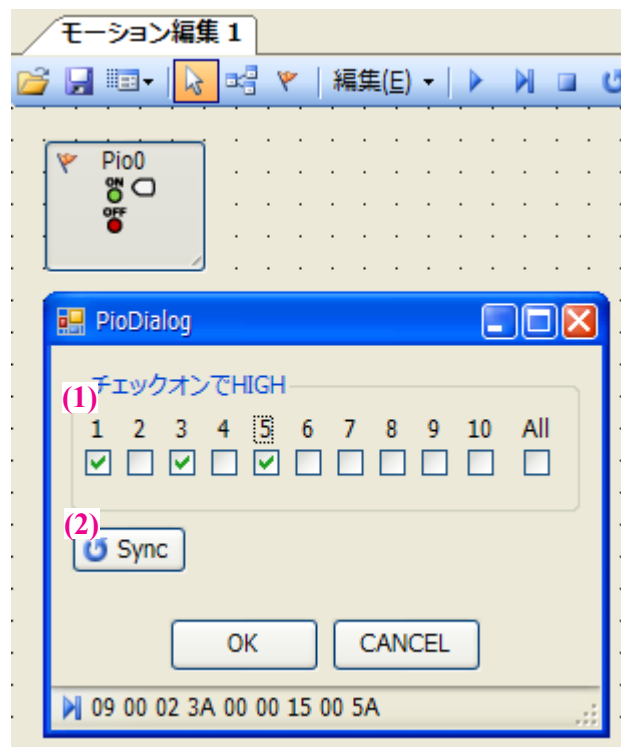
High (5 V) is output from PIO port by turning ON the check box. Does not output when turned OFF. Synchronizes with RCB-4HV by pressing Sync button.

* The only output port is the one assigned in the following "PioConfig". Values set to the input port will be ignored.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) High is output by checking on the check box. Becomes Low when check is taken off.
- (2) Sends state of check box to RCB-4HV.



PioConfig

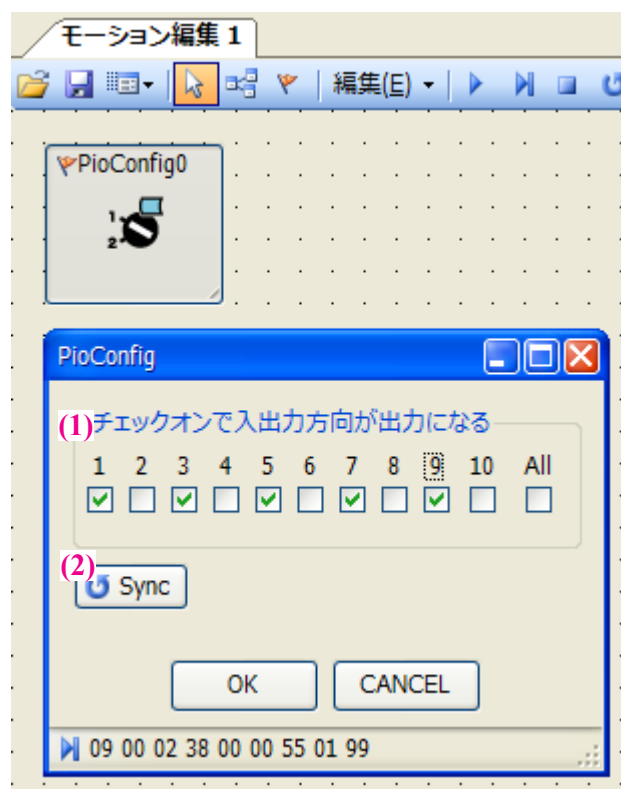


Set Input/Output of PIO port. Port is set as output when check box is turned ON. Port is set as input when check box is turned OFF. Synchronizes with RCB-4HV by pressing Sync button.

Number of valid connection points: Output 0 or 1

Description of all operation parts.

- (1) The assigned port whose check box is checked becomes the output port.
- (2) Sends state of check box to RCB-4HV.



Troubleshooting

Program does not launch

If trouble occurs during installation of HeartToHeart4, there may be a chance that installation has not been completed. Try uninstalling if possible, and reinstall.

Robot returns to Home position when booted, even after setting posture in the project setting screen.

In the current version, servo motor position are all set to neutral when saving project. If initial data is saved in the ROM after setting a pose, that pose will be run when next booted. However, the pose can not be saved as a project.

Communication error occurs at COM port

First, check the connection of serial USB adapter HS.

In HeartToHeart4, communication can not be made without having project read, so open project setting window after reading a project.

