DENSO *ROBOT*

Motion Monitoring Option
USER'S MANUAL (T03)

Preface

Thank you for purchasing this high-speed, high-accuracy assembly robot.

Before use, read this manual carefully together with related manuals to safely get the maximum benefit from your robot in your assembling operations.

This manual covers the following products

Robot system configured with the RC7M controller (T03) incorporating the motion monitoring option

Important

To ensure operator safety, be sure to read the precautions and instructions in "SAFETY PRECAUTIONS."

Contents

Chapter 1   Outline

The motion monitoring option is designed for safe robot operation. It controls the robot unit to prevent its arm from getting out of the restricted area and exceeding the speed limit.

The robot controller (RC7M) and the robot safety controller (RSC) 1 concurrently monitor the robot motion.

- Robot controller (RC7M)
    Software in the robot controller, e.g., Virtual Safety Fence (VSF)

- Robot safety controller (RSC) 1 manufactured by JTEKT
    Software in the RSC1 mounted in the RC7M, which works independent of the RC7M software. The RSC1 is compliant with the ISO10218 Safety Level, Category 3, SIL2.

Chapter 2 System Configuration

This chapter describes the system configuration of the motion monitoring option and the RC7M controller incorporating the motion monitoring option.

2.1 System configuration of motion monitoring option
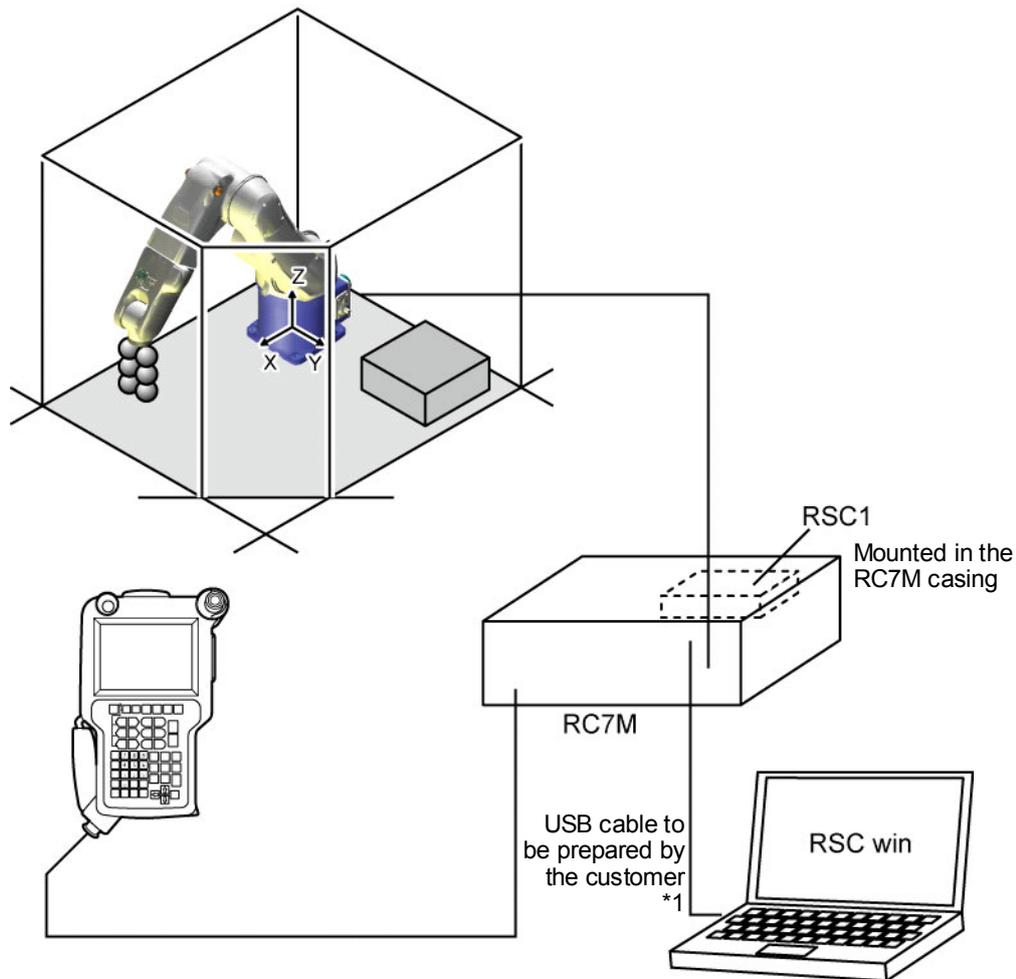
*1 The USB cable for connecting the RC7M with the PC running RSCwin should be prepared by the customer. The USB interface on the RC7M is B type.

2.2 Specifications of the robot controller incorporating the motion monitoring option

Specifications given in this section are exclusive to the robot controller incorporating the motion monitoring option. For other specifications, refer to the RC7M Controller Manual.

Specifications

Item	Specifications			
Robot series	Medium-sized, vertical articulated (VM-G-T series)	Small-sized, vertical articulated (VS-G-T series)	Medium-sized, horizontal articulated (HM-G-T series)	Small-sized, horizontal articulated (HS-G-T series)
Model	VMG6BA-GP	VSG6BA-GP	HMG4BA-GP	HSG4BA-GP
Weight (Mass)	Approx. 29 kg (64 lbs.)		Approx. 28 kg (62 lbs.)	

ATTENTION: Only the robot system models having a suffix "-T03" can apply.

Outer Dimensions

426

506

(Min. 200)
Cabling space

230

19

(mm)

3
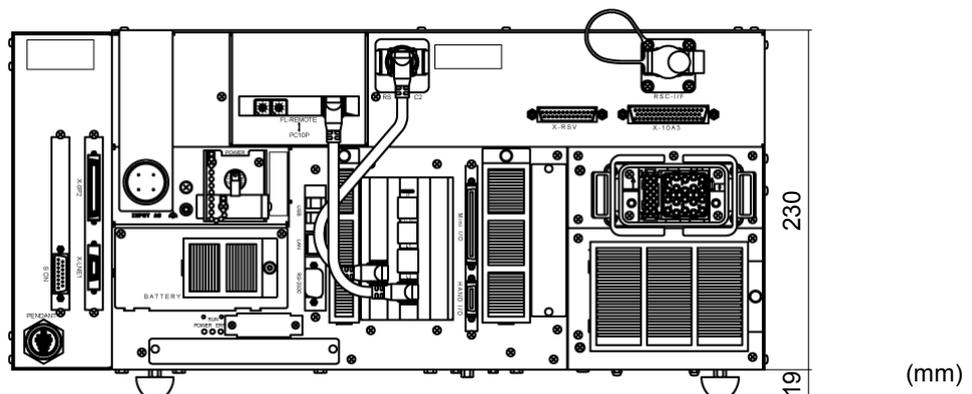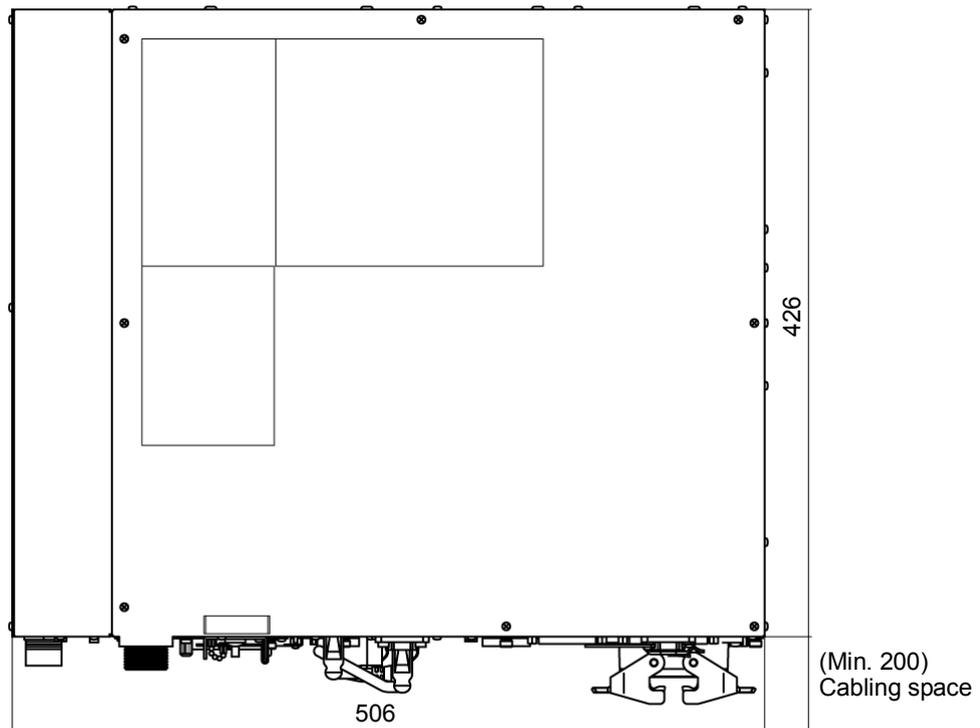
2.3 Interface of the robot controller incorporating the motion monitoring option
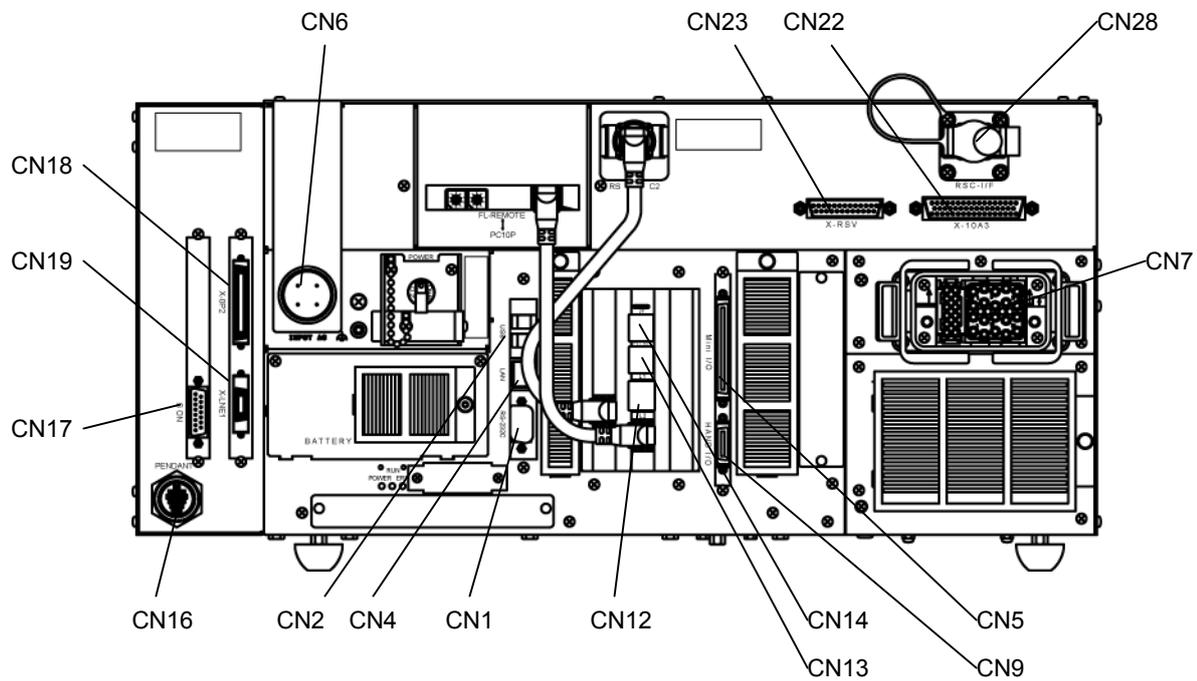
No.	Marking	Name
CN1	RS-232C	Serial interface connector
CN2	USB	USB connector (2 lines)
CN4	LAN	Ethernet connector
CN5	Mini I/O	User and system I/O connector
CN6	INPUT AC	Power supply connector
CN7	MOTOR	Motor & encoder connector
CN9	HAND I/O	HAND I/O connector
CN12	---	FL-net connector (X-FL) for line controller
CN13	---	USB connector for PLC
CN14	---	USB connector for PLC
CN16	PENDANT	Teach pendant connector
CN17	S ON	Servo ON output & user power input connector
CN18	X-OP2	Operation panel connector
CN19	X-LNE1	Line controller wiring connector
CN22	X-10A3	User wiring connector for robot unit
CN23	X-RSV	User wiring connector (Reserved.)
CN28	RSC-I/F	USB interface (B type) for connecting the RSC1 with the PC (running RSCwin)

