RCB-3J is a 3rd generation controller for robots, and it is used for KHR-2HV with more powerful and easier than previous controllers. The instruction of RCB-3J and HeartToHeart3J are written in this manual. Please refer to other manuals with this manual. For KHR-2HV assemble, please refer to assemble manual for KHR-2HV at first.

CONSTRUCTION

EXPLANATIONS OF HARDWARE
It explains how to connect the RCB-3J control board and so on. Also it introduces equipment that can be connected to it. Please read this explanation first.

HEART TO HEART 3J SOFTWARE

SOFTWARE
It explains details of the software. It can be referred to look for name or instructions of each work.

BEGINNING
Basic control of the software.
Making of simple motions.
Heart to Heart 3J has been used GUI interface.

INTERMEDIATE
Controlling with gyro sensor or remote control. It can be realized a lot of motions understanding this intermediate level.

Advanced technics and other sample motions have been shown at manufacture's web site. In case of needing repair service, please take a contact to the shop you purchased, or to Japanese distributor.

Distributor in Japan : iXs Research Corporation
http://www.ixs.co.jp   email to info@ixs.co.jp

http://www.kondo-robot.com
* This manual's contents and the software would be modified or updated without notice because of improvement or other reason.

* The software Heart to Heart 3J has been opened to the public on condition that customers utilize KHR-2HV. This robot kit is copyrighted and protected with other legal rights by Kondo Kagaku co., ltd. It's prohibited to distribute, exhibit or reverse engineering without permission.

* The company and products' name of the manuals are registered trademark or trademark of Kondo Kagaku co., ltd.

* The product was produced on condition for domestic users. It could be needed of permission or reports to each countries government depending on circumstances.

* The software would work with Windows2000 or XP. It should not be worked with virtual software or emulator environment.

* It is possible to use RCB-3J with other Kondo's servo motors, however there is limit.

  KRS-4014HV and 4013HV are ICS2.0 version. However it is not possible to control with RCB-3J.
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Characteristics for RCB-3J

RCB-3J is developed as 3rd generation controller for robots

- Renesas M16 MPU is adopted.
- This board has 24 output ports, which can be used as PWM output ports and H/L output ports.
- This board has 115200 bps high speed serial port and low speed serial port specialized for a radio control unit.
- This board has 3 analog input ports, and you can connect gyro sensor and so on to them. These can be used for mixing and bifurcation of motion.

Name

Specification

- Size: 35 x 45 [mm]
- Height: 14.5 [mm]
- Weight: 12 [g]
- Interface (input/output):
  - Output: 24
  - Input:
    - High speed serial connector: 1
    - Low speed serial connector: 1
    - AD input connector: 3
- Memory Capacity
  - Number of motion: up to 80
  - Number of motion components: up to 255
  - Number of scenario: up to 5
  - Count of motion in scenario: up to 200
- Driving Voltage
  - From DC 9 to 12 [V]

Specification of connector

Power connector

Take care for pin function if you make cables by yourselves.

Analog input connector

Signal

Maximum current for VDD pins for analog input connector is up to 50mA totally.

High speed serial connector

High speed serial connector can be connected a serial USB adapter, ICS PC interface2 cable.
High speed serial cable has 3 wire, and the black one is a GND, the other are signal wire.

Low speed serial connector

You can connect KRR-1, KRR-2 and KRI-1 radio receivers to this low speed serial connector.
Pin layout of low speed serial connector is that black line is a GND, red one is a Power and white one is signal.
How to switched on the board

RCB-3J does not have any switch for power on/off, the connection with battery is the switch for it.
Please use the cable with power switch in the case of KHR-2HV.
Please refer to the assemble instruction manual for KHR-2HV.

Concerning sample motions

22 sample motions are enclosed in the original CD-ROM for KHR-2HV. Each motions are available for appropriate assembled robot. KHR-2HV is a assemble kit, therefore, you should some modification for each motions by yourselves.
Install

Install a serial USB adapter

A serial USB adapter should be available in your computer in advance. Please refer to the instruction manual for a serial USB adapter.

Install the "Heart to Heart J " software

You can use softwares only to copy from a CD-ROM to a Hard disk on your computer.

