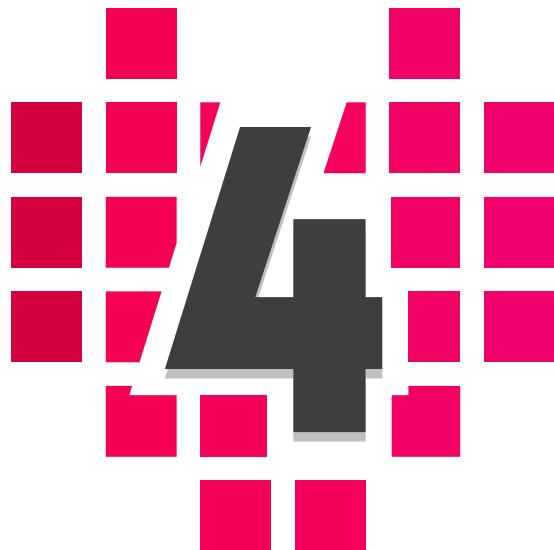


# **HEART TO HEART 4**

## **FOR RCB-4**



## **USER'S MANUAL**

manual Ver.5  
for HeartToHeart4 Ver.2.0

**KONDO**  
KONDO KAGAKU CO., LTD.

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# Introduction

Thank you for choosing the KHR series and HeartToHeart4. The new HeartToHeart4 has been newly designed to be easier to handle than HeartToHeart3, multifunctional, and scalable.

- ▶ Motion management on a per-project basis is now possible.
- ▶ Corresponds to the Microsoft.NET Framework.
- ▶ Multi-window system enables docking and undocking of all windows.
- ▶ Plug-in system has been adopted for motion creating controls, allowing enhanced scalability.

This manual describes the method of installation and detailed use of HeartToHeart4. In such descriptions, operation of the KHR series hardware may be required. We recommend that you read the hardware manual, as well.

## Licensing

- The installation and use of HeartToHeart4 (hereinafter referred to as "this software") is permitted only if you agree to the current 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 in the future, is referred to as "this software."
- Copyrights, all legal rights, copyrights for the logo mark, designs of some icons, and all files attached to this software belong to Kondo Kagaku Co., LTD.
- This software is distributed as freeware provided that Kondo products are used. This software may be reproduced only for use with Kondo products.
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- All company names and product names used in this manual are trademarks or registered trademarks. All illustrations and logo marks used in this manual may not be used without prior written consent.
- Use and transportation of this software out of Japan may require registration and permission in accordance to related laws.
- Please be informed that the contents of this manual and this software are subject to change without notice for improvement or other reasons.

## Precautions

This manual and this software may be applied to some of our microcomputer boards and servo motors for robots. However, please note that the applicable functions may be limited.

Please contact our service section for reports of defects, inquiries and comments regarding this software. However, please understand that we do not respond to individual requests for software update or modifications.

# About HeartToHeart4

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## Outline / Features

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

The screen structure is now multi-window, which enables docking and undocking of sub windows to the main window. The motion editing window can be used as a tab-form multi-window. By opening multiple motion data windows and using editing functions such as copy-and-paste between the windows, motions can be created easily.

Further, the inline-running function enables running of motions in the editing window without saving the motion to ROM. In inline-running, step-running and repeated running is made possible. Moreover, run, stop and run-from-middle is possible, even after saving to the motion to ROM.

In the motion editing screen, conventional methods for using position etc. has been inherited, while allowing additional changes by creating a control (called "Objects" in HeartToHeart 3) using the DLL (Dynamic Link Library). Also, by basically implementing one function to one control, program editing in the motion editing screen is much clearer. By exhibiting icons for each function, the program flow is much easier to visualize and understand.

## Conditions of Use

---

Specifics	Content
<b>OS</b>	Windows XP (Service Pack 2 or above) / Windows Vista / Windows7 32bit / 64bit each
<b>Processor (CPU)</b>	Pentium 4 2GHz or above or equivalent recommended
<b>Hard Disk</b>	32 MByte or larger (not including data file)
<b>Memory</b>	256 MByte or larger
<b>Drive</b>	CD-ROM drive (for installation only)
<b>USB</b>	USB2.0 capable port(s)
<b>Software</b>	Microsoft.NET Framework 2.0 is necessary

## Introduction to the RCB-4HV Corresponding Hardware

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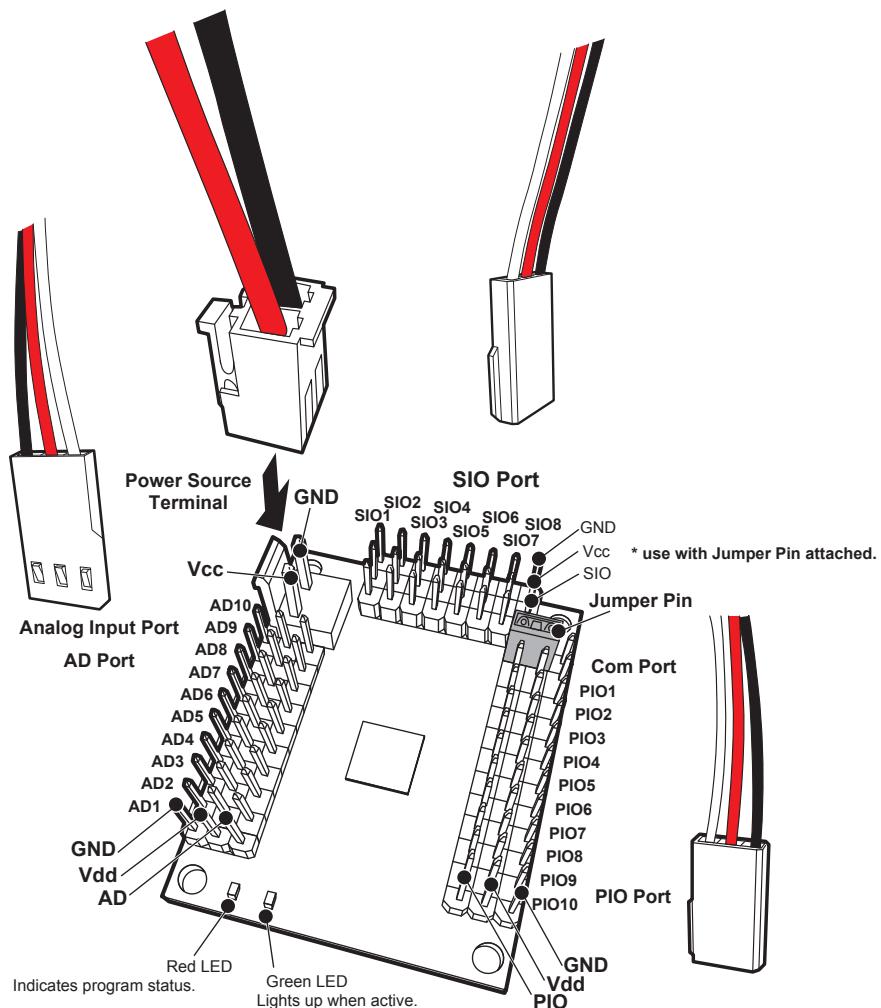
### ● Features

- M16C/26A microcomputer by Renesas Technology has been adopted.
- Contains eight serial ports for ICS3.0/3.5 capable devices, and can connect up to 36 ICS3.0/3.5 devices.
- With ten AD ports, multiple analog sensors can now be used. In addition, AD input for power management is available separately.
- Ten PIO ports have been added. Use of ON/OFF switch and light up of LED is made easier.
- The COM ports enable a maximum communication speed of 1.25 Mbps.
- EEPROM, known for its high-speed and high capacity, has been adopted.

## Difference between HeartToHeart4 Ver.2.0 and earlier versions

- Motion write area has been increased from 50 to 120 slots.
  - Project settings screen has been redesigned.
  - Motion editing screen has been redesigned. Simultaneous transfer of multiple controls is now possible.
  - Undo / Redo can now be used in Motion Editing.
  - The control connection line has been redesigned.
  - Many new controls have been added.
  - Position division function has been added.
  - Control icons have been redesigned.
  - Project writing is now possible without overwriting the robot's trim data.
  - Number of motion button assignments has been increased to 32.
  - Supply voltage monitoring motion can now be registered.
  - Group display in the servo selection field has been eliminated.
- Various other changes have also been made.

## ● Part Names



## ● Specifications

<b>Dimensions</b>	45 x 35 x 13 (W x H x D) mm. (Same as RCB-3HV)
<b>Weight</b>	12 g
<b>Interface</b>	SIO port, COM port, AD port, PIO port
<b>Power Supply Voltage</b>	Kondo specific HV power source (10.8V) is recommended. Minimum 6V, Maximum 15V. (Does not necessarily guarantee motion of device.)
<b>Internal Voltage</b>	Set at 5 V by a regulator (for 1 A).
<b>Power Supply Terminal</b>	Please use battery or stabilized power supply corresponding to the above operating voltage.
<b>COM Port</b>	Used for data communication by connecting to PC using serial USB adapter HS. Conventional serial USB adapter can also be used. (Communication speed may be limited for conventional product.)
<b>AD Port</b>	For connecting analog device. Operating voltage is 0 to 5 V. Verify the maximum current requirements for devices needing power.
<b>PIO Port</b>	For connecting digital binary input/output device. Can be used as an output. Operating voltage is 0 V (LOW), 5 V (HIGH). 1KΩ is connected in series as a current-limiting resistor, so an LED can be connected directly. However, please verify the LED operating voltage requirements.
<b>SIO Port</b>	For connecting ICS devices. Operating voltage is the same as the power supply voltage. DO NOT CONNECT device requiring 0 to 5 V (such as analog sensors). Operation may be limited depending on the ICS version of the connected device.

## ● Changes 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 supports 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).
- The reset button has been eliminated.

# Preparation

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## Install Software

---

- Insert the software CDROM to the drive and double click on the CDROM screen icon or open from the right-click menu. Double click "setup.exe" in the Software folder to automatically run the setup program. Continue the installation process as instructed by the setup program.
- In order to run this software, "Microsoft .NET Framework Ver. 2.0" is required. Install ".NET Framework Ver. 2.0" as instructed by the setup program. In WindowsXP, when service pack 2 or later is installed, ".NET Framework Ver. 2.0" is pre-installed. In Windows Vista, and 7, it is pre-installed.
- If the setup program does not automatically boot up, activate the installer by opening the CDROM icon and double clicking "Setup.exe" in the "Software" folder.

## Uninstall Software

---

### ● Windows XP

In Control Panel, select "Add/Remove Programs," then select "HeartToHeart4 Ver.X.X.X" to uninstall.

### ● Windows Vista / 7

In Control Panel, select "Program" then "Programs and Features" then "Uninstall Program" and choose "HeartToHeart 4 Ver.X.X.X" to uninstall.

## Install Serial USB Adapter HS Driver

---

After installing HeartToHeart 4, install the Serial USB Adapter HS driver. Please refer to "KONDO USB DRIVER INSTALL MANUAL" on the CDROM for installation procedures.

## Confirm After Installation

---

### ● Files Installed (Outline)

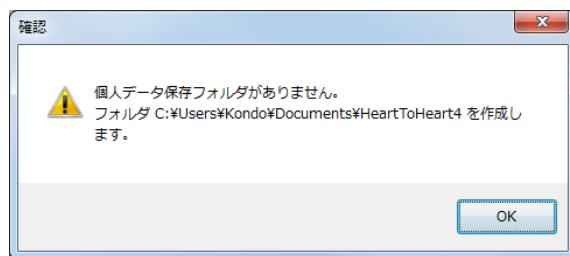
Install Folder: In default, c:\Program Files\HeartToHeart4  
Content:  
HeartToHeart4.exe (Program file)  
Projects (Folder containing sample projects)  
Toolbox (Folder containing controls)  
Do not rewrite files within the Install Folder.

### ● Folders and Files Automatically Created After Installation

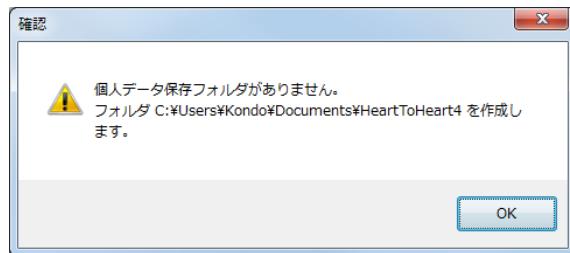
Folders Automatically Created: My Document\HeartToHeart4  
Content:  
Projects For saving project files created  
Log Folder for saving log of output data etc.  
Motions Folder for saving motion data etc.  
HTH4.xml File for storing project data  
Layout.xml File for saving state of windows

## Activate Software

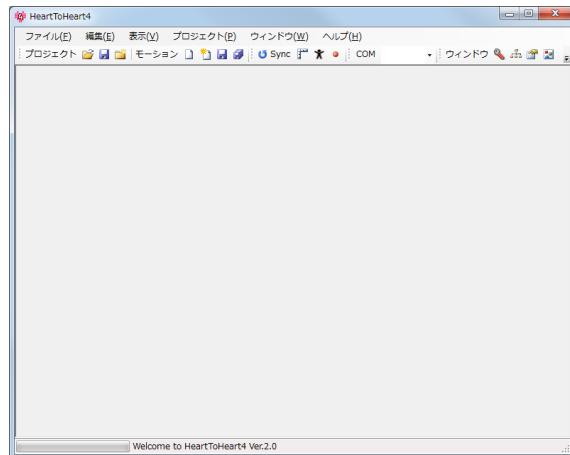
- 1.In the Start Menu, click “HeartToHeart4” then choose “HeartToHeart4.exe”. When activating for the first time, a folder for saving data is created in the “My Document” folder. Press the “OK” button.



- 2.The HeartToHeart4 settings file is created and saved when the program is terminated for the first time.



- 3.When HeartToHeart4 is activated, the following screen appears. Do nothing and proceed to termination of software.



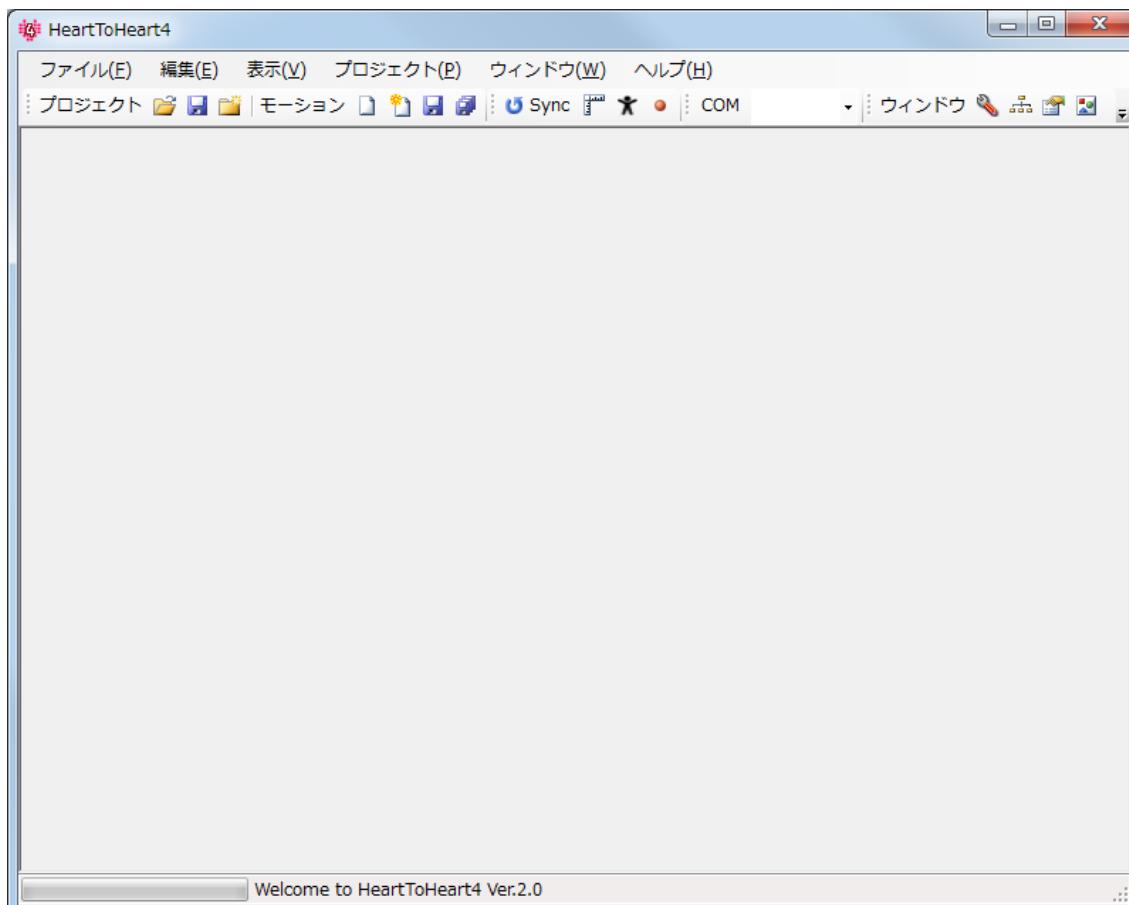
## Terminate Software

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

# Function of Each Menu

## Main Window

The Main Window consists of the Main Menu and the Toolbar. Other Sub Windows may be connected to (docked) or separated from (undocked) the Main Window.



## ● Main Menu

ファイル(F) 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 Main Menu, files are read or written. The parenthesized and underlined alphabets following each selection item in the menu indicates the shortcut key. The item may be selected without clicking on the mouse by pressing the corresponding key while pressing down on the ALT key. For example, the file menu “File (F)” can be opened by pressing the F key while pressing down on the ALT key. Abbreviations such as “Ctrl + S” indicate that the item can be chosen by pressing down on the CTRL key and S. A list of keyboard shortcuts can be found at the end of this manual.

## ● File Menu

In the File Menu, files are loaded and saved.

### ● New Document

#### ▶ Project

A new project is created. Existing projects may also be imported as new projects.

#### ▶ Motion

A new motion is created. Motions can be created after loading in a project.

### ● Open

#### ▶ Project

Existing project is loaded.

#### ▶ Motion

Existing motion is load in. Motion can be loaded after loading in a project.

### ● Recently Used Projects

Projects that have been loaded are listed starting with the most recent. The maximum number of recent projects shown can be changed in the project setting window.

### ● Save Motion

Motion that is currently being edited is saved. In order to save a motion, the motion editing window has to be active.

### ● 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 editing window has to be active.

### ● Save All Motions

All motions currently being edited are saved.

### ● Save Project

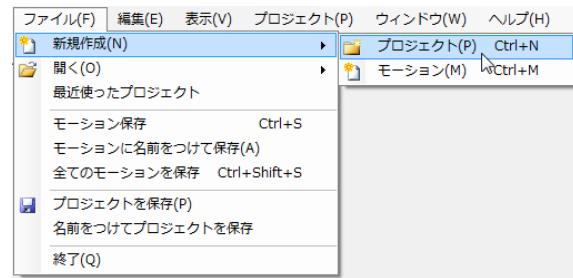
The current project is saved.

### ● Save Project Under a Different Name

Choose a different name for the project and save.

### ● Quit

Shut down HeartToHeart4.



## ● Edit Menu

In the Edit Menu, controls arranged on the motion editor canvas (see Motion Editor Window section) currently being edited are copied and/or pasted.

### ● Cut

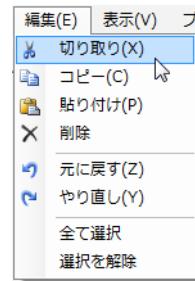
The selected control (see Motion Editor Window section) is cut. The cut control is saved in the clipboard and can be pasted.

### ● Copy

The selected control is copied. The copied control is saved in the clipboard.

### ● Paste

The control in the clipboard is pasted. The position at which it is pasted will be on the bottom-right of the copied control. The control may be pasted into different motion data, as well.



### ● Delete

Selected control is deleted. The deleted controls cannot be restored.

### ● Undo

Changes made in the Motion editing screen are undone.

### ● Redo

Redo the operation undone.

### ● Select All

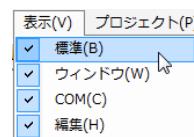
Select all controls on the canvas currently being edited.

## ● Display Menu

In the Display menu, toolbars can be shown or hidden. When a toolbar is shown, a check mark appears on the left side of the item. For more details on toolbar, refer to the “Toolbar: Main Window” section.

### ● Standard

The standard toolbar is displayed.



### ● Window

The window toolbar is displayed.

### ● COM

The COM toolbar is displayed.

### ● Edit

The edit toolbar is displayed.

## ● Project Menu

In the Project Menu, project is set.

### ● Project Setting Window

Displays the Project Setting window.

### ● Move to Home Position

Moves to the position saved with the "Save as Home Position" button.

### ● Save as Home Position

Saves the present posture as the Home Position.

### ● Move to Trim Position

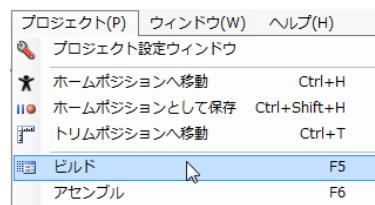
Moves to the Trim Position.

### ● Build

The motion currently being edited is built (see "Motion Editing Window" section on page 52) and written to the RCB-4HV.

### ● Assemble

The motion currently being edited is assembled (see "Motion Editing Window" section on page 52). The result is displayed in the message window. The Message Window Information button must be turned ON beforehand.



## ● Window Menu

Sub Windows that are connected to the Main Window are shown or hidden. When the icon on the left side of each item is selected, the window is shown. For details on each Sub Window, refer to the "Sub Window" section.

### ● System Settings

Shows the window for HeartToHeart4 system settings, except for projects.

### ● Project Browser

Shows / Hides the Project Browser window.

### ● Property

Shows / Hides the Property window.

### ● Toolbox

Shows / Hides the Toolbox window.

### ● Motion Table

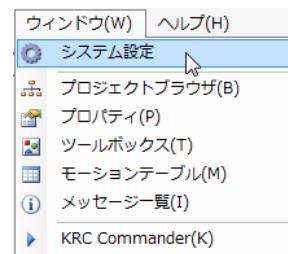
Shows / Hides the Motion Table window.

### ● Message List

Shows / Hides the Message window.

### ● KRC Commander

Shows / Hides the KRC Commander window.



## ● Help Menu

Help and version information are displayed.

### ● Help Menu

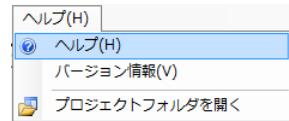
Help is displayed.

### ● Version Information

Version Information dialog is displayed.

### ● Open Project Folder

Opens Project folder with Explorer.



## Toolbar: Main Window

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

### ● Standard Toolbar

In the Standard Toolbar, projects and motions are controlled.

#### ● Project

-  : Load Project
-  : Save Project
-  : Create New Project



#### ● Motion

-  : Load Motion Data
-  : Create New Motion Data
-  : Save Motion Data
-  : Save All Motion Data

### ● Window Toolbar

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

#### ● : Project Settings

Show / Hide the window for setting content of project.



#### ● : Project Browser

Show / Hide the Project Browser window.

#### ● : Property Window

Show / Hide the Property Window.

#### ● : Toolbox

Show / Hide the Toolbox window.

#### ● : Motion List

Show / Hide the Motion List window.

#### ● : Message Window

Show / Hide the Message window.

## ● COM Toolbar

The COM Toolbar is used to set the communication speed to match the serial USB Adapter HS.

### ● Select Port Box Menu

Displays the list of all port (device) names currently connected to the COM port. Selecting immediately begins connection to the port.



### ● 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 set for the RCB-4HV. This is normally not used in regular operation. Port settings are saved at termination of the program, and the program automatically reconnects the next time it runs. However, if the communication port, speed, or settings have changed since the last time the program ran, then readjustment using the project setting display will be necessary.

## ● Edit Toolbar

### ● Sync : Sync Button

When this button is checked the servo will automatically move in accordance with the settings displayed in the project setting window and the POS control.



### ● Trim Position Button

Moves to the Trim Position.

### ● Home Position Button

Moves to the posture saved with the Home Position Save Button.

### ● Save Home Position Button

Saves the present position of the servos as Home Position.

\*The Save Home Position button is valid for position changed in the POS control and Project Setting screen. Position changed in the Motion List Window will not be reflected.

## Sub Window

Sub Windows are windows that are used along with the Main Window according to their functions. Sub Windows may be detached (undocked) from or attached to (docked) the Main Window.

### ● Project Browser Window

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

Displays the list of folders and files in project root. Files with the same name as the folder and having the extensions ".h4p" or ".xml" are the project files. Only the icons of the project files change on screen.

#### ● : Project File

Double click to change projects.

#### ● : Motion File

Double click to open the motion editing window.

By selecting a file and right-clicking, the context menu (as shown in the figure) is displayed, enabling copy, paste and delete. When pasting file with the same name, the prefix “copy- ” is added to the file name. When pasting a file, select the folder to which the file is pasted after copying.

The file name can be edited by selecting a file and pressing the F2 key. When file name is edited, the actual file name is automatically changed.

Double clicking and loading the project file displays a list of motions saved in the Motion List Window.

When file is changed using, for example, Windows Explorer, the changes are reflected on the screen. (\*check footnotes)

\* Motion files can not be opened without loading the project.

#### ● : Change Project Root button

Clicking and selecting an arbitrary folder can change project root. Although normally not used, USB memory can be selected as a project root.

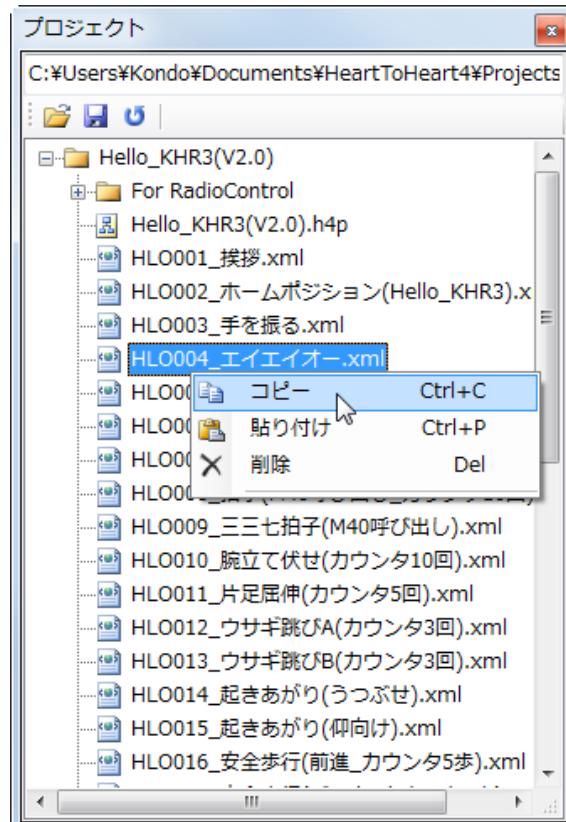
#### ● : Save button

Click to save currently the open project.

#### ● : Reload button

Click to update the Project list.

\* Update by clicking the Reload button.



## ● Toolbox Window

The Toolbox Window displays a list of controls necessary for creating motion.



State where "Details" is selected



State where "Tile" is in the Display Menu

Robot motions are created using drag-and-drop of a control from the toolbox window to the motion editing window. Holding the mouse over an item will display a short description.

### ● : Reload button

Reload controls and update the toolbox list.

### ● : Display menu

In the toolbar's Display menu, the display method can be chosen from Icon, List, Detail, and Align.

When toolbox window is displayed, the controls are shown in detail (left).

The control name, description, and group are displayed.

### ● : Sort menu

In the toolbar's Sort menu, files can be sorted by name or type. By selecting Display by Group, files can be displayed by group, as shown in the figure. The right figure shows the screen when "Tile" is chosen in the Display Menu.

## ● Motion List Window

For writing motions saved in the project and editing button data.

The motion number, motion name, write address, run button number, method of button comparison, motion area utilization, and write date are shown on the screen.

### ● : Reload button

Click to update the motion list.

### ● : Run button

After selecting a motion, click to run the motion.

### ● : Mid-run button

Click to begin the motion from the stopped position.

### ● : 一時停止ボタン

モーション再生中に一時停止ボタンをクリックするとモーションを一時停止します。モーション停止中に途中再生ボタンを押すと、同じ位置から再生を開始します。

### ● : Stop button

Click while running to stop the motion. The Mid-run button will be disabled when the motion is stopped.