2.4　Notes on mounting the robot controller

Instructions given in this section are exclusive to the robot controller incorporating the motion monitoring option. For others, refer to the RC7M Controller Manual.

Installation type

The robot controller can only be floor mounted. Do not wall mount it.

Connecting the FL-net cables

Connect the FL-net cables as shown below.
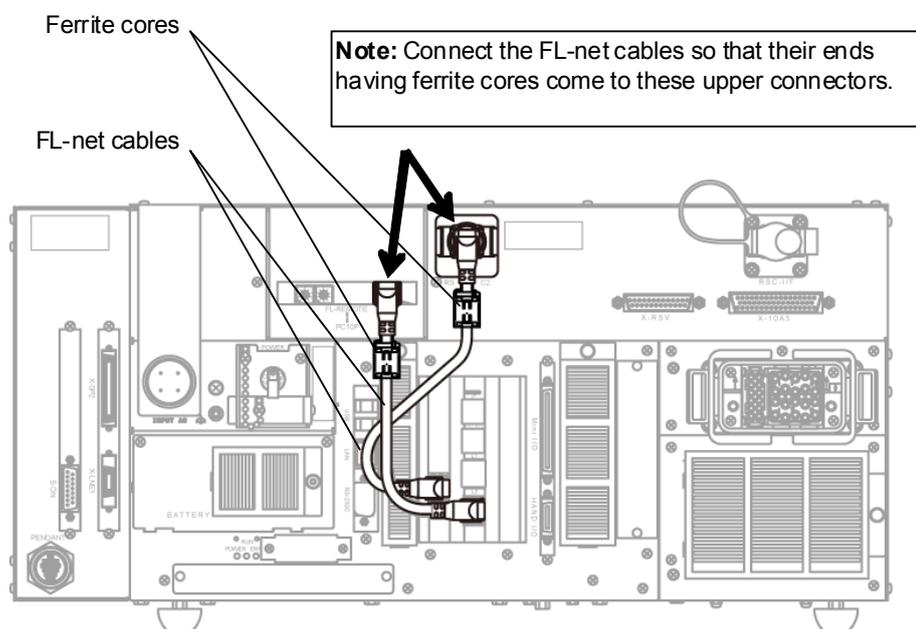
When transporting the robot controller, disconnect the FL-net cables from the controller beforehand to prevent them from getting broken.

About protection box

Protection boxes having an old parts number cannot be used. Use the ones having a new parts number.

・ Old parts number
　　410181-0090

・ New parts number
　　410181-0091

2.5 Connecting the robot controller with the RSC1 unit

Connect the robot controller with the RSC1 unit as shown below.
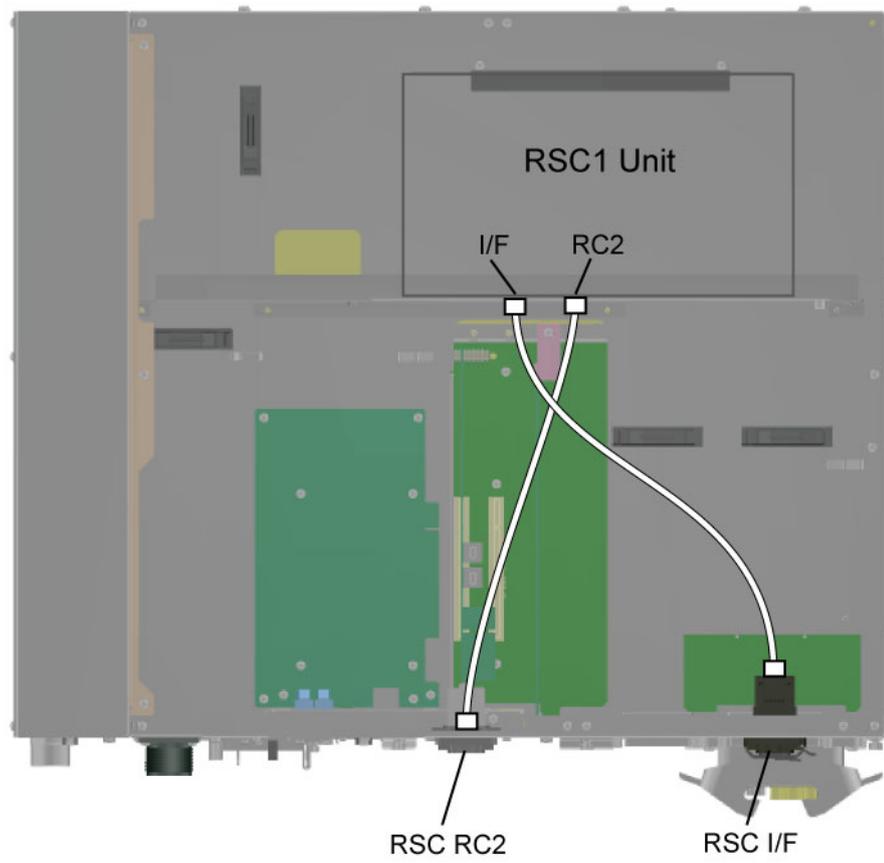
Chapter 3 Detailed Description of Motion Monitoring Option

The motion monitoring option has the following functions.

- Motion-restricted area monitor

  This function monitors the robot unit to prevent its arm from getting out of the restricted area (just like an area surrounded by a safety fence) or from intruding into the partial restricted area (robot entry-prohibited area). Those areas can be defined arbitrarily.

  The monitor targets include the center of the flange (on the end of the robot arm), the tool center point (TCP), the external shape of the end-of-arm tooling (tool interference object), and points (arm interference monitor points) such as an elbow of the robot.

  For details, refer to Section 3.1.

- Automatic tool interference changer

  This automatically changes the tool interference object when a tool is changed.

  The tool interference object can be defined by combining tool interference balls and rectangular parallelepiped.

 The RSC1 checks also whether the current tool number corresponds with the one specified by external equipment. When the RSC1 leaves the factory, the default monitor mode is Tool 1 (fixed). To use the automatic tool interference changer, change the default. For details, refer to the RSC1 User's Manual.

  Note: The robot controller incorporating the motion monitoring option can use only nine tools (TOOL1 to TOOL9).

- Joint motion limiter

  The RSC1 monitors each joint to prevent it from getting out of the motion limit, as well as the RC7M controller software does it with the software motion limit.

  The joint motion restriction values of the RSC1 and the software motion limit values of the RC7M are configured to be the same when the robot system leaves the factory. Since the RSC1's values and the RC7M's ones are independent of each other, modify each of them if necessary.

- Speed limiter

  This controls the robot arm to prevent it from exceeding the safety speed (250 mm/s) during manual operation.

  The monitor targets include the center of the flange and the tool center point (TCP or the origin of the tool coordinates in the controller software).

> ATTENTION: If newly configured, the data needs to be reflected to the RSC1. Use the JTEKT software "RSCwin" to read out the configuration data from the robot controller and send it to the RSC1. If the data is not send, the motion monitoring function does not operate correctly. For details about the RSC1 and RSCwin, refer to the corresponding user's manual.

3.1 Motion-restricted area monitor

This function monitors the target defined on the robot unit to prevent it from getting out of the arbitrarily defined, restricted area or from intruding into the partial restricted area (robot entry-prohibited area). If the target has gotten out of the restricted area or intruded into the partial restricted area, or if the target comes to close to doing it, this function stops the robot motion and displays an error.

This monitor is carried out by both the RSC1 software and RC7M software. The monitor of the RC7M software is called Virtual Safety Fence (VSF).

Each of the VSF and RSC1 monitors the motion-restricted area at periodic intervals specified below for prediction control.