1. You can find the "KHR-2HV" folder in a CD-ROM, and open it.

2. Please open "Software" folder.

3. "HTHJ.exe" is a controller for KHR-2HV, and please copy this file to your hard disk.
Start HTHJ software

Icons you use are categorized for 4 groups, and each tool bar can be used as floating windows as follow:

This figure shows that whole tool bars are floating windows.
Main menu

Load
You can use this icon when you read files. If you click this icon, you can find the dialog box.

Save
You can use this icon when you save files. If you click this icon, you can find the dialog box.

Environment setting for HTHJ window
You can change the parameter of this HTHJ software window.

- Width and Height: These parameters correspond with the size of data sheet window.
- Resolution of grid: You can change the resolution of grid.

If you check this box 「RCBのファイルアイコンを表示する」, data file will be shown at a special icon.

If you check following 4 boxes in 「表示」, you can show the menu bars on your window. 「Tool menu」, 「Parts menu」, 「Communication setting」 and 「Command menu」.

Information window
You can see the version information. If you want to close this window, please click "x" button.

Close
You can close HTHJ software when you click this icon. You can see this window after click, please bush (Y) button.
Tool menu

Tool menu is available when you connect RCB-3J to PC, please connect RCB-3J to PC in advance.

Trim setting

You can adjust the home position of each servos which corresponds to each output connectors.

Option setting

You can set parameters of RCB-3J.

- Start command is sent from RCB-3J when the motion is finished.
- Permits the play motion scenario from transmitter.
- Be control from KRC1.
- Play motion scenario from start switch.
- Play motion scenario when power switch is pushed.
- Play/Stop motion scenario when a battery below following voltage.

Analog setting

RCB-3J has 3 kinds of analog input function, and you can select it according to connected sensors.

There are 2 kinds of function using analog input as follow;
1. Realtime mixing
2. Motion interruption

1. Realtime mixing
Input signal is added to the output signal with some amplitude. This function is useful for gyro sensors.

2. Motion interruption
Motions are selected by the sensor value. This function is useful for accelerometer when robots fall down and wake up.

ICS setting

You can change servo characteristics by ICS in this software.

If you open ICS window, please switch off the power and switch on it again. Servos will be ICS communication mode.

You can get servo condition when you click button which located on the top of window.

If you double click each channels, you can change parameters in each. Also if you click "Initialize button" servos will be a original condition.

If you want to finish this function, please close this window and switch off the power and switch on it again. Servos will be driving mode.
Receiver button

You can monitor signals from receiver in this window when you use a radio transmitter.

You can use 4 commands as analog value, and you can apply each value to 1 Byte command each.

Data table viewer

You can download motion/scenario data from RCB-3J when you use data table viewer icon.

You can memory not only motion/scenario data but also data name and date.

Communication setting

- □ SYNC Synchronize switch
  - If you check this box, RCB-3J will move in real-time when you move slide bar.
  - If you don’t check it, RCB-3J will only move when you click “send button”.
  - This means that only current position of each servos will move, and motion and other parameters don’t change.

- ▼ COM8 Port selection
  - You can select COM port from this pull-down menu.
  - The serial USB adapter is recognized as virtual serial port in your computer. Please refer the device manager on your PC.
  - If you select a wrong port, RCB-3J can not communicate with your PC.
You can use this parts menu when you put on different parts on the data sheet.

**Select tool icon**
You can select parts and move it using this icon.

**Grid icon**
You can use the grid line when you check this box. If you use it, the parts will be located on this grid line.

**Starting position indicator**
You can set the starting position in your data sheet using this icon. If you put some icons on a data sheet, only the motion will run which includes "Starting point".

**Position icon**
You can put this icon when you make a posture(position) on a data sheet. If you click this icon on a data sheet, a window will open which corresponds with each icon. You can put up to 30 position icon on a data sheet.

**Set object icon**
If you click this button, following window will open.

You can use this icon between postures when you want to change parameters during motion. You can change mixing parameter, number of loop and so on in this icon.

This window does not have a save button, parameters are available when you closed this window.