### ● : Write All Motion button

Click to write all motions saved in a project simultaneously.

### ● : Area Delete button

Click after selecting the motion name to delete the selected motion.

The buttons in the toolbar and the right-click menu having the same icons have the same functions.

### ● : Write All Button Data button

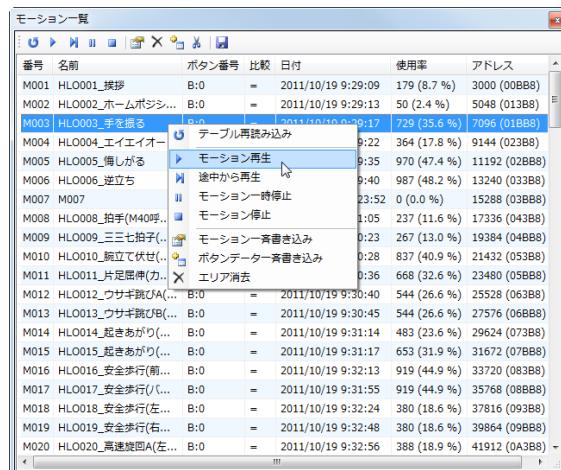
Button data associated with each motion is written simultaneously.

### ● : Delete All Button Data button

Button data associated with the selected motion is deleted. Clicking without selecting a motion deletes all button data.

### ● : Save All Motion button

Motion data is saved as a CSV file. CSV is a file format that can be load by spreadsheets such as Microsoft Excel.



\* In HeartToHeart4 ver.2.0, the startup motion is registered in the Project Settings window. A start flag does not appear on the startup motion.

## About the Motion Area

In HeartToHeart4 Ver.2.0, the motion area that can be saved is divided into 120 slots. If a motion data is larger than the slot, the warning dialog appears and you can choose overwriting the next slot or not.

**●Move Display List**

Items such as motion window number, name and button number can be moved by using the mouse to drag-and-drop.

**●Sort Display Item**

Click on the item name to sort in increasing order. Click again to sort in decreasing order.

## ● Message Window

The Message Window displays log of all instructions run or sent by HeartToHeart4. Since the commands currently being executed and the related error messages appear, it is easy to detect where the program failed.

The Message List Display field in the window shows the type of command currently being executed, its number, content, the address to which data was sent to, the length of the command, and other information.

### ● : Command button

The background of the button changes and becomes selectable when clicked. The command currently being run and the command sent can be copied or deleted.

### ● : Information button

Click and select to display messages related to the information used in HeartToHeart4.

### ● : Error button

Click and select to display messages related to errors occurring in HeartToHeart4.

### ● : Warning button

Click and select to display messages related to warnings occurring in HeartToHeart4.

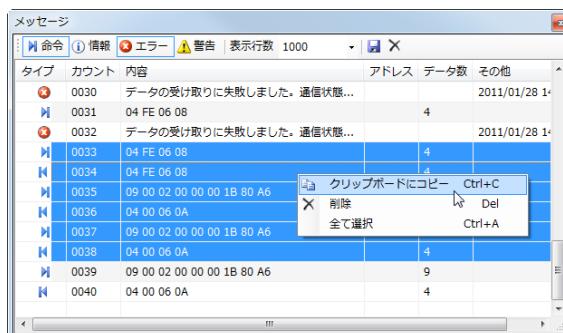
The number of lines displayed is controlled in the Select Number of Lines ComboBox. When not selected or under standard conditions, the maximum number of lines for the message is 1000.

### ● : Save Log button

Click to save the list of messages currently displayed as a CSV file.

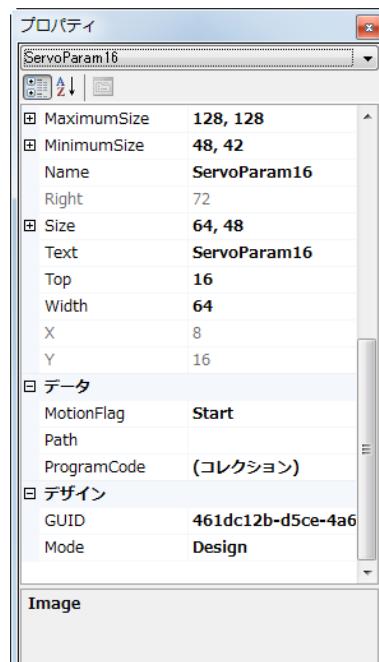
### ● : Delete button

Click to delete the message list.



## ● Property Window

The property window is for future developers and experienced users. The content of the control is displayed by clicking on the control in the motion editing screen. The ProgramCode property in the Property of the control is the control command. Other items will not be described here, but rewriting them may cause malfunctions in the data. For details on the commands, refer to the RCB-4HV Command Reference.



## ● KRC Commander Window

Used while connecting RCB-4HV and PC using a serial USB adapter, to assign the controller and to check motions.

Data can be sent when "Send ON/OFF" button in the center is turned ON and the COM port is selected in the Main Window. Press the KRC Commander button using the left button of the mouse to send the corresponding button data to the RCB-4HV. Releasing the mouse button sends the Neutral(Nothing is pressed). Continuing to press the button will not continuously send button data. If you wish to press several buttons at the same time, turn the LOCK KEY switch ON and press the desired buttons. Holding the cursor over a button on the commander shows the keyboard shortcut assigned.

Keyboard operation of the KRC Commander is also possible. Press the keyboard key(s) assigned to the button to send the corresponding button data to RCB-4HV. Releasing the key(s) sends the Neutral. Several keys may be pressed at once.

A PC game controller may also be used. Connect the game controller to the PC and select from the game controller selection field of KRC Commander to send button data to KRC-4.

※ KRI-3 と同時に使用できません。取り外してお使いください。

### ● : Open button

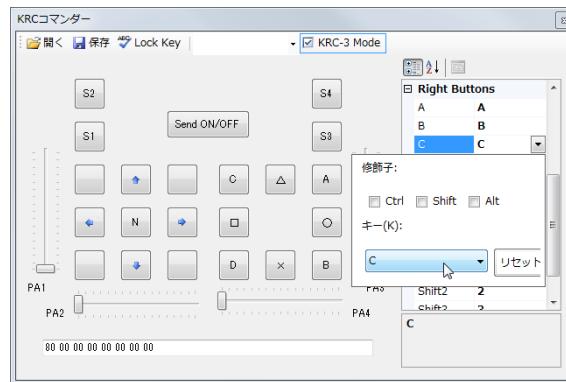
Open the keyboard layout file.

### ● : Save button

Save the keyboard shortcut data assigned to a button as a file.

### ● : Lock Key

Usually, letting go of the mouse button after clicking on a button returns the button to its unpressed state. By turning the Lock Key ON, the button becomes modal - clicking on the button once will keep it depressed, while clicking on it once again releases it.



### ● Game Controller Selection Field

A list of the game controllers that are connected to the PC and are recognized by HeartToHeart4 appears automatically. Select the game controller you want to use. Joystick position data is usually sent at an interval of 100 ms. The Send ON/OFF button must be ON for data to be sent. When a game controller is selected, it has priority over the mouse and keyboard.

### ● : KRC-3 Mode

In KRC-3AD, button is entered by tilting the stick at a large angle. By turning this button ON, the same behavior as KRC-3AD can be had.

### ● Send ON/OFF

Turn this button ON to send.

### ● Change Keyboard Shortcut

Keyboard Shortcuts can be assigned from the Shortcut Assignment List on the right side of KRC commander. In the list, the name of the button is shown on the left and the keyboard assignment is shown on the right. By clicking the keyboard section for the button name you wish to assign, the keyboard assignment menu appears. The key names are as follows:

▶ Alphabet: There is no uppercase / lowercase distinction.

▶ NumPad: The numbers on the numerical keypad.

▶ Numbers: Numbers are assigned. In the balloon help, D appears before the number, as in D0 and D1.

▶ Oem: Mainly represents symbols (Oemcomma, OemQuestion and so on).

Shortcuts can be assigned to the Ctrl key, Shift key, and Alt key, but it would be better to avoid them, as they are often used in the Main Menu and other controls.

● By saving keyboard shortcuts in the HeartToHeart4 folder under the file name "KrcShortcutKey.xml", the edited keyboard shortcut data will automatically be loaded at the next time the program starts. If

this file does not exist, standard keyboard shortcuts are assigned.

#### ●Caution

The KRCCommander analog data channel and the increasing/decreasing value direction was designed to accommodate the PS3 controller. Tilt direction and value changes may not match other game controllers.

To check the Analog Stick Mixing operation, note the following:

- ▶ If the KRI-3 and KRR-1 are connected, disconnect or turn on the KRC-1/2/3 power. The RCB-4HV internal data may be unknown if the controller's power is not turned on.
- ▶ When using a PC game controller, make sure the KRI-3 and KRR-1 are disconnected to prevent data conflicts with the RCB-4HV.

#### ● Motion Editing Window

For details on the Motion editing window, refer to the "Motion Editing Window" section on page 52.

# How to Use HTH4 - Basics

## Create a Project, Run a Sample Motion and Save Data

In this chapter, HTH4 operation from creating a project, registering motions to a RCB-3HV equipped robot, to running a sample motion is described in sequence. The Kondo KHR-3HV humanoid robot is used as an example.

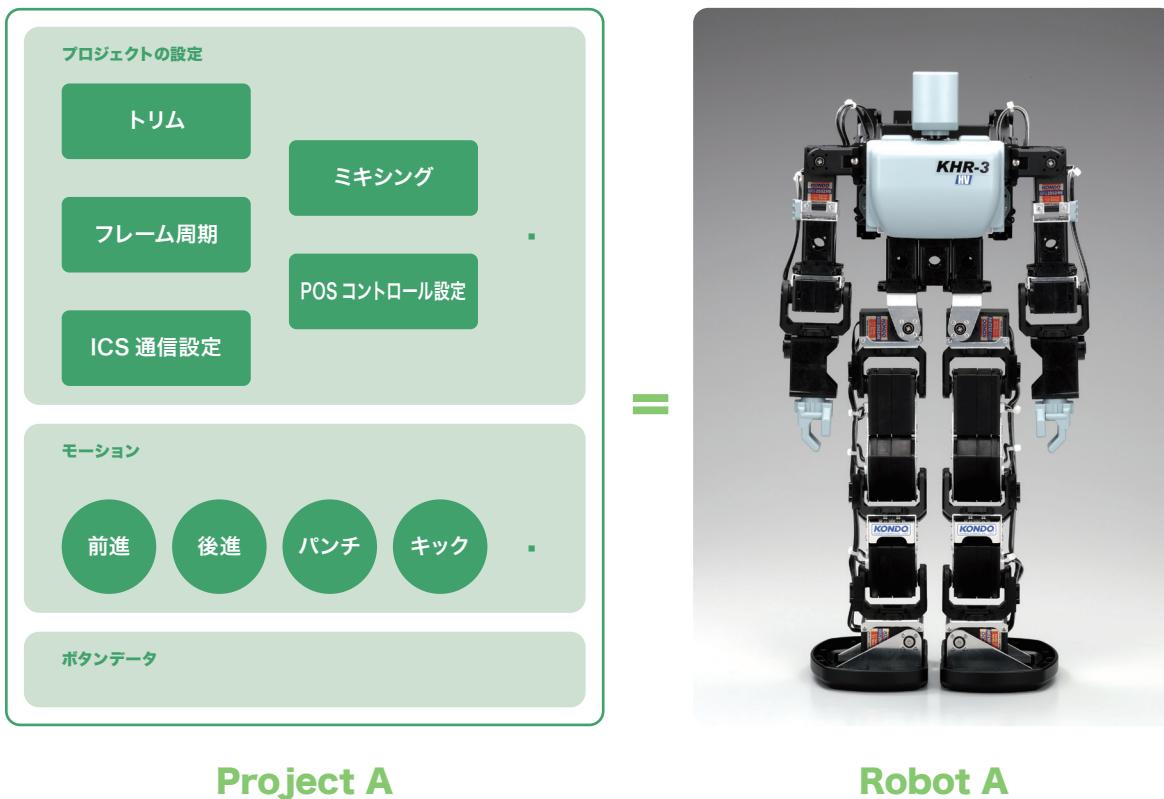
### ● Operation Procedures

- 1.Load Project (Import)
- 2.Project Settings and Adjustment of the Robot Trim
- 3.Run Sample Motion
- 4.Wireless Control
- 5.Edit Sample Motion

## 1. Reading Project

In HeartToHeart4, a project must first be created or imported.

In the project file, information necessary for a robot to operate such as initial settings of the RCB-3HV, motion data, mixing settings, and other information necessary to create motion, are managed as one data set, along with position and trim data. A project serves as the overall folder for organizing operations, as shown in the following diagram.



In a project, there are three categories: "Project Settings" "Motion Data" and "Button Data". By setting each of these categories, the robot movement can be created freely, and it can be made to remember motions.

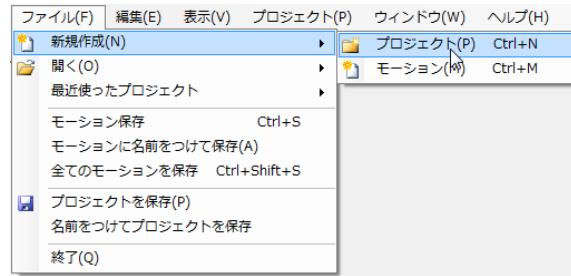
### ● Project Creation / Import

Project files can be created from scratch, but in this example, an existing project is imported from the HeartToHeart4 installation folder and is used as a new project. Importing a project is almost the same as copying, but does not rewrite the original imported project file. It can be copied to the user's project folder under a new name.

1. Connect the RCB-4HV to the personal computer using the serial USB adapter HS, and turn the power switch of KHR-3 (RCB-4HV) ON.
2. Run the HeartToHeart4 software.
3. In HeartToHeart4, use the port selection menu of the COM toolbar to select the serial USB adapter HS COM port. In the screenshot, COM3 and COM4 are selectable. (This may differ based on your PC configuration.) (For method of checking the COM assignments, refer to the Serial USB Adapter HS Manual.)



4. Select “Project” from the New Document menu in the File menu.



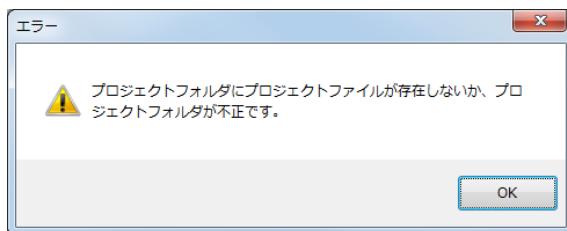
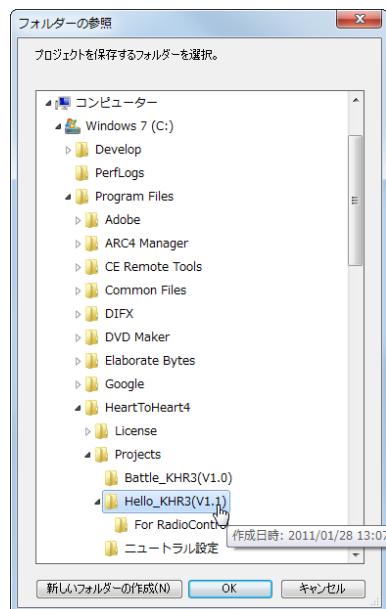
5. A New Project dialog will appear.

## ● Setting a New Project Dialog

1. Do not change “Save Project at:”
2. Use a suitable name for “New Project Name”. In this example, “Hello\_KHR3(V2.0)” is used, the same name as the project being imported.



3. Using the reference button at the bottom right side of the dialog (where the cursor is located in the screenshot), specify the project folder to import from. For this example, the folder “c:\Program Files\HeartToHeart4\Projects\Hello\_KHR3(V2.0)” should be selected. Also, check the “Import Project” check box.



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

4. Complete the project import by clicking the OK button. A folder with the name "Hello\_KHR3(2.0)" will appear, containing a project file with the name "Hello\_KHR3(2.0).h4p" in the "HeartToHeart4¥Projects" folder in the My Document folder. The standard extension for a project file is h4p, (starting from HeartToHeart4 Ver.2.0).

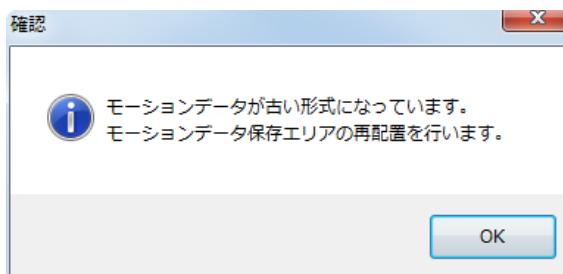
## ● Check Project Structure

Project structure can be confirmed in the Project Browser window. The project folder created contains a motion file along with a project file. (Refer to "Project Browser Window" section on page 17.)

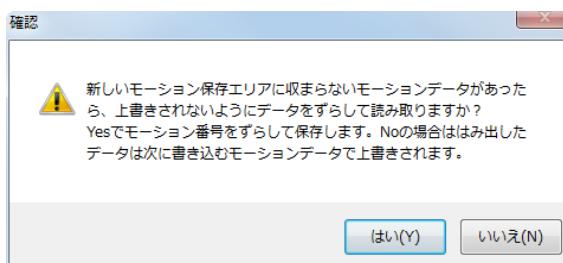
In HeartToHeart4, each project folder basically contains one project file, and the project file name must coincide with the folder name. For other motion files, the name can be chosen arbitrarily.

When data from HeartToHeart versions prior to HeartToHeart4 Ver.1.3 is read in:

Since the motion write area is now divided into 120 slots, the write area size has changed. When reading in or importing motions prior to Ver.1.3, the following warning appears.



After pressing OK, the motion area relocation method choices appear along with what to do when motion is too large to fit into the new area.



If the "YES" button is pressed, a motion that does not fit into the new area will overflow and be written over the next motion area. If "NO" is pressed, the motion that is too large to fit in the new area will not overflow and be written over the next motion area. In other words, multiple motion areas may be allocated by the "YES" button, but the motion number will deviate. On the other hand, when the "NO" button is pressed, the motion number will remain the same but operation of those motions that were too large will not be guaranteed.

In the standard motions, the handstand contains the largest amount of data, which is about 48% of the area usage rate in Ver.2.0.

After any area relocation, always save the project file and rebuild all motions. If motions are run without rebuilding, motion will stop in mid-flow. Further, since motion jump control has been revised, when using motion jump control in a motion, open the motion jump control screen once and verify all jump destinations are correct.

## 2.Project Setting and Robot Trim Adjustment

For HeartToHeart4 and RCB-4HV to communicate properly, first the project must be set up. Since the robot trim adjustment is done using the Project Setting window, the trim adjustment procedure will also be described.

### ● Project Setting

Starting with HeartToHeart4 Ver.2.0, the Project Setting window has been revised to a tab form. Further, windows are now dockable and can always be shown.

The Project Setting window is opened from the Project menu in the Main Window or the button in the Window toolbar. Settings such as Edit Startup Position, Trim Adjustment, and Analog Mixing, are possible anytime in the Project Settings window. Each function is organized by tabs and various settings are possible. In this example, only the settings and checking of the items necessary to move a robot will be discussed.

#### ● Toolbar



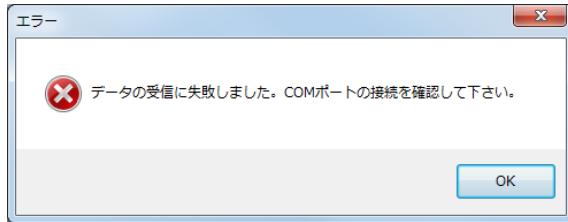
In the Toolbar, the content of the project is sent to the ROM or RAM (Refer to "ROM and RAM of RCB-4HV" section on page 31) of RCB-4HV.

#### ● Project Setting tab

The RCB-4HV initial setting is done in the Project Setting Tab.



Frame Cycle	Determines the interval at which the robot changes its posture. For example, creating a frame number of 100 at a frame cycle of 15 ms changes posture 1500 ms = 1.5 seconds.
COM communication Speed	The communication speed between RCB-4HV and PC is selected. The larger the number, the faster the communication speed is.
ICS Communication Speed	ICS communication speed refers to the communication speed between the ICS-standard device (servos) and the RCB-4HV. Normally, the speed should match the speed set for the serial servo. The value may differ from the COM communication speed.

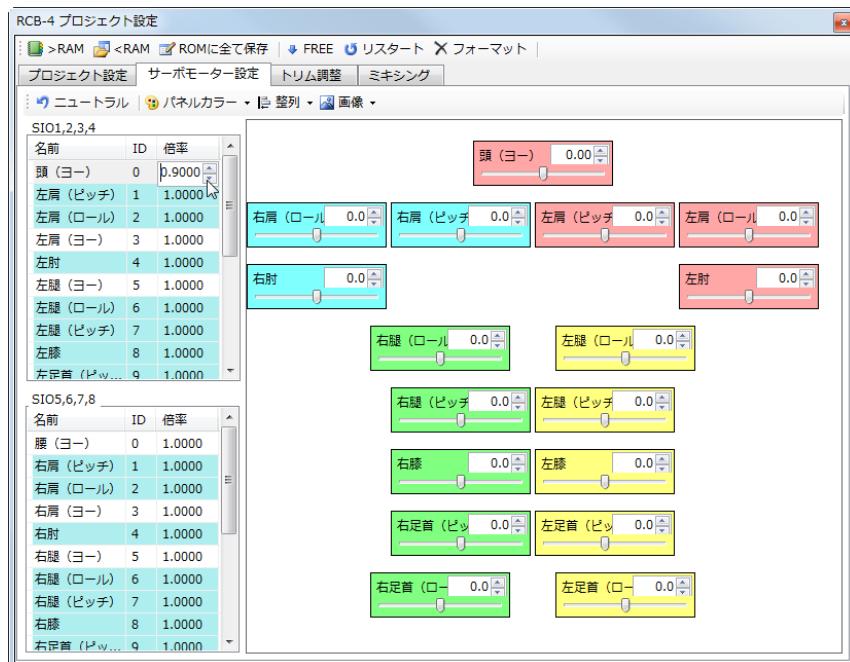


The above dialog may appear when opening the Project window. This message appears when the COM communication speed setting is wrong or when the serial USB adapter HS is not connected. In such case, select the correct COM port in the COM toolbar in the Main Window and select the communication speed you wish to use in the Set COM Communication Rate field in the Project Setting window. For the settings to be stored even after turning the RCB-4HV power off, save the project data currently being edited to the RCB-4HV ROM using the Save To ROM menu.

In the Project window, check the following settings in System Setting. The numbers shown in parentheses are the default values.

COM Communication Speed (arbitrary)	Select the communication rate you wish to use.
Frame Cycle (15 ms)	10 ms when the servo is set at 1.25 Mbps.
ICS communication rate (115200)	Adjust according to the communication rate of the connected servo.

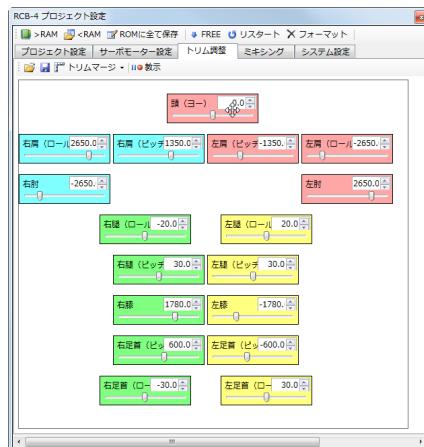
### ● Servo Setting Tab



- After setting of the communication speed etc. is completed, the servo can be operated. To make the servos operable after loading the project, click Write To RAM button in the toolbar which will write the values edited in the project to the RAM. For a new project, the default servo position is set at 7500 and trim is set at 0. If writing to RAM is successfully completed, the servo will rotate to its initial position in about 2.5 to 6 seconds (depending on the frame cycle setting). After writing to RAM, to interactively move the servo, press the "Sync" button in the Main Window and move the sidebar in the Position panel located at the right hand side of the Servo Setting tab.

2.次にトリムの調節をします。

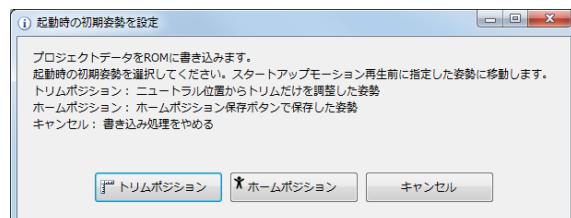
### ● Trim Adjustment Tab



Open the Trim Adjustment tab in the Project Setting window. The position panels are arranged in the same order as the Servo Setting tab. Move the slider of the servo you wish to adjust, or directly enter values to adjust the servo trim. Turning the mouse wheel with the slider or entering values into the input field changes the servo trim setting also. Check the Sync button in the Main Window to synchronize the robot servo with the position panel, and adjust trim.

After the trim is adjusted for all servos, press the toolbar "Save All To ROM" button. This saves all trim positions that are currently set to the RCB-4HV EEPROM. When the RCB-4HV power is turned on, the servos automatically move to this position. When saving to ROM, a startup position can be chosen between the Home position and the Trim position. The dialogue shown in the figure will appear. When the Trim Position is selected, the trim values adjusted in the Trim Adjustment tab are saved as standard values (Neutral Position, see column "Position and Trim" ) for the servo positions.

When the Home Position is selected, the posture saved using the "Save As Home Position" button becomes the start-up position. Pressing "Cancel" interrupts the writing process.



### Position and Trim

The robot servo angle is set by values, not "degrees." These values are called "positions." For a serial servo, a rotation range from 3500 to 11500 is possible. The middle value, 7500, is referred to as the Neutral Position.

Trims are used to offset this neutral position. When building a robot, even if the servo position is at Neutral, in reality, there will be a slight physical inconsistency. This inconsistency is offset and adjusted using the trim values. By adjusting for these inconsistencies using trim values, the robots postures can be correctly adjusted without changing positions (when creating motions for example).

3.All basic settings are completed. Save the project by selecting the Save Project menu in the File menu or the toolbar of the Main Window.

## RCB-4HV ROM and RAM

ROM is a memory storage area where data does not disappear even if the power is turned off. On the other hand, although data in RAM disappears when the power is turned off, RAM memory has extremely high access speed.

In the RCB-4HV, settings such as motion data and communication speed can be saved in ROM by writing the project data. When turned on, the RCB-4HV firmware automatically reads the settings from the ROM, and temporarily saves the information in RAM memory. Motion commands are then read from ROM, and the commands are followed using data saved in the RAM.

Writing project data, such as trim and position, to RAM using the RAM button allows the firmware to immediately reflect any changes. However, when the power is turned off, this data will disappear. Saving the project data to ROM, using the SAVE TO ROM button, allows the data to be retained even when the power is turned off. However, restarting is necessary to enable changes.

## ● From RCB-4HV Power-ON to Motion Running

### ●スタートアップについて

In HeartToHeart4, the program is written into the RCB-4HV ROM so that power-on to motion running process takes place in the order shown in the figure.

After moving to the start-up position, the start-up motion is run, executing the main routine. If no change is made to the main routine, it will always be in a state of waiting for button input.

#### ▶Home Position

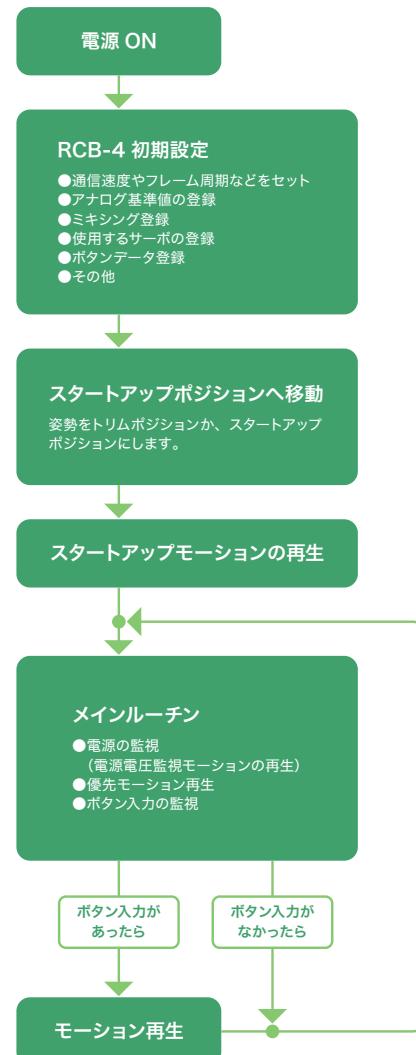
All postures set in the Motion Editing window and the Project Settings window can be saved using the "SAVE HOME POSITION" button. The posture set at this point is called the Home Position.