· VSF : 16 ms
· RSC : 15 ms

The prediction control calculates the robot stop position assuming that a stop command is issued to the robot currently in motion. It stops the robot if the predicted stop position comes to be outside the restricted area or inside the partial restricted area (robot entry-prohibited area).

The prediction control of the VSF assumes that each joint stops at the maximum deceleration. For the prediction control of the RSC1, refer to the RSC1 User's Manual.

The VSF allows the settings of the "VSF area margin" and "VSF warning margin." The former is used to stop the robot inside the boundary of the motion-restricted area; the latter issues an I/O signal as a warning when the robot arm is approaching the boundary of the motion-restricted area.

Partial restricted area
(Robot entry-prohibited area)

VSF area margin

VSF warning margin
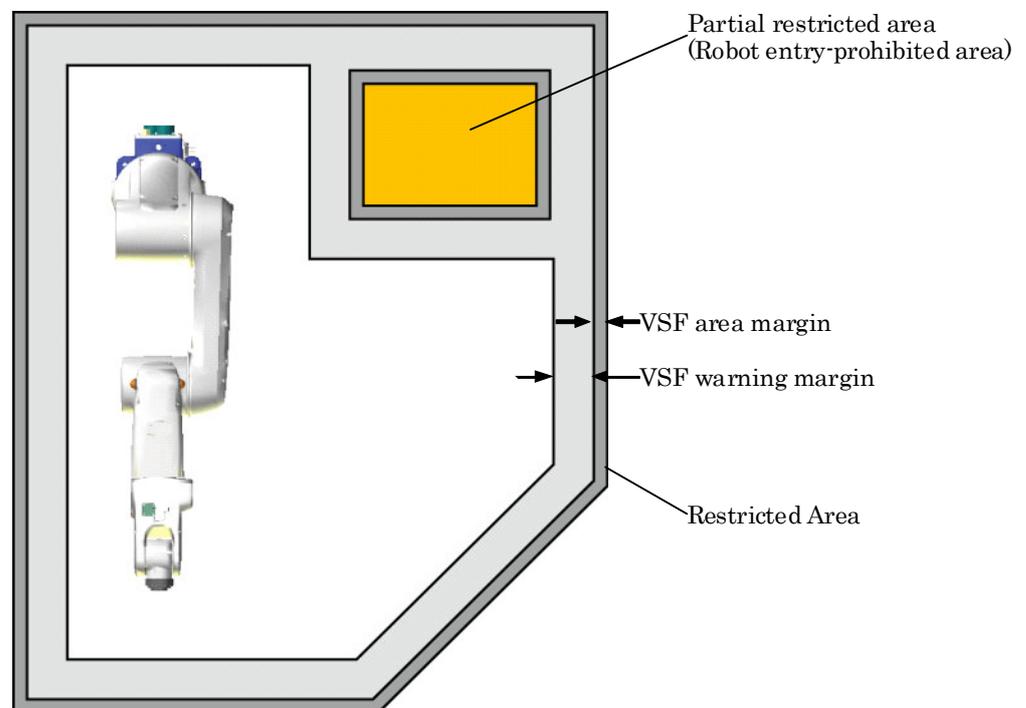
Restricted Area

Defining the motion-restricted area

It is possible to define the restricted area (just like an area surrounded by a safety fence) and the partial restricted area (robot entry-prohibited area).
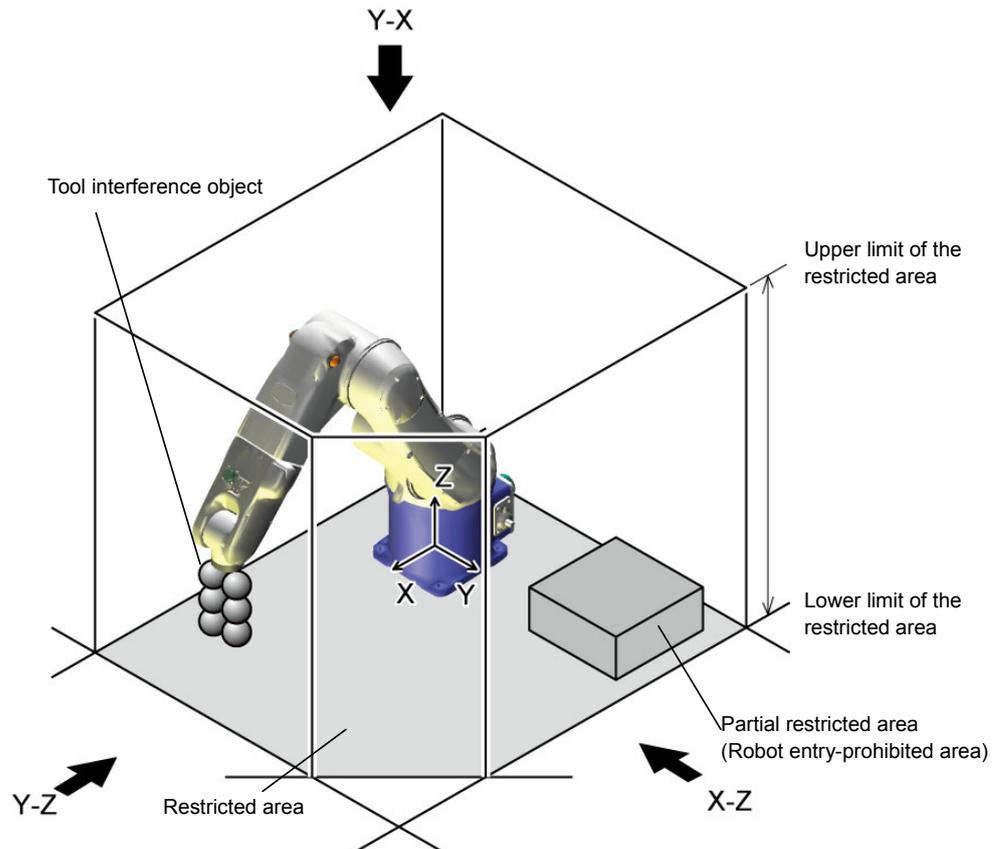
- Restricted area

  Area to be monitored for preventing the robot arm from getting out of this area.

  It is configured with "an area surrounded by a maximum of eight straight lines and containing a restricted area reference point on the Y-X plane" and "a pillar specified by the upper and lower limits in the Z-axis direction."

- Partial restricted area (Robot entry-prohibited area)

  A part of the restricted area, into which the robot arm should not intrude. It is used when there are facilities inside the restricted area and it is necessary to avoid interference with the robot arm.

  It is configured with "an area surrounded by four straight lines on the Y-X plane" and "a pillar specified by the upper and lower limits in the Z-axis direction."

Monitor targets

The motion-restricted area monitor function monitors the following four types of targets.

· Center of the flange

Center of the flange on the end of the robot arm

· Tool center point (TCP)

The VSF uses the origin of the selected tool coordinates as a TCP.

The RSC1 uses the TCP defined as an object of the tool interference. (Refer to Edit TCP [EditTCP].)

Note: The setting of the tool coordinates to be used by the VSF and that of the RSC1's TCP are not interlocked with each other. Define each of them independently.

· Tool interference object

The tool interference object can be defined on TOOL1 to TOOL9 by expressing the external shape of the end-of-arm tooling (hand and workpiece). The motion monitoring function checks whether the tool interference object gets out of the restricted area or intrudes into the partial restricted area (robot entry-prohibited area).

The tool interference object can be defined by combining tool interference balls and rectangular parallelepiped. Using tool interference balls only allows the configuration of a maximum of 20 ball-shaped areas; using both the balls and a rectangular parallelepiped allows the configuration of a single rectangular parallelepiped area plus a maximum of 12 ball areas.

If a rectangular parallelepiped area is defined, the RSC1 monitors the tool interference balls and the top (only) of the tool interference rectangular parallelepiped.

Tool interference object
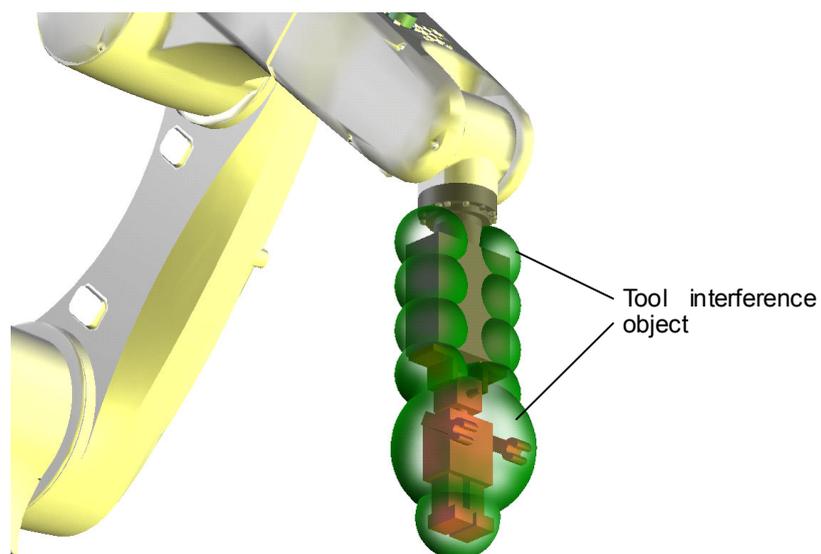
- Arm interference monitor points

    These points are used to prevent the elbow of the robot from getting out of the restricted area or intruding into the partial restricted area (robot entry-prohibited area).