<table>
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<th>Menu</th>
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| SET | | *教示で計測した値をパラメータにセットする*  
教示で計測した値をパラメータにセットする  
| | | *ループカウンタにループ回数をセットする*  
ループカウンタにループ回数をセットする  
| | | *比較レジスタに数値をセットする*  
比較レジスタに数値をセットする  
| | | *アナログ入力の基準値を校正する*  
アナログ入力の基準値を校正する |

This means that you can set a value by teaching function to the parameter. You can select FREE, SET1, SET2 and SET3, and the result of them are set to servo parameter. And it will be a start point to a next position.

This means that you can set a initial number of loop. This value is used by CMP icons which are introduced later.

This means that you can set a value to compare register. This value is also used by CMP icons. This will be a threshold value for bifurcation.
You can change the effect of force during moving if you use this set window.

**Compare tool icon**

You can select the following 10 bifurcation conditions:
- Jump when loop counter is not 0.
- Jump when AD1 value > register value
- Jump when AD2 value > register value
- Jump when AD3 value > register value
- Jump when PA1 value > register value
- Jump when PA2 value > register value
- Jump when PA3 value > register value
- Jump when PA4 value > register value
- Jump when button input = register value
- Jump when (button input and register value) >> 0

Button value is a command input value from receiver when you use radio control unit. If this equation is satisfied, the wire which is located on the lower part of this icon will select.

These "cmp" and "set" windows are for professionals. The detail of this function will be reported on the technical support website soon.

**Wiring icon**

You can connect this wiring icon between position, parameter, and bifurcation which are located on the data sheet. If you connect them with wire, you can make motions.

**Bifurcation icon**

If you put the cmp icon on a data sheet, you can put this icon after cmp icon, that is, the starting point of this wire should be cmp icon. If comparison of the equation in a cmp icon is satisfied, the icon which locate on the end of this wire will be executed.

**Compile icon**

If you click this icon, the data which is constructed by graphical icons will be calculated into numerical data which can be recognized by RCB-3J.

Usually this instruction will be executed automatically when you send the motion to RCB-3J.

Motions are constructed that you put posture icon, cmp icon and set icon on data sheet of HTHJ.

If you connect them with wire, the motion will be generated.
Command menu

🏠 Home position icon

If you click this icon, a robot will move to home position which is memorized in RCB-3J. Please take care a robot will move immediately when you click this icon.

🤖 Write icon

If you click this write icon, the motion data which are shown in data sheet will send to RCB-3J. If you click it, following window will open and you can select the motion number which you want. Press OK, then it will send to RCB-3J.

🗂️ Read icon

If you click this read icon, the motion which is memorised in RCB-3J are download from RCB-3J. If you click it, following window will open and you can select the motion number which you want. Press OK, then it will be downloaded from RCB-3J.

❌ Delete icon

If you click this icon, you can delete motions which you select. If you click it, following window will open and you can select the motion number which you want. Press OK, then it will be deleted.

⏹️ Stop icon

Stop the running motion.

⏸️ Pause icon

Pause the running motion. If you want to run again, please click start icon.

▶️ Start icon

If you click this icon, the following window will open and you can select the motion number which you want to start. Press OK, then it will start.
メッセージ The message will be displayed at Bottom of a window.

データステージ

Data stage is a campus which you make motions and scenario.
If you double-click each icons, you can find a window which corresponds
with each icons and you can modify and change some parameters and
conditions.

Also you can find the sheet tab on the top of data stage.
「EDIT 無効」is graphical motion data, and 「List」is numerical motion
data.

データダイアログ You can find the data dialog window if you double-click on a data sheet.

You can set and change some parameters such as
a motion data name, control input form receiver,
channel which robot use.

「データ名」means name of this motion.
「コントロール入力」means control input from
receiver. If you drive a receiver and push 「実行」
button which located this box, the control input
value will be displayed.

These parameters is same to them which you can set on data table window.
The difference between them is that parameters which modify on a data table will be
synchronized with RCB-3J simultaneously, however
parameters which modify this window is not synchronized with RCB-3J.

データシート上のオブジェクト

You can see the menu when you right-click of each parts on data sheet. In this menu, you can
change the color and name of item of the icon.
「選択解除」means "Cancel selection".
「コピー」means "copy".
「貼り付け」means "paste".
「変換」means "change".
「色」means "color".
「プロパティ」means "property".
「削除」means "delete".
This section introduces the procedure to make a simple motion using RCB-3J and HTHJ. RCB-3J has many kinds of function, however, it is easy to make simple motions.