#### ▶Trim Position

The postures at which only the trim is adjusted, while all servo positions are in Neutral. Normally, this will be the standard posture (standing still).

#### ▶Start-up Position

The first posture the robot takes when activated, and can be selected from the Home Position or the Trim Position. Normally, the Trim Position is selected.



## ● LED Display

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

- 1.The Green LED and red LED light up during boot.
- 2.The Red LED turns off while the robot moves from the power-off position to the Home position (about 2 to 5 seconds).
- 3.After movement to the Home position is completed, the red LED appears slightly dim. This indicates a state where RCB-4HV is waiting for the next command from the wireless controller or COM port.
- 4.When a communication error or other problem occurs while writing data to the ROM and the robot is rebooted, the red LED lights up because the program in ROM is faulty. In this case, double check the connection and reload the data.

### 3.Running Sample Motions

This section describes the procedures for registering motions to the robot and running them.

#### ● Run Motion

Saving all data such as settings to ROM using the procedures described above enables selecting and running motions from the Motion List window. (Refer to "Motion List Window" section on page 19)

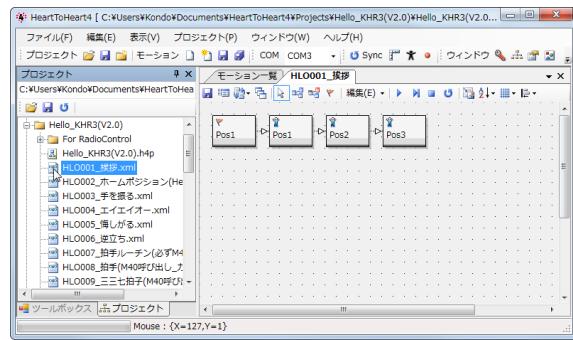
#### ● Run Motion Source File

Motion Source Files are built after editing and written to the RCB-4HV ROM. In this section, the method for reading sample motions, building, and running will be described. (For editing of specific motions, refer to "How to Use HTH4 - Intermediate" section on page 41.)

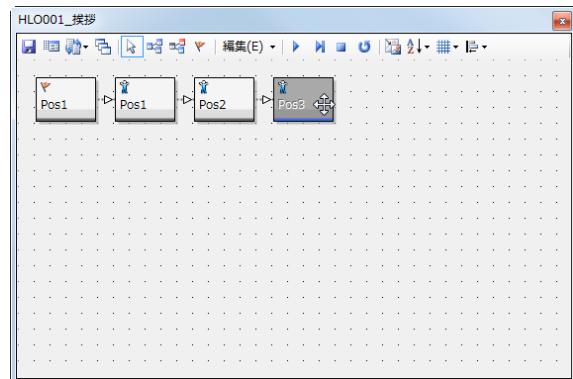
#### ● From Loading to Running Sample Motion

The project file contains sample motion data that have been previously saved. These are read in.

1. Open the Project Browser window, and read the motion source file "greeting.xml" in the current project folder by double-clicking on the source file.



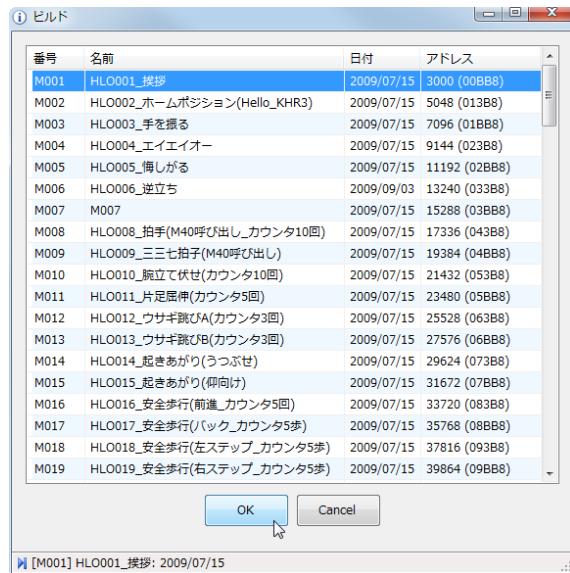
2. When the motion source file reading is completed, the motion editing window appears in the center of the main window, and the greeting motion data appears. The screenshot shows the state where the window associated with the main window is undocked. (To undock, drag-and-drop the title area of the tab.)



3. Building is the process of converting motion source file data from ROM into an executable program. In this example, the greeting motion is registered to motion data number M01.

- a. The Build button located in the toolbar of the motion editing window is used; or select Build from the Project menu of the Main Window.

b.The Build dialog appears.



c.Select the motion number which you wish to write from the Motion Data List shown in the Build dialog.

d.Writing begins by clicking the OK button. The status and content of writing is displayed in the message window.

4.When building is completed, the motion name is logged in the Motion List window. Click the motion you wish to run and click on the ▶ : RUN button or select RUN MOTION in the right-click menu. Sample motion running is now completed.

### Motion Data and Build

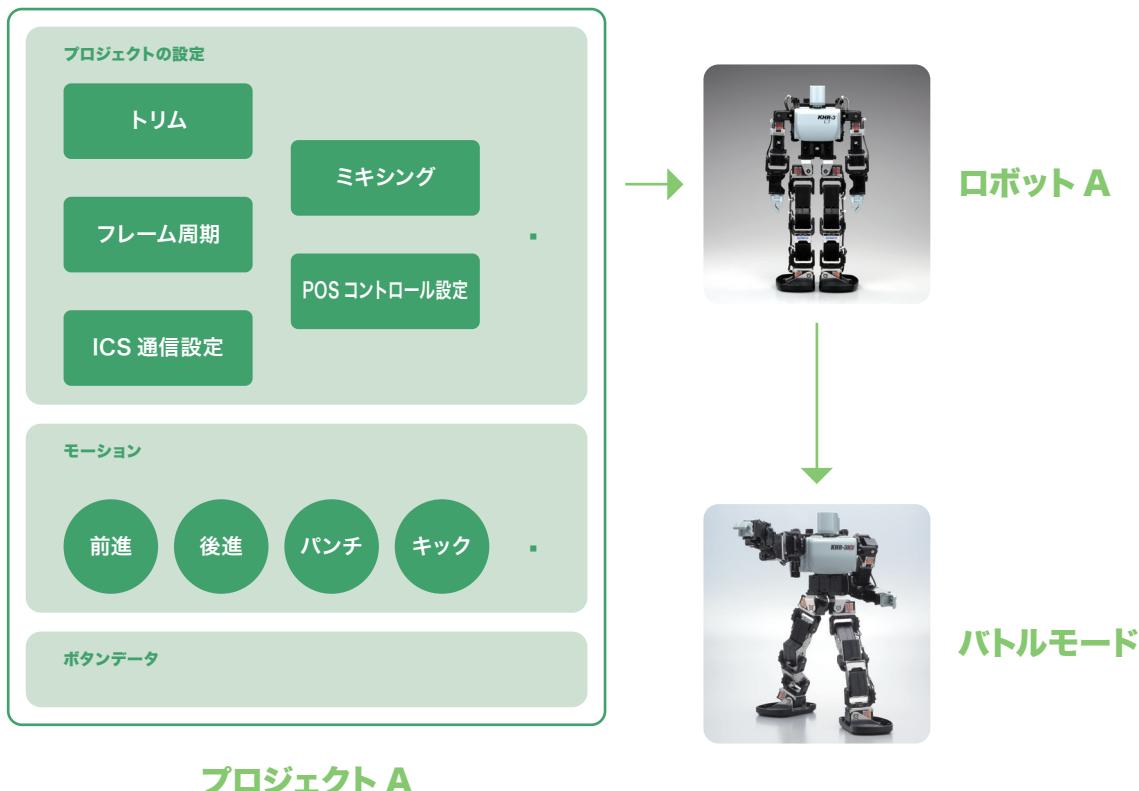
The content of a motion is called Motion Data. The contents of the Motion Data include the connection state and type of controls. The file saved in an editable form is called the Motion File.

Motion data is difficult for the RCB-4HV to use directly. Therefore, HeartoHeart4 converts it into data specific for the RCB-4HV. This process is called Building.

The built motion data are saved in projects instead of motion files. Therefore, once built, it can be changed to be used for different robot types just by copying and editing the project.

## ● Register All Motion Data Simultaneously

Data recorded after completing the build process and motion data previously saved in a project can be saved to the RCB-4HV ROM simultaneously. By using this function, different motion patterns created previously can be saved simultaneously.



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

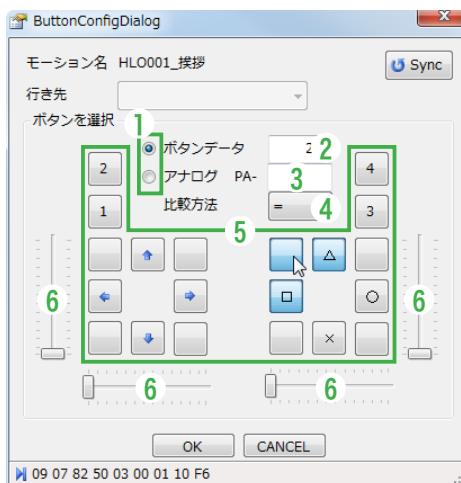
## 4.Wireless Control

To participate in robot games or move your robot freely, wireless control is essential. Here, the procedure for running motions registered to your robot using wireless will be described.

### ● Link Wireless Controller Buttons to Motions

To run motion data using the wireless controller, a Start Run button must be assigned. The Wireless Controller button needs to be registered in the Motion List window.

- 1.The Button Registration screen for the Wireless Controller appears by double-clicking the motion field in the Motion List window after writing the project file to ROM, or while motion data is written to ROM.
- 2.The following Button Data Registration dialog appears.
- 3.Click on the button you wish to register and click OK. The button will be linked to the motion. Two, or more, buttons can be used in combination, as well.
- 4.After completing button registration for each motion you wish to run, click Button Data Registration button in the toolbar of the Motion List window, to register all the button data.
- 5.The maximum number of button data sets that can be registered is 32. If you try to register more than 32 an error message will appear. Furthermore, the same button data can not be registered multiple times. To change the assignment of overlapping buttons, delete the button data first, and then assign it to a different motion.
- 6.After the registration process is completed, power cycle the RCB-4HV and restart.



### ● Operating Description

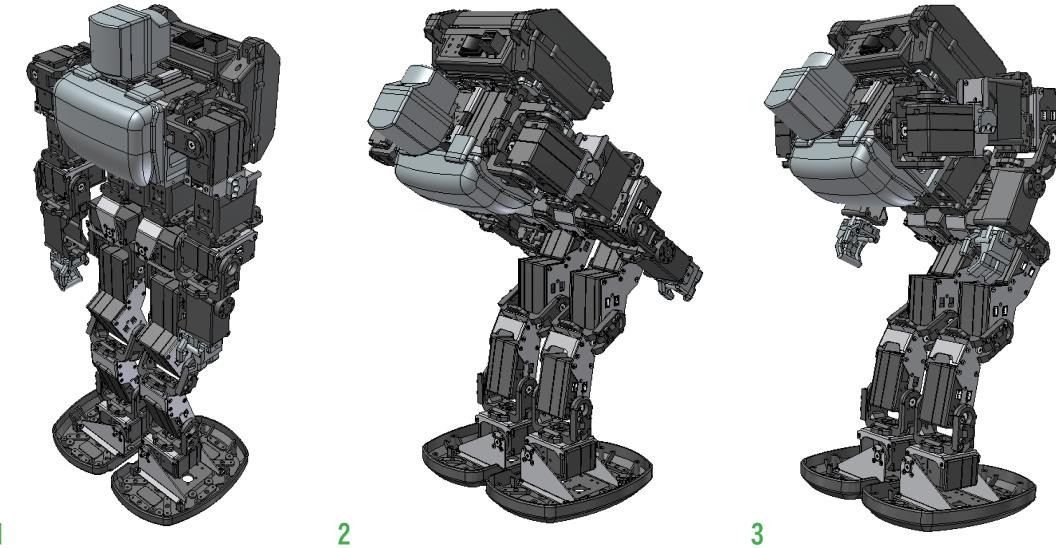
- 1.Automatically switches depending on the type of data last set.
- 2.The corresponding control input value appears by clicking each button.
- 3.The corresponding port names and analog values appear by scrolling the four (6) track bars.
- 4.Method of comparison: when comparing to analog value, a comparative operator is selected.
- 5.Button
- 6.Trackbar

## 5.Edit Sample Motion

Once the process of writing motions to the robot is understood, the next step is motion creation. In this section the method of changing motions by editing sample motions included with the KHR-3HV kit is described.

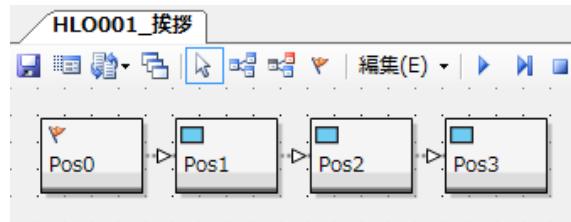
### ● Edit Sample Motion

- The greeting sample motion is edited to make a slight change in the position of the arm, then written to the RCB-4HV, and run. Try changing the greeting pose in figures 1 to 2 to the "Osu" pose of figure 3 with the arms bent.



### ● Preparation

1. Activate HeartToHeart4 and open the Sample Motion project.



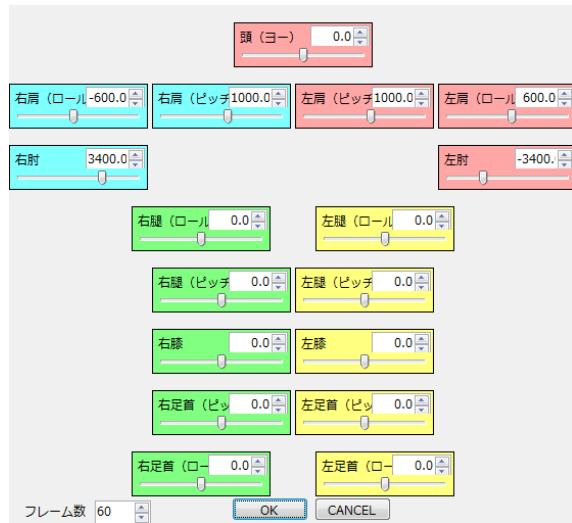
2. Double-click on the greeting motion file in the Project Browser window to open it, or open the greeting motion file using the File menu in the Main Window.
3. Pos0, Pos1, Pos2, and Pos3 appear in line on the screen. Notice that the red flag on Pos0 shows the control at which motion begins. Each control is connected by a line. The control execution order proceeds in the direction and sequence of the arrow at the middle of the connection lines. (Refer to the "Motion Editing Window" section on page 52 for more detail.)
4. Run the greeting motion to check the content of the motion. This is done by clicking the RUN button in the toolbar in the Motion Editing window. If the motion does not run properly, or if it stops mid-way, check the COM communication speed and other settings in the Project Settings window.

## ● Position Editing Basics

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

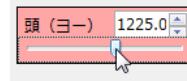
6.The Position Editing dialog appears.

In the example, 17 servo settings are completed, but if you wish to modify individual slidebars from their initial position, refer to the Motion Editing section. (Refer to the “Motion Editing” section on page 60.)



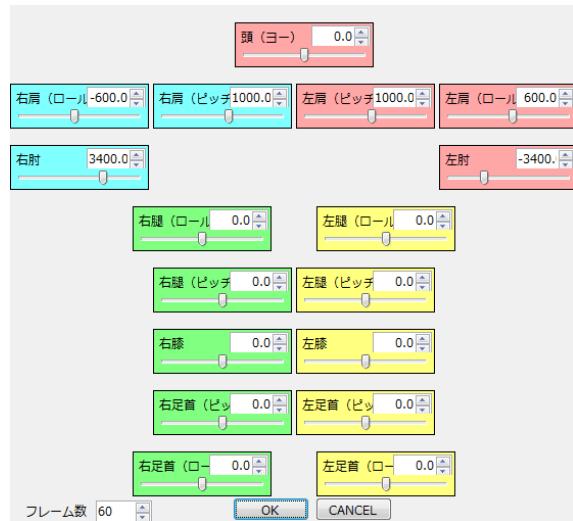
7.When the Sync button is pressed, the synchronization with the robot becomes active (in Windows XP the background color changes, while in Windows Vista/7, a blue frame appears). At this point, synchronization of the position data on the screen and the position data of the robot to which RCB-4HV is attached begins. Synchronization stops by clicking the Sync button again.

8.While in the Sync mode, moving the servo scroll bar will change the input value, and the servo rotation angle. Alternatively, you can enter a value into the position input field and then press ENTER to change the servo angle. In this example, the Neutral position is shown as 0. When “0” is entered, the actual value sent to the servo is 7500, and the robot will move to the Neutral position.



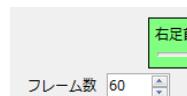
Head (Yaw) angle is being changed using the slider.

9.In this example, to create the greeting pose “Osu” with the robots hands at the hip position, the following servo position data should be written. Please be aware that when you enter the values while the Sync button is ON and press ENTER it will cause the servo to move to the entered position values.



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

10.Once the position of each servo is set, enter the number of frames in the frame number input field to the bottom-right. Here, a slightly longer value of 60 is selected.



11.Pressing the RUN button in the Position Setting dialog moves the servos to the set position.

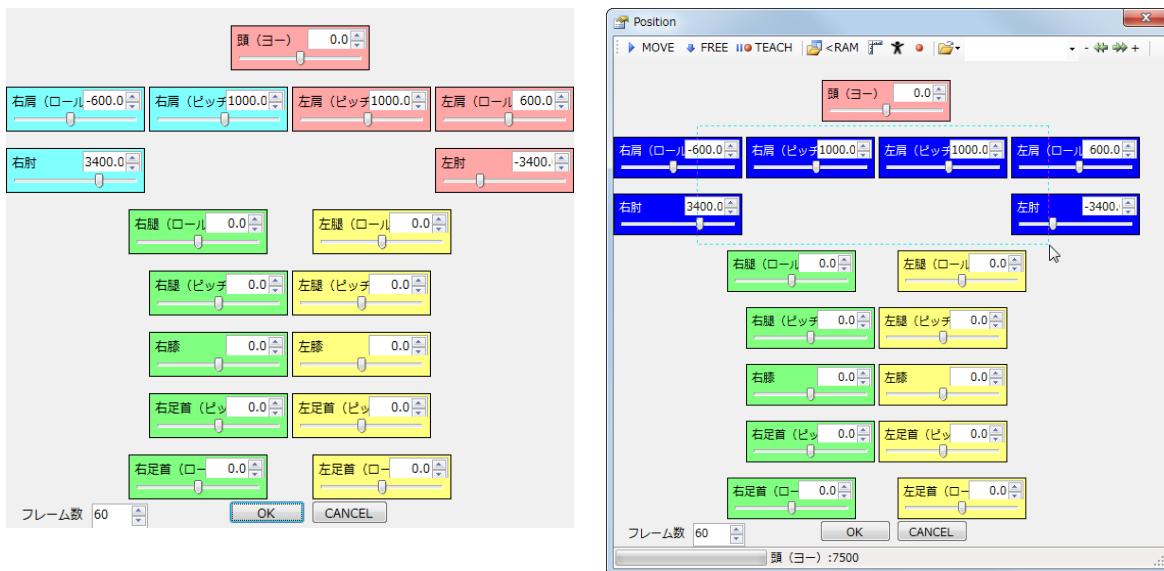
12.When setting is completed, press the OK button to complete the Pos0 position setting.

## ● Edit Using Smart Teach

13.Next, set the position data for Pos1 and Pos2, so that the arm positions are the same as Pos0.

14.To check the Pos1 pose, press the Move button (upper left) and run the position set in Pos1(the robot moves automatically when synchronization is active).

15.Data for additional positions can be entered the same way as Pos0. However the alternative Smart Teach position setting method can be much more effective. In the Position Setting dialog, select an arm servo (right shoulder (pitch), right shoulder (roll), right elbow, left shoulder (pitch), left shoulder (roll), or left elbow). Move the cursor to the position panel, and right-click when the cursor shape changes (left figure); the panel color changes and becomes selected. Or, you can select multiple servos collectively by holding down the the right mouse button and moving the cursor over the desired servos (right figure).



16.After selecting the desired position panel, press the : Smart Teach button once. The servo(s) selected in the position panel will go into the Instruction state and relax. Move the servo(s) by hand to create the desired posture.

17.Once the posture setting is complete, press the : Smart Teach button once again to capture the position.

18.When all the servo position changes are complete, press the OK button, close the position setting dialog, and save the Pos1 control data.

19.Using the same method, change the Pos2 posture so that the arm is bent.

20.When completed, Test the changes by clicking the : RUN button in the motion editing window.

21.Clicking the : Save button will overwrite the saved data. If you wish to save using another name, choose "Save Motion As" in the File menu. The new name you enter here becomes the name of the motion that is currently being edited.

### Instruction and Smart Teach

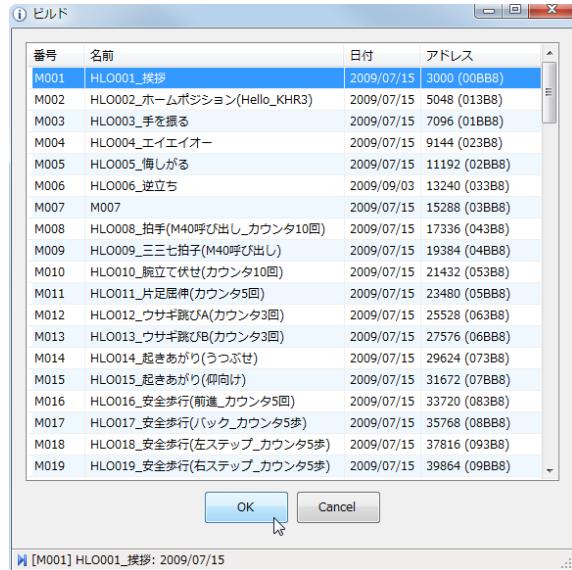
The "Instruction Function" capability is designed into many of the Kondo servos, including those used in the KHR-3HV. In this mode, the servo retains enough position stability so that the posture does not change on its own, but it can still be easily rotated by hand. The servo always reports its position, so the robot's posture can be determined by observing the position data. This is called the "Instruction Function".

In HeartToHeart4, the Instruction Function has been enhanced to include a "Smart Teach" function. In this mode, only the selected servos are in the Instruction Mode, while the other servos remain stationary. Using this function, flexible position creation, such as changing only the pose of the upper body while maintaining the lower body pose, is made possible.

## ● Save Motion to ROM and Run

- 22.**When the motion data editing is completed, save the motion data to the RCB-4HV ROM. (Note: If you save motion data often under different names, you will be able to re-use that data in the future using copy/paste.)
- 23.**Press the Build button or press the F5 key. “Build” refers to converting the control structure into a program that can be understood and executed by the RCB-4HV, and saving it to ROM.

- 24.**When the Build dialog opens, specify the motion slot where you want to register the motion and press OK. In the figure, the motion is saved to M001.



- 25.**When writing is completed, the “Osu” motion is registered to M001 of the Motion List.
- 26.**By selecting the “Osu” motion (M001 in this example) in the Motion List window and clicking the ▶ : RUN button, the motion is run.

# How to Use HTH4 - Intermediate

## Project, Guide and Motion Creation

In this chapter, various items such as project and motion creation of HeartToHeart4 will be described in detail.

### ● Operation Procedures

- [1.Project](#)
- [2.Motion Creation](#)
- [3.Motion Conversion Function](#)
- [4.Description of Control](#)

## 1.Project

In HeartToHeart4, all related motion data, button data for wireless control, HeartToHeart body settings, and other data are managed together as a “Project” . Using this approach has many benefits as described below.

### ● Project Creation Flowchart

The figure shows a flow chart that shows the sequence of operations for moving the robot, including motion editing and project management, using HeartToHeart4.

#### 1.Project Creation

In HeartToHeart4, a project is always created first. A project includes all the information and settings that manages everything necessary to move a robot as a unit. In the HeartToHeart4 process, a project is created first, then the overall settings made, and then settings for the RCB-4HV are written. Within the PC, the project is treated as one file. By interchanging the projects, different Kondo robot types can be managed.

#### 2.Motion Data Management

There are two basic Motion Data types; pre-build data that can be edited in the motion editing screen and post-build data that is executed by the RCB-4HV. Pre-build data can be saved as individual motion files. Post-build motion data is managed by the project file.

#### 3.Project Setting

The created project data is edited in the Project Setting window.

#### 4.Motion File

After the Project Setting is complete, motions are created. Motions are edited in the motion editing window.

#### 5.Run Motion

Edited motion can be run after writing to the RCB-4HV (build), and can also be run without writing (inline-running). If a motion does not run properly, edit the motion again to correct any errors or problems.

#### 6.Individual Writing

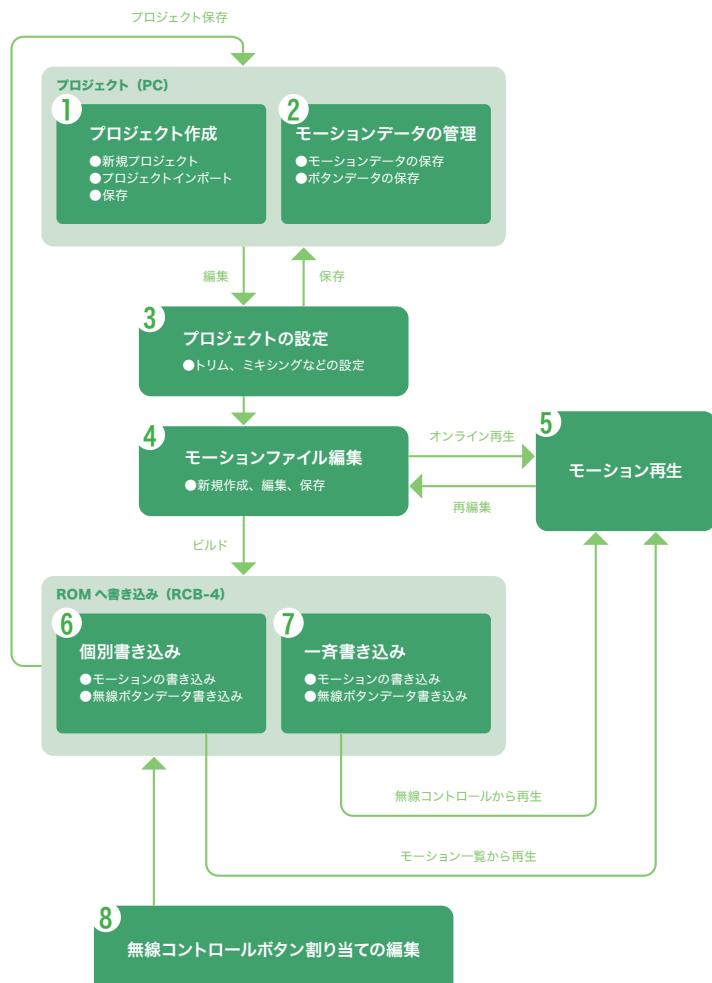
The Motion currently being edited is saved to the RCB-4HV when the build is done. It is also saved in the project data.