    Three arm interference monitor points are configured around the elbow of the robot by factory default. When electrical wiring and air piping for hand control are made on the arm, modify the configuration for monitoring the motion area.
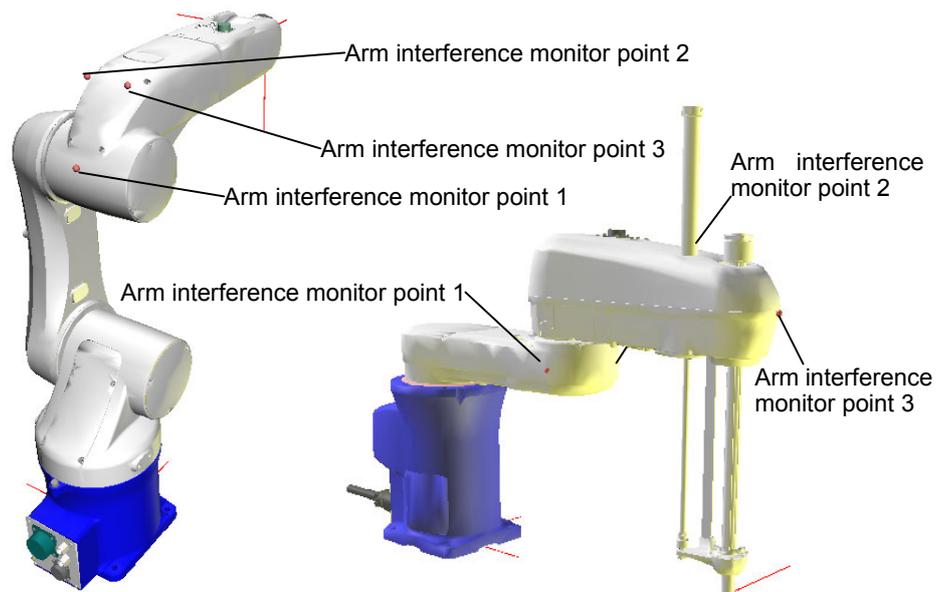
    To edit arm interference monitor points, enter a joint number and the offset value from the coordinate origin of each joint.

    Shown below are a coordinate origin of each joint and the coordinate system. Refer to them in conjunction with the external dimensions given in the General Information About Robot.
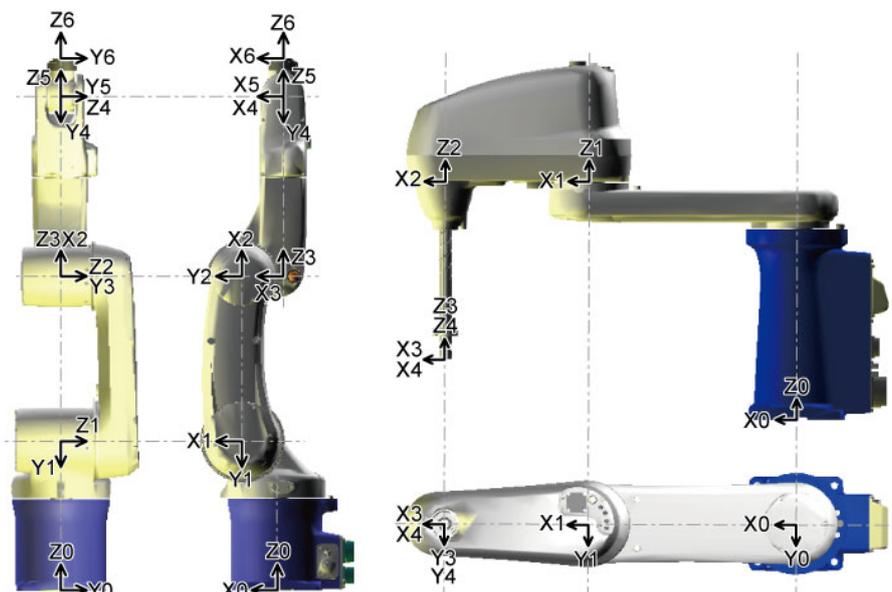
Monitoring the motion of the slider-equipped robot

Even the slider-equipped robot can use the motion-restricted area monitor and the speed limiter. Up to two sliders can be configured for linear motion axes. No rotation axes can be selected as a slider.

The sliders should be installed parallel to any of the X-, Y- and Z-axes on the robot base coordinates.

The mounting position of the robot unit is indicated by an offset value from the reference position and the rotation angle on the robot base coordinates when all sliders are positioned at the origin point (0 point).

Reference position

Robot mounting position input value

Z

X

Y

Origin point of the slider

Robot base coordinates
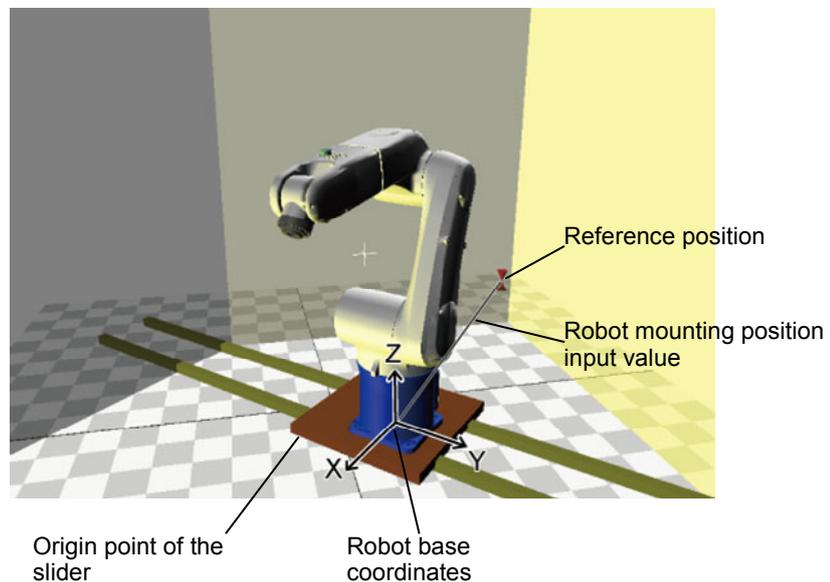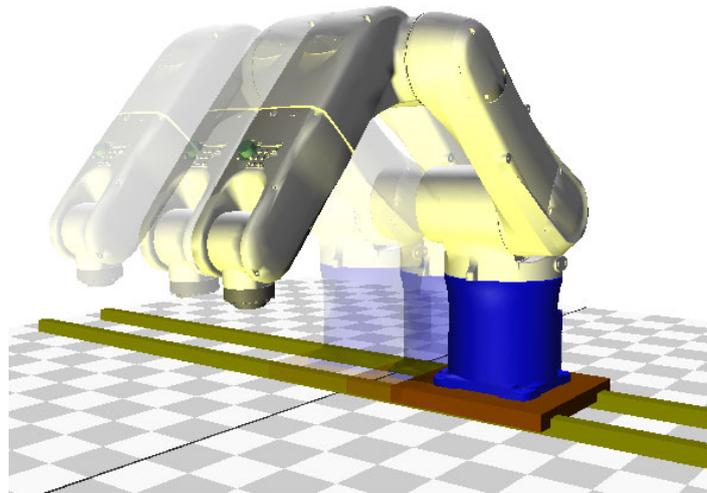
3.2 Errors detected by the motion monitoring option

If the RSC1 detects any abnormal motion, it issues an error signal. Upon detection of the error signal, the robot controller issues the "160D Limit Stop ON" error and brings the robot to an emergency stop.

Pressing the OK button on the error message confirmation dialog cancels errors that have occurred in the robot controller and the RSC1.

To check the error content, see the error log of the robot controller. All errors that have occurred in the RSC1 are recorded as a "160D Limit Stop ON" error. To check the error content, see RSC error log [RSCErr].

If the HM-T series of robots drives the end-of-arm tooling with large inertia in quick motion, it may overshoot (return) at an emergency stop. Be careful with the overshoot.

About overtravel

An overtravel refers to an error state where any of motion targets has gotten out of the restricted area or intruded into the partial restricted area (robot entry-prohibited area).

If the VSF or RSC1 detects an overtravel, the motor power can no longer be turned ON. To recover the robot from the overtravel state, temporarily disable the motion monitoring function (that is, release the overtravel), move all monitor targets to the inside of the restricted area and the outside of the partial restricted area, and then enable the motion monitoring function again. The motion monitoring function can be disabled with "Release Overtravel." For the operating procedure, see Release overtravel [OTRels].

3.3　Motion　monitoring　related　data

The motion monitoring function handles the following data.

- RSC parameters

    All data relating to the motion monitoring function

- RC parameters

    Data specific to the robot controller, included in data relating the motion monitoring function

- Safeguard data

    Motion monitoring data exclusive to the DENSO robots, which is produced by 3D CAD

    The RSC1 uses the RSC data and RC data whose contents can be checked with RSCwin.

    The safeguard data is a file for exchanging the data with 3D CAD software made for facility design. Its data format is exclusive to the DENSO robots. WINCAPSIII reads or writes from/to the safeguard data file.

    The safeguard data file contains data on the restricted area, partial restricted area, and tool interference object. When WINCAPSIII reads in the safeguard data file from the robot controller, the data existing in the file will be overwritten on the data having the same name in WINCAPSIII; there is no change on other data in WINCAPSIII. When reading in the safeguard data file, check whether the setting data is appropriate, using the teach pendant or RSCwin.

3.4 Transmission of RSC data

Use RSCwin to transmit RSC parameter values configured by the RC7M software to the RSC1. For the transmission procedure, refer to the RSCwin User's Manual.

When the project is made newly with RSCwin, transmit the RSC parameters from the RSC1 in the beginning. The motion monitoring function does not operate correctly in the default parameters of RSCwin.

Do not change the following IP address settings in the RSC data though they are possible to change with RSCwin. If the settings are changed by mistake, correct to the following settings and transmit the RSC data to the RSC1.