1. First of all, please connect a serial USB adapter and setup it. Please make sure the number of COM port in the device manager of your computer.

2. Switch on the power after connecting a servo and a serial USB adapter to RCB-3J. The green LED on RCB-3J turns on for 2 seconds.

3. Start HTHJ software, and the status monitor will display the current status such as current time and connected COM port number. In this figure, it shows that current time is 19:31:35, and COM8 is available.

4. Please select COM port in a pull down menu. Then message board will display following figure.

If you select an unavailable COM port or the COM port is busy because the other software use it, you can find the error message in the message window. At that time, please select available COM port or close the other software.

5. Make sure that the check box for SYNC is filled. If you check it, your operation will be realized on a robot immediately.
6 Please put the pos icon on a data sheet. At first, click "POS" icon, then click on the datasheet. The pos icon will be shown in a data sheet.

7 Please double-click the pos icon, then POS window will open. At the initial condition of RCB-3J, all ports output 0V (L).
Right click on the panel which is connected a servo, and change the function to servo. Then you can find the slide bar on that panel.
If you click other position while setting, the pos window will close. Please re-open it with double-click again.

A servo will move corresponding with the position of slide bar after setting servo mode. Please make sure that a servo moves immediately when you move a slide bar. You can put off a servo after setting the initial position which you assemble a robot.

A servo moves immediately when you change the output condition to servo mode. Take care if you put some part on a servo such as servo hone and so on.

8 If a servo moves normally, please switch a servos to other one. And repeat this operation to all servos. Please use a port for this operation, don't use several port simultaneously because the channel function will be changed by your operation.

Please refer to KHR-2HV assemble manual for more information.
Home position is a most important posture, whole motions are moved based on this position. In general, the home position of a biped robot is standing position. Servos should be set center position of its driving range.

1 In adavance

In a previous section, whole servos are set to center position. Please assemble a robot refer to KHR-2HV assemble manual. In this section, we assume that KHR-2HV is assembled completely. Please check structures and wires are connected normally.

2 Change output condition to servo mode

You can change output conditions to servo mode which are connected servos in pos window. Take care servos will move immediately when you change it.

If you don’t check in the SYNC box, servos don’t move, please check it.

In the left figure, all servo position are 0. Close this window after setting them.
3 ホームポジションの設定。

Open the window for setting trim form tool bar.

In this window, you can make the home position using slide bar. These values depend on robots.

There is a limitation which you can adjust the home position in this window. Otherwise if the home position is in driving range of each slide bar, it may be not suitable one.

Because a servo has a driving range (normally 180 degree), and even if you make a home position in this window, some servos may be the edge of its driving range. The servo can not go that way any more.

4 ホームポジションの登録。

Right-click to open a menu on the POS window, and select 「ホームポジションにする」. Then current position becomes home position, and it becomes default position for all posture. After that, you can refer a home position immediately when you click “Default position” button on a main window and POS window.
Making of start-up motion

A start-up motion is a setting that the robot composed of RCB-3J works at the position of the home position when turning on power and starting. RCB-3J can be reproduced in the standard automatically by making an easy motion and setting, though it doesn't output the signal when starting. Making this start-up motion is based on the default position in the preceding clause assumption. Please work after doing the setting to the preceding clause. (This is only available when using our RED version specification servo.)

Sample motions for KHR-ZHV is enclosed to a CD-ROM. Also this instruction explain the usage of RCB-3J using these sample motions.

1 Placegment of POS1

You can select POS icon on a main window, and put it on a data sheet. The POS icon will appear.

The selection of POS, SET and CHMP icons are canceled when you put it on a data sheet. If you want to put them continuously, please select these icons every time.

2 Editing of POS1

When you double-click the POS1 icon, a POS window will open. In this time, whole servo mode switch to free in this window.

3 Setting of speed

The speed in a POS window should be 1 such as following figure.

The activated window will close automatically when you change following operation.

4 Placement of SET1

You can select SET icon on a main window, and put it on a data sheet. The SET1 icon will appear.
5 Editing of SET1

When you double-click the SET1 icon, a SET window will open. Select radio button for ‘設定で計測した値をパラメータにセットする’.