#### 7.Write At Once

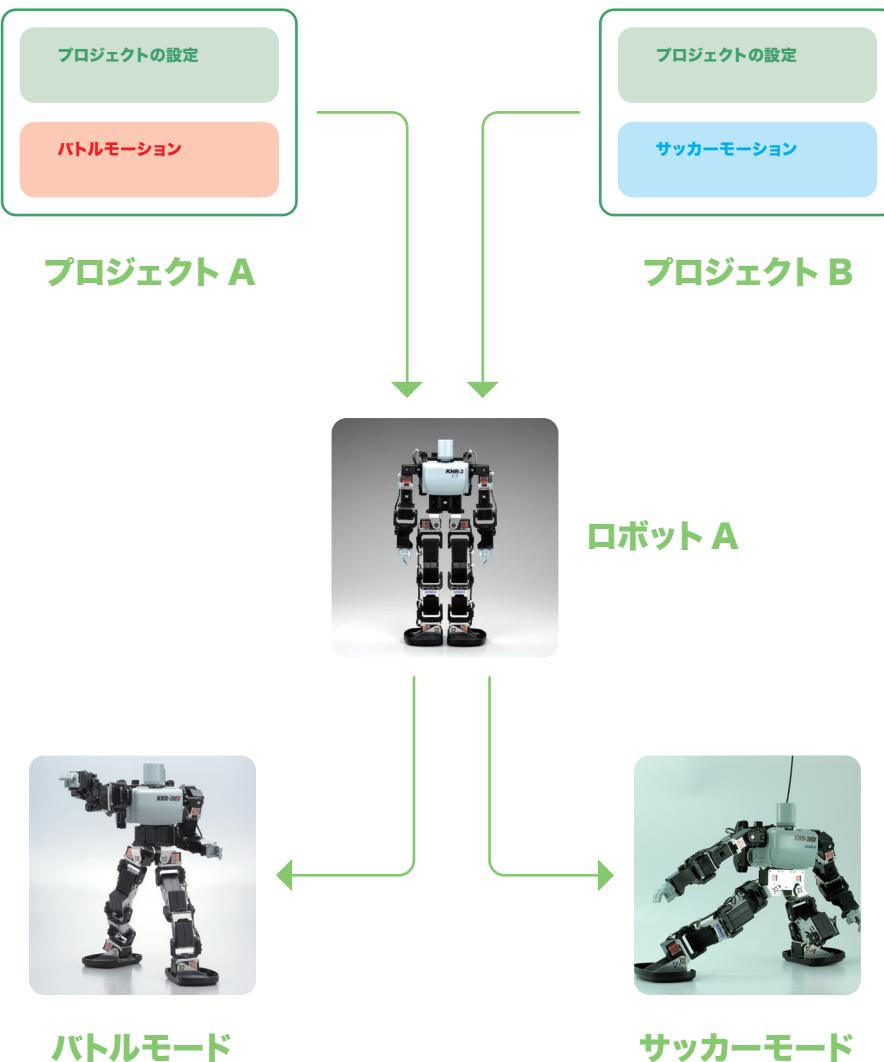
When “Write At Once” to the RCB-4HV is chosen in the Project Setting screen, all the post-build data that the project manages is written at once as a whole.

#### 8.Wireless Control Button Assignment

A Wireless Control button can be assigned to the built motion. The assigned button data is also managed by the project.



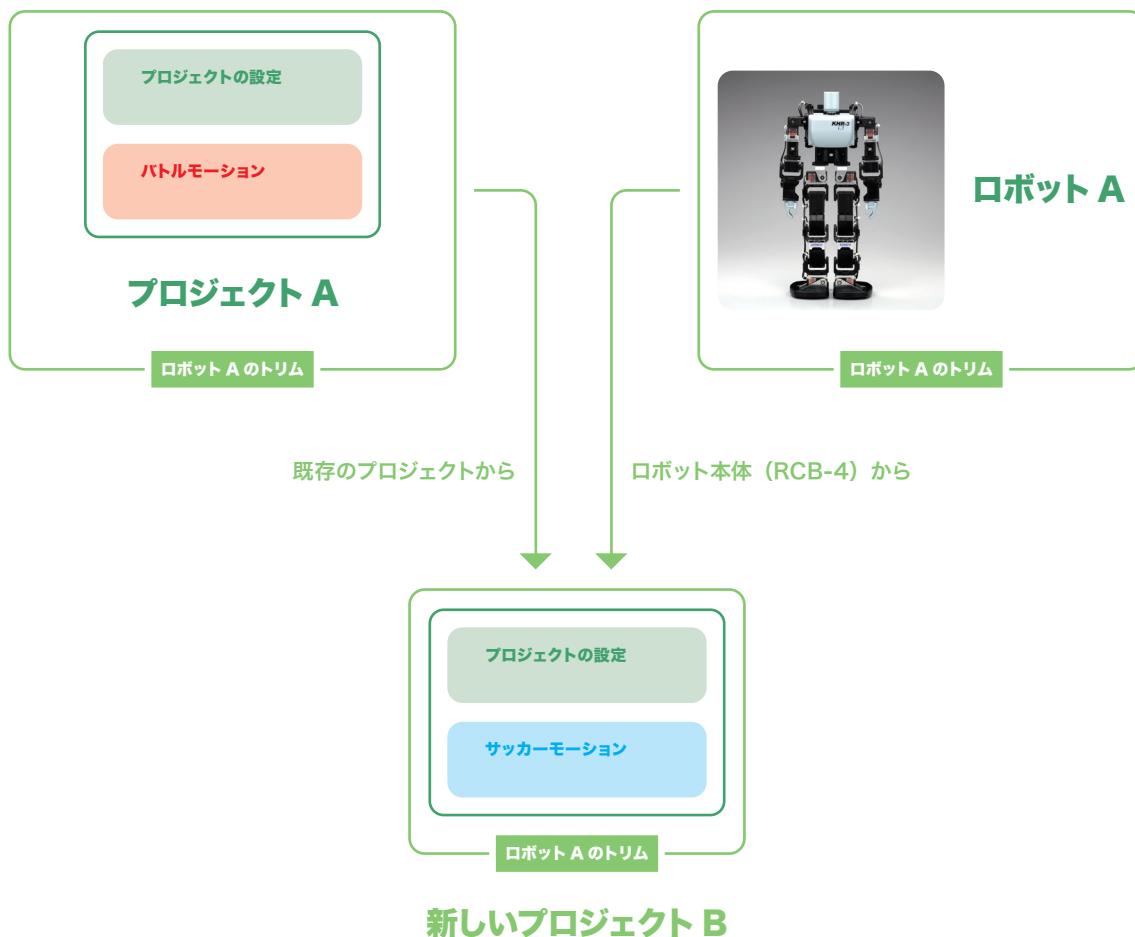
● Motions can be managed according to games or other use



By managing motions in terms of projects, the character of the robot can be changed immediately according to different games or other use.

By creating unique projects for robot games such as soccer and battle, motion management becomes easy. Also, by using the Write Motion At Once button, all the robot motions can completely be rewritten by one click.

## ● Projects can be shared using Trim Merging and Import.



Using the Trim Merging and Import functions, projects obtained from other users can be adjusted to match the settings for your robot, without requiring trim adjustments.

## ● Project Setting Window

In HeartToHeart4, the initial RCB-4HV settings, motion program data, and wireless control assignment are all saved as a single project setting file. The Project Setting window enables the modification and editing of project settings using a simple GUI. Primarily, servo settings, analog mixing and the frame cycle can be set. When you click the check boxes and Write buttons on the screen the robot status will be updated with the latest settings, so it is important to make sure the communication speed of your computer and the RCB-4HV are synchronized before making changes to the data.

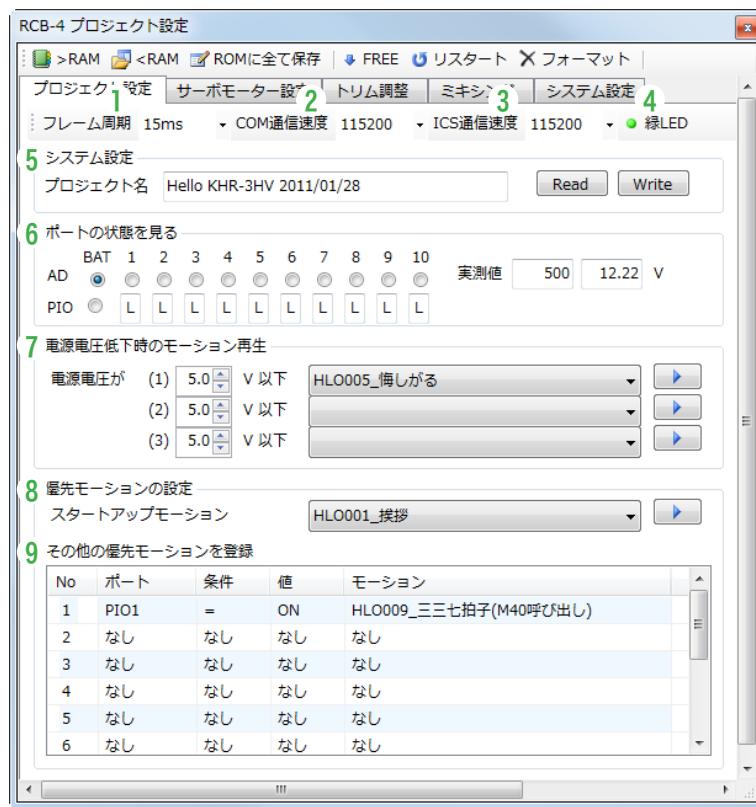
## ● Toolbar



- 1.RAM Write button is used to developing the set trim position data and other settings to the RCB-4HV RAM, and moves the servos to the set positions. Use this function when you want to check the settings status before saving to ROM.
- 2.RAM Read button is for reading the current system setting values from the RCB-4HV RAM and displaying them on the screen.
- 3.Save All To ROM button writes all of the data set in the Project Setting window along with the motions to the RCB-4HV. When writing, the Start-up Position can be selected from the Trim Position or the Home Position.
- 4.Software is rebooted by pressing the Restart button.
- 5.The ROM can be formatted (zero records) by pressing the Format button.

## ● Project Setting Tab

In the Project Setting Tab, the following options for the system's initial settings can be selected.



### 1.Frame cycle

Refers to the base time interval for sending commands to the servos when running a motion. Assign 15-20 ms when ICS communication speed (later described) is 11500, and 10-15 ms when it is 1250000. As a general rule, the smaller the interval, the more agile the motion becomes, but if communication speed is slow, motion may not finish within the frame cycle.

### 2.COM communication speed

The communication speed between the PC and the RCB-4HV is set.

### 3.ICS communication speed

The communication speed for serial device devices, like servos connected to the SIO port of the RCB-4HV. If the ICS communication speed is not set correctly, the device, like a servo, will not operate.

### 4.Green LED

Indicates the RCB-4HV green status LED. If the Green LED is OFF, data can not be read from the ROM, so after checking, be sure to turn it ON.

## ● System Setting Field

### 5.Project Name

English single byte characters of up to 32 characters in length can be registered to the RCB-4HV ROM. Entering the project name then pressing the Write button writes the information to the ROM. The Read button reads from RCB-4HV. If nothing is saved, it remains blank. Used when saving project name and date.

### 6.See Port Condition

Indicates the status of the RCB-4HV analog ports and PIO ports.

While the Sync button is clicked, clicking the radio button for each port the current state of the indicated ports is displayed. Clicking on the analog ports displays the analog-digital conversion values and voltage in the Measured Value field. Clicking on the PIO port, the port state is displayed as H (HIGH) or L (LOW). Clicking again the same radio button stops reading.

### 7.Motion at Reduced Voltage

Specific motions can be designated to run after the start-up motion at start-up corresponding to the RCB-4HV battery voltage (POW port voltage). Up to three motions can be registered. The registered motion will repeatedly run as long as the conditions are met.

## ● Priority Motion Setting

### 8. Start-up Motion

One motion can be designated to run at start-up after moving to the start-up position.

### 9. Other Priority Motions

As with the Motion at Reduced Power Voltage, the motion will be repeated as long as the conditions are met. For conditions, the PIO port, along with the analog port, can be used.

#### ► Caution

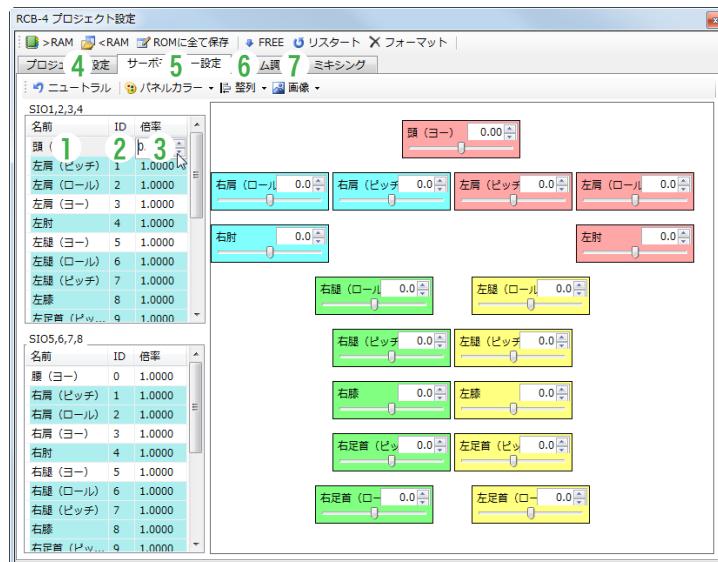
The Motion at Reduced Power Voltage and other Priority Motions are canceled by external input such as KRC-1/2/3.

To clear each priority motion from registration, select "none" and write to ROM.

## ● Initial Setting of Servo (Servo Setting Tab)

Servo Selection Field: There are two servo selection fields, one for SIO1, 2, 3, 4 and one for SIO5, 6, 7, 8. The names corresponding to each ID are registered. By deleting the position panel of the servo you wish to remove from the panel on the right and writing to RAM, or writing to ROM and rebooting, the signal will not be sent to the particular servo, thus shortening the frame cycle.

Press the Sync button in the Main Window to synchronize the movement of the position panel's sidebar and its connected servo.



### ● Selection of Position Panel

By clicking the position panel, the color of the background and characters change and it becomes selected. Clicking it once again cancels selection.

Clicking on an area without a position panel cancels the selection of all position panels.

## ● Servo List

### 1. Name

Name assigned to a servo can be changed. Slowly click twice on the name to make it editable. After editing is completed, press the enter key or click another place to finalize the change. Be sure to save the project.

### 2. ID

List of servo IDs.

### 3. Display Rate

The displayed value of the serial servo rotation range ( $\pm 4000$  from Neutral) can be changed. For example, the rotational range for KRS-2552HV is  $\pm 135$  degrees, by setting the display rate to  $135/4000=0.0338$ , the position panel's value is displayed as  $\pm 135$  (There may be a round-off error). Clicking on the display rate field of the servo, the value input field appears.

## ● Toolbar

### 4. Neutral

By pressing this button, all positions become "0". When the Sync button is ON, the servo moves simultaneously.

### 5. Panel Color

Background and frame color of the selected position panel can be changed. They can also be returned to

standard setting.

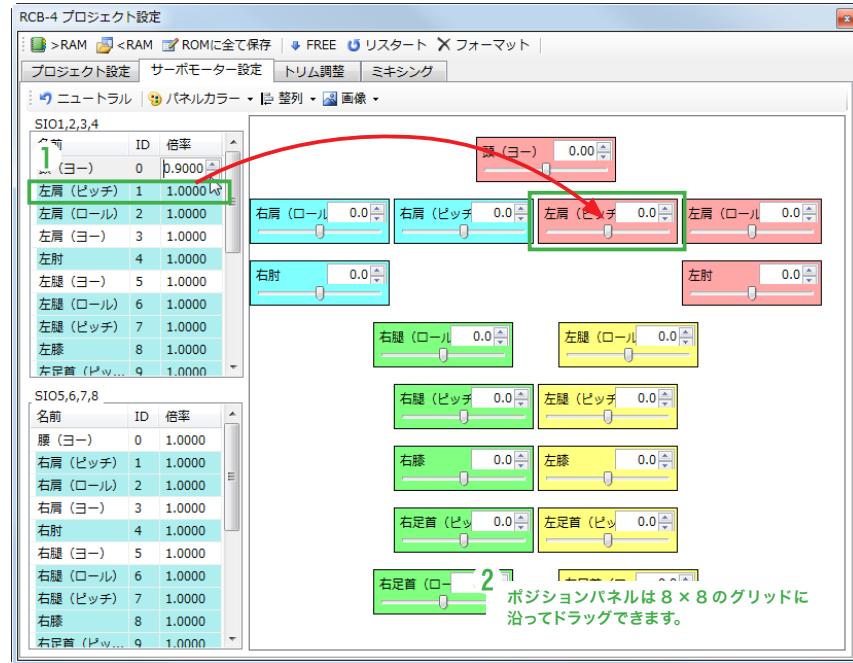
## 6.Align

Enables alignment of selected position panels.

## 7.Graphics

Changes the graphic background of the position panel arrangement area. The changed graphics is also applied to the backgrounds of the Trim Adjustment tab and the POS control.

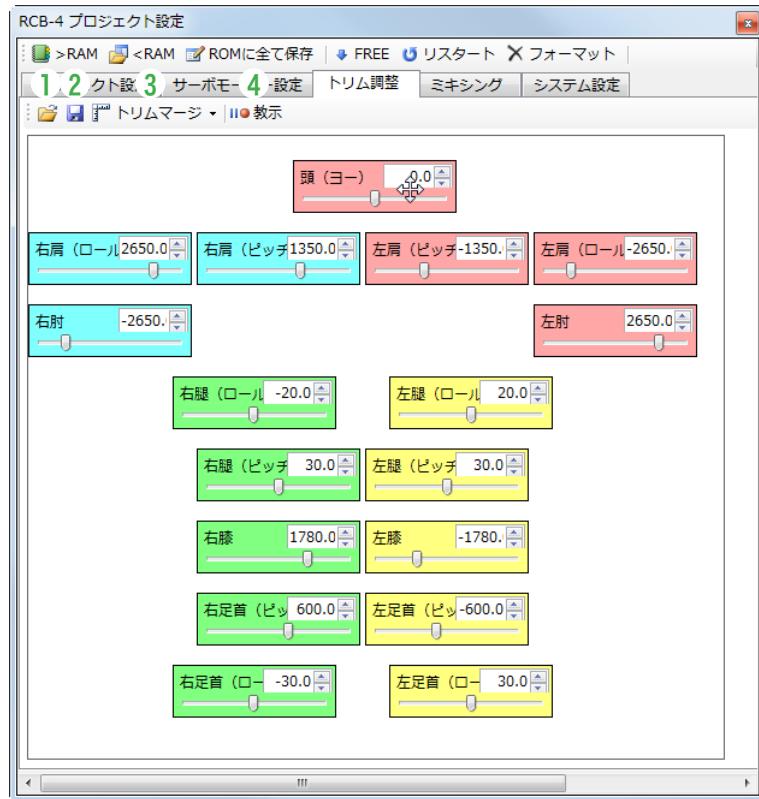
## ● Servo Setting Panel Layout (Servo Setting Tab)



1. To position servos on the servo setting panel, using the mouse drag the name field of the required servo from the Servo List, and drop it in the desired position on the servo setting panel. Multiple servos can be dragged and dropped using this technique. However, those that are already in the Servo Setting panel can not be dropped. Data such as the servos used, the arrangement and color of the Position panel, etc. are managed by the project file. Be sure to save the project file after changing any colors or positioning, otherwise your changes may be lost.
2. Position panels can be moved by dragging them with the mouse after being dropped. Movement automatically snaps to a fixed 8 dots per grid, but holding down the ALT key while dragging enables smooth movement.
3. Arrangement is immediately reflected on the Position Setting screen of the motion editing screen.

## ● Trim Adjustment (Trim Setting Tab)

In the Trim Adjustment tab, the posture, which becomes the robot's reference pose, is set using the Trim Position.



### ● Toolbar

#### 1. Open button

Reads saved trim data and applies it to the project.

#### 2. Save button

The trim position on the Trim Setting panel are saved to a file separate from the project. The file's extension will be ".h4t".

#### 3. Trim Merge Menu

##### ▶ From Project

The trim data alone can be read from another project file, and applied to the present project.

##### ▶ From RCB-4HV

The trim data from a connected RCB-4HV can be read out and applied to the present project.  
Appropriate trim data must be saved in the RCB-4HV.

#### 4. Instruct

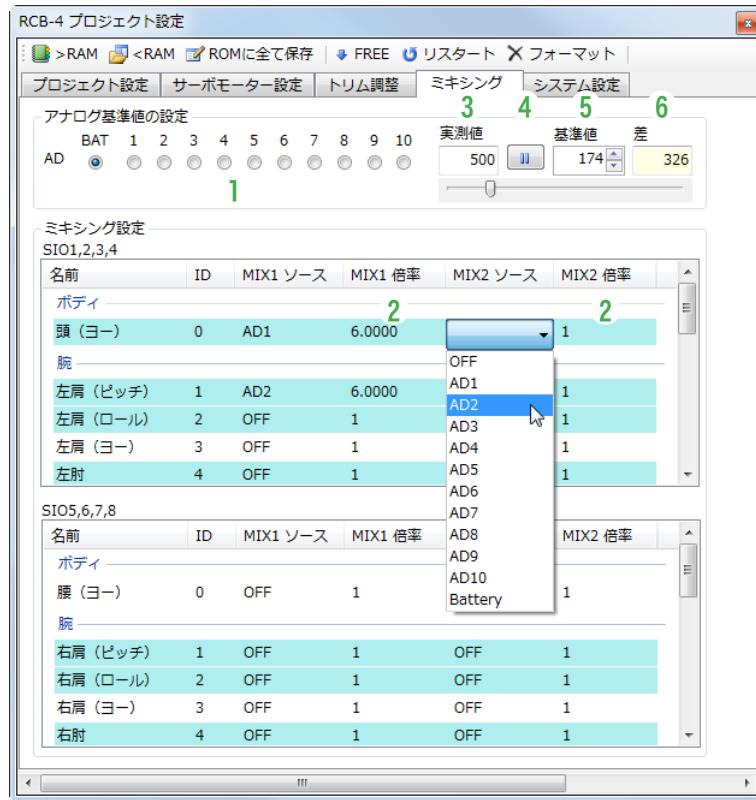
Pressing once puts the servo in a state of relaxation allowing you to change the robots posture and to setup the standard posture. Once the robot is in the standard posture, press the Instruct button again, and the posture will be recorded as the Trim Position.

### ● Trim Panel

The Trim panel uses same layout as set in the servo setting tab. In the Trim Adjustment tab, you can not change the layout or change colors. The Trim Position is changed using the sliders. Changing slider values while pressing the Sync button in the Main Window synchronizes with the corresponding servo.

## ● Analog Mixing

Analog mixing refers to the adjustment of servo angles using analog sensor inputs from sensors like a gyro or accelerometer. It is normally used to stabilize the posture of the body by controlling vibration and servo angle by multiplying a suitable factor based on the sensor input.



### ● Operating description

#### 1.BAT, AD1-10 Radio Button

By clicking the BAT or AD1-10 radio buttons while the Sync button is being pressed, analog port data will be read from RCB-4HV, and the measured value will be displayed on the screen. Clicking the checked box again stops the reading.

#### 2.Factor

Assign a multiplication factor to increase or decrease the effect of the mixing data. If you need an inverse effect, assign a - (negative) value.

#### 3.Measured Value

The actual output of the analog port specified in the Source field.

#### 4.Capture button

Transfers measured value being measured to the standard value.

#### 5.Standard Value

Sets the mixing data standard value.

#### 6.Difference

Displays the difference between the standard value and the measured value. For example, in the case of a sensor that outputs 200 under normal conditions, by setting the standard value as 200, the actual variation from the standard (difference between the AD conversion value and the standard value) can be utilized. The servo output is then adjusted using this difference value multiplied by the Factor. Note: The standard value can also be changed using the slider on the bottom.

### ● Method of Operation

- 1.Press the button for the port for which you wish to set the standard value(Set Analog Standard Value field). The current measured value and the set standard value are displayed. Set the standard value using the Capture button and/or the slider. When setting the standard values for multiple ports select each port and set the standard values for all of them.
- 2.Press the Sync button in the Main Window to synchronize with the RCB-4HV.
- 3.In the mixing settings field, select the servo to which you want to apply mixing. The selected servo background will be blue. Note: Setting is not enabled for servos with a white background, so setting mixing

for those with a white background will not make them operable.

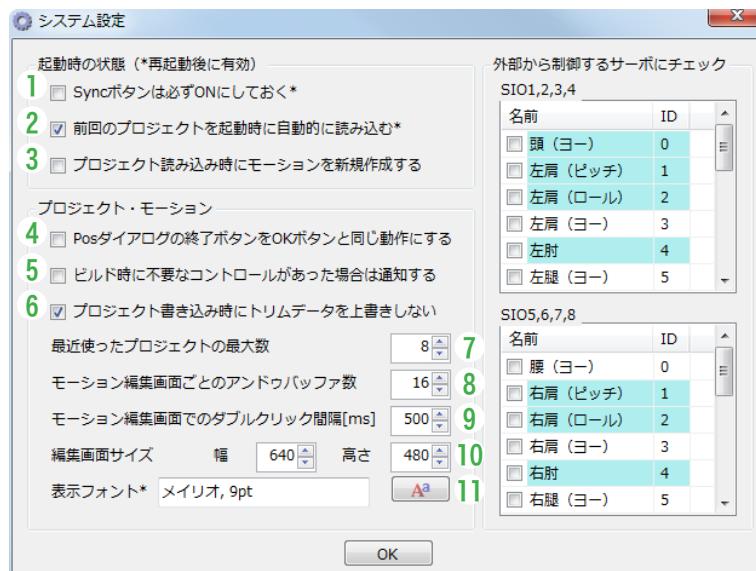
- 4.Click on MIX1 source or MIX2 source field to display the Usable Analog Port Selection menu. Select the analog port for the sensor to be used. In the Sync state, the actual data will be displayed in the measured value field.
- 5.Enter the Factor in the MIX1 or MIX2 factor field on the side to complete the mixing setting.

To replicate the mixing settings at start-up, make sure to save the project file, and write it to ROM. Settings will be reflected after reboot.

For more details, refer to "KHR-3HVOptionManual\_KRG-4.pdf" included in the CD-ROM.

## ● System Settings (System Setting Window)

The software settings for HeartToHeart4 are set in the Systems Settings tab. Open from the “Windows” menu. Selections with \* marks will be enabled after rebooting HeartToHeart4.



### ●Condition at Start-up

#### 1.Always Turn Sync button ON \*

At start-up, if the COM port is connected the Sync button is automatically turned ON. If HeartToHeart4 is terminated while the COM port is connected, the COM port will automatically be connected the next time.

#### 2.Load Last Project Automatically \*

The last project that was used is automatically re-loaded at start-up.

#### 3.Create New Motion When Loading Project

A new motion editing screen appears when a project is loaded.

### ●Project / Motion

#### 4.End POS Dialog Button treated the same as the OK Button \*

The End Dialog button (position control) is treated as an OK button. Pressing the End button confirms the edits.

#### 5.Notify when an Unnecessary Control is Found at Build.

If there is a control that is off the connection line path during motion building, a notice will appear.

#### 6.Do Not Overwrite Trim Data when Writing Project.

When writing the project to the RCB-4HV using the Save All To ROM button, trim data alone is not overwritten. Note: When no project has written, the trims are not correct, so make sure to write the trim data to ROM at least one time.

**7.Maximum Number of Recently Used Projects**

The maximum number of recently used projects displayed in the "Recently Used Project" menu in the File menu.

**8.Number of Undo Buffers in the Motion Editing Screen \***

The maximum number of commands held in the buffer that can be undone in the motion editing window.

**9.Interval of Double-clicks in the Motion Editing Screen \***

The time interval between mouse clicks for them to be recognized as a double-click.

**10.Edit Screen Size**

Sets the size of the edit area in the motion editing window.

**11.Display Font \***

The font used in the screen can be changed.

**●Externally Controlled a Servo Regardless of POS Control.**

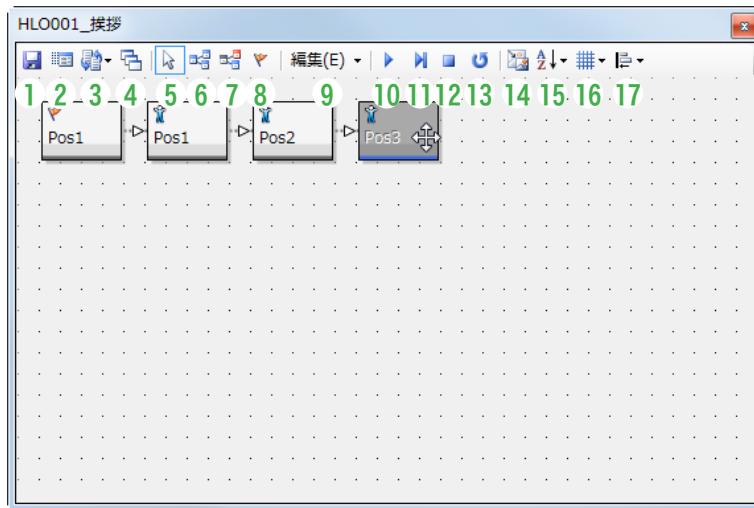
By adding a check mark on the servos whose background color in the servo list is white, they become responsive to external commands from the COM port, even though they will not appear in the POS control.