No.	Name	Value
1189	IP address of RSC	10.255.255.250
1190	Subnet mask	255.255.255.252
1191	IP address of robot controller	10.255.255.249

Chapter 4 Configuring the Motion Monitoring Function

The motion monitoring function adds the following commands to the menu tree for the pendant screen.

```
ExtScrn ┬Set   ┬Options.  ─T03 Opt. ─MotionSp┬Restrict
        │      │                             ├Partial
        │      │                             ├Ball          ─EditTCP
        │      │                             ├Rect          ─EditTCP
        │      │                             ├Arm
        │      │                             ├RbtBase
        │      │                             ├PosState
        │      │                             ├JntRstrc
        │      │                             ├OTRels
        │      │                             └SupMaint   ┬Password
        │      │                                         ├VSF set.
        │      │                                         └Slider(*)
        │      ├Log       ─RSCErr
        │      ├USB mem.  ─RSC      ┬ReadRSC
        │      │                    └WriteRSC
        │      └Maint.    ─RSC version
        └Shortcut         ─OTRels
```
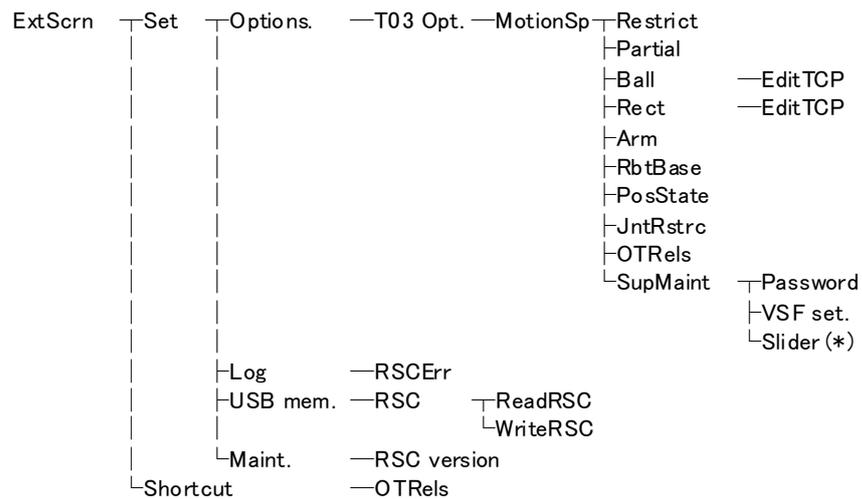
(*) Available only for extended-joint support robot controllers

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4.1 Motion monitor [MotionSp]

Configuring [MotionSp] requires entry of the password which is "1111" by factory default. The user can change the password.
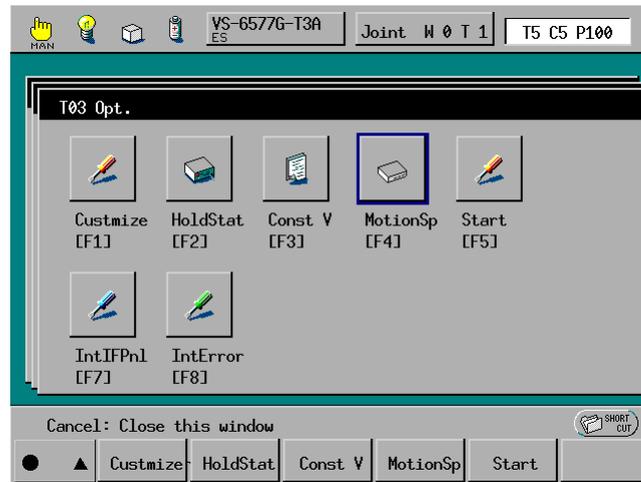
4.2 Restricted area [Restrict]

Configure the restricted area.

The configuration pane at the left side of the screen shows the two-dimensional figure of the restricted area. The origin of the coordinates is a base point. In order not to define the center of the robot base as a base point, see Robot mounting position [RbtBase].

Using the plane switching button switches the direction of the plane; moving the drag button moves the two-dimensional figure.

The right side of the screen shows the restricted area setting items.

- Reference point setting

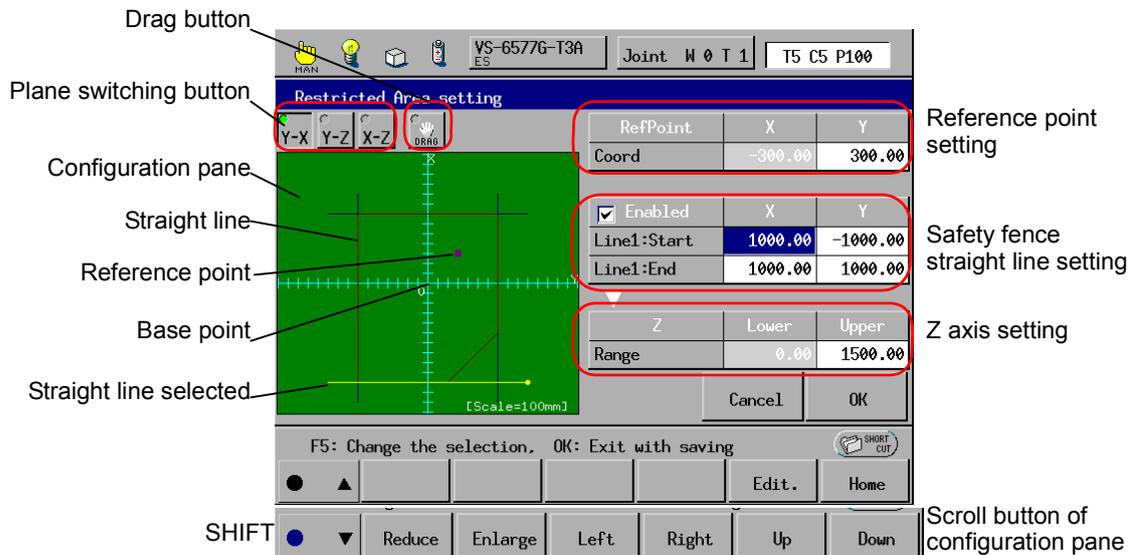   Define a reference point using the coordinates whose reference point is a base point on the Y-X plane. The area surrounded by straight lines and containing the reference point is regarded as a restricted area.

- Straight line setting

    Define a boundary of the restricted area by drawing a maximum of eight straight lines on the Y-X plane. Enter the start and end points of a line on the coordinates whose reference point is a base point.

    Deselecting the Enabled check box does not monitor the restricted area.

- Z axis setting

    Define the upper and lower limits of the height of the restricted area, as the range of the Z axis.

Configuration example
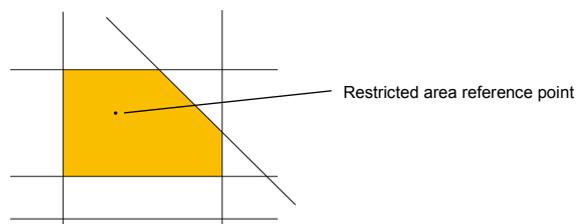
The area surrounded by straight lines and containing the reference point is regarded as a restricted area.

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4.3   Partial restricted area [Partial]

Configure the partial restricted area (robot entry-prohibited area) inside the restricted area.
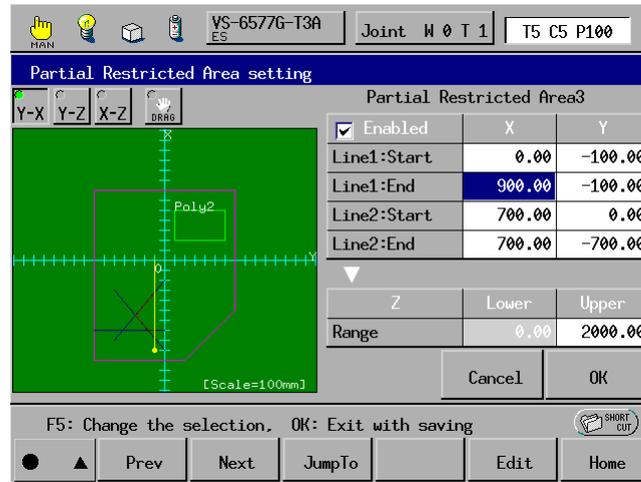
To configure a partial restricted area, draw a maximum of four straight lines on the Y-X plane and define the upper and lower limits in the Z-axis direction, relative to the area surrounded by the straight lines.
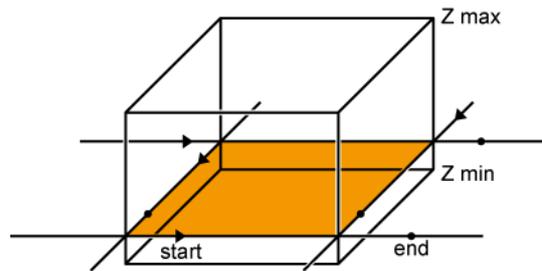
Configuration example
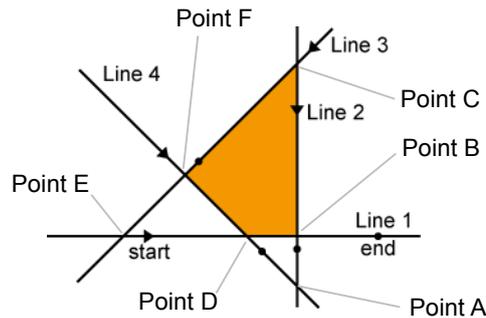
The above definition enables the colored section as a partial restricted area.

The arrows indicate the direction from the start to end points.

Determination algorithm

First, separate the plane with Line 1 and disable the plane containing fewer intersections. (In the above figure, the plane containing Point A is disabled and the plane containing Points C and F is enabled.) If two planes contain the same number of intersections, enable the right side of Line 1 when viewed from the start point to the end point. Repeat the algorithm for other lines in ascending order.

4.4   Tool interference ball [Ball]

Configure an external shape of a tool interference object such as the end-of-arm tooling (hand and workpiece), using balls.