Because communication speed can be chosen from three types in RCB-4HV, communication can not be made when the communication speed of RCB-4HV and serial USB adapter HS do not coincide. Press the communication speed adjustment button (indicated as COM) in the HeartToHeart4 main window to match the communication speed of RCB-4HV and that of serial USB adapter HS. If communication speed is changed in the project setting window, make sure to match the communication speed by using the communication speed adjustment button.

Wireless controller does not operate.

Check the following items:

1. The position at which KRI-3 is connected to is one of the ports from SIO5 to 8.
2. Communication speed of servo motor and KRI-3 match. To change communication speed of KRI-3, ICS USB adapter HS and manager software for KRI-3 are needed.
3. Turn power on at a state where KRR1 is attached to KRI-3.
4. Restart or reboot after writing button data.
5. Data written to the ROM becomes valid only after rebooting.

Motion does not occur when run button is pressed in online run.

Put a check mark in the check box that says “signal operation end” in project setting screen. If there already is a check mark, take off the check mark first, and then put a check mark on by clicking on the checkbox once again.

In the current version, repeats and branch instruction do not operate normally. Write to ROM before running.

The message “unreachable control found” appears in build.

This message appears when there is a control to which a line is not connected. In such case, the unreachable control becomes selective on canvas.

Troubleshooting

Motion does not operate correctly.

Motion does not operate by simply laying out the controls. Always double click control to open setting dialog and click OK after setting to fix setting. When setting is fixed, the program that is to be run by RCB-4HV is saved.

If numerous lines that cannot be supported by control are connected, program is combined in the order found by HeartToHeart4, so invalid controls appear. Please check connection.

If focus is switched to another window or if other operations are performed while controls are being connected by lines, connection point may remain even without connection. In such case, motion may not become what is intended in build. If only the connection point remains, copy and paste the particular control alone, and reconnect.

Appendix List of Sample Motions

Project Specifications

Project Name: Hello_KHR3.xml

COM communication speed: 1.25 M

Frame cycle: 15 ms

ICS communication speed: 115 K

Precautions on Running Motion

- * Robot may make unexpected movement or fall.
Move in a wide space without objects in the premises.
A space of 1 sq. meters or more is recommended for the sample motion attached to the kit.
- * Robot should be moved at a leveled place without protrusions. Motion run result differs depending on the condition of the surface.

Motion-Surface adequacy is as follows:

| | |
|---|-----------------|
| Top of conference room table, flooring, p tile: | OK |
| Concrete, Linoleum: | not Good |
| Poly vinyl chloride sheet, cutter mat: | not Good |
| Thin carpet (punch carpet): | OK |
| Thick carpet, asphalt, dirt: | not recommended |
| Tile, tatami: | possible |

- * Due to qualities unique to the robot, sample motions may not run properly. In such case, trip adjustment and adjustment of motion itself may be necessary.

List of recorded motions

| Motion Number | M o t i o n N a m e | D e s c r i p t i o n |
|---------------|-------------------------------|---|
| HLO001 | Greeting | Bows slowly. Used as example in manual. |
| HLO002 | Home Position (Hello_KHR3) | Home position of this project. Sample motions in this project always return to this position. |
| HLO003 | Wave | Wave right arm while swinging. |
| HLO004 | Hip, hipm hurray! | Pull down right arm twice and then raise fist. |
| HLO005 | Chagrined | Drop on all fours, and bangs right arm on ground. |
| HLO006 | Headstand | Bend forward and do a headstand. |

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| HLO007 | Clap routine (build in M40) | Sub program of clap-type motion. Not used singularly. *Sub program should not be run singularly. *Build into motion number M40. |
| HLO008 | Clap (call M40_counter 10 times) | Clap 10 times. Can change number of claps by changing value in counter. |
| HLO009 | 3-3-7 rhythm clap (call M40) | Claps the “3-3-7” rhythm. Can change rhythm by changing value in counter. |
| HLO010 | Push-ups (counter 10) | Does 10 push-ups. Can change number by changing value in counter. |
| HLO011 | One legged knee bend (counter 5 times) | Bend and stretch right knee while keeping left leg straight to the front. Can change number by changing value in counter. * Adds heavy load on servo motor of right leg, so do not run repeatedly. |
| HLO012 | Bunny hop A (counter 3 times) | Jump forward 3 times from a crouch position. Jump with slightly forward tilt, and is better suited on carpets. * Adds heavy load on servo of lower body. Frequent running may cause damage to servo and frame. |
| HLO013 | Bunny hop B (counter 3 times) | Jump forward 3 times from a crouch position. Jump with slightly backward tilt, and is better suited on carpets. * Adds heavy load on servo of lower body. Frequent running may cause damage to servo and frame. |
| HLO014 | Stand up (from stomach) | Stands up from a position of lying on stomach. * Do not run this motion from a standing position. Robot may fall and cause unexpected accident. |
| HLO015 | Stand up (from back) | Stands up from a position of lying on back. * Do not run this motion from a standing position. Robot may fall and cause unexpected accident. |