Note: the servos with blue backgrounds are already registered as those to be used. In other words, regardless of the motion, a servo can be controlled by external commands. To move a servo from the COM port, see the RCB-4HV Command Reference.

## 2.Creating Motion

### ● Motion editing window

In the motion editing window, arrangement of controls, connection and writing of created motion data etc. are performed. By connecting controls by lines, the process sequence is determined. Load a motion from the File menu in the Main Menu, or double-click the Motion file in the Project Browser window, to open the motion editing window. When the motion editing window is in tab form, the current motion name can be changed by right-clicking on the tab.



#### ● Parts Name

- |   |                            |                                       |
|---|----------------------------|---------------------------------------|
| <b>1.</b> Save button                   | <b>7.</b> Branch button    | <b>14.</b> Change Control Size button |
| <b>2.</b> Build button                  | <b>8.</b> Flag button      | <b>15.</b> Rename                     |
| <b>3.</b> Conversion Table Display menu | <b>9.</b> Edit menu        | <b>16.</b> Grid Size Setting menu     |
| <b>4.</b> Divide Motion button          | <b>10.</b> Run button      | <b>17.</b> Alignment menu             |
| <b>5.</b> Select button                 | <b>11.</b> Step-run button |                                       |
| <b>6.</b> Connect button                | <b>12.</b> Stop button     |                                       |
|   | <b>13.</b> Repeat button   |                                       |

#### ● Description of Parts

##### **1.**Save motion using Save button

Saving overwrites previously saved versions. To save under a different name, select "Save Motion Under New Name" in the File menu (Main Menu).

##### **2.**Build button

Pressing the Build button displays the Build dialog. Motion data is written to the ROM when the write position is set in the dialog and OK is pressed.

##### **●**Conversion Function

##### **3.**Conversion Table Display menu

The position data content can be converted at once. (For use of the Conversion Function, refer to the "Conversion Function" section on page 64.)

##### **4.**Divide button

Connected POS controls can be divided into multiple POS controls. (For use of the Division Function, refer to the "Division Function" section on page 67.)

##### **●**Edit Menu

##### **5.**Select button

Used to select controls. Can be selected with the "s" key or the ESC key on the keyboard.

##### **6.**Connection button

Used to connect controls with a line. Can be selected with the "c" key of the keyboard.

##### **7.**Branch button

A branching line is drawn from a conditional settings control to a destination control that matches the

condition. Can be selected with the "b" key of the keyboard.

### 8.Flag button

Flags can be attached to the start and end positions of the control. The Start flag and Stop flag switch according to the number of clicks you make on the control under the flag-mode. Can be selected using the "f" key on the keyboard.

### 9.Edit menu

Copy, cut, and paste can be done. The same operation is possible by right-clicking.

### ●Inline-Running

### 10.Run button

A motion on the canvas is run from the Start flag position to its end or to the Stop flag position.

### 11.Step-run button

Incremental program control with the Start flag or the mid-run position being processed. Note: Step-run is ineffective for some controls.

### 12.Stop button

Running stops. While step-running, all mid-run marks will disappear.

### 13.Repeat button

By setting the repeat button during regular running, repeat-running is continuously executed. To stop, press the Stop button.

### ●Others

### 14.The size of selected controls can be changed at once.

### 15.Name and number is reassigned to controls selected on the screen.

The names and numbers are reassigned from left to right or top to bottom.

### 16.Grid Size Setting Menu

Grid size is changed.

### 17.Alignment Menu

Controls are aligned. Align Left; Center Vertically; Align Right; Align Top; Center Horizontally; Align Bottom can be selected from the menu.

## ● Control Arrangement Procedure

### ●Arrangement of Control

1.The arrangement of servo panels in the Position Setting screen is done in the "Servo Setting Tab" (Project Setting screen). Set the servo panel position and color, then save the project. After saving the project, to arrange the servo panels arrange the position controls by dragging from the toolbox window to the motion editing screen. (Refer to "Setting Sidebar of the Position Editing Dialog (Servo Setting Tab)" section on page 47)

2.Drag the control from toolbox window and drop it onto the canvas.

3.The dropped control can be moved by dragging with the mouse. Drag while pressing the CTRL key to move smoothly.

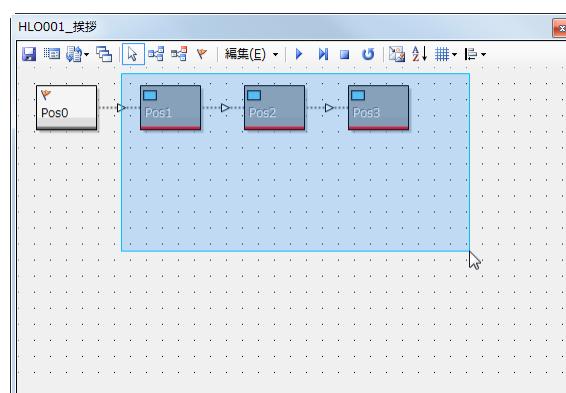
4.The mouse cursor shape changes when the mouse comes in close contact with the right and bottom sides of the control. The size of the control can be changed by dragging in that state. Also, the size of the control can be changed by dragging the bottom-right corner. By pressing the CTRL key while changing size, the size can be changed smoothly.

### ●Selecting and Moving Controls

5.Click on a control to select it. The control color will change.

6.To make multiple selections, hold down the SHIFT key while clicking on the controls.

7.Or, drag the mouse to surround the controls you wish to select for multiple selections.



8.Range selection while pressing the SHIFT key enables selecting controls that are spaced far apart and can

not be easily selected at one time.

9. Pressing the DEL key while selecting will delete the selected controls.
10. Controls can be moved by dragging. If an anchor point is selected in addition to a control, the anchor point will move, as well. To move the anchor point by itself, select the anchor point by itself and drag.
11. When changing the size of multiple controls, drag the right side, the bottom side, or the bottom-right hand corner while pressing the SHIFT key.

### ●Connecting by Line

- 12.The mode changes to line connection mode by pressing the Connect button. By moving the mouse cursor onto a control, the mouse cursor snaps to the center of the control. (Center snap function)
- 13.A line appears by moving the mouse cursor after snapping. Snapping to another control in this state displays a line and fixes the connection. Lines currently connected are bold and blue.
- ▶Clicking on a part of the screen other than a control while connecting adds an anchor point (break point).
  - ▶Pressing the ESC key while connecting cancels anchor points. When the ESC key is pressed a number of times until there are no anchor points, the connection mode automatically shuts down, and changes to the selection mode.
  - ▶Anchor points are displayed only in the selection mode.
  - ▶Double-clicking on an arrow on the line creates an anchor point.
  - ▶If you wish to reconnect lines after confirming, first click on the arrow at the center of the connection lines to turn it selected (the line color changes to blue), then press the DEL key to delete the line.
  - ▶To delete an anchor point, click on an anchor point to select it, then delete by pressing the DEL key. Double-clicking on an anchor point will select all anchor points on the path.
- 14.The number of lines that can be drawn from one control is two for conditional controls (the Compare group) and one for all other controls.
- 15.There is no limitation to the number of lines coming into a control.

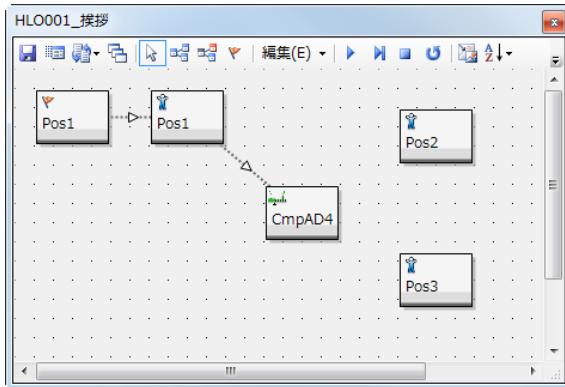
### ●Copy, Cut and Paste

- 16.Control and line information are copied to the software buffer by pressing CTRL + C keys while selecting control.
- 17.Pressing CTRL + V pastes a copy of information saved in the buffer on the canvas.
- 18.Pressing CTRL + X keys after selecting a control cuts it from the canvas and saves a copy in the buffer.
- 19.Copy-and-paste can be done across each motion editing window.

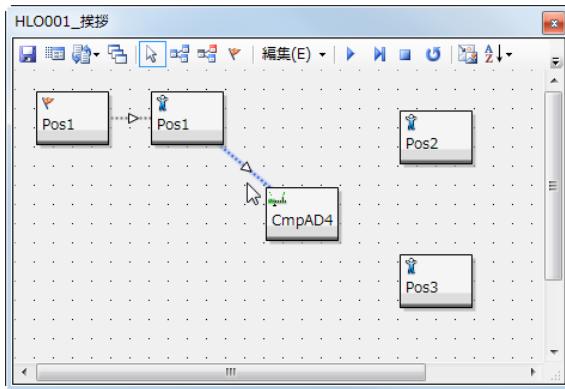
### ●Illustrated Guide to Motion Editing

The HeartToHeart Ver.2.0 motion editing method has changed considerably from previous versions. In this section the editing procedure is described, in the order of line connection and editing, anchor points, as well as moving and changing control size. Note: The motion shown in the figure is merely a connection example and has no actual meaning in terms of movement.

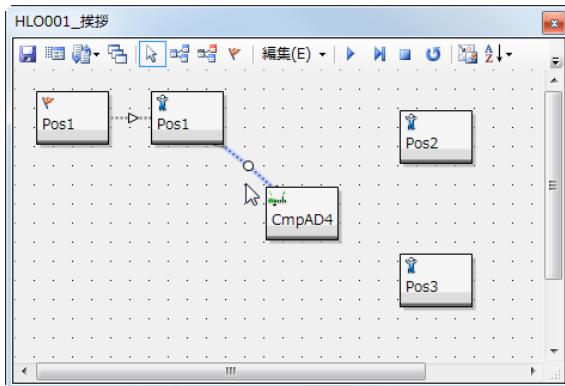
1. First, open a new motion editing screen. Arrange four POS controls and one CmpAD4 control on the screen, as shown in the figure.



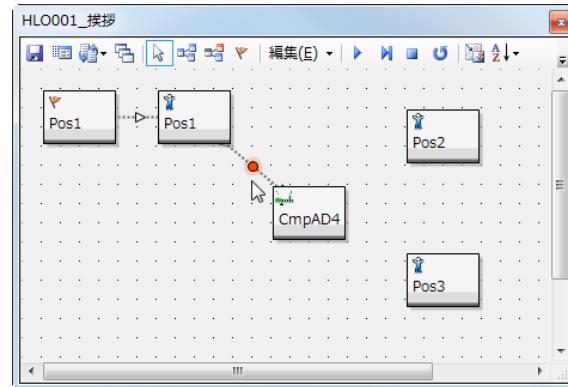
2. Click on the arrow; the color of the line changes to blue and becomes selected. Pressing DEL while the control is selected will delete the line.



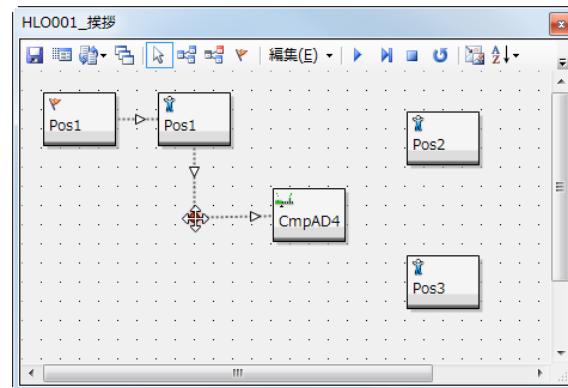
3. Double-clicking on the arrow while in the selected mode turns it to an anchor point.



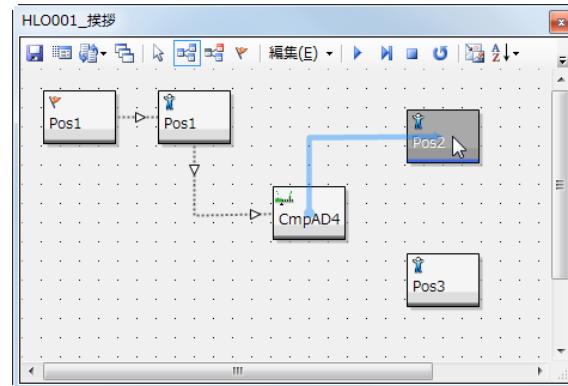
4. Clicking on the anchor point selects the anchor point. Press the DEL key while it is in a selected state to delete the anchor point.



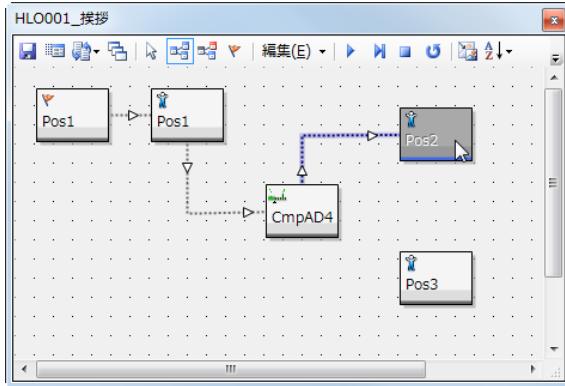
5. An anchor point can be dragged.



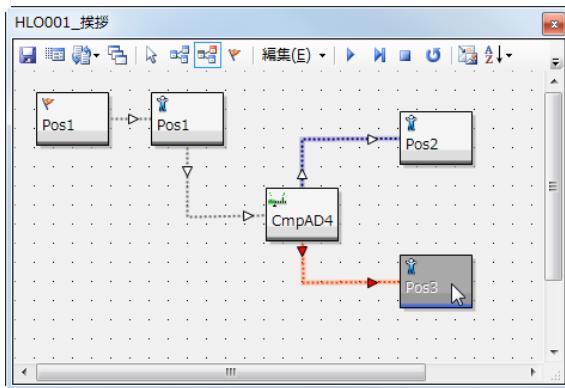
6. Switch to connection mode. In the connection mode, by drawing out a line from the branched control, a line for when condition is not met can be connected. Click on the screen while a line is being drawn to turn it into an anchor point. The line and anchor point can be canceled with the ESC key.



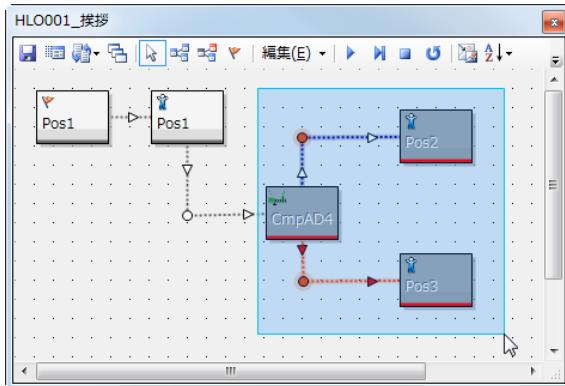
- 7.Click on a destination to complete connection of line for when branch condition is not met.



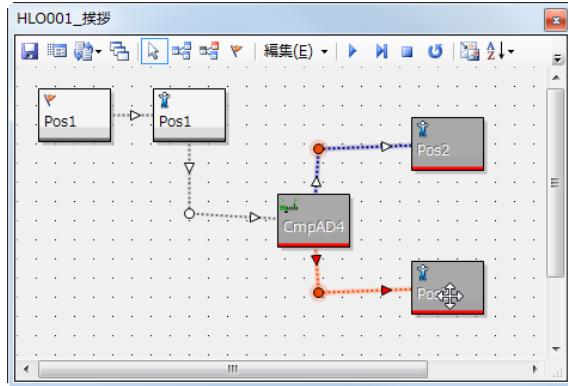
8.To connect to a destination for when branch condition is met, use the branch connection mode. By switching to the branch connection mode and connecting a line to another control, the branched line turns red. In the figure, the connection is created so that when the conditions set in CmpAD control is met, the program proceeds to Pos3, and when the condition is not met, the program proceeds to Pos2.



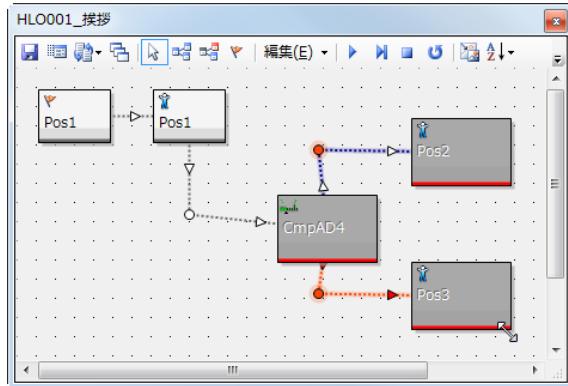
9.Switching to the selected mode with the ESC key displays round anchor points. By area-selecting, anchor points can be selected, too.



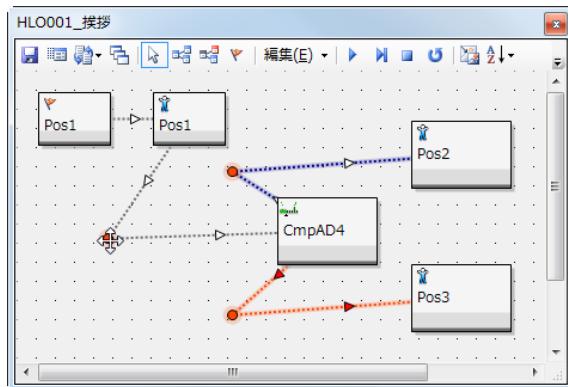
- 10.Multiple controls can be moved by pressing the SHIFT key.



11.Dragging on the right side, bottom side, or bottom-right corner of a control allows you to change its size. By selecting multiple controls, the size of multiple controls can be changed at the same time.

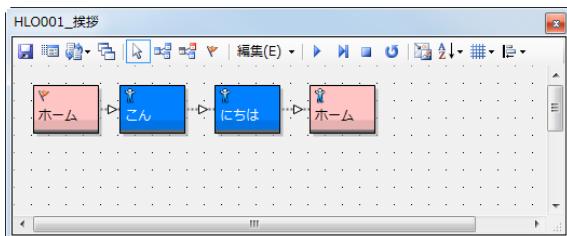
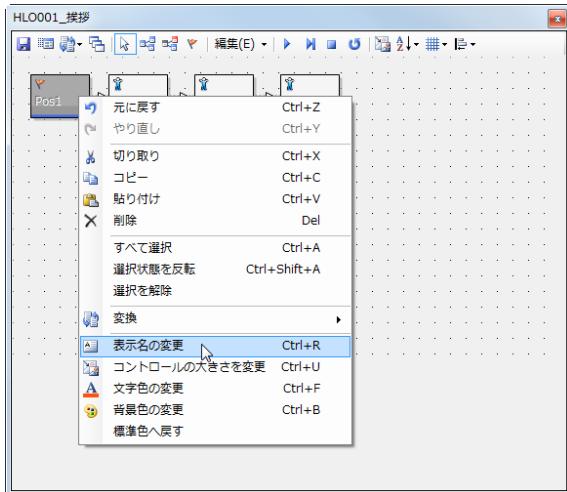


12.By clicking on a control or anchor point while pressing the SHIFT key, objects located apart from each other can become selected at the same time, too. Dragging will move them at the same time.

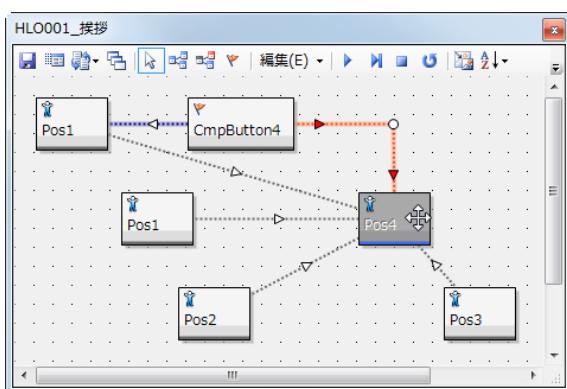


- 13.Dragging the Edit Screen while pressing the ALT key will scroll the screen.

- 14.Undo is performed by pressing Ctrl+Z, returning to the state of one operation before. After Undo, pressing Ctrl+Y will allow to Redo.
- 15.Right-clicking after selecting a control displays option menus. Control names can be changed by selecting "change display name".

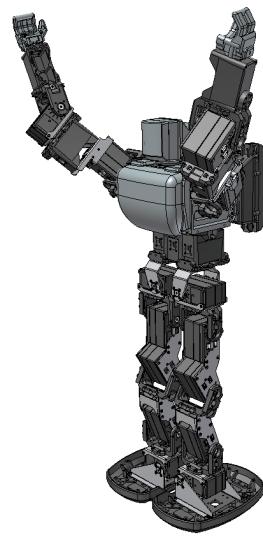


- 16.The number of lines that can be drawn coming out of a control is one, or two for a branch control. There are no limitations to the number of lines that can be connected into a control.



## ● Creating Motions from Scratch

Creating and running new motion data is described in this section. Step-run will also be described. In this exercise, the Home Position data is used to create a motion where the robot swings both arms several times, as shown in the figure.

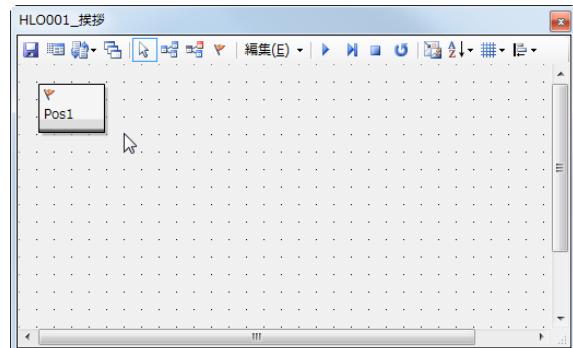


### ● Creating a New Project

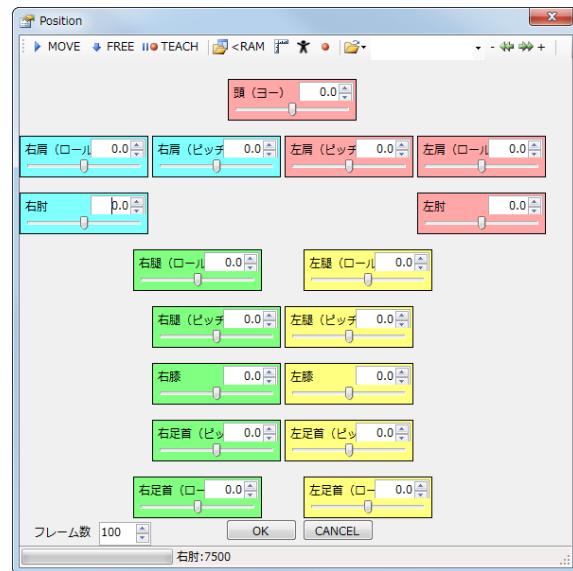
1. First, create a new project or load an existing project. (Refer to "Project Creation / Import" section on page 25.)
2. Connect the COM port, and complete the trim adjustment and initial setup in the Project Setting window.
3. Select motion from the New Document menu from the File menu, or press the Create New Motion Data button.
4. Open the toolbox window from Window menu, or press "Display Toolbox" button in toolbar.

### ● Create Basic Position

5. From the Toolbox window, drag-and-drop a POS control onto the canvas.



6. Starting with HeartToHeart4Ver.1.2, when a POS control is placed on the canvas, the positions of the arranged position panels are automatically reflected on the POS control, and all positions are set to Neutral.



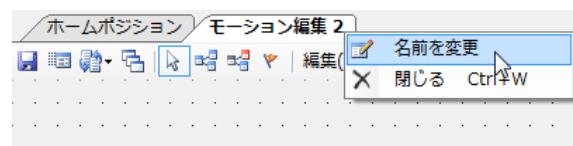
7. Set the frame number to 80 and press the OK button. Any changes made to the settings on screen will not be saved until you press the OK button.  
 8. The motion data file should be saved at this point. Click the Save Motion button, and name the file "homeposition.xml". The name on the saved tab will change.

### POS Control Initial Value

When a POS control is drag-and-dropped from the toolbox, all positions will be as they were set in advance. When a POS control is copied and pasted, the positions will be copied as well. To return the positions currently being edited to Neutral, press the : POS control Trim button.

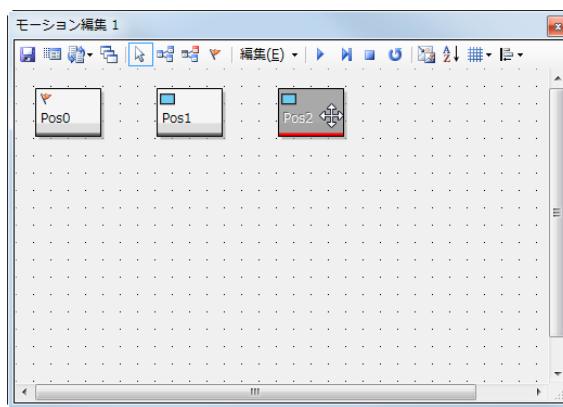
### ●Create Motion Data

9. By creating new motion data using New in the File menu, the motion editing window is displayed in two tabs, as shown in the screenshot. Clicking the text on the tab displays the tab screen to the front. Also, the windows can be separated or connected by dragging-and-dropping the tabs.



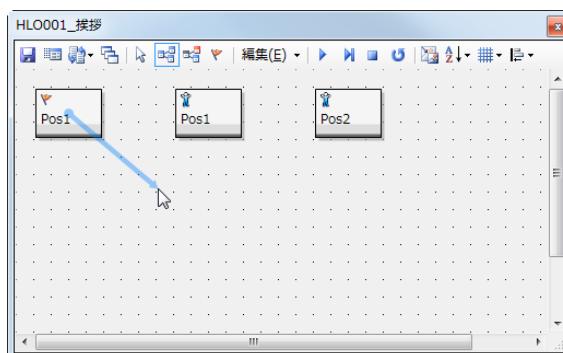
10. Click the "Home Position" tab to bring it to the front, and click on the Pos0 control created in the preceding step to select it. When selected, the button appears to be pushed in.  
 11. Select "copy" from the right-click menu or the Edit menu. The short cut key CTRL+C combination can also be used.  
 12. Click on the "Motion Edit 2" tab to bring it to the front and select "paste" from the right-click menu or the toolbar to paste the copied control.

- 13.**Repeat copy-and-paste three times and arrange the controls as shown in the screenshot. The controls in the screenshot are already renamed.



- 14.**Press the Connect button to switch from Edit mode to Connect mode.

- 15.**Click on the first control you wish to connect. Then, move the mouse cursor over the next control you want to connect; a connection line will snap to the center of the control. Click to confirm the connection.



- 16.**When controls are connected an arrow appears at the center of the connection or between anchor points, to indicate the motion sequence. Using the same steps, connect all three controls. When all connections are completed, save the motion with the name “wave\_hand\_basic.xml” .

### Copy and Paste

When the position panel is arranged on the motion editing screen by dragging-and-dropping from the toolbox window, the positions previously used will be reflected. The Frame Number becomes 100.

By copying and pasting position controls, the content of the copied position controls are duplicated.

### Duplication of Position using Home Position Button

Positions can also be duplicated using the Home Position button. Open the position panel you wish to copy, and press the Save Home Position button to save positions set in the POS control as the HTH4 (Home Position). Next, open the POS control where you wish to copy the position, and press the Home Position button. This will paste the saved Home position to the POS control.

The Home position saved here can also be used as the start-up Home position.

### ●Motion Edit

- 17.**Pos0 should be left as is, since it is the first position when running the motion. Open the Pos1 control by double clicking. With the Position Setting dialog is displayed, change the posture to have the arms raised and wide apart, using the Smart Teach function or the Sync button. Press the OK button when completed and save the 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

**18.** Next, open Pos2 and set the posture with the arms closed in a raised position. When editing is completed, press the OK button and close the Position Setting dialog. The following table shows reference positions.

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

#### ●Inline-Running

**19.** Find the control with the Start Flag before pressing the Run button. The motion will start running from this point. If you wish to change the position of the Start flag, click the Flag Mode button and then click on the control you want to make the Start. If you right-click on the control instead, a Stop Flag will appear. This indicates the stop position when inline-running is performed.

**20.** Set the Start Flag at Pos0 and press the Run button. Inline-Running begins until the motion-stop position (Stop Flag).