6 Placement of POS2

You can select POS icon on a main window, and put it on a data sheet. The POS2 icon will appear.

7 Editing of POS2

When you double-click the POS2 icon, a POS2 window will open. In this time, the default position data is used. When you click “Default position button” on the bottom of the window (‘+’ mark), the default position will be available on this window.

The speed in a POS2 window should be 100 because if you select this parameter small, a robot will move quickly and it is dangerous.

8 Wiring

The wire tool can connect each icons. The POS1, SET1 and POS2 are connected by wire in series. Wiring tool is not canceled when you select other icons on a main menu.

9 Specification of start position

The motion data should have a starting position. You can use start flag tool on a main menu when you set it. The start flag tool is also not canceled when you select other icons on a main menu. You can put only one start flag in a motion.
10 specification of start position

If you double click on an empty space in a data sheet, following window will open. You can denominate this motion as you like. In this time, it is denominate "start up motion". If you change this name, you can see its name on a tab in a data sheet.

11 Saving the created data

You can save motions which you make as a file.

You can denominate the file name as you like.

12 Confirming the destination of data transfer

It is better to confirm the current data before writing the data. Select "Data Table" from Data Table Window of Main Window. Please click the "read" button when the data table opens. A current content of data is read and displayed. The data name and other items are displayed when reading and saving it next time, if you display the data in Data Table once.

* You can keep to open Data Table window simultaneously with other windows.
13 sending the created data

You can send the displayed data to RCB-3J, by clicking the "writing button". Please note that the servo control connected to RCB-3J temporarily becomes a sleep, when writing. When opening "データ書き込み (Writing Data)" Window, select the place which you are going to send the data, and click OK button.

14 registration as a start-up motion.

Register the transmitted motion to execute it automatically when booting. Please open the "option setting" in the main window. When the option setting is opened, the start-up motion registered ahead is specified by "電源投入時にモーション・シナリオを再生する (When the power supply is turned on, the motion scenario is replayed)". Please close the option setting window after specifying. When the option setting window is closed, the content is written to connected RCB-3J.

After setting, turn the power supply of the board off once, and turn on power again. It is OK, if it move to the default position automatically when RCB-3J is started.

The start-up motion set here is effective to our RED version servo. It is ideal for the control board to move each servo to the home position set when starting slowly, but because the position of each servo is irregular when starting, there is no standard position to move slowly. The start-up motion made this time is a motion that slowly moves to the home position as a standard position that is captured at first, on the assumption that the connected servo is the Red version servo.
Making and execution of motion

You can make other motions in the same way if you made a start-up motion. Making and the execution of the motion are summarized again here.

1. Connection and turning on power supply
   - The power supply is turned on, with the status of connecting the servos to RCB-3J.
   - Each servo slowly moves to the initial position if a start-up motion is set.

2. Starting software
   - Start the software, HeartToHeart3J, and do the followings.
     - The communication ports, according to the port number of interface, are set. Please confirm it by displaying the message
     - Put the check in the synchronized switch. By this, The result of changing the state of each servo is reflected at once.

3. Create motion
   - This software creates the motion, by placing each object of the part menu on the data stage (データステージ).
   - Basic operation is placed by clicking POS (position) and further clicking on the data sheet.
   - The order of execution of each position is specified by connected wiring
   - The supplemented data between each position is created automatically by the software
   - Put the mark of the starting point on the one executed most first among the placed positions.

The number of motion

The number of the position and SET that can be placed in one motion is up to 30. But putting more than 30 is actually possible. However, when sending more than 30 motions to the board, it is a bit tricky. When 30 or more is placed, two storage area of the motion of the board are used. For instance, if 30 or more are placed in M1, M2 must be open.
4. Editing motion

It doesn’t actually operate, by only placing the positions, it is necessary to make the data of the placed position. The position window opens by double-clicking the placed position. The active position of each servo is decided in the position window.

5. Sending the created data

The created motion can be played by sending (Writing) it to RCB-3J. And it is also possible to play the motion more than the capacity of RCB-3J by saving the motions as the files and replacing them.