A tool ball can be defined with the central coordinates (flange coordinates) and radius of the ball.
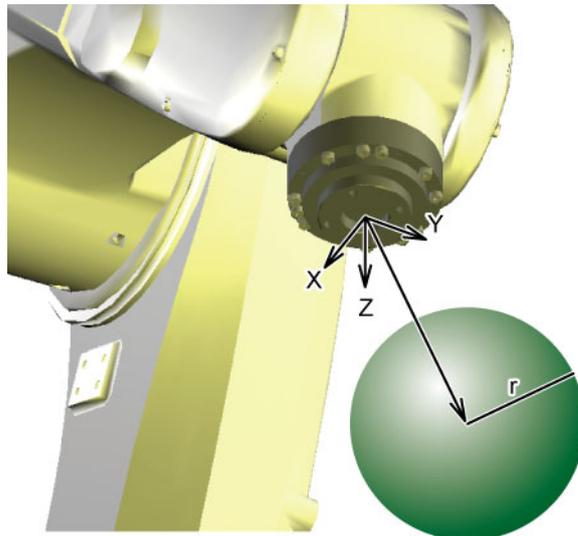
4.5   Tool interference rectangular parallelepiped [Rect]

Configure an external shape of a tool interference object such as the end-of-arm tooling (hand and workpiece), using a rectangular parallelepiped.
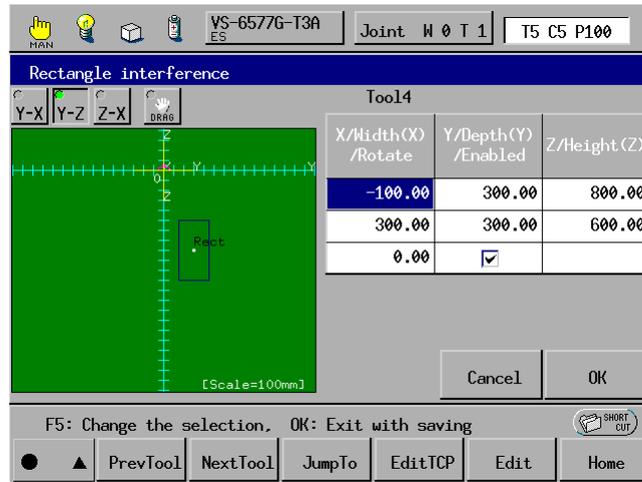
A tool rectangular parallelepiped can be defined with the central coordinates (flange coordinates), width (W), depth (D) and rotation angle (Z direction) of the rectangular parallelepiped.
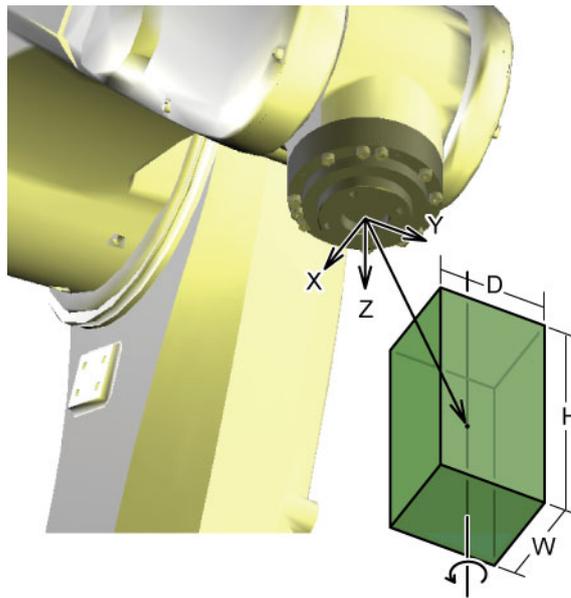
4.6   Edit TCP [EditTCP]

Configure a tool center point (TCP) by entering an offset value from the center of the flange in mm.
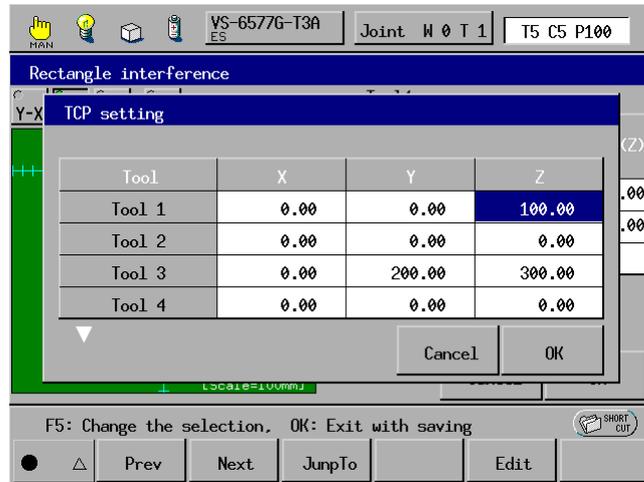
4.7   Arm interference [Arm]

Configure arm interference monitor points that restrict the elbow and other part of the robot.
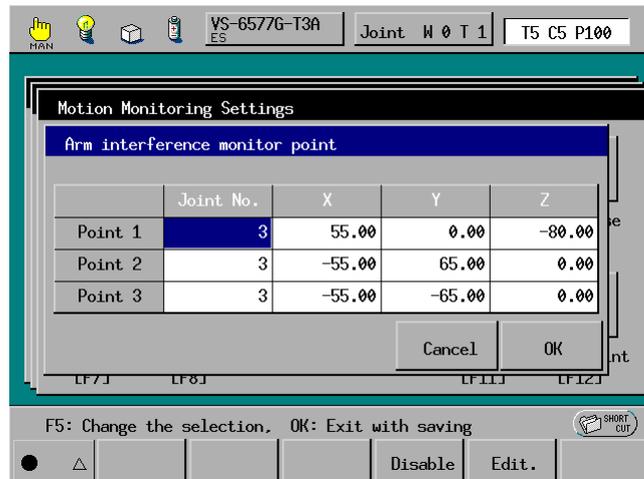
An arm interference monitor point can be defined by entering the joint number and the coordinates based on the origins of X, Y and Z coordinates.

Appropriate values of the elbow are preset by factory default. If modified, the default settings will be lost.

4.8   Robot mounting position [RbtBase]

Configure the mounting position of the robot inside the motion-restricted area.
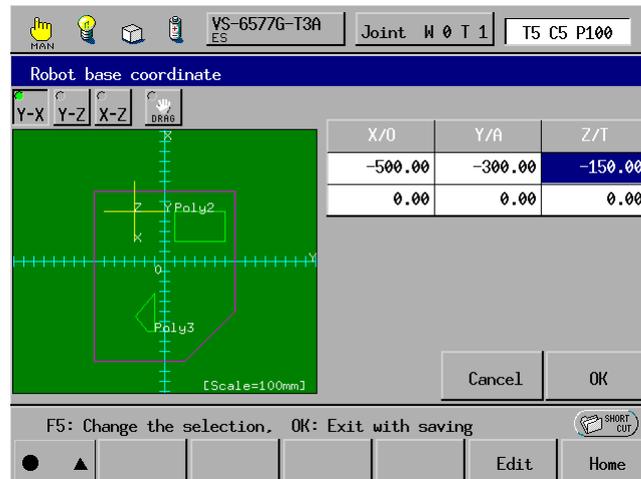
Enter the robot mounting position and direction.

Setting all of the mounting position values to zero (0) uses the robot base coordinates as the base.

To change the mounting position or direction, enter the movement distance from the base point. For the rotation angle, specify Euler angles to convert the coordinates in the following order (Rotation O → Rotation A → Rotation T).
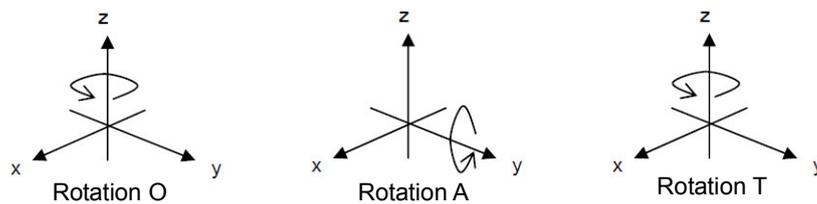
Note: The configuration of the robot mounting position does not affect position variable values.

4.9 Position status monitor [PosState]

Monitor the position status of the target being monitored by the RSC1.

This command is used for checking during configuring of the motion monitoring option.

For detailed information, refer to the RSC1 User's Manual.

	X	Y	Z
1: TCP	-14.99	0.00	1034.99
2: Ball 1	-14.99	0.00	1084.99
3: Ball 2	-14.99	49.99	1084.99
4: Ball 3	-14.99	-50.00	1084.99

RSC OperationState: RobotMonitring   TCP speed: 0.0 mm/s
Flange Speed: 0.0 mm/s

Cancel: Close this window

Prev | Next | JumpTo
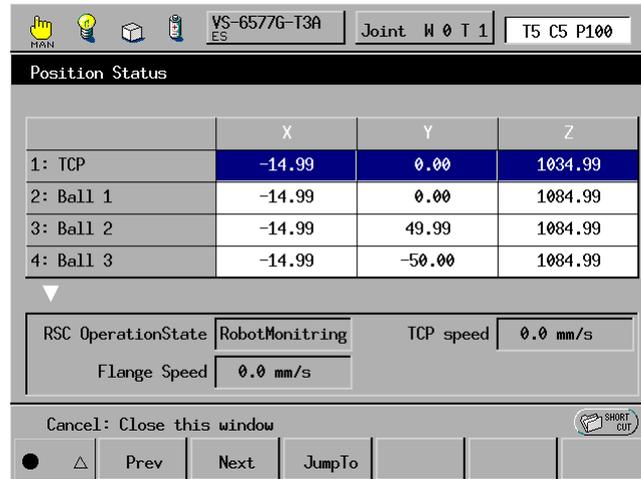
4.10 Joint motion limiter [JntRstrc]

Configure the motion restriction values of each joint of the robot monitored by the RSC1.

By factory default, they are greater than the software motion limits of the RC7M. Since the RSC1's values and the RC7M's ones are independent of each other, modify each of them if necessary.

Restriction value of Joint

Upper limit value of J1(deg)	170.03
Lower limit value of J1(deg)	-170.03
Upper limit value of J2(deg)	135.03
Lower limit value of J2(deg)	-100.03
Upper limit value of J3(deg)	169.03
Lower limit value of J3(deg)	-119.03

Cancel   OK

F5: Change the selection, OK: Exit with saving

Prev | Next | JunpTo | Edit
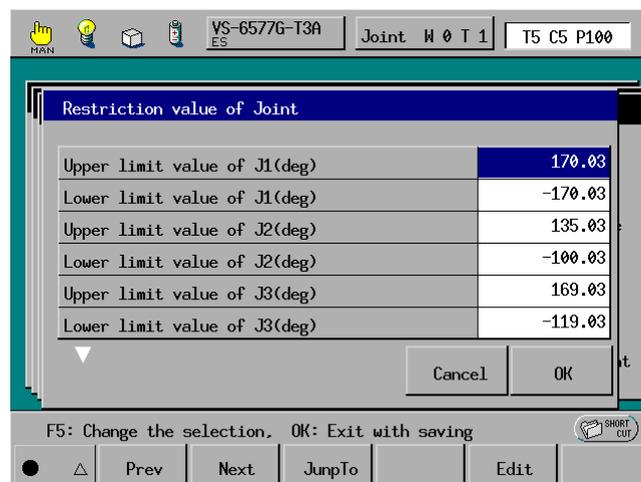
4.11 Release overtravel [OTRels]

If any monitor target is outside the restricted area or inside the partial restricted area (robot entry-prohibited area), the motor power can no longer be turned ON.