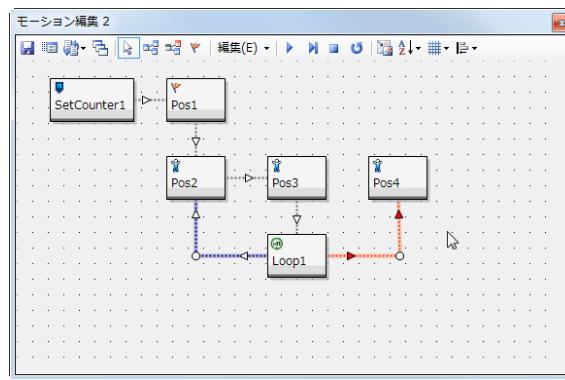
**21.** By pressing the Step-Run button, controls are run one at a time. When running is completed, a Step-Run mark appears on the next control that is to be run. By pressing the Step-Run button again, the control with the Step-Run mark will be run.

**22.** Pressing the Stop button during Step-running or normal running causes motion to stop. The Step-Run mark disappears and the Start position is reset to the control with the Start flag.

### ●Inserting Repeat Process

23. Next, the open-arm state and the closed-arm state are repeated five times to create a waving motion. Add a SetCounter control and a LoopCounter control from the toolbox to the "wave\_arm\_basic.xml" currently being edited. Copy and paste Pos0 to create Pos5 and arrange as shown in the figure. Connections should be made as follows: SetCounter → Pos0, Pos2 → Loop4, Loop4 → Pos1, Loop4 → Pos5. The value following the control name indicates the sequence in which the controls were arranged, and may not coincide exactly.

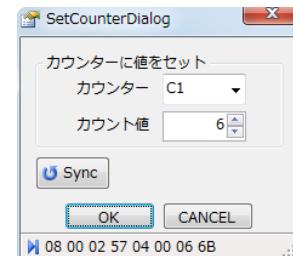
24. When arrangement of the controls is completed, connect the other lines as shown.



25. In the LoopCounter control, when the set count value minus 1 becomes 0, the process moves on to the next connected control. Since 1 is first subtracted and its result is evaluated, if you wish to repeat the loop five times, the SetCounter control should be set to 6.

26. As with the LoopCounter, the destination of branch controls in the "Compare" group are changed conditionally. For branch controls, each connection has a ConnectMode value that can be viewed and set in the Properties tab. ConnectMode values are True, False, and Normal. Connections with ConnectMode values set True appear Blue, False appear Red, and Normal appear with no highlighting. Set each connection to the ConnectMode value you want based on the desired motion process flow. In the present example, Loop4 → Pos5 is the process flow when the condition is met, so set that connection ConnectMode value to True. Loop4 → Pos1 is the process flow when condition is not met, so set that connection ConnectMode value to Normal.

27. Select C1 for SetCounter counter control and enter 6 as the count value.



28. Next, the loop counter control is set. Select a counter (C1) which is selected at the SetCounter control. If a branched line is already connected, the destination control of the branched line should be displayed on the "Destination" field. By changing the destination in the Destination menu, the connected line and branched line will change, as well. When values or selections are changed in the LoopCounter etc., be sure to close the dialog with the OK button. Branched lines can be attached after changing the content of the control.



29. Beginning with HeartToHeart4 Ver.2.0, inline-running applies to LoopCounter's and similar controls. If a repeat is performed correctly while executing inline-running, the motion is completed. However, the timing of inline-running will differ from that of regular movement. Therefore, always write to ROM using the Build button and recheck movements. In this example, the robot should wave 5 times when running from the ROM.

### ●Motion Adjustment

30. When the robot moves from Pos0 to Pos1, its arms are rapidly raised. Because the robot is lightweight, this rapid motion can cause minor swaying. In this type of situation, increasing the frame number to slow down the motion, or inserting an additional posture, which does not keep the arms away from the body, between Pos0 and Pos1, can be effective.

### 3.Motion Conversion Function

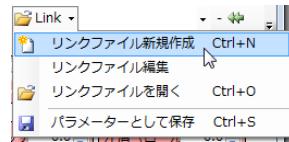
Normally the Position Setting screen specifies the position of the servo to create robot postures. By using other functions such as the Link/Parameter, the Conversion, and Division functions, changing of motion data can be semi-automated.

#### ● Link / Parameter Function

With the Link function, the robot's posture can be created by setting a displacement value in the Position panel. The Parameter function is used to save and read positions being currently edited. Both functions are used from the LINK menu of the POS control.

##### ● How to use Parameter Function

- To save the current position as a parameter file, select : Save as Parameter in the "Read Link Function Button" and save file after setting the position. The file extension is ".h4l".



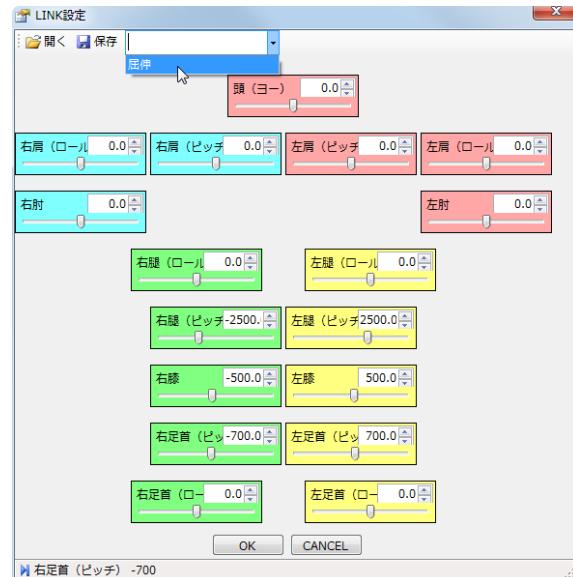
- To load the saved parameter file, press : Open Link File in the "Read Link Function Button" and load the link file. Loading the file applies the saved position to the position panel.

- The saved link file will be added to the menu the next time it is used. Note: Be sure to save the project. Otherwise the menu will revert to its previous state. Also, since the link references an external file it will cease to function if the external file is deleted or moved.



##### ● How to use New Link Function

- Open the Position Setting screen and change the robot's posture to the current position using the MOVE button.
- Open the LINK menu and select the "Create New Link File" menu.
- A LINK Setting dialog will be displayed. Input the desired displacement value per button in each position panel. The screenshot shows an example of a knee bend.
- After completing the input, press the OK button to return to the POS control screen. If you wish to use the set data more than once, save the file using the Save button. Be sure to save the project afterwards so that the link will be displayed in the Link File Selection menu the next time it is booted.
- The Link data will be set when you return to the POS control.



- 6.Press the Move to +, - Direction buttons to change position.



### ●Reading Link Function

- 1.Even though the Link function file and the Parameter function file have the same extensions, their contents are different and automatically switch to the corresponding mode.
- 2.If a Link function file is loaded, it shifts automatically to LINK mode after loading is completed. By performing actual operations and pressing the LINK Function button, the position is changed.
- 3.Positions can be changed using the slider in the position panel even under the Link mode.

## ● Conversion Function

The Conversion function allows you to change set positions at concurrently by various methods, without opening the Position Setting screen in the Motion editing screen.

Currently, it is only effective for positions in the Position Setting screen.

### ● Description of Operations

#### 1. Read Conversion Function menu

Read the conversion function file.

#### 2. Save Conversion Function menu

The conversion function is written to a file.

#### 3. Clear List button

Deletes the list of conversion functions currently being edited.

#### 4. Name field

The name of the servo to be converted is displayed. In the screenshot, the Head (Yaw) servo's position is being converted to 50.

#### 5. Operating field

Select conversion function.

#### 6. Value field

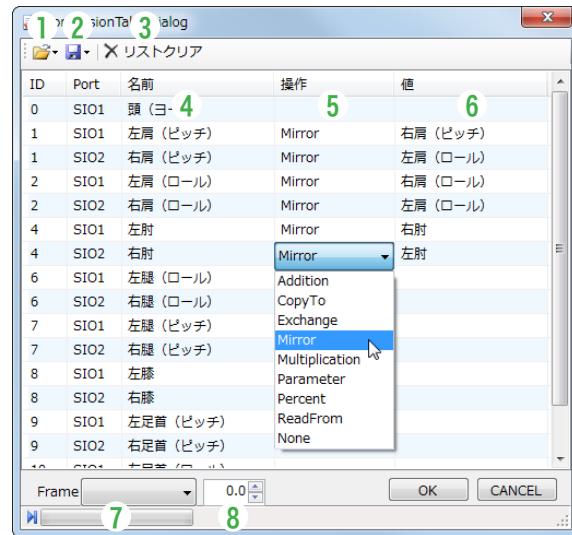
Input conversion value.

#### 7. Select Frame Function menu

Select type of conversion for frame.

#### 8. Frame Number Input field

Input frame conversion value.



### ● Conversion to Servos

Item	Content	Range of Change	Remarks
<b>Addition</b>	Add a specified number to the position of the conversion target.	± 8000, minimum unit 1	
<b>CopyTo</b>	Copy the position of the conversion target to a specified control.	Selectable servo	
<b>Exchange</b>	Reverse the position data of the conversion target and the specified control.	Selectable servo	*
<b>Mirror</b>	Move the value of the control that specifies the position of the conversion target to the opposite direction from its center.	Selectable servo	
<b>Multiplication</b>	Multiply a specified number to the position of the conversion target.	± 100, minimum unit 0.1	
<b>Parameter</b>	Directly input position of the conversion target.	± 8000, minimum unit 1	
<b>ReadFrom</b>	Copy specified position to the position of the conversion target.	Selectable servo	
<b>None</b>	Choose when canceling selection.	-	

\* The former Change command

### ● Conversion to Frame

Item	Content	Range of Change	Remarks
#	Set the specified number as the number of frames.	± 255 unit 1	*
+	Add the specified number to the number of frames.	± 255 unit 1	*
-	Subtract the specified number from the number of frames.	± 255 unit 1	*

Item	Content	Range of Change	Remarks
*	Multiply the specified number to the number of frames.	± 1000 unit 0.1	*
/	Divide the number of frames by the specified number.	± 1000 unit 0.1	*
%	Set the specified % against the present number of frames.	± 1000 unit 0.1	*
<b>None</b>	Override conversion.	ignore	*

\* All results are within the range of 1 to 255. Even if 0 is specified as #, the number of frames will be 1.

### ●Difference from Former Conversion Function

In HeartToHeart3, the Conversion Function conversion was performed in sequence starting from CH1; so, after CH1 was converted, CH2 referred to the converted value in CH1. In HeartToHeart4, the conversions are performed on the original data, so it is no longer necessary to consider the sequence of conversion. However, the Exchange (the former Change) function alone actually transfers the position data.

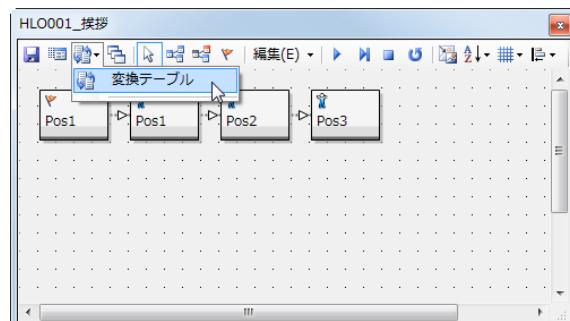
MIRROR has been added as a new function. Similar to the former Reverse function (where the direction was reversed relative to the Neutral position of a servo), the MIRROR function allows specifying a point of reference. If the same servo is specified as both the conversion target and the destination, the same effect as the Reverse function is obtained. The MIRROR function is convenient for transferring positions that are symmetrical but opposite to each other relative to the Neutral position, like knee servos.

For Frame Conversion, specification by % is now possible.

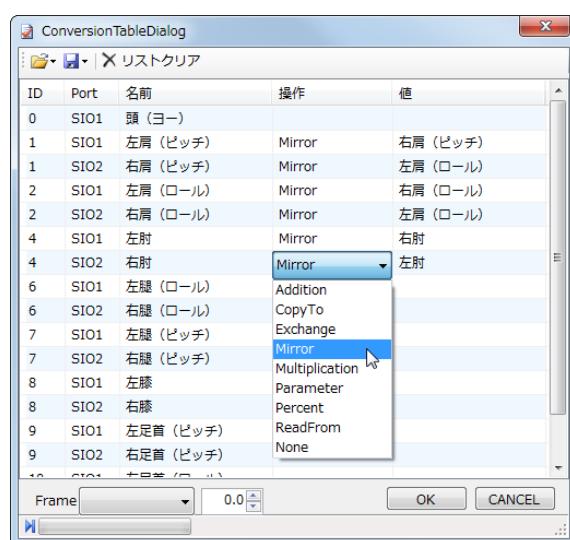
### ●How to use the Conversion Function

1. Select the control you wish to convert in the motion editing screen. The conversion table will not be displayed without selecting. In the current version, only POS controls are enabled and selection of other controls will be ignored.

2. Press the Read Conversion Table button or select a saved conversion file from the menu.



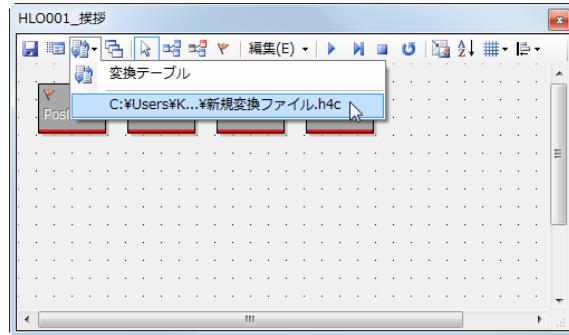
3. A Conversion Table screen will be displayed. Click on the operation field of the target servo, display the conversion menu and select a conversion function. The screenshot shows an example of producing a symmetric movement in the upper body.



4. After selecting a conversion function, click on the value field in the same line. Different value setting menus will appear depending on the type of conversion. Select an appropriate number or servo name.

5. If necessary, input the frame function and value.

- 6.To cancel a selected conversion function, select "None." The value in the value field will remain but will not be applied.
- 7.The conversion function currently being edited can be saved using the Save button. By saving, the function will be added to the reading menu for the next time. However, in order to avoid having the function deleted from the menu, even after terminating HeartToHeart4, the project must be saved. The extension for the conversion function file is "h4c".
- 8.Saved conversion files can be read from the Read menu. This list will be saved in the project file. If you wish to use the conversion file again, the project file must be saved.



- 9.Conversion is executed by pressing the OK button.

## ● Division Function

The Division Function is a function that divides the interval between of two position controls by a specified interpolation number. There are four division methods (interpolation methods).

### ●ポジションコントロールを選択

モーション編集画面でポジションコントロールを2つ選択します。2つのコントロールはラインでつながっている必要があります。選択後、分割機能ボタンを押すと補間設定ダイアログが開きます。

### ●Interpolation Setting Dialog

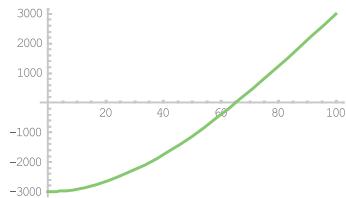
- 1.Select an interpolation number. The specified number of position controls will be inserted between the selected controls.
- 2.The number of position control frames inserted can be specified when "insert only" is selected as the Interpolation Type, as described in 3 below.
- 3.The number of resulting number of frames is determined by dividing the number of frames in the destination by the interpolation number. For example, if the number of frames in the destination is 100 and the interpolation number is 4, the number of control frames inserted becomes 20, and the number of frames in the destination control becomes 20, as well.
- 4.When insert only is selected, the specified number of controls will be inserted, independent of the number of frames in the destination.

### 5.Interpolation Method

#### ►Equal Number of Frames by Uniform Division

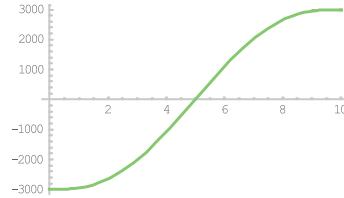
In uniform division, the position changes by the amount of the travel distance divided by the insertion number.

#### ►Third-order Polynomial Interpolation



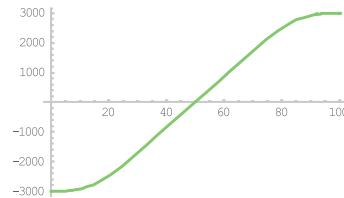
In third-order polynomial interpolation, the amount of travel distance is calculated by a third-order polynomial equation. There is no deceleration state and the servo reaches the designated control at maximum speed.

#### ►Fifth-order Polynomial Interpolation

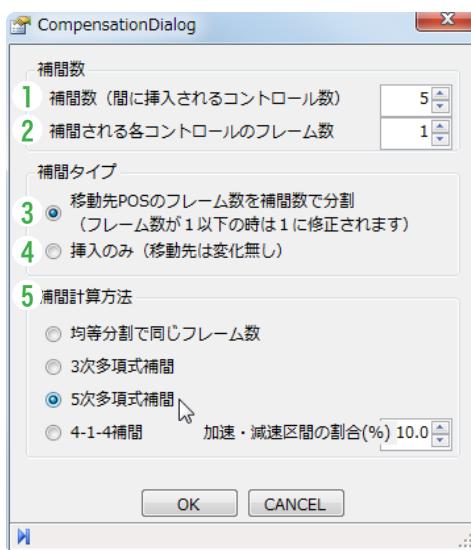


In contrast with the third-order polynomial interpolation, the fifth-order polynomial interpolation has a deceleration section, and the servo reaches the designated control at a speed of 0.

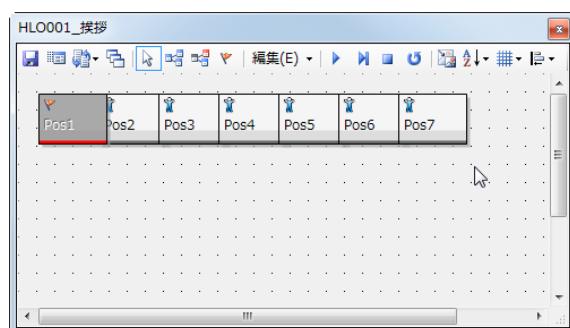
#### ►4-1-4 Interpolation



The 4-1-4 interpolation method allows a uniform velocity section to be inserted while moving. 0 to 25% of the total can be allocated to the uniform velocity section. Specifying 0 will have the same effect as the fifth-order polynomial interpolation.



Division is executed by pressing the OK button.  
In the example, five are inserted. When the resulting number of frames is less than 1 as a result of the interpolation (division), it will be set to 1. In this situation, servo movement may be slowed.



## 4. Control Description

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Controls used in the creation of motion are described. Examples described in this section are used for the sole purpose of describing the control and have no meaning in their movement.

A setting dialog appears when each control is double clicked. In order to apply the values set in the setting dialog, make sure to click the OK button to close the dialog. If there is a check mark on the "Make the Exit Control Dialog button the same as the OK button" in the system setting tab of the Project Window, the Exit button in the dialog's title bar will also confirm the command.

To close the dialog without setting a command, press the Cancel button.

## Position Setting

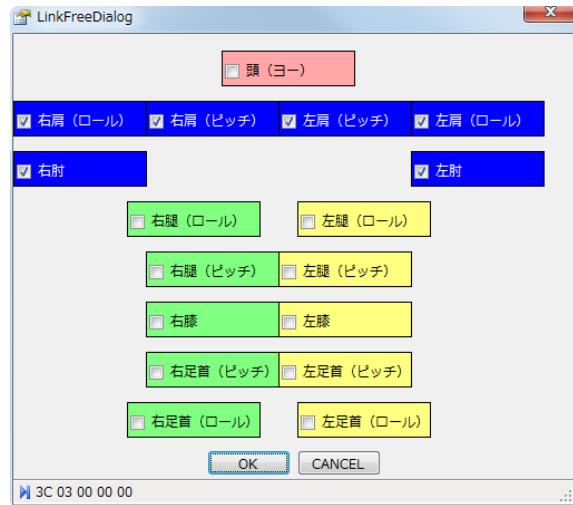
### ● Free



Puts the selected servo to a free (powerless) state. Clicking the name of the servo you wish to free (Checkmark will appear). In the screenshot, the left shoulder (pitch) to right elbow are in a free state.

#### ● Operating description

Select using left mouse click.



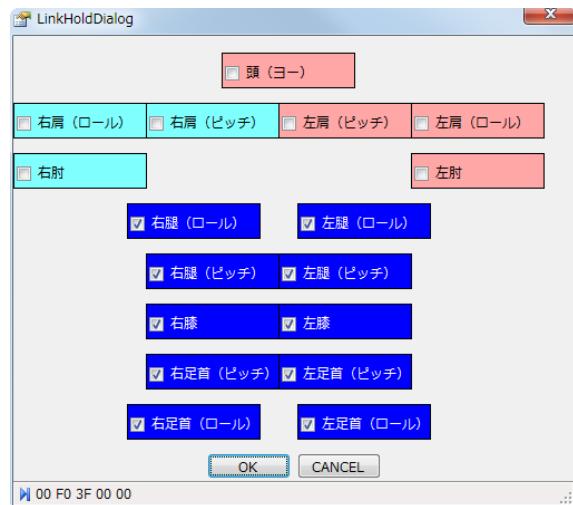
### ● Hold



Puts the selected servo to a hold state. Clicking on the name of the servo you wish to hold (retain state). In the screenshot, only the lower body is at a hold state.

#### ● Operating description

Select using left mouse click.

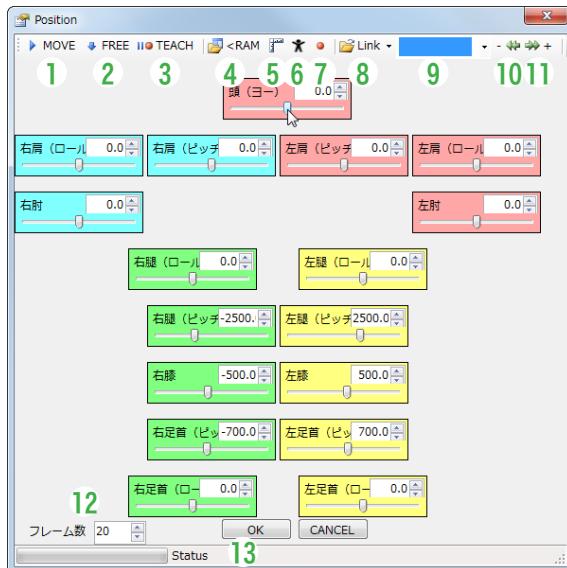


## ● Position



The robot's posture is determined by selecting servos and setting their angle. Beginning with HeartToHeart4 Ver.2.0, opening a POS control while the Sync button is pressed automatically moves the servo to that position.

### ● Operating description



#### 1.Move button

Move to the position assigned in the Position Setting dialog. Also moves by pressing the SPC key.

#### 2.Free button

Puts the robot to a powerless state.

#### 3.Smart Teach button

Selecting a position panel on screen the pressing the Smart Teach button puts the selected servo into Teach Mode. After positioning the servo, press the button again and the position will be applied to the position panel.

#### 4.Load from RAM

Pressing this button applies the position data from the RCB-4HV RAM to the position panel.

#### 5.Trim button

Moves to the trim position set in the Trim Adjustment tab.

#### 6.Home Position button

Moves to home position saved by the Save Home Position button.

#### 7.Save Home Position button

Saves the present position as Home Position.

#### 8.Load Link Function menu

Includes the Create New Link File, Edit Link File, Open Link File, and Save Link Parameter menus.

#### 9.Call Link Function menu

By selecting link parameter data saved in the project, the data is set in the POS screen. (It is not displayed on the screen if it is a link file.) After the data is set, the position can be changed using the +- Link Movement button.

#### 10.One Direction Link Movement button

Moves in the opposite direction to the value specified in the position panel. Note: a link file needs to be loaded before the button is pressed.

#### 11.+- Direction Link Movement button

Moves toward the direction of the value specified in the position panel. Link file needs to be loaded before the button is pressed.

#### 12.Number of Frames

By changing the number of frames, operation from the previous position to the current position uses the number of frames specified. The length of time for the movement becomes the number of frames x the frame cycle.

#### 13.Status

(For details on LINK function, refer to "LINK / PARAMETER Function" section on page 62.)

## ● SingleServo

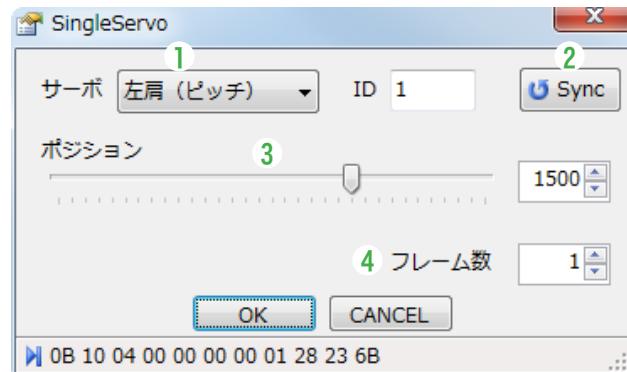


This control moves only a single servo. Select the servo you wish to move from the servo list and set its position using the track bar at the center of the dialog. The number of frames can also be set.

Number of valid connection points: Output 0 or 1

### ● Operating description

1. Select servo you want to move.
2. The position of the track bar and the angle of the servo are linked by pressing Sync button. (Servo moves.) \* Beware of the servo's output axis. Unexpected injuries such as catching your finger may occur.
3. The current position data is shown. You may also directly enter a value to make it move.
4. Assign the number of frames.



## Conditional Branching / Repeat

In the Conditional Branching / Repeat control, the motion flow direction is determined by satisfying the branching conditions such as analog input and others. The branch lines, indicating the desired motion flow, need to be connected according to the desired conditions. If the set conditions are insufficient, then the flow will not take place. This control does not support inline-running.

1. Arrange the control on the canvas using drag-and-drop.
2. For conditional branching control, first connect only two destinations to the control. Other controls can be connected later.
3. Double click the control to open the setting dialog.

### ● CmpAD



The dialog shown at the bottom left side of the screen opens when a CmpAD control is double clicked. Set the port, comparative operator, reference value and destination in the Setting dialog and then press OK to apply the settings.

The screenshot shows a Free Position control and a Hold Position control connected to the CmpAD controller.

#### ● Screen Process

- ▶ When AD port is larger than the reference value 100  
"Free2" position connected on the right is executed.
- ▶ When AD port is smaller than or equals to the reference value 100  
"Hold3" position is executed.

#### ● Part Names

##### 1.PORT

Select the analog port.

##### 2.Compare

Specify a comparative operator.

- ▶ When AD Value is \_\_\_ than the specified standard value:
  - = (equal to)
  - > (more than)
  - $\geq$  (more than or equal to)
  - < (less than)
  - $\leq$  (less than or equal to)
  - $\neq$  (not equal to)

##### 3.Reference Value

Specify a reference value.

##### 4.Destination

Select the destination for when the condition is met. Unconnected items are not shown.

##### 5.Sync button

Load present the analog value from the RCB-4HV

##### 6.Measured Value

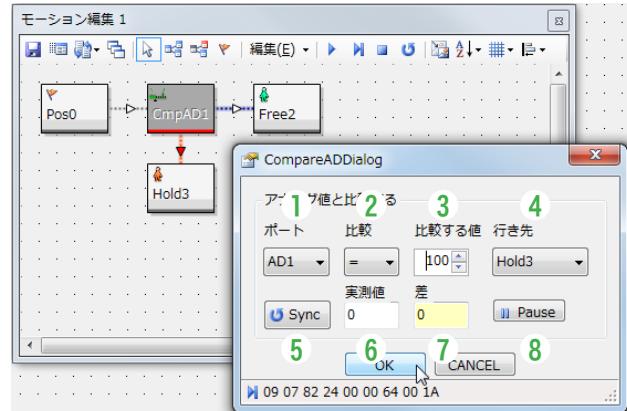
Displays the analog value of the port loaded when Sync button was pressed.

##### 7.Difference

The difference between the measured value and the reference value.

##### 8.Pause

Copies the measured value to the reference value.



## ● CompareButton



The motion flow branch is determined based on the button input values of the wireless controller. Motion flow can be branched based on the button input values and the analog input values from the wireless controller.

The desired button is selected by clicking the dialog button (↑, ↓, Δ, ○ etc.), and the corresponding control input values appear. By using the Method of Comparison (see 5 below) a motion can be executed by comparing the value set with the slide bar and the input value. When the button is clicked, the Method of Comparison is fixed at “=” (equal).