6. Playing motion

To play the motion, the play button is clicked. Specify the motion number in "再生する番号を選択してください (Select the motion number)" window. And, it is also possible to stop playing to click the pause button or the stop button.
Customizing position window

It explained the making procedure of a start-up motion by the previous section. Actually, you can understand the basic procedure of creating motion by making a start-up motion.
It is a POS object and a position window that open by double-clicking the POS object, that is used to make each servo work when the motion is actually made.

In the position window, you can make it easy to use further if various settings

The POS window opens by double-clicking placed POS.

The menu like the left opens by right-clicking in the background in blank area of the POS window. Various customizing is possible by using this menu.

The items are displayed by checking in the "表示 (display)" menu.
If you don't display an item, remove the check from corresponding menu item.
And by removing the check on "Fix the panel (パネルの固定)" below, the displayed panel can be moved.

The example below is when only a necessary panel is displayed, and moved according to the arrangement of the robot that uses the position.
In this example, you can move according to the servo placement of hands and feet, with a servo of 21 axes, and display.
you can change the background color, by selecting color from the "色 (color)" menu, or display the background image specifying the background image and checking the "背景の表示 (display the background image)". The panel that controls each servo can also change the view by right-clicking with the mouse and displaying the menu.

Example of changing panel color

Name change window

Setting of display rate
The numerical value is different for the case of the serial servo and PWM, though the active position of the servo in each panel can be displayed even by the numerical value.
Moreover, it is difficult to use the numerical value to know a actual position, because it is only displaying an internal value as it is.

By setting the display rate to cancel this, it is possible to make the displayed numerical value approximate by the value at an actual active position (angle).

Samples
PWM180° Moving Servo (KRS-2350HV etc.) ⇒ 0.69
PWM270° Moving Servo (KRS-4014HV) ⇒ 1.03
PWM260° Moving Servo (KRS-4024HV) ⇒ 1.0
The example below is specifying the photograph taken from the back of KHR-2HV as a background of the position window. The panel of each servo moves to the position that each channel shows.
The introductory chapter explained a basic operation. Only using the function to explain until now can move KHR-2HV. you can play sample motions. However, it is not full function of RCB-3J. In the middle chapter, let's use the advanced function such as a wireless control and master RCB-3J.
Setting of wireless control

When controlling by the wireless, RCB-3J provide two methods.
One is a method of using the button type transmitter such as KRC-1 wireless control set, KRT-2 and KRT-1, KRT-1 or KRT-3 connected to PC. Another one is a method of enhancing the command of a current wireless control. Here, it explains the setting method using the button type transmitter.

1. First, connect the receiver to RCB-3J. Following figure is an example when KRR-1 is connected. The transmitter is KRC-1.

2. Because RCB-3J is a setting to disregard the data of the receiver in the initial setting, you must make it effective. First, open the option window.

Check the "KRC-1から制御する (Control by KRC-1)" item when the option window is opened. Then close the window.

* Though the transmitter is assumed to be KRC-1 here, in the case of using KRT-1, KRT-3 and the RCB commander (software) on PC, these are also similar.
3. Next, it is necessary to decide which motion to be played when the transmitter's button is pushed. Please open the data table from the menu.

Read the data to the data table by clicking the "reading button" to display the data. Then double-click the motion that is wanted to control by KRC-1 from the list. The data dialog will be opened.

When the data dialog is opened, turn the power supply of KRC-1 on to launch the electric wave, then keep to push the button that wants to be allocated.

Hold the button, and click the "受信 (Receive)" button of the data dialog. If the value of the control input is changed, the setting is completed. So you can release the button of the transmitter. When the data dialog is closed, the setting is written to RCB-3J.

The data dialog can be opened by even double-clicking in the blank area of the data sheet when data is read on the data sheet. However, please note that data on the data sheet doesn't become effective if you don't write it to RCB-3J after editing it.

The receiver setting with the data table operates internal data of RCB-3J directly. On the other hand, the dialog setting on the data sheet operates data of PC. Therefore, when the motion data is written, the value set with the data table is overwritten. We recommend preserving motion in the file on PC after the motion data is read from the board when setting it with the data table to match data.

The setting here is already done by RCB-1. However, more advanced use is possible by RCB-3J.