Use [OTRels] to temporarily disable the motion monitoring function and then move all monitor targets to the inside of the restricted area and the outside of the partial restricted area (robot entry-prohibited area).

At the start of an overtravel release sequence, the following dialog appears.
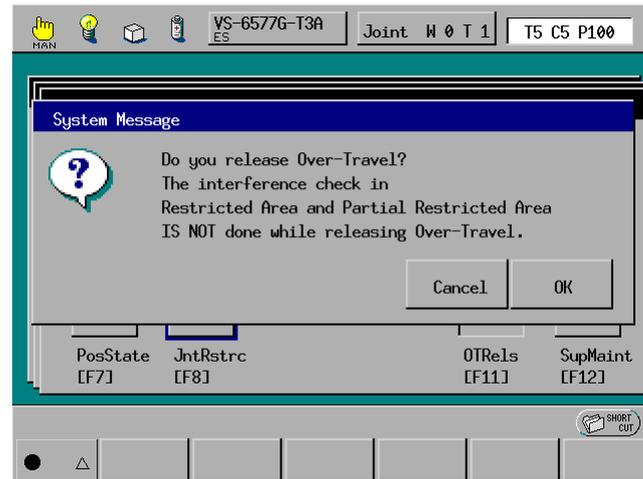
Upon completion of an overtravel release sequence, the following dialog appears.

4.12 Motion monitoring maintenance [SupMaint]

Specify the password to proceed to the T03 Opt. window and make the VSF settings.

```
┌─────────────────────────────────────────────────────────────┐
│ 👆  🔔  📦  🔋  VS-6577G-T3A   │ Joint  W 0 T 1 │ T5 C5 P100 │
│ MAN              ES                                          │
│  ┌──────────────────────────────────────────────────────┐   │
│  │ Motion Monitoring Maintenance                        │   │
│  │  ┌──────┐   ┌──────┐                                  │   │
│  │  │ 📄   │   │ 📄   │                                  │   │
│  │  └──────┘   └──────┘                                  │   │
│  │  Password   VSF set.                                  │   │
│  │  [F1]       [F2]                                      │   │
│  │                                                      │   │
│  └──────────────────────────────────────────────────────┘   │
│  Cancel: Close this window                    (SHORT CUT)    │
│  ● △ │Password│VSF set.│      │      │      │      │         │
└─────────────────────────────────────────────────────────────┘
```
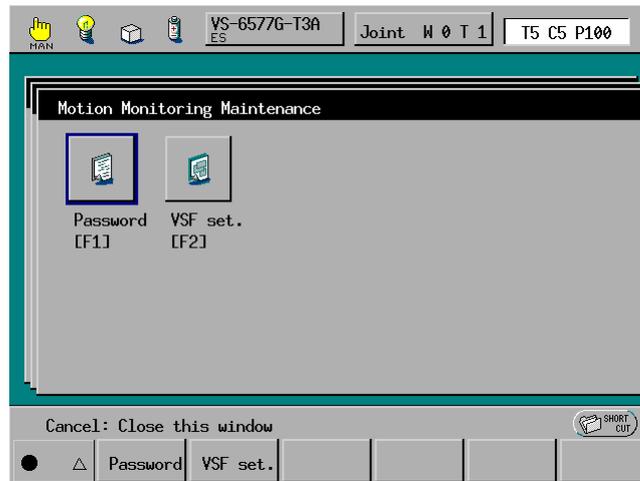
- ・ [Password]

    Specify or modify the password which is required on the T03 Opt. window.

- ・ [VSF set.]

    Browse or modify the VSF-related parameter values.

4.13 VSF parameter settings [VSF set.]

```
┌─────────────────────────────────────────────────────────────┐
│ 👆  🔔  📦  🔋  VS-6577G-T3A   │ Joint  W 0 T 1 │ T5 C5 P100 │
│ MAN              ES                                          │
│  ┌──────────────────────────────────────────────────────┐   │
│  │ VSF setting                                          │   │
│  │  VSF prediction control              │   Enabled │   │   │
│  │  VSF area margin(mm)                 │     30.00 │   │   │
│  │  VSF warning margin(mm)              │     20.00 │   │   │
│  │  VSF warning output type             │         L │   │   │
│  │  VSF warning output number           │       645 │   │   │
│  │  VSF warning output bit              │         1 │   │   │
│  │                          ┌────────┐ ┌────────┐        │   │
│  │                          │ Cancel │ │   OK   │        │   │
│  │                          └────────┘ └────────┘        │   │
│  └──────────────────────────────────────────────────────┘   │
│  F5: Change the selection.  OK: Exit with saving (SHORT CUT) │
│  ● △ │      │      │      │      │ Edit │      │             │
└─────────────────────────────────────────────────────────────┘
```
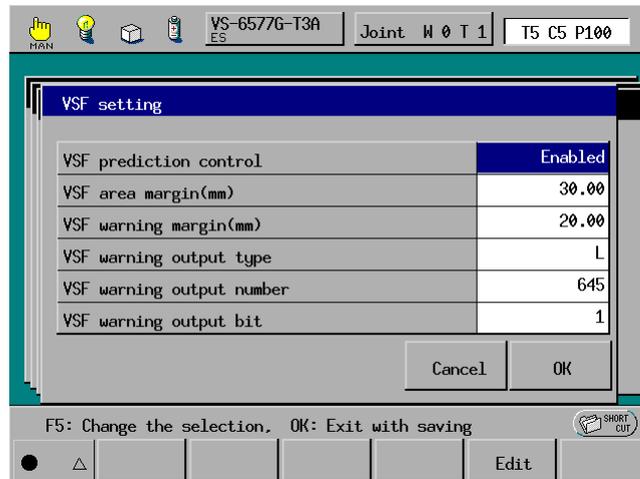
For details about each item, refer to the list of VSF configuration items given in Section 4.17.

4.14 Slider settings [Slider]

To use the monitoring function of the slider-equipped robot, make the slider settings.

First select a desired joint as a slider.

```
[MAN] [icons]  HM-40852G-T3AI    Joint  W 0 T 1    T1 C1 P1
                ES

    Moti    Slider Setting

      [    (?)   Please select the joint


    Pas          Joint 7
    [F1
               ▼
                              Cancel      OK




                                              [SHORT CUT]
     ●   △                    '
```

Configure the parameters of the selected joint.

```
[MAN] [icons]  HM-40852G-T3AI    Joint  W 0 T 1    T5 C5 P100
                ES

     Slider Setting

      Slider Setting(J7)                          None
      Operation direction setting(J7)        Xdirection
      Installation position[Xdirextion](mm)       0.00
      Installation position[Ydirextion](mm)       0.00
      Installation position[Zdirextion](mm)       0.00



                              Cancel      OK

     F5: Change the selection,  OK: Exit with saving   [SHORT CUT]
     ●   △                                  Change.
```
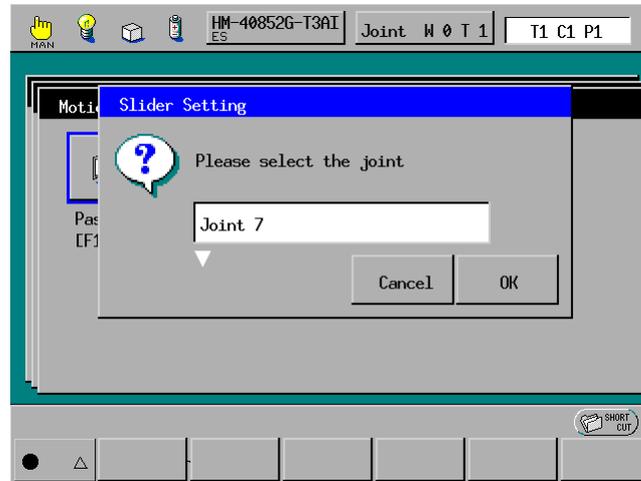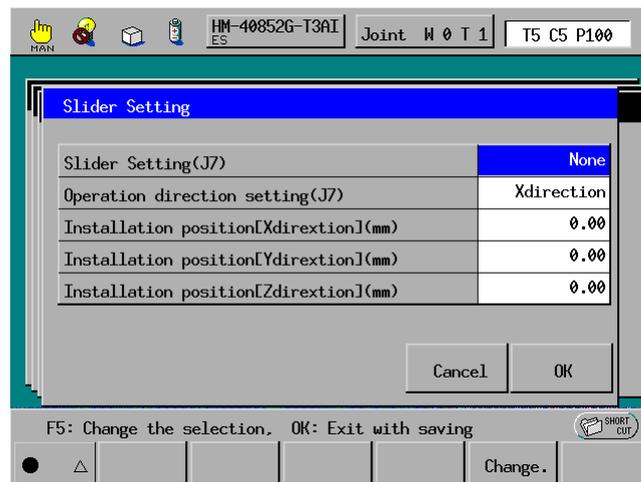
- ・ [Slider setting]

    Assign a slider number to the selected joint, then press [F5 Change.].

    "Slider 1" should be assigned to the lower joint.

    No rotation joint can be selected as a slider.

- ・ [Operation direction setting]

    Enter the motion direction of the selected joint, then press [F5 Change.].

    The motion direction should be based on the base coordinates of the robot.

- ・ [Installation position]

    Enter the offset value from the original installation position if the robot is relocated on the slider.

Note: The X direction should be assigned to "Slider 1" and the Y direction, to "Slider 2." No opposite setting can be made.