In the screenshot, when the button ↑ is pressed, the Pos1 control is executed after the servo parameter is changed. If this is not the case, the Pos1 control is run without changing parameters.

Number of valid connection points: Output 2

### ● Operating description

#### 1.Destination

Specifies the destination when button data condition is met.

#### 2.Switches automatically depending on the type of data set at the end.

#### 3.The corresponding control input value appears when each button is clicked.

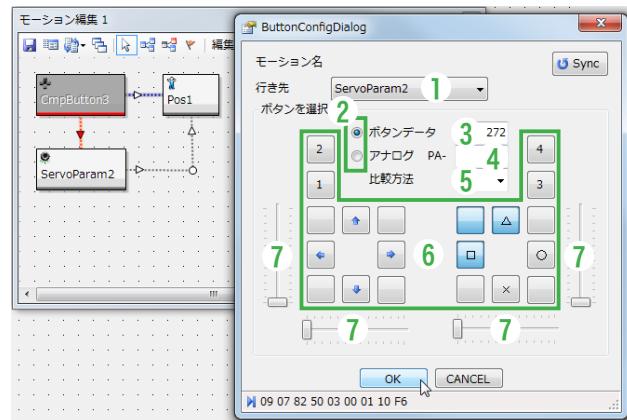
#### 4.The corresponding port name and analog values appear by scrolling the four track bars.

#### 5.Method of Comparison

Select a comparative operator when comparing with an analog value.

#### 6.Button

#### 7.Trackbar



## ● Cmp PIO



The ComparePIO control allows changing the destination depending on the state of the PIO.

### ● Operating description

#### 1. PIO Port

The desired PIO port can be selected from PIO1-PIO10. To validate, add a check mark to the check box.

A PIO port without a check mark can not be the branch target.

#### 2. State

The branching condition of PIO port can be selected from HIGH or LOW.

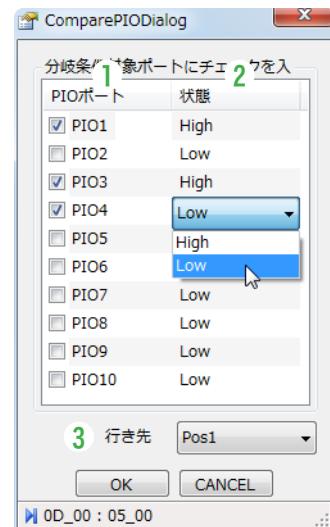
#### 3. Destination

Selects the destination control to which the process proceeds when the set condition is met. Unconnected controls can not be selected.

#### ► Caution

If multiple checkmarks are set, branching occurs when multiple conditions are met at the same time.

To use this control, be sure to set the PIO port you wish to use as the "input" for the PIOConfig control.



## ● CmpTmr



CompareTimer control creates branching processes based on the remaining time in the working timer.

### ● Operating description

#### 1.Timer

Up to three timers from T0 to T3 can be selected.

#### 2.Compare

Set the method of comparison between the remaining time in the timer and the value to be compared.

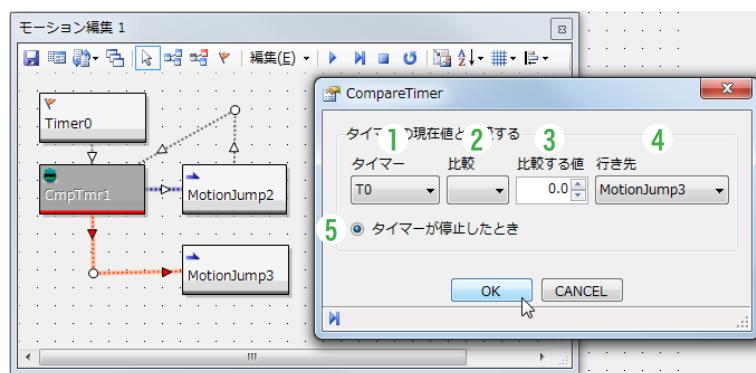
#### 3.Compared Value

The value that is to be compared with the timer's remaining time. The maximum value that can be set is 50 minutes (30000: unit 100ms).

#### 4.The destination is the control to which the process proceeds when the timer's comparison condition is met. The destination can not be specified when control is not connected by a branched line.

#### 5.When Timer Stops

When a check mark is added, the process moves to the control specified in "Destination" when the timer stops, not with the above condition. By adding a check mark and re-opening the dialog, the value to be compared will be 1, but ignore this since the value is NOT being compared in this case. In the example, motion 2 runs continuously until the timer stops.



### ▶ Precautions on Using Timer-related Controls

- ▶ The timer is a countdown timer. A countdown timer decreases its value in increments of 1.
- ▶ The timer increment is 1 count every 100ms.
- ▶ A countdown timer does not stop at 0 but stops when its value becomes negative. The timer final value will be 32768, not -1 in that case.
- ▶ If you wish to create a condition where the timer T0 > 1.0, the condition will be met when the timer stops since its value will be 32768. Be aware of this fact.

## ● CmpValue



CompareValue control is a control where a value is set in relation to the counter variable or a user variable, and then the motion flow branches according to the comparison result. In the screenshot, the posture changes by comparing the counter variable, which decreases every time a loop is repeated.

### ● Operating description

#### 1.Counter Variable

The counter variable can be chosen from C1 to C10. The counter variable is 1 byte, so it can be compared from -128 to 127.

#### 2.User Variable

The user variable can be chosen from U1 to U20. It is a 2 byte variable and can be compared from -32768 to 32767.

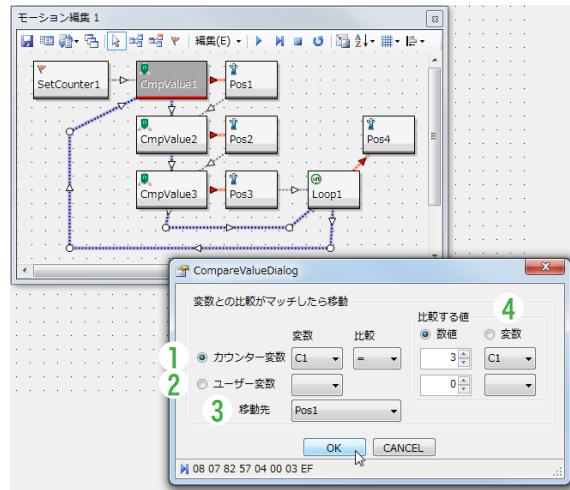
#### 3.Destination

The process proceeds to the specified destination when the set condition is met. Controls without a branched line can not be selected.

#### 4.Variable

Compares to the specified counter variable or user variable.

Note: Not enabled during inline-running.



## ● LoopCounter



The LoopCounter control is used in conjunction with a SetCounter control as a pair. The Counter number (C1 - C10) is set in the SetCounter control. When the LoopCounter control is run, 1 is subtracted from the set counter value each time, until the result is 0, then the process moves on to the specified control.

In the screenshot, first the SetCounter() control C1 counter is set to a number. When the process proceeds to the LoopCounter control, 1 is subtracted from the C1 counter. If the result is greater than 0, the Pos1, Pos2 controls are repeatedly run. When the result becomes 0, the MotionJump4 control is run, and the process proceeds to the specified motion.

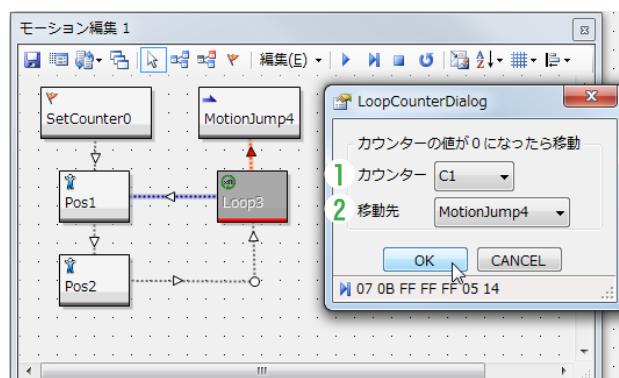
### ● Operating description

#### 1.Counter

Specifies the desired counter.

#### 2.Destination

The destination control to be used when the counter value set in SetCounter1 becomes 0 is selected from the name of the controls that are connected. Unconnected controls can not be selected.



## Set

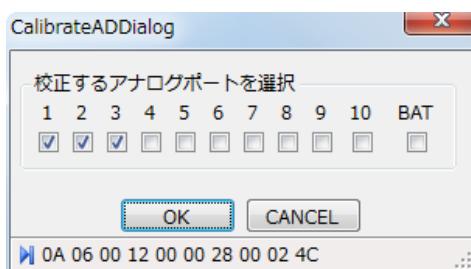
### CalibrateAD



Analog Value is calibrated.

Depending on the analog sensor, the output data may deviate with environment or over time. When the expected sensor reference output deviates, the mixing result will change. This control is used to recalibrate the analog sensor value to adjust for deviations.

Add a check mark to the analog port you wish to calibrate. The standard value for the port will be reset. This has the same effect as the mixing standard value setting in the RCB-4HV setting screen.



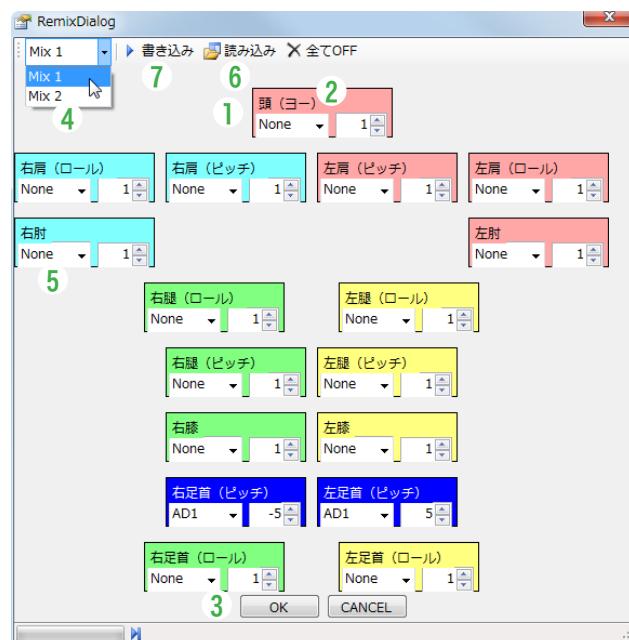
### Remix



The selection of the port and servo mixing factor can be changed. The panel needs to be selected for the set values to be valid. In the screenshot, only the settings for the two ankles (pitch) are valid.

#### Operating description

1. Select the servo for which you wish to change mixing setting by clicking.
2. In the mixing source selection menu and the value input field, specify the port and the mixing factor. Selecting "None" in the mixing source selection menu turns mixing off.
3. Press the "OK" button to save the setting for the selected servo only. The settings will not be applied if the port is not set, even if there is a check mark.
4. Mix1 or Mix2 can be selected from the menu on the upper left side of the dialog.
5. To cancel mixing of a servo for which mixing has already been set, select None and press OK button while the servo is selected.
6. To load the mixing setting saved in the RCB-4HV ROM, press the "Load" button.
7. Pressing the "Write" button immediately applies the mixing setting of the selected servo to the RCB-4HV. In this case, turning the RCB-4HV power off will disable settings.



## ● ServoParameter



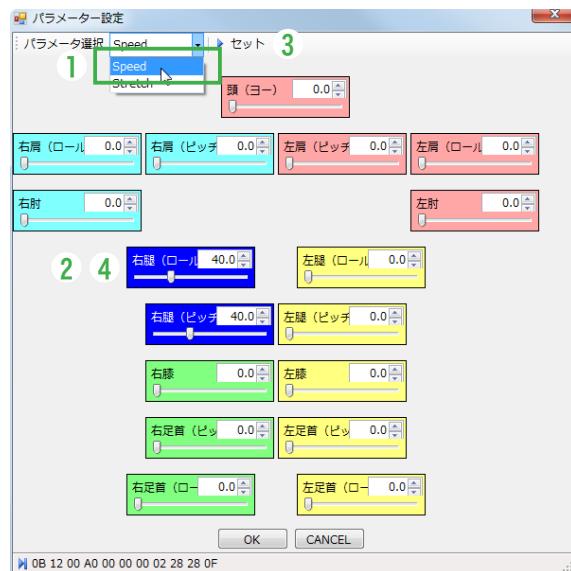
Stretch(Compliance) or speed of the servo is changed.

In the setting dialog, servo names, ID, insertion port and the parameter values are displayed. First, select the stretch or speed in the dialog. Then, enter a value by using the slider in the position panel or by entering in the value input field of the servo you wish to set. To apply the set parameters, select the position panel by clicking. The Command will not be correctly saved if the position panel is not selected. Clicking on a part other than the position panel cancels the selected state. Only the speed or stretch will be valid. 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.

To cancel the speed or stretch that was previously confirmed by pressing the OK button, turn off the selected state of the position panel and press the OK button.

### ● Operating description

1. Select Speed or Stretch in the parameter selection menu.
2. Set the parameter using the slider or the value input field of the position panel.
3. Click the position panel to select it (color changes to blue) before pressing the OK button.



## ● SetCounter



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

### ● Operating description

#### 1. Counter

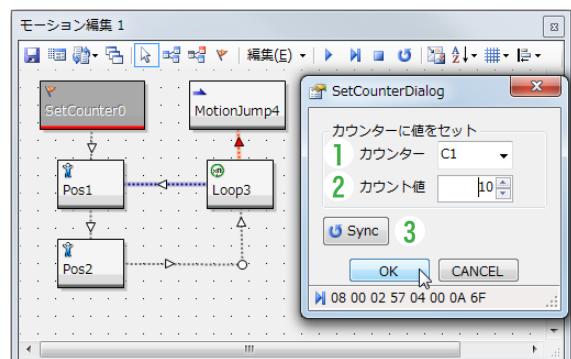
The counter area is specified.

#### 2. Count Value

Value to be stored. (0 - 255)

#### 3. Sync button

Store the value in the counter area. (Data is sent to the RCB-4HV, but is not currently used.)



## ● Timer



The Timer control is used by selecting the timer to be used and the maximum measurement time. The timer count begins when motion flow executes the Timer control.

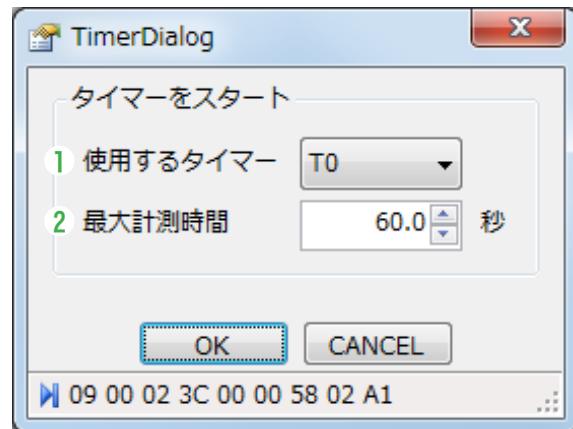
### ● Operating description

#### 1. Timer to be used

Up to three timers of T0 to T3 can be used.

#### 2. Maximum measurement time

When the set time arrives, timer stops. The maximum measurement time is 50 minutes (3,000 seconds).



## Motion Transfer

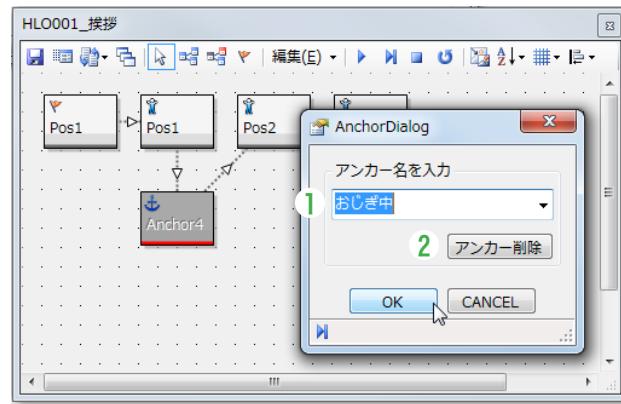
### ● Anchor



This control enables transfer from other motions using the MotionJump control by adding an anchor destination mark at an arbitrary position within the motion flow.

#### ● Operating description

1. Anchor name: Any unique name can be used.
2. Delete anchor: Deletes the anchor which is selected from pull-down menu.



#### ● How to Use an Anchor

1. Anchors are inserted into the motion flow. When an anchor is inserted, the motion flow stops at that point unless it is connected with a connection line.
2. When an anchor is inserted, make sure to build the motion. When the motion is built, the anchor position is confirmed in the ROM.
3. To jump to the anchor position, use the MotionJump control.
4. Anchor positions are not managed by the motion file, so be sure to save the project file.

#### ► Precautions

- Anchors can not be used unless the motion is built.
- To delete an anchor, make sure to press the "Delete Anchor" button to delete the anchor data before deleting the anchor control. Delete the Anchor control in the Motion editing window after pressing the Delete Anchor button.
- If an Anchor control is deleted in the Motion editing window before pressing the Delete Anchor button, place an Anchor control in the Motion editing window, select the anchor name from the pull-down menu, and then delete the Anchor control using the Delete Anchor button.

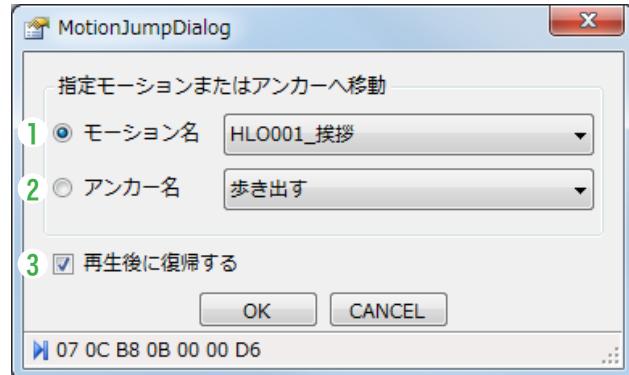
## ● MotionJump



Causes the motion flow to jump to the assigned motion. Adding a check mark in “Return After Running”, returns the motion flow to the present motion after it completes the motion flow at the jump destination. Other controls can be connected after the return. MotionJump does not function in inline running. Beginning with HeartToHeart4 Ver.2.0, anchors can be selected. To select, decide the anchor position beforehand.

### ● Operating description

- 1.A mark appears on the motion name button when the motion is selected from the Select Motion menu.
- 2.A mark appears on the anchor name button when the motion is selected from the Select Anchor menu.
- 3.Returns to the Motion Jump starting position after the motion is run or with the Return command, when a check is added to the check box.

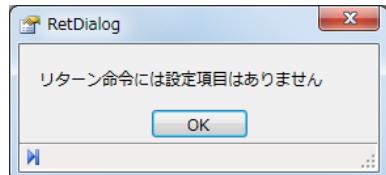


## ● Ret



Returns from the jump destination. The command is used in combination with a Motion Jump control, but since a Ret is automatically inserted at the end of each motion, it is not used independently other than when debugging to return in the middle of a motion. Does not function in inline-running.

A Return only returns to the calling position, so there are no parameters to be set.



## General Input / Output

### ● Pio

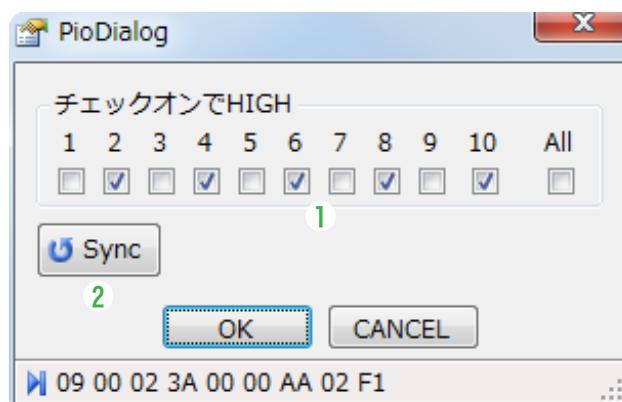


A High state (5 V) is output from the PIO port by turning ON the check box. A Low state (0V) is output when the check box is turned OFF. Synchronizes with the RCB-4HV by pressing the Sync button.

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

#### ● Operating description

- 1.A High state is output by checking the box. The state becomes Low when the check is removed.
- 2.Sends the check box state to the RCB-4HV.



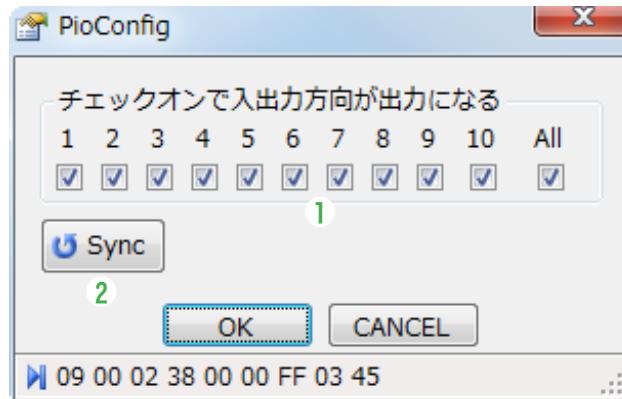
### ● PioConfig



Set the PIO port Input/Output. The Port is set as output when check box is turned ON. Synchronizes with the RCB-4HV when the Sync button is pressed. Starting with HeartToHeart4 Ver.2.0, the PIO port is set as input when the RCB-4HV starts up. Always use the PioConfig control when using outputs in Pio control.

#### ● Operating description

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



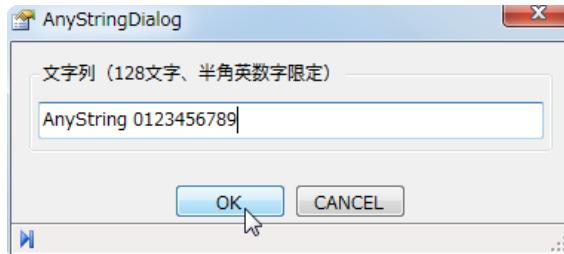
## Advance

### ● AnyString



Outputs an arbitrary string of English one byte characters from the COM port. Can be used to output notices such as motion run completion, and messages from the robot. The output data format is shown below. For details, please refer to the RCB-4HV Command Reference etc.

In inline-running, the returning data will be displayed.



Size	00h	English one byte character set	SUM
コマンド全体のデータバイト数	00h 固定	ASCII コード	SIZE～セットした文字列までの総和を 255 で割った時の余り。 255 に満たない場合はそのままの数値。

Example: The data that is returned when "ABC" is set in the AnyString control. (Numerical value is hexadecimal.)

Size	Fix	ASCII Code	SUM
データ数は全部で 6 バイト	00h 固定	「A」「B」「C」の ASCII コード	チェックサム $(06h+00h+41h+42h+43h)\% FFh = CCh$

## ● Calc



In the Calc control, calculations (operations) can be carried out on one of the following: servo position, servo trim, MIX1 factor, MIX2 factor, analog standard value, control input value, counter, and user variables. Individual values can be specified as the calculation source data from the source list. Selecting from the source list adds a mark on the button. Since it is written to the RAM, the written data will become invalid once power is shut down.

For example, when a +100 calculation is applied to a servo whose current value is 7500, the position of the servo moves to 7600.

### ● Operating description

#### 1. Servo position

Calculation can be carried out on the current servo value specified in the source list.

#### 2. Servo Trim

Calculation can be carried out on the servo trim specified in the source list.

#### 3. MIX1 Factor

Calculation can be carried out on the servo MIX1 factor specified in the source list.

#### 4. MIX2 Factor

Calculation can be carried out on the servo MIX2 factor specified in the source list.

#### 5. Analog Standard Value

Calculation can be carried out on the analog standard value trim specified in the source list.

#### 6. Control Input Value

Calculation can be carried out on control input value with the check mark.

#### 7. Counter

Calculation can be carried out on the counter variable (C1-C10, only 1 byte calculation).

#### 8. User Variable

Calculation can be carried out on the user variable (U1-U20, only 2 byte calculation).

#### 9. Calculated Value Field

Enter a value to calculate the source on the left. Only integers can be entered as the calculated values.

#### 10. Execute Calculation button

Calculation is carried out temporarily. In the screenshot, 50 is added to the trim value of the head. Be careful, as the robot will actually move when calculation is executed.

#### ▶ Precautions

- ▶ The data prior to calculation will be overwritten by the calculation result.
- ▶ If the calculation result exceeds 1 byte or 2 bytes, certain values may become negative. Malfunctions resulting from such situation are not taken into consideration by the program. Use with caution as servo may go out of control.



## ● UserCalc



UserCalc コントロールは Calc コントロールと同じ使い方ですが、計算値は直接指定せずにカウンター変数またはユーザー変数から選びます。例えば現在値が 7500 のサーボモーターに + U03(200 が入っているとする)の計算を行うとサーボモーターのポジションは 7700 となります。計算結果はサーボポジションやトリムなどのソースに反映されます。データは RAM に書き込まれますので、書き込んだデータは電源を消すと無効になります。

ソース欄内容については Calc コントロールを参照してください。

### ● 各操作部の説明

#### 1. ソース (計算元データ選択欄)

計算元データ種類を選びます。

#### 2. 計算種類

計算の種類を選びます。

#### 3. 計算値欄

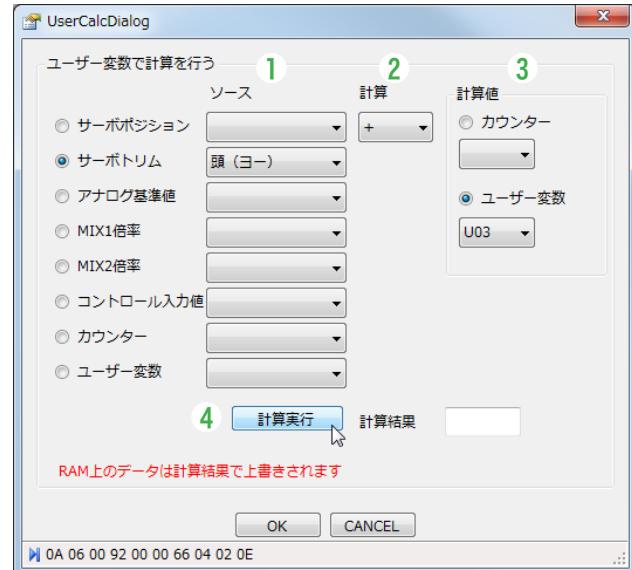
計算値をカウンター変数またはユーザー変数から選びます。

#### 4. 計算実行ボタン

計算実行ボタンでは計算を一時的に行います。図の例では、サーボモーターの頭 (ヨー) のトリム値に U03 に保存されている値を足し合わせます。

#### ▶ 注意事項

- ▶ 計算元データは計算結果より上書きされます。
- ▶ 計算結果が 1 バイトまたは 2 バイトを越えると値によっては負数となります。その場合の誤動作については関知していません。サーボモーターなどは暴走する恐れがありますので、注意して使用してください。
- ▶ このコントロールではカウンター変数やユーザー変数を初期化していません。かならずカウンター変数やユーザー変数を SetValue コントロールなどで適当な値に初期化してから使用してください。初期化をせずに計算を実行するとサーボモーターなどが意図しない位置へ移動する可能性があります。
- ▶ MIX1 倍率、MIX2 倍率、コントロール入力値、カウンターへの計算値はカウンターのみです。



## ● GetValue



GetValue control sends the RCB-4HV RAM data to the COM port, counter, or user variable. It is used for reading current values with PC, or saving to a user variable.

### ● Operating description

#### 1. Current Servo Value

Outputs the current value of the servo selected from the servo list on the right side.

#### 2. Servo Position

Outputs the target position of the servo selected.

#### 3. Servo Trim

Outputs the trim value of the servo selected.

#### 4. Analog Standard Value

Outputs the standard value of the analog port selected.

#### 5. Analog Conversion Value

Outputs the current value of the analog port selected.

#### 6. Control Input Value

Outputs the input value of the control selected.

#### 7. Counter

Outputs the current counter value.

#### 8. User Variable

Outputs the current user variable.

### ● Output Direction of Obtained Data

#### 9. COM Output

Outputs the data obtained from the COM port. Output formats from the COM port are as follows:

##### ▶ 1 Byte Data (PA1-PA4, for counter)

04 00 DATA SUM

##### ▶ 2 Byte Data (other than 1 byte data)

05 00 DATA\_L DATA\_H SUM

##### ▶ Data

1 byte data

##### ▶ Data\_L

Low 1 byte of the 2 byte data.