The signal from the receiver can be temporarily invalidated or validated, by the setting with the SET object that can be placed in each motion. Moreover, not only the playing the motion but also a more advanced control can be available by using the analog control with the multi byte, that is another wireless control method.
Use of gyro sensor

The gyro sensor is used to control the change, detecting the attitude change of the robot. When the gyro unit is used, it is common that gyro unit is put between the control board and servo motor that need the gyro effect, but one gyro or one system can effect on only one servo. Using RCB-3J, Analog output gyro "KRG-3" is used up to three axis, and further, each gyro be put on a favorite servo control channel by a favorite gain. In addition, it is also possible to change the setting by setting the SET object in the motion while the motion is playing.

Connection of KRG-3.

When gyro sensor KRG-3 is connected, it connects to analog input (AD1, 2, 3).

Confirmation of basic gyro operation.

The easiest method to confirm the operation of the gyro is using an analog window from the command menu. When turning on the power supply, the robot equipped with RCB-3J moves slowly to the home position, if a start-up motion was made in the introductory chapter. In this situation, open the analog window clicking the "analog" button. Next, set the value of リアルタイムミキシング (real-time mixing) CH1 to "×5" on the tab of input1 (AD1), on trial. The servo connected with CH1 is sure to work by moving the gyro, if there is no mistake on a current procedure and the connection.

Although it set to only CH1 as an example, a gyro can control not only one servo but two or more servos. Moreover, the gain of the gyro can be changed by the value, and the gyro works at the opposite direction with the minus value. The content set in this analog window is memorized in the memory of RCB-3J, and executed when the power supply is turned on.

If the position of the servo in the state that the gyro is not moved and the state that the effect of the gyro is not worked is different, the standard set in the upper part of the window will be executed.

The reference value is updated by clicking the "AUTO" button while fixing the gyro and making it not move, and the reference value of the gyro will be corrected.
In the movement of the gyro that uses the analog window confirmed on the former page, the effect of the gyro between turning power on and off is constant. Moreover, it is not possible to correspond to the drift of the gyro according to the temperature change and the passage of time. And, in some case, it is inconvenience because the same effects of the gyro on all motions. Therefore, more dynamic method of using a gyro is prepared for the setting with the analog window in RCB-3J.

**Gyro setting with SET object.**

Inserting The SET object used by a start-up motion in the introductory chapter while executing in the motion, various settings are available. First, make a new motion. If there are a motion not saved in the data sheet, save it, and send it to RCB-3J. When a new motion is made, delete all objects on the screen once. Right-click in the blank area on the data sheet, the menu is opened, and select "全選択 (select all)". If all objects are selected, select "削除 (delete)" by right-clicking on the objects or pushing the deletion of the keyboard (DEL key).

After deleting all data, then place the SET object and double-click it to open.

When the SET window opens, select "ミキシング (mixing)" tab, not "その他 (other)" tabs used at the start-up motion. The left side of each channel shows the kind of mixing and the right side shows the gain.

Selects "R" of the AD channel that connects the gyro on the left side. R is abbreviation of real-time mixing.

The plus and the minus can be used to set the gain. The mixing direction for gyro is changed by the plus and the minus.

The setting of the gyro with SET Object can also put the effects on two or more channels by separate gains as same as an analog window. Moreover, the gain can be arbitrarily changed by inserting the SET object in wherever you like while moving. How you use it changes by the robot and the motion used. After trying variously, decide it.

When you use the gyro, proofread the reference value of the analog input with another SET object after the posture of the robot is steady using such a start-up motion. If the reference value is not correct, the position is changed every time when the home position is executed. And, it is better to prepare the motion for the proofreading, and execute it, if necessary, in the case of the continuous operation for a long time.
The setting of our RED Version servo can be changed by ICS, however, you have to remove the servo from the control board once and use another software. In RCB-3J, the setting of the connected RED Version servo can be unitary managed together.

- KRS-4014 HV and 4013HV operate by the ICS2.0 standard. Then it is not possible to read in this window.

1. First of all, using by the serial signal, open the option setting.

Check the channel set by ICS. So, even if the noncompliant model exist together, the inconvenience is not caused.

Open ICS window to do setting.