4.15 RSC error log [RSCErr]

Display the log of errors detected by the RSC1. For the error contents, refer to the RSC1 User's Manual.

```
┌─────────────────────────────────────────────────────────┐
│ 👆   💡   📦   🔋  VS-6577G-T3A  │ Joint  W 0 T 1 │ T5 C5 P100 │
│ MAN              ES             │                │            │
├─────────────────────────────────────────────────────────┤
│ RSC error log : Hide the warning log                     │
│   ▲          Date          Time       ErrorNo    ErrSrc   │
│      9    2012/07/10     16:56:39       e3[3]      MP-A    │
│     10    2012/07/10     16:56:39       e3[3]      MP-B    │
│     11    2012/07/10     16:52:45       8f[1]      MP-A    │
│     12    2012/07/10     16:39:12       8f[1]      MP-A    │
│   ▼                                                       │
│                                                           │
│  Error │ Axis lower limit over                          │
│  Sub Code            ● hex      ○ long      ○ float      │
│       &h5   &hffffd114          &h0         &h0      &h0 │
│                                                           │
├─────────────────────────────────────────────────────────┤
│  Cancel: Close this window                    [SHORT CUT] │
│  ●   △   Prev    Next    JumpTo   DisplLvl               │
└─────────────────────────────────────────────────────────┘
```

4.16 Read/write of RSC configuration data [ReadRSC]/[WriteRSC]
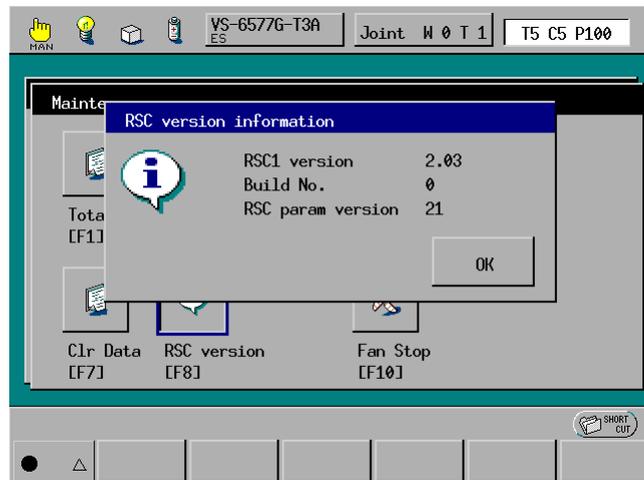
Read the RSC1 configuration data stored in a USB memory to the robot controller or write the data stored in the robot controller to a USB memory.

For details about the RSC parameters and RC parameters to be selected in reading or writing data, refer to the RSC1 User's Manual.
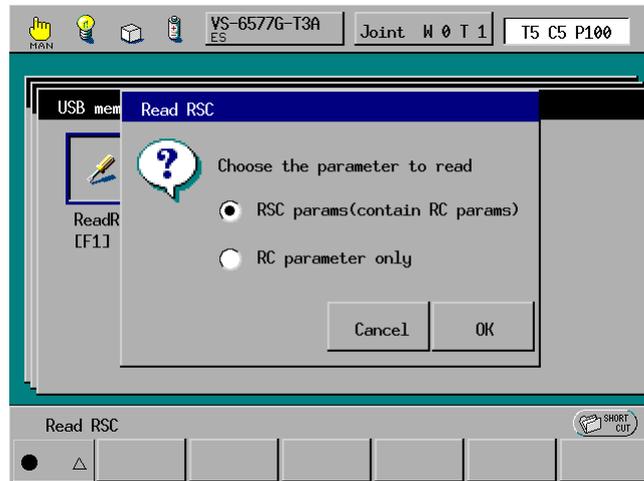
4.17 Version information of the RSC [RSC version]

Display the version information of the RSC1.

4.18 List of VSF configuration items

No.	Parameter name	Value/unit (entry range)	Factory default
0	VSF prediction control	0: Disable 1: Enable	1: Enable
1	VSF area margin	mm (0 to 50000)	30
2	VSF warning margin	mm (0 to 50000)	20
3	VSF warning output number	-1: No output 0: Mini I/O 1: L 2: R	1: L
4	VSF warning output type	0 to : I/O number	645 (0x285)
5	VSF warning output bit	0 to 15	0

Note: The robot controller RC7M and the robot safety controller RSC1 (manufactured by JTEKT) monitor the robot motion. In most cases, the initial settings of the VSF configuration items are configured so that the motion monitoring function of the RC7M software detects dangerous motions earlier than the RSC1 software.

Chapter 5　Appendix

5.1　Internal Circuits of the RC7M Controller

The block diagram below shows the internal circuits of the RC7M controller designed for a 6-joint robot as a typical example.
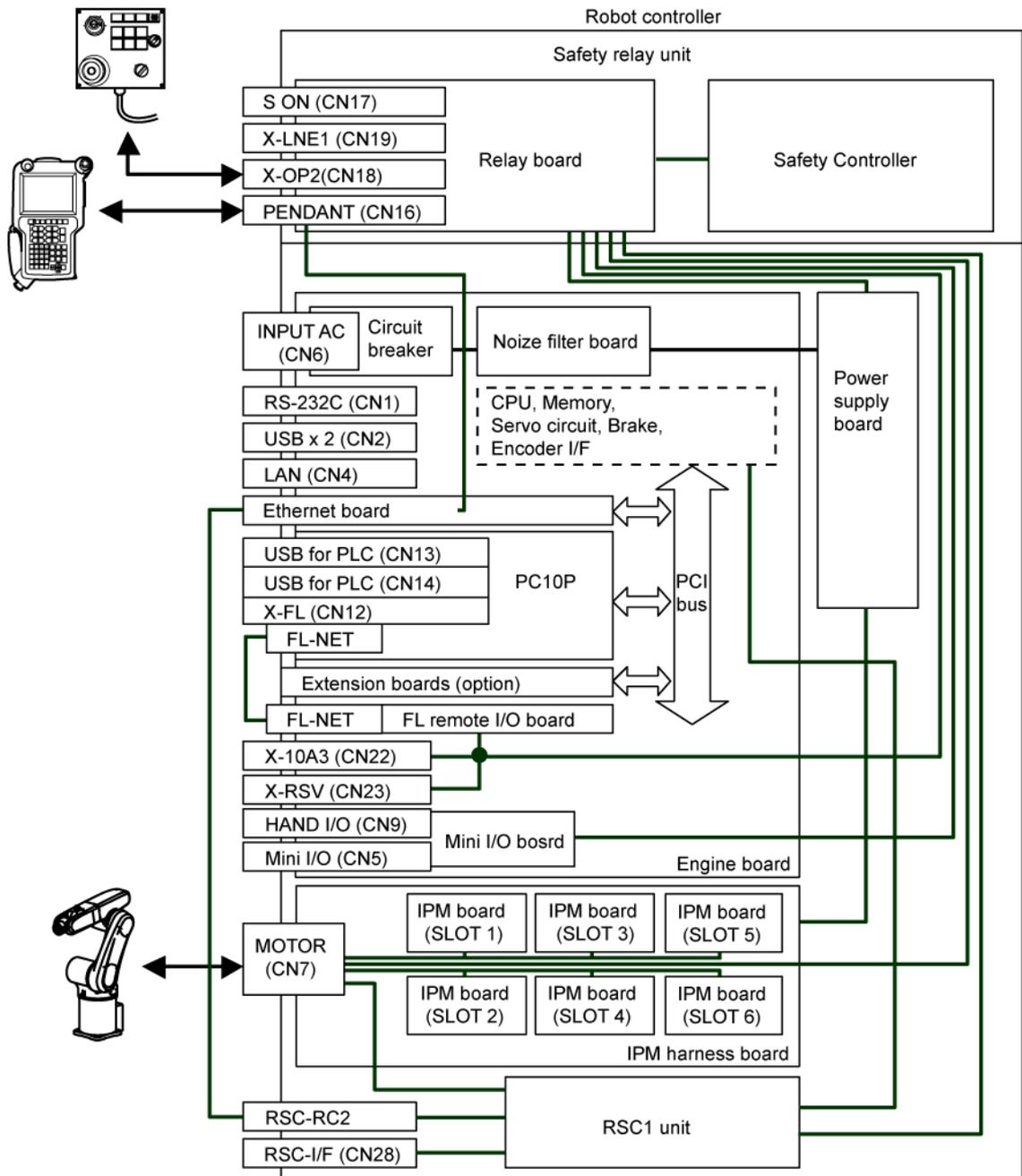
5.2 Entry of TOOL Number from External Equipment

The RSC1 monitors whether the current TOOL number matches the TOOL number specified by the external equipment. For details about the monitoring function, refer to the RSC1 User's Manual.

Enter the TOOL number specified by the external equipment to the I/Os as shown below.

FL Remote I/O Assignment for the Controller with Motion Monitoring Option

Input		Output	
X00	Operation panel Safety unit	Y40	Operation panel
X01		Y41	
X02		Y42	
X03		Y43	
X04		Y44	RSC1 TOOL bit 0
X05		Y45	RSC1 TOOL bit 1
X06		Y46	RSC1 TOOL bit 2
X07		Y47	RSC1 TOOL bit 3
X08		Y48	
X09		Y49	
X0A		Y4A	
X0B		Y4B	
X0C		Y4C	
X0D		Y4D	
X0E		Y4E	
X0F		Y4F	
X10	Robot unit (CN22: X-10A3)	Y50	Robot unit (CN22: X-10A3)
X11		Y51	
X12		Y52	
X13		Y53	
X14		Y54	
X15		Y55	
X16		Y56	
X17		Y57	
X18		Y58	
X19		Y59	
X1A		Y5A	
X1B		Y5B	
X1C		Y5C	
X1D		Y5D	
X1E		Y5E	
X1F		Y5F	
X20	Reserved. (CN23: X-RSV)	Y60	Reserved. (CN23: X-RSV)
X21		Y61	
X22		Y62	
X23		Y63	
X24		Y64	
X25		Y65	
X26		Y66	
X27		Y67	

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Motion Monitoring Option
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The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

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