##### ▶ Data\_H

High 1 byte of the 2 byte data.

##### ▶ SUM

##### ▶ For 1 byte data

04 + DATA rounded by 1 byte (255)

##### ▶ For 2 byte data

05 + DATA\_L + DATA\_H rounded by 1 byte (255).

#### 10. Counter

Stores data in the specified counter.

#### 11. User Variable

Stores data in the specified user variable.



## ● Restart



RCB-4HV is rebooted through software. There are no items to be set.



## ● SetValue



SetValue control allows directly applying values to servo position and analog standard value etc. Since it is written to the RAM, the written data will become invalid once power is shut down.

### ● Operating description

#### 1. Servo Position

The position of the servo.

#### 2. Trim Position

The trim value of the servo.

#### 3. Analog Standard Value

The standard value for analog input.

#### 4. Controller Button Data

An arbitrary value can be written in the button code, PA1 to PA4. All values are written at the same time.

#### 5. Counter

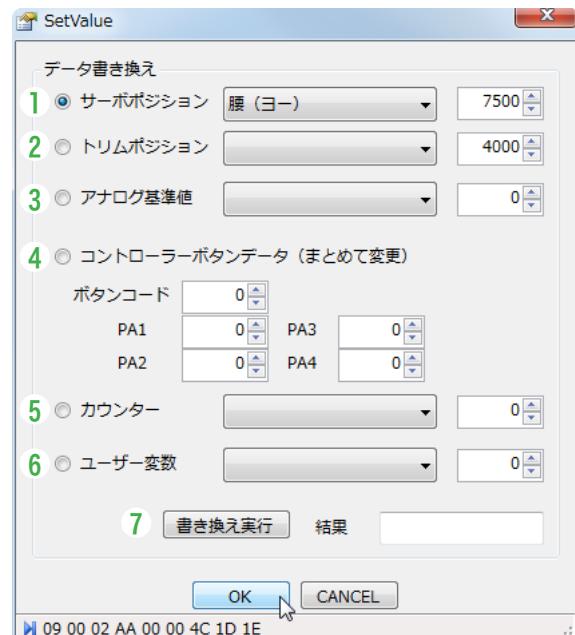
An arbitrary value can be written in the counter variable (C1 to C10).

#### 6. User Variable

An arbitrary value can be written in the user variable (U01 to U20).

#### 7. Execute Rewrite button

Rewrite is temporarily executed. Be careful, as the robot will actually move when executed.



## ● StickMix



The StickMix control performs mixing on an arbitrary servo, based on the analog stick input values of a KRC-3 or other remote control. Servos other than the servos set in the Project Setting Window, such as those set in the System Set Window, can be targets of mixing.

Even if mixing is set to a servo set in the Project Setting Window, the servo position will return to that set in the motion when running other motions. For the servos set in the System Setting Window, the last mixing position will be retained even after running other motions. Unlike analog mixing, mixing occurs only when a StickMix control is executed within the motion.

When using the KRC-3AD, please be careful, because tilting the analog stick to the extreme will have the same effect as pressing the button. When running a control to which StickMix is applied, tilting the stick to the extreme while running motion using an assigned button could cause another button to be pressed, thus inhibiting the motion running as expected.

### ● Operating description

#### 1. Source

Specifies the input source to be used in applying analog stick mixing. PA1 to PA4 provide analog data of extended low-speed serial data. PA1 corresponds to the up-down direction of the left stick, PA2 to the left-right direction. PA3 corresponds to the up-down direction of the right stick, PA4 to the left-right direction.

#### 2. Offset

The tilt angle of the stick becomes a value of 0 to 127. In the Neutral position, half its value, i.e. 64, will be output. To set the center neutral position as the standard value of 0, use the offset. In this case, by setting the offset at 64, the stick operating range becomes -64 to 63, instead of 0 to 127. Offsets can be set in the range of 0 to 127.

#### 3. Factor

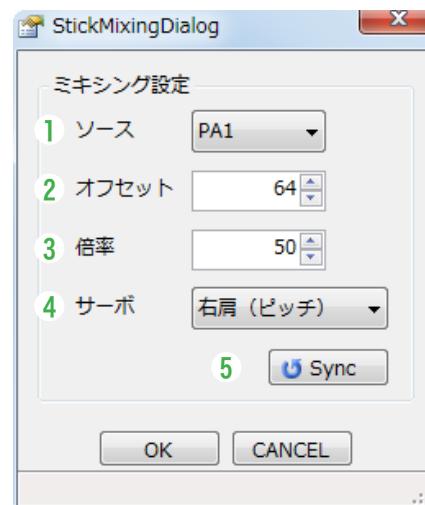
The tilt angle of the stick can be amplified in the range of -128 to 127. Beware of the servo's maximum angle to avoid accidentally damaging the servo.

#### 4. Servo

Select the servo you wish to apply mixing to.

#### 5. Sync

By changing the source, offset, factor, and servo settings while pressing this button, the servo will actually move.



### ● Calculation Formula

Mixing is implemented using the following equation.

`servo position = ("PAn value" - "Offset") x "factor" + "servo neutral=7500"`

For example, when PA1's value is 100, offset is 64, and factor is 50, servo moves to the 9300 position when executing this control.

## ● StickMix2



コントローラーのスティックの傾きをユーザー変数に代入します。URemix コントロールと併用して、サーボモーターにスティックの傾きをミキシングできます。

### ●各操作部の説明

#### 1.ソース

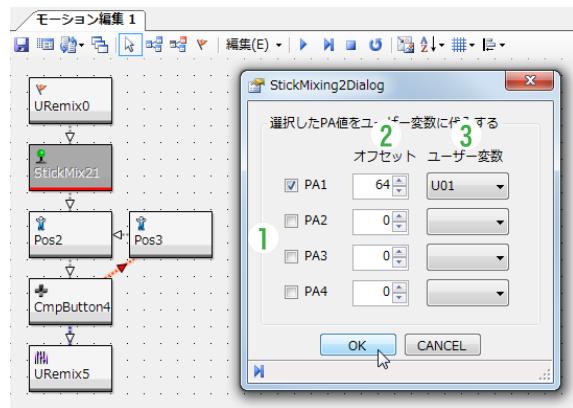
ミキシング設定をしたいスティックの番号を PA1 ~ PA4 から選びます。複数選択できます。

#### 2.オフセット

オフセット（スティックのニュートラル位置、スティックに手を触れていないときの値）を設定します。オフセットはスティックごとに異なりますので、必ず設定してください。

#### 3.ユーザー変数

スティックの傾きを指定したユーザー変数へ代入します。各スティックには同じユーザー変数を割り当てることはできません。



### ●StickMix2 の使い方

1. モーションでミキシングをかけたい動作の直前に URemix コントロールを配置します（例では URemix0）。URemix コントロールではミキシングをしたいサーボモーターにユーザー変数と倍率を割り当てておきます。
2. StickMix2 コントロールを配置して（StickMix21）、ミキシングの元になるスティックにチェックマークを入れて、ユーザー変数を割り当てます。モーション内でこのコントロールが実行されるとユーザー変数にミキシング値がコピーされるので、次にサーボモーターが動くときにミキシングがかかります。
3. モーションを抜けるときには、ミキシングのトラブル回避のために再度 URemix コントロールを配置し、ミキシングのユーザー変数割り当てを解除しておくとよいでしょう（URemix5）。

#### ▶ 注意事項

- ▶ 起動時はユーザー変数が初期化されていませんので、何も初期化しない状態で StickMix2 コントロールや URemix コントロールを使用すると、サーボモーターが意図しない位置へ移動する可能性があります。必ず URemix コントロールとペアで使用して、ミキシングの ON/OFF を切り替えるか、SetValue コントロールなどでユーザー変数を初期化してください。

## ● Swap



Swaps the RAM counter value (C0 - C10) or the user arbitrary variable (U01 - U20). In the screenshot, counter values are swapped at the button condition branch by entering a value in the counter variable using SetValue control.

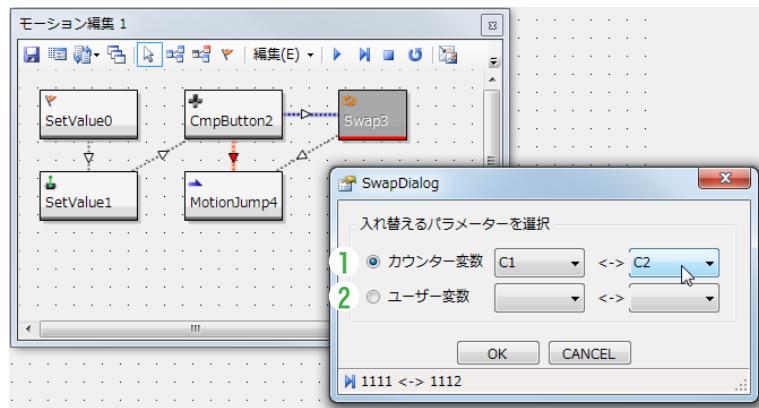
### ● Operating description

#### 1.Counter Value

Swaps counter variable.

#### 2.User Variable

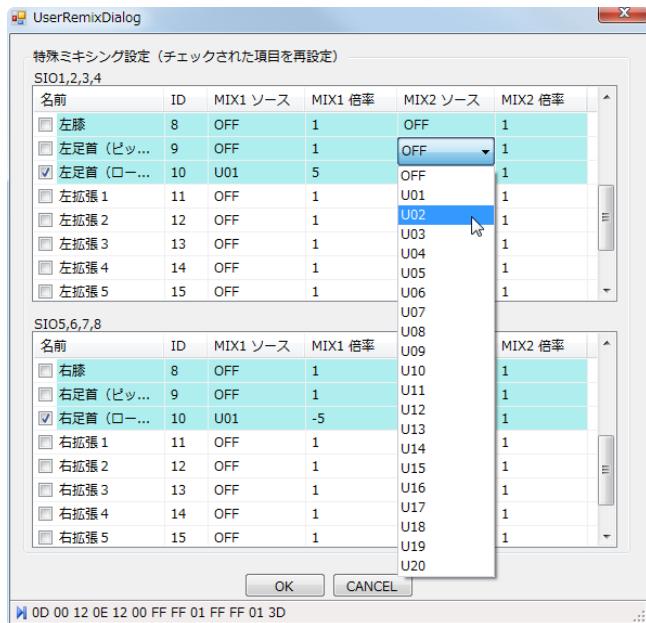
Swaps user variable.



## ● URemix



The URemix control is similar to the Mixing tab in the Project Setting Window, except that the user variable can be used as the mixing source. To validate the mixing settings, check the box on the left of the servo name. To cancel the setting, uncheck the box.



A user variable must be specified. When a value is substituted in the user variable by other motions (SetValue control), the mixing result of the specified servo changes. For example, if the U01 user variable address is set to x 3 by the URemix control and 10 is set for U01 in the SetValue control, the servo selected by the URemix control will be subjected to mixing of U01 x 3 = 30.

In the initial state, the mixing setting of the project is displayed. Mixing setting of the servo with the check mark will become active. An AD port can not be newly selected as the mixing source, but its factor can be changed.

### ▶ Precautions

- ▶ The value of user variable at RCB-4HV start-up is undefined. Always be careful to set the user variables first, and then execute the URemix control.
- ▶ Mixing will change even when rewriting user variables in other controls such as Calc. (Conversely, mixing can be adjusted according to the result of the Calc control.)

## ● Wait



The Wait control is a control that stops motion by setting the timer to be used and the stop time.

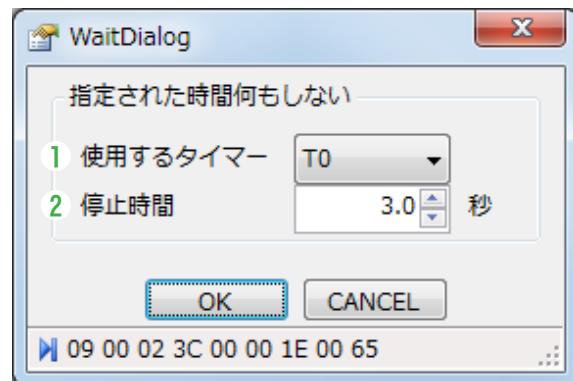
### ● Operating description

#### 1. Timer Used

Up to three timers from T0 to T3 can be used.

#### 2. Maximum Measurement Time

Timer stops when the set time comes. The maximum measurement time is 10 minutes (600 seconds).



# Appendix List of Sample Motions

## Project Specifications

● **Project Name**

Hello\_KHR3(V2.0).h4p

● **Frame cycle**

15ms

● **COM Communication Speed**

1.25M

● **ICS communication speed**

115K

## Running Motion Precautions

● The robot may make unexpected movements or fall. Always operate the robot in a wide space free of nearby objects. An open space of 1 sq. meters or more is recommended for the sample motions included with the kit.

● Robot should be operated on a level surface without bumps, holes, or edges. The robots motion may differ depending on the surface condition. Motion-surface combinations are:

<b>Top of conference room table, flooring, p-tiles</b>	○
<b>Concrete, linoleum</b>	△
<b>Poly vinyl chloride sheet, cutter mat</b>	△
<b>Thin carpet (industrial carpet squares)</b>	○
<b>Thick carpet, asphalt, dirt</b>	not recommended
<b>Tile, tatami</b>	possible

○ = Best

△ = OK

● Due to qualities unique to the assembly process and robot variation, some sample motions may not run properly. In those cases, some trim adjustment and possibly adjustment of the motion itself may become necessary.

## Sample Motion List

Motion Number	Motion Name	Description
<b>HLO001</b>	Greeting	Bows slowly. This motion is used as example in this manual.
<b>HLO002</b>	Home Position (Hello_KHR3)	Home position of this project. Sample motions in this project always return to this position.
<b>HLO003</b>	Wave	Wave right arm while swinging.
<b>HLO004</b>	Hip, hip hurray!	Pull down right arm twice and then raise fist.
<b>HLO005</b>	Chagrined	Drop on all fours, and bangs right arm on ground.
<b>HLO006</b>	Handstand	Bend forward and do a handstand.

Motion Number	Motion Name	Description
<b>HLO007</b>	Clap routine (always build in M40)	Sub program of clap-type motion. Not used singularly. *Sub program should not be run singularly. *Always build into motion number M40.
<b>HLO008</b>	Clap (call M40_counter 10 times)	Clap 10 times. Can change number of claps by changing the counter value.
<b>HLO009</b>	3-3-7 rhythm clap (call M40)	Claps the “3-3-7” rhythm. Can change rhythm by changing value in counter.
<b>HLO010</b>	Push-ups (counter 10)	Stretches out front and does 10 push-ups. Can change number by changing value in counter.
<b>HLO011</b>	One legged knee bend (counter 5 times)	Bend and stretch right knee while keeping left leg straight to the front. Can change the number by changing the counter value. * Puts a heavy load on the right leg servo, so do not run repeatedly.
<b>HLO012</b>	Bunny hop A (counter 3 times)	Jump forward 3 times from a crouch position. Jump with slightly forward tilt. This motion is better suited on slippery surfaces such as flooring boards. * Adds heavy load on servo of lower body. Frequent running may cause damage to servo and frame.
<b>HLO013</b>	Bunny hop B (counter 3 times)	Jump forward 3 times from a crouch position. Jump with slightly backward tilt, and is better suited on surfaces with grip such as carpets. * Adds heavy load on servo of lower body. Frequent running may cause damage to servo and frame.
<b>HLO014</b>	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.
<b>HLO015</b>	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.
<b>HLO016</b>	Safe walk (forward_counter 5 steps)	Slowly walks 5 steps forward. Can change the number of steps by changing the counter value.
<b>HLO017</b>	Safe walk (backward_counter 5 steps)	Slowly walks 5 steps backward. Can change the number of steps by changing the counter value.
<b>HLO018</b>	Safe walk (left step_counter 5 steps)	Slowly walks 5 steps to the left. Can change the number of steps by changing the counter value. * This motion is assumed to be operated on a gripping surface such as carpet and may not operate smoothly on a slippery surface such as flooring. The problem may be resolved by using the optional “sole grip” .

Motion Number	Motion Name	Description
<b>HLO019</b>	Safe walk (right step_counter 5 steps)	<p>Slowly walks 5 steps to the right. Can change the number of steps by changing the counter value.</p> <p>* 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 using the optional “sole grip” .</p>
<b>HLO020</b>	Quick turn A (left_counter 5 times)	<p>Turns around 5 times to the left by shuffling feet on the spot. Can change the number of steps by changing the counter value.</p>
<b>HLO021</b>	Quick turn A (right_counter 5 times)	<p>Turns around 5 times to the right by shuffling feet on the spot. Can change the number of steps by changing the counter value.</p>
<b>HLO022</b>	Regular walk (forward_counter 5 steps)	<p>Walks 5 steps forward at a relatively high speed. Can change the number of steps by changing the counter value.</p> <p>* Due to unique characteristics of each robot, it may not be able to walk straight or fall. Attempt trim adjustment.</p>
<b>HLO023</b>	Regular walk (backward_counter 5 steps)	<p>Walks 5 steps backward at a relatively high speed. Can change the number of steps by changing the counter value.</p> <p>* Due to unique characteristics of each robot, it may not be able to walk straight or fall. Attempt trim adjustment.</p>
<b>HLO024</b>	Regular walk (left_step_counter 5 steps)	<p>Walks 5 steps to the left at a relatively high speed. Can change the number of steps by changing the counter value.</p> <p>* Due to unique characteristics of each robot, it may not be able to walk straight or fall. Attempt trim adjustment.</p>
<b>HLO025</b>	Regular walk (right_step_counter 5 steps)	<p>Walks 5 steps to the right at a relatively high speed. Can change the number of steps by changing the counter value.</p> <p>* Due to unique characteristics of each robot, it may not be able to walk straight or fall. Attempt trim adjustment.</p>
<b>HLO026</b>	Kick ball forward (left leg)	<p>Kicks ball positioned in front of left leg forward. Compliant to KONDO CUP Official Ball and colored rubber balls.</p>
<b>HLO027</b>	Kick ball forward (right leg)	<p>Kicks ball positioned in front of right leg forward. Compliant to KONDO CUP Official Ball and colored rubber balls.</p>
<b>HLO028</b>	Kick ball sideways (left leg)	<p>Kicks ball positioned on the side of left leg to the left. Compliant to KONDO CUP Official Ball and colored rubber balls.</p>
<b>HLO029</b>	Kick ball sideways (right leg)	<p>Kicks ball positioned on the side of right leg to the right. Compliant to KONDO CUP Official Ball and colored rubber balls.</p>

Motion Number	Motion Name	Description
<b>HLO031</b>	Kick ball backward (right leg)	Kicks ball positioned behind the right leg backward. Compliant to KONDO CUP Official Ball and colored rubber balls.

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

Required Equipment: KRI-3 transmitter (KRC-1, KRC-3AD, etc.), receiver (KRR-1, etc.), and the related connection cables

## Sample Motion List - Wireless/Remote Control

Motion Number	Motion Name	Setting Number
<b>HLO016RC</b>	Safe walk (forward) wireless-applicable	1
<b>HLO017RC</b>	Safe walk (backward) wireless-applicable	2
<b>HLO018RC</b>	Safe walk (left step) wireless-applicable	8
<b>HLO019RC</b>	Safe walk (right step) wireless-applicable	4
<b>HLO020RC</b>	Quick turn A (left) wireless-applicable	1024
<b>HLO021RC</b>	Quick turn A (right) wireless-applicable	4096
<b>HLO022RC</b>	Regular walk (forward) wireless-applicable	513
<b>HLO023RC</b>	Regular walk (backward) wireless-applicable	514
<b>HLO024RC</b>	Regular walk (left step) wireless-applicable	520
<b>HLO025RC</b>	Regular walk (right step) wireless-applicable	516

\* Motion continues as long as the assigned transmitter button is pressed.

# Glossary

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## ● Mouse

Click	..... Press the mouse button once and immediately let go of the button.
Left Click	..... Click the left mouse button once.
Right Click	..... Click the right mouse button once.
Drag	..... Move the mouse while holding on the mouse button down.
Drop	..... Release the mouse button after dragging.

## ● Window

Focus	..... Condition under which the buttons and other controls are selectable and functional.
Dialog	..... A modal window where the focus can not be changed unless the operation in that window is completed.
OK Button	..... A button which says "OK" or "YES".
Active	..... The condition where the window is focused, selectable, and functional.

## ● Hardware

IO	..... INPUT and OUTPUT.
AD	..... Analog-Digital converter; converts an analog voltage into a digital numeric value.
PIO	..... Programmable IO. Input and output can be switched using 2 digital values (may be chosen between 0 V or 5 V).
COM	..... Communication port.
GND	..... Ground. In this manual, the point where 0 V is obtained.
bps	..... Bits per second. Data transfer rate. Refers to the number of bits transferred per second.
EEPROM	..... Electronic Erasable Programmable ROM. ROM (Read Only Memory) that can be electrically written/erased. ROM data is not lost even with the power off. May be referred to simply as ROM in this manual.
RAM	..... Usually refers to Random Access Memory, but in this manual RAM refers to all volatile memory. RAM memory loses its data when the power is shut off.
ROM	..... Read Only Memory. ROM memory retains its data even when the power is shut off. The RCB-4HV uses EEPROM so read/write operations can be repeated.

## ● SOFTWARE

Menu	..... A list of items that can be selected. When selected, the corresponding process is performed.
Pull-down	..... When the pull-down menu is selected using the mouse, a more detailed list appears with selections.
Main Menu	..... The pull-down menu in the main window.
Toolbar	..... The selection of clickable icons/processes that appear in a movable bar.
ComboBox	..... A box-shaped pull-down menu. Some ComboBoxes allow entering text.
csv format	..... The CSV (Comma Separated Values) data format includes data fields separated by a ','. This is used to import/export data in a format that can be read and changed using other applications like a spreadsheet program.

## ● Keyboard

CTRL	..... Control key
SHIFT	..... Shift key
SPC	..... Space key
ALT	..... Alt key
ENTER	..... Enter key
DEL	..... Delete key

- + ..... Press two keys simultaneously. For example: "CTRL + X" means to press the X key while pressing the Control key.

## ● Robot Servo Device

Servo	..... A motor equipped with a position feedback circuit that allows it to adjust its rotational angle.
Serration	..... The ridge on the servo axis for the purpose of easy attachment of arms etc.
Servo Horn	..... The servo horn is attached to the servo drive shaft serration and transmits rotational movement to parts connected to the horn.
Trim	..... The offset from a center position that can be specified by the servo. This occurs due to misalignment of the servo drive shaft serrations when the servo horn is attached. The adjustment of this offset is called trim adjustment.
Stretch	..... The stiffness of the servo motion. Compliance.
Gyro Sensor	..... A sensor that detects the angle and/or the angular velocity of the object it is attached to.
Mixing	..... Applying a factor to the rotational position of a servo based on sensor input or other conditions.
Free (powerless)	..... Condition where no force is applied to the servo drive shaft. The servo drive shaft can be moved freely by hand.
Hold (retention)	..... Condition where the servo is stopped at its current position and tries to maintain that position.
Teach	..... Mode in which the current servo drive shaft is free and the shaft rotation position is frequently updated. The servo value is saved when hold the state is obtained after rotating output axis of servo to the desired position.
Frame cycle	..... The time base interval for commands sent to the servo when setting the servo rotational angle. The Frame Cycle can be set to 10, 15, 20, or 25 ms for the RCB-4HV.
Number of frames	..... When rotating a servo from one angle to another, the motion is smoothed by dividing it into a number of frames. The time that it takes to move from the beginning angle to the final angle is referred to as the frame cycle. For example, when a motion of ten frames takes place at a frame cycle of 10 ms, the total time would be 10 frames x 10 ms = 100 ms.
Neutral	..... The rotational center position of the servo motion, 7500. For simplicity, in the Robot Position Setting Window, Neutral is shown as 0.
Home Position	..... The robot's Standard Starting Position. Normally, a state where all motors are in their Neutral position.
Startup Position	..... The initial posture the robot assumes after booting.
Startup Motion	..... The first motion that is executed after the robot is booted and has moved to its startup position.

# Keyboard Shortcuts

Main Window	
<b>Ctrl+N</b>	Create new project
<b>Ctrl+M</b>	Create new motion window
<b>Ctrl+P</b>	Open project
<b>Ctrl+O</b>	Open motion
<b>Ctrl+S</b>	Save motion
<b>Ctrl+Shift+S</b>	Save all motions
<b>Ctrl+H</b>	Move to Home position
<b>Ctrl+Shift+H</b>	Save current position as Home position
<b>Ctrl+T</b>	Move to trim position
<b>F5</b>	Build
<b>F6</b>	Assemble
Motion editing screen	
<b>S</b>	Select Mode (Select)
<b>C</b>	Connect Mode (Connect)
<b>B</b>	Branch Mode (Branch)
<b>F</b>	Flag Mode (Flag)
<b>Esc</b>	
	<b>[In Connect / Branch Mode]</b>
	Return connecting anchor point to one before. Return to Select mode when point becomes 0.
	<b>[Others]</b>
	Disable selected state of present selected control and move to Select mode
<b>Ctrl+Z</b>	Undo
<b>Ctrl+Y</b>	Redo
<b>Ctrl+X</b>	Cut
<b>Ctrl+C</b>	Copy
<b>Ctrl+V</b>	Paste
<b>Delete</b>	Delete
<b>Ctrl+A</b>	Select All
<b>Ctrl+Shift+A</b>	Reverse selected state
<b>T</b>	Convert
<b>D</b>	Divide
<b>Ctrl+R</b>	Change display name
<b>Ctrl+U</b>	Change size of selected control
<b>Ctrl+F</b>	Change font color
<b>Ctrl+B</b>	Change background color
<b>TAB</b>	Moves to the next control to be executed after the currently-selected control. If there are no controls to select, the control with the start flag will be selected.
<b>Ctrl+TAB</b>	Moves to the previous Control to be executed.
<b>ENTER</b>	The setting screen for the currently-selected control will open. When multiple controls are selected, the setting screen of the control that is created first will open.
<b>[</b>	Move the currently-selected control to the back (last).
<b>]</b>	Move the currently-selected control to the front (first).
Project Browser Window	
<b>Ctrl+X</b>	Cut

Project Browser Window	
<b>Ctrl+C</b>	Copy file
<b>Ctrl+V</b>	Paste file
Message Window	
<b>Ctrl+C</b>	Copy the selected list to the clipboard
<b>Ctrl+A</b>	Select all
<b>Delete</b>	Delete the selected list
Motion List Window	
<b>Delete</b>	Delete the selected Motion

# Trouble Shooting

## ● Program does not launch

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

## ● Robot returns to the Home position when booted, even after setting the posture in the Project Setting screen.

In the current version, when the project settings are saved to the ROM during posture created in the Project Setting screen or the Motion Setting screen, a dialog that asks whether to boot at the current posture or the Home position will be displayed. Select the desired posture in this dialog, and save.

## ● COM Port Communication Error

First, check the serial USB adapter HS connection.

In HeartToHeart4, communication can not be established without having a project loaded. First load a project and then open the Project Setting Window.

Because the RCB-4HV communication speed can be selected from three different choices, sometimes communication can not be established when the RCB-4HV and the serial USB adapter HS settings do not match. When a COM port is selected, the port becomes active under the standard state. Open the Project Setting screen, and select the communication speed you wish to use in the "COM communication speed" ComboBox. The RCB-4HV setting is rewritten after selection.

The RCB-4HV setting must be saved to ROM or else it will be lost after rebooting.

## ● Wireless controller does not operate.

Check the following items:

KRI-3 is connected to one of the ports from SIO5 to 8.

Communication speed of servo and KRI-3 coincide. To change the communication speed of the KRI-3, the ICS USB adapter HS and manager software for KRI-3 are necessary.

Turn the KRI-3 power on, while the KRR1 is attached.

Restart or reboot after writing button data.

Data written to the ROM becomes valid only after rebooting.

## ● The message “unreachable control exists” appears in Build.

This message appears when there is a control to which a line is not connected in the Motion editing window. In such case, the unreachable control becomes selected on canvas after building is completed. Although the message will appear, there is no problem with the data written.

## ● Motion does not operate correctly.

A motion does not operate simply by laying out the controls. Always double click the control to open the Setting dialog and click OK after setting to confirm the setting. When setting is confirmed, the program to be run by the 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 will appear. Please check the connection state.



## Contact Information

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(Inquiry by email is welcomed. However, please be informed that replies may require some time.)