When the ICS window opens, turn off once and on the power supply of RCB-3J again. It starts in the ICS mode by turning on the power supply again. To read data, click "読み込み (Read)" button.

An individual set window opens by clicking each channel, the setting can be changed here.

After closing ICS window, the power supply of RCB-3J is turned off and on again. It changes from the ICS mode to a usual servo control mode by turning on the power supply again.
Making of scenario

Continuously executing the motion becomes possible by making the scenario. It is possible to demonstrate it by autonomous operation in a set period of time.

1. Clear the data sheet.

   By right-clicking on the data sheet to open the menu and selecting "全選択 (all select)", everything placed on the seat is selected.

   While selected all, by right-clicking on any object and selecting "削除 (delete)" or push DEL key to the keyboard, delete all.

   The motion is located in the data sheet when the scenario is made, but this cannot be done if the position is placed on the data sheet (while making the motion). Therefore, delete all on the data seat once.

2. Opening the data table.

   The data table window like the right opens when the data table icon is clicked. When data is not displayed, data is read by clicking the read button on upper left.
3. Placing the motion

Drag & drop the motion from an opened data table and locate on the data sheet.

The placed motion can appropriately change the display by property.

Select the wiring tool to wire.

The wiring tool is not released as long as another tool is not selected. Click the first motion, then click the tool executed next.

- To stop wiring while the wiring (a red line is showed), wiring is released by right-clicking.

Add the start flag to the data sheet.
You can add the flag to the object executed first by selecting icon in the tool.

- The start flag tool is not released until another tool is selected.

When the motion is placed on the data sheet, the data sheet recognize it as a scenario. The wiring tool and the start flag besides the motion can be used in the scenario. POS, SET, and CMP cannot be placed.
4. Write the scenario.

To input the data name before writing, double-click the part where the data sheet is white to open the data dialog. If you use the wireless control unit, it is also possible to input the control input.

Scenario is written to the board by selecting the writing tool. The written scenario can be played just like the motion.

Content and notes in scenario

There is no information such as the locations of the servo to actually operate in the scenario though making motion to work the robot connected with RCB-3J. Contents of the scenario are only information which motion in which order to execute. So, if the content of the motion specified by the scenario is changed, operation naturally changes when the scenario is played. Therefore, when you make the scenario, it is necessary to confirm the content of the specified motion neatly. It is likely not to move as thought if there is the mistake in the motion. And, the executions of the motion will not be end when the repetition processing (loop) is mistaken described in the advanced chapter. Please confirm the operation of each motion used enough when you use the scenario.
Using the teaching function.

When making the motion of the robot, the pose is made specifying the active position of the servo of each channel in the figure and the slide bar, usually one motion is made by a series of the poses. On the other hand, in the teaching function, by making each servo of the robot free status, making the robot favorite position, and taking the position of each servo, the pose can be made. Our RED version servo is required to use the teaching function. (When the servo without the teaching function is used, this function cannot be used.)

1. One position is placed on the data sheet.

2. Double-click the placed position to open the position window.

3. Select "組み合わせの設定 (Setting of the combination)" in the LINK setting. At the same time as selecting it, "指定動作の設定 (Setting of specified operation)" window opens.

4. In "指定動作の設定 (Setting of specified operation)" window, Specify the setting of the channel that wants to teach "TCH". "TCH" means the teaching.
5. Change all channels that want to teach to "TCH". Here, when the combination of channels that specify the teach is finish, the name of the combination is filled in the name column. ("教示 (Teaching)" is used as name in the example.) Then close the window pushing OK.

6. Returning to the position window, select the name specified ahead ("教示 (Teaching)" in the example) in LINK setting.

7. When the teaching has been selected in LINK, it is possible to teach according to the following procedure.

When the shutter button is clicked once, the servo that specified by TCH in the LINK window becomes free and position (pose) can be made.

A present position is red when the shutter button is clicked again, and the channel that specifies teaching(TCH) is changed from FREE to SERVO of.

If LINK is specified once, because it can be selected even at the position that opened newly, you can make quickly in each position that wants teaching.

When the motion is made by using the teaching, even if the servo is moved and taught to the place where the out of range of the servo operation, the position obtained by the teaching becomes within the range of the servo operation.