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| HLO016 | Safe walk (forward_counter 5 steps) | Slowly walks 5 steps forward. Can change number of steps by changing value in counter. |
| HLO017 | Safe walk (backward_counter 5 steps) | Slowly walks 5 steps backward. Can change number of steps by changing value in counter. |
| HLO018 | Safe walk (left_step_counter 5 steps) | Slowly walks 5 steps to the left. Can change number of steps by changing value in counter. * This motion is assumed to be operated on a gripping surface such as carpet and may not operate smoothly on a slippery surface like flooring. The problem may be resolved by adhering the optional “sole grip”. |
| HLO019 | Safe walk (right_step_counter 5 steps) | Slowly walks 5 steps to the right. Can change number of steps by changing value in counter. * This motion is assumed to be operated on a gripping surface such as carpet and may not operate smoothly on a slippery surface like flooring. The problem may be resolved by adhering the optional “sole grip”. |
| HLO020 | Quick turn A (left_counter 5 times) | Turns around 5 times to the left by shuffling feet on the spot. Can change number of steps by changing value in counter. |
| HLO021 | Quick turn A (right_counter 5 times) | Turns around 5 times to the right by shuffling feet on the spot. Can change number of steps by changing value in counter. |
| HLO022 | Regular walk (forward_counter 5 steps) | Walks 5 steps forward at a relatively high speed. Can change number of steps by changing value in counter. * Due to unique quality of each robot, may not be able to walk straight or fall. Attempt trip adjustment. |

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| HLO023 | Regular walk (backward_counter 5 steps) | Walks 5 steps backward at a relatively high speed. Can change number of steps by changing value in counter. * Due to unique quality of each robot, may not be able to walk straight or fall. Attempt trip adjustment. |
| HLO024 | Regular walk (left step_counter 5 steps) | Walks 5 steps to the left at a relatively high speed. Can change number of steps by changing value in counter. * Due to unique quality of each robot, may not be able to walk straight or fall. Attempt trip adjustment. The problem may be resolved by adhering the optional “sole grip”. |
| HLO025 | Regular walk (right step_counter 5 steps) | Walks 5 steps to the right at a relatively high speed. Can change number of steps by changing value in counter. * Due to unique quality of each robot, may not be able to walk straight or fall. Attempt trip adjustment. The problem may be resolved by adhering the optional “sole grip”. |
| HLO026 | Kick ball forward (left leg) | Kicks ball positioned in front of left leg forward. Compliant to KONDO CUP Official Ball and color balls. |
| HLO027 | Kick ball forward (right leg) | Kicks ball positioned in front of right leg forward. Compliant to KONDO CUP Official Ball and color balls. |
| HLO028 | Kick ball sideways (left leg) | Kicks ball positioned on the side of left leg to the left. Compliant to KONDO CUP Official Ball and color balls. |
| HLO029 | Kick ball sideways (right leg) | Kicks ball positioned on the side of right leg to the right. Compliant to KONDO CUP Official Ball and color balls. |
| HLO031 | Kick ball backward (right leg) | Kicks ball positioned behind the right leg backward. Compliant to KONDO CUP Official Ball and color balls. |

To run motions recorded in “For Radio Control” Folder, equipment sold separately are necessary.

Necessary Equipment: KRI-3 transmitter (KRC-1, KRC-3AD, etc.), receiver (KRR-1, etc.), Various connection cables.

List of Wireless-applicable recorded motions

| Motion Number | M o t i o n N a m e | Setting Number |
|----------------------|---|-----------------------|
| HLO016RC | Safe walk (forwards) wireless-applicable | 1 |
| HLO018RC | Safe walk (left step) wireless-applicable | 8 |
| HLO019RC | Safe walk (right step) wireless-applicable | 4 |
| HLO020RC | Quick turn A (left) wireless-applicable | 1024 |
| HLO021RC | Quick turn A (right) wireless-applicable | 4096 |
| HLO022RC | Regular walk (forward) wireless-applicable | 513 |
| HLO023RC | Regular walk (backward) wireless-applicable | 514 |
| HLO024RC | Regular walk (left step) wireless-applicable | 520 |
| HLO025RC | Regular walk (right step) wireless-applicable | 516 |

*** Motion continues as long as assigned button on transmitter is pressed